ELSAG DATAMAT
Una Società Finmeccanica

P50501/DSAMTA-0819-09/00

Rome, 09.04.2009

VERSUS 2

System Architecture Design

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CHAPTER 1 – INTRODUCTION

1.1 AIM OF DOCUMENT

This document will describe what the new system VERSUS 2 is capable of. This description can be regarded as a “System Architecture Design” (SAD), where you can find a list of system requirements analysed and re-organized to give all information for the system implementation.

1.2 DOCUMENTATION

In this paragraph there are all reference documents:

- VERSUS Reference and User Manual - delivered end of 2008
- VERSUS 2 COSMO – Priority Project
- MET Version 1.1 2008: Model Evaluation Tools Version 1.1 User’s Guide. NCAR, July 2008.
- Casati, B. et al., 2008: Forecast verification: current status and future directions. Met App. 15: 3-18
- Ebert, E. 2008: Fuzzy verification of high-resolution gridded forecasts: a review and proposed frameworks. Met. Appl., 15, 51-64.
- Jolliffe IT, Stephenson DB. 2003: Forecast Verification: A Practitioner’s Guide in Atmospheric Science. John Wiley and Sons: Chichester, UK; 240pp.
- Nurmi P. 2003: Recommendations on the verification of local weather forecasts. ECMWF Technical Memorandum 430: 19.
- Stephenson, D.B. et al. 2008: The extreme dependency score : a non-vanishing measure for forecasts of rare events. Met App. 15: 41-50.
- Eckert P. 2009, High Resolution Verification Priority Project Report, COSMO Report. To be published.
- Wernli, H., P. Paulat, M. Hagen. C. Frei 2008: SAL – anovel quality measure for the verification of quantitative precipitation forecasts. Mon. Wea. Rev. 136, 4470-4487
- Methods and scores used for verifying ensemble forecasts

  http://www.bom.gov.au/bmrc/wefor/staff/eee/EPSverif/scores/scores.html

CHAPTER 2 – VERSUS

2.1 ARCHITECTURAL DESIGN

The Versus system is a flexible and configurable tool that verifies the trends of numerical models in weather forecasting by means of a set of statistical scores. VERSUS consists of following modules:

- An RDBMS (MySQL) for:
  - data that are to be verified:
    - observation (synop and temp data)
    - versus forecast (in grib format)
  - weather type dependent verifications
  - information for a full configuration
  - verification results (scores and images)
- Loader Front end for loading of data into DB
- Scores Front End for:
  - scores computation, by means of R
  - graphical production, by means of jpgraph
  - storing the numeric and graphical results in DB
- A parser component to manage the configuration of weather type dependent verifications
- A Web-based GUI for man-machine interface

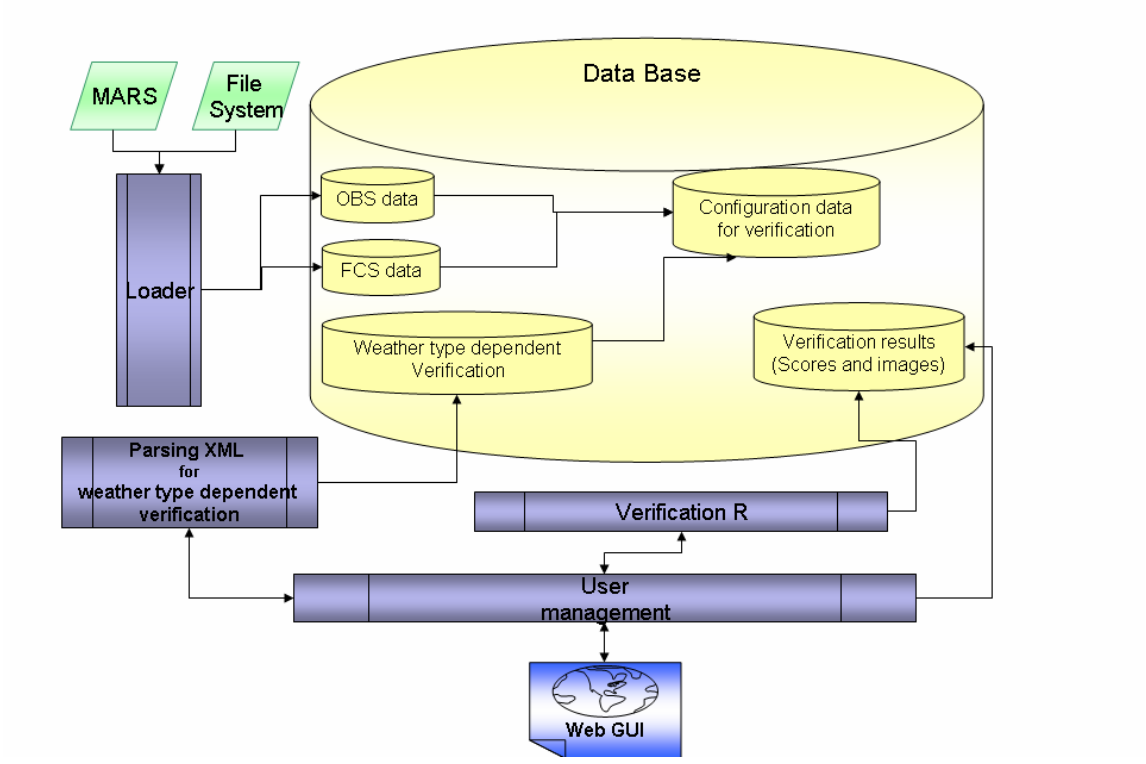


Figure 1.VERSUS- Architectural Design

2.2 FRONT END

The VERSUS system implements two kinds of front end:

- Loader Front-End, for storing observation, forecast and assimilation cycle in DB.
- Scores Front-End, for computing numerical and graphical scores defined as monthly or seasonal.

The **Loader Front End** is responsible for loading of data according to a defined configuration such as:

- The kind of FE that depends on the format of data: grib, bufr, ascii
- The stratifications of the stations
- The method of searching of the points: nearest, best nearest, the list of points that are included into a circle of radius R, 3D optimized nearest (COSMO algorithm).

Actually, data that the VERSUS system incorporates are:

- Synop in bufr format that are loaded into the surface_data table;
- Radio-soundings in bufr format that are loaded into the upperair_data table;
- Any other site observations that can be coded in bufr format using decriptors and templates (raingauge networks for example), surface or upper air type;
- Forecast data in grib format that are loaded into the grib table

The **Score Front End** is responsible for computing scores and generating graphics for data contained in the DB. This FE is activated once a day to check if there are scores to be calculated and if related data (forecast and observation) are loaded into the DB, after which the numerical scores are computed and the related graphics are generated and saved in the DB. The FE can be activated in batch and interactive mode.

By means of a Web-based GUI, it is possible to configure, start up and shut down the front-end.

2.3 R PROJECT

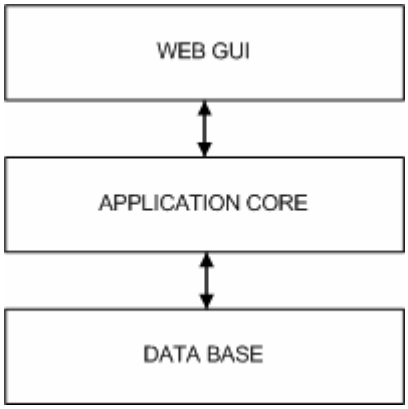
Standard and conditional verifications are carried out with the aid of the “R project” package.

R is a free software environment for statistical computing with an integrated suite of software facilities for data manipulation, calculation and graphical display. Among other things it has:

- an effective data handling and storage facility,
- a suite of operators for calculations on arrays, in particular matrices,
- a large, coherent, integrated collection of intermediate tools for data analysis,
- graphical facilities for data analysis and display either directly at the computer or on hardcopy, and
- a well developed, simple and effective programming language (called `S') which includes conditionals, loops, user defined recursive functions and input and output facilities. (Indeed most of the system supplied functions are themselves written in the S language.)

2.4 WEB GUI

Versus is a complex system complemented by a Web-based GUI. Usually a system with a Web-based GUI has a complex technical model composed of a first level associated with a web GUI



(web browser), a second level associated with the application core (server side code) and a third level associated with the database.

Figure **2**. System structure

For the Versus system the second level, “APPLICATION CORE” is associated with the PHP code and the third level, “DATABASE” with the Mysql database.

The Web-based GUI for Versus is composed of different areas. Public area does not need any login and access is allowed only about some general information, User and Technical Manual and a Glossary. Any other function needs a user/password login.

2.5 HARDWARE AND SOFTWARE MINIMUM REQUIREMENTS

Hardware

- CPU: Intel Core2 Duo 2GHz
- RAM: 2 GB
- HD: 300 GB

Software

VERSUS has been developed on a Linux Machine with the following features:

- Kernel 2.6.21
- MYSQL v. 5.0.45 with engine INNODB
- PHP v. 5.2.1 or later with MYSQL, gd v.2.0 graphic library, XML DOM and Apache modules
- Web server Apache 2.xxx

The previous software has to be already installed on your machine.

- R v. 2.5.0 with following additional packages: DBI v 0.2.3, RMYSQL 0.6.0, CircStats v. 0.2.3, WaveSlim v. 1.6, Fields v. 3.5, Verification v 1.20
- SWIG v. 1.3.31 or upper
- GRIB API
- BUFR API

This software will be provided together with the VERSUS package.

CHAPTER 3 – VERSUS 2

3.1 INTRODUCTION

The development, implementation and operational use of the VERSUS package should satisfy most of the needs for traditional verification, but the ever increasing model resolution as well as the current and planned ensemble systems (EPS) and post-processed products will require more suitable information from verification activities.

The extension of the VERSUS package to VERSUS 2 will cover these items and will provide the COSMO community with a “state-of-the-art” verification tool.

If VERSUS is a tool for traditional and conditional verification based on conventional methods, VERSUS 2 is the extension of VERSUS. With VERSUS 2 will be possible the use of new observations data, for example RADAR data, raingauges network, satellite, etc… Also with VERSUS 2 shoud be possible to create verification using probabilistic models (COSMO-EPS, COSMO-LEPS, COSMO-SREPS) with gridded and point observations.

The new system should use also new verification techniques (fuzzy and object oriented).

In this chapter will be presented also the priorities of requirements (as from VERSUS 2 workshop in Langen March 2009 – “APPENDIX 1 – PRIORITY LIST OF REQUIREMENTS”) with top priority for

- enhancement of standard and conditional verification of deterministic forecasts;
- inclusion of additional observation system and typed, including remote sensing data;
- using feedback files as an additional source of information that contains observation, deviation from forecasts and quality information

3.2 GLOSSARY

In this paragraph you can find all acronyms used in this document. In the document they will be written in **bold** letters.

AIREP	Aircraft Report They are messages from an in-flight aircraft to a ground station
AJAX	Asynchronous JavaScript and XML. It is a group of interrelated web development techniques used to create interactive web applications or rich Internet applications. With Ajax, web applications can retrieve data from the server asynchronously in the background without interfering with the display and behavior of the existing page.
AMDAR	Aircraft Meteorological Data Relay Data are collected by the aircraft navigation systems and the onboard standard temperature and static pressure probes. The data are then preprocessed before linking them down to the ground either via VHF communication (ACARS) or via satellite link ASDAR.
API	Application Programming Interface

	It is a set of routines, data structures, object classes and/or protocols provided by libraries and/or operating system services in order to support the building of applications.
Area Conditional Verification	Deterministic Conditional Verification defined on an area stratification.
Area Standard Verification	Deterministic and Probabilistic Standard Verification defined on an area stratification.
Area Stratification	An area delimited by a geometrical shape where all points are geolocated.
Area Verification	Standard and Conditional Verifications defined on an area stratification.
ASCII	American Standard Code for Information Interchange it is the built-in binary code for representing characters in all computers except IBM mainframes, which use the EBCDIC coding system.
BUFR	Binary Universal Form for the Representation of meteorological data.
CAPE	Convective Available Potencial Energy In meteorology, convective available potential energy (CAPE) [1], sometimes, simply, available potential energy (APE), is the amount of energy a parcel of air would have if lifted a certain distance vertically through the atmosphere. CAPE is effectively the positive buoyancy of an air parcel and is an indicator of atmospheric instability, which makes it valuable in predicting severe weather.
Conditional Verification	Deterministic Conditional Verification
COSI	A global Score for models COSMO.
COSMO	Consortium for Small-scale Modeling The Consortium for Small-scale Modeling (COSMO) was formed in October 1998. It's general goal is to develop, improve and maintain a non-hydrostatic limited-area atmospheric model, to be used both for operational and for research applications by the members of the consortium.
COSMO-LEPS	COSMO - Limited area Ensemble Prediction System. Probabilistic model from COSMO
COSMO-SREPS	COSMO - Short Range Ensemble Prediction System Probabilistic model from COSMO
Cross Model	The aim is to group in a single graphic two or more scores obtained from different meteorological models.
Deterministic Forecast	Forecast from Deterministic model
ECMWF	European Centre for Medium Range Weather Forecast It is an international organisation that provides state-of-the-art weather forecast data and products to our Member States.
ECMWF-EPS	ECMWF - Ensemble Prediction System

	Probabilistic model from ECMWF
EDS	Depency Score Estreme. Score to verify severe weather events.
E-GVAP	EUMETNET GPS water vapour programme EGVAP is set up to provide its EUMETNET partners with European GPS delay and water vapour measurements for operational meteorology.
EPS	Ensemble Prediction System Forecast uncertainty due to the partial knowledge of initial conditions is tackled by Ensemble Predictions Systems (EPS). Probabilistic forecasting is a relatively new approach which may properly account for all sources of uncertainty.
Daily Cycle	The daily cycle graphic shows the trend of observation and forecast data in a month group by daily steps. Parameter configuration for this kind of graphic are those of time series graphics.
DB	Data Base
Deterministic Conditional Verification	Conditional verification from deterministic forecast.
Deterministic Model	A mathematical model which contains no random (stochastic) components; consequently, each component and input is determined exactly by mathematical equations. In principle, for any specified input scenario, the corresponding model output variables are exactly determined. For VERSUS, there are: ECMWF, all COSMO-Model implementations and GME.
Deterministic Standard Verification	Standard verification from deterministic forecast.
DRIBU	DRIfting Buoys Floating (or drifting on ice) ocean buoy equipped with meteorological and/or oceanographic sensing instruments linked to transmitting equipment for sending the observed data to collecting centers.
FeedBack Files	These files should contain the observation and the deviation of forecasts for model runs of different COSMO-Model implementations for different forecast times. Normally, separate files are available for each model. These observations do not contain only traditional observation data but also radar and satellite data, aircraft measurements and so on. Information on data quality and status should be also included. Eventually those files should be also produced and used for verification, turned out from experimental runs. For all COSMO-Model implementations and for GME.
Forecast	Deterministic e Probabilistic Forecast
Front End	A front-end is the part of a software system that interacts

	directly with the user.
Fuzzy Tool Box	System to manage fuzzy verifications created by Dr. Beth Ebert from BOM.
Fuzzy Verification	Verification from deterministic forecast on an areal stratification through fuzzy methods
GIS	Geographical Information System A geographic information system (GIS), or geographical information system, captures, stores, analyzes, manages, and presents data that is linked to location.
GPS	Global Positioning System GPS is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world.
GRIB1	GRIdded Binary It is a mathematically concise data format commonly used in meteorology to store historical and forecast weather data.
GRIB2	Extension of GRIB1
GUI	Graphical User Interface. It is a human-computer interface (i.e., a way for humans to interact with computers) that uses windows, icons and menus and which can be manipulated by a mouse (and often to a limited extent by a keyboard as well).
In-Situ Observations	These observations can be classified in **Surface Level** Synop, SATOB, WINDPROFILER, PAOB, DRIBU, BUOY, SHIP, raingauges network, BUOY**.** **Upper Air Level** AIREP, AMDAR, TEMP, PILOT.
LIDAR	Light Detection and Ranging o Laser Imaging Detection and Ranging. Light Detection and Ranging (LIDAR) is a remote sensing system used to collect topographic data. This technology is being used by the National Oceanic and Atmospheric Administration (NOAA) and NASA scientists to document topographic changes along shorelines.
Map graph	It is a graphic with a map in background.
MET	Model Evaluation Tools Modular set of verification tools
Monthly Graphics	This kind of graphics are useful to show the trend analysis for the monthly scores.
MOS	Model Output Statistics. It is a technique used to objectively interpret numerical model output and produce site-specific guidance.

NETCDF	Netwok Common Data Form. It is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data. The project homepage is hosted by the Unidata program at the University Corporation for Atmospheric Research (UCAR).
PAOB	Observations for mean sea-level pressure.
PILOT	A method of winds-aloft observation, temperature, and relative humidity of the upper that is, the determination of wind speeds and air and to automatically transmit that directions in the atmosphere above a station. This is done by reading the elevation and azimuth angles of a theodolite (instrument) observation while visually tracking a pilot balloon.
Point Stratification	A set of geolocated points where there are stations on which calcolate the verification.
Point Verification	Standard and Conditional Verifications defined on an point stratification.
Probabilistic Forecast	Forecast from probabilistic models.
Probabilistic Model	A probabilistic model estimates, on tha basis of the past data, the probability of an event occuring again. (**EPS)**. For VERSUS 2 , there are: COSMO-EPS, COSMO-LEPS, COSMO-SREPS, ECMWF-EPS
Probabilistic Verification	Standard verification from probabilistic forecast.
RADIANCES	Radiation temperature Radiances are radiometric measures that describe the amount of light that passes through or is emitted from a particular area, and falls within a given solid angle in a specified direction.
RADIO OCCULTATIONS	Bending angles sensitive to temperature and humidity Radio Occultation is a rather new method for indirect measurement of temperature, pressure and water vapour in the stratosphere and the troposphere. The technique is based on utilizing the radio signals continuously broadcast by the GNSS satellites (GPS/GLONASS/Galileo) orbiting the Earth at an altitude of about 20000 km above the surface.
Remote Sensing Observations	Remote sensing observation are data from: Radar, Scatterometer, LIDAR, Satellite (RADIANCES, RADIO OCCULTATIONS), GPS (E-GVAP).
RMSE	Root Mean Squared Error In statistics, the mean squared error or MSE of an estimator is one of many ways to quantify the amount by which an estimator differs from the true value of the quantity being estimated.
Object Oriented Verification	Verification from deterministic forecast on an areal stratification through object oriented methods.

SAL	Structure Amplitude Location New types of verifications that use three independent components addressing the quality: Structure – S, Amplitude – A, Location – L. For a perfect forecast: S = A = L = 0
SATOB	Satellite Observations
SCATTEROMETER	A radar instrument used in remote sensing from aircraft or satellites.
SYNOP	Surface Synoptic Observations It is a numerical code (called FM-12 by WMO) used for reporting weather observations made by manned and automated weather stations.
Standard Verification	Deterministic and Probabilistic Standard Verification
Time Series	The time series graphic shows the trend of observation and forecast data in a month.
VAD	Velocity Azimuth Display. A radar display on which mean radial velocity is plotted as a function of azimuth.
Weather Type Verification	Deterministic Standard and Conditional Verifications defined on non-contiguous time intervals. VERSUS will use a parsing component to manage their configuration and stores data in the database (Figure 1.VERSUS- Architectural Design)
WINDPROFILER	A wind profiler is a type of weather observing equipment that uses radar or sound waves (SODAR) to detect the wind speed and direction at various elevations above the ground.
XML	eXtensible Markup Language. XML is made up of tags enclosing text. XML is used increasingly for config data and data transfer as it is more of a standard. XML parsers exist for most platforms and have been written in many computer languages.

3.3 SOFTWARE REQUIREMENTS

The aim of requirements analysis is to formalize what the system has to do in order to define a simple interface to share with the client.

3.3.1 CLASSIFICATION OF ORIGINAL REQUIREMENTS

The aim of the production of a structured list is to create a document on which to work and develop the system. For each requirements it should be defined:

- **Type**:

  "**functional**": functional requirements describe all functions that the system has to execute. They are sometimes known as capabilities;

  '**non-functional**": this type of requirements are sometimes known as constraints or quality requirements

"**operational**": operational requirements describe rules and procedures to manage the system and the procedures to use by users (such as the definition of workstations, their functions, procedures and forms of terminal procedures degraded, messaging, etc..). It may be necessary to define the attribute Subtype;

"**performance**": performance requirements describe the static and dynamic behavior of the system;

"**interface**": interface requirements describe the characteristics of physical and logic interface that system uses to exchange data with the outside (equipment, communication lines).

"**environmental**": environmental requirements describe hardware, software and data that system uses;

"**constraint project**": constraint project requirements describe the restrictions on the design and implementation of the system by specific standards or by the contract documents (eg, documentation requirements, quality). It may be necessary to define the attribute Subtype;

- **Subtype**: if the Type is not sufficient.

For each requirement could be defined also:

- **Priority:** the alphanumeric qualifier to define the importance for the requirement.

  ("A" = high, "B" = medium, "C" = low) .

  For all requirements haven't a priority, the client shall define it during the system development.

After the classification there will be a structured list of original requirements defined as follows:

VERSUS2-RU- ***n***

where

RU (User Requirement) is the acronym to identify the requirement

n is a progressive integer that starts from 1.

When a numerical code n is assigned cannot be re-assigned, so if the requirement will be removed there will be a hole in the list.

3.3.2 REQUIREMENTS CLASSIFICATION

The requirements are classified related to the functions types that VERSUS 2 shall manage. Each function type is representend by an acronym. The list of main functions for VERSUS 2 are:

F1. Acquisition of Observations - ACQ_OBS

This set of functional requirements is related to the observations data acquisition that VERSUS 2 shall manage.

F2. Acquisition of Forecasts - ACQ_FCS

This set of functional requirements is related to the forecast data acquisition that VERSUS 2 shall manage.

F3. Management of Verifications - MAN_VER

This set of functional requirements is related to the management verifications.

F4. Generation of Numerical Scores - GEN_NSC

This set of functional requirements is related to the generation of numerical scores that VERSUS 2 shall calculate using all verifications.

F5. Generation of Graphical Scores - GEN_GSC

This set of functional requirements is related to the generation of graphical scores that VERSUS 2 shall create using all scores previously calculated.

F6. Management of Graphical User Interface - MAN_GUI

This set of functional requirements is related to the management of graphical user interface of the system.

F7. Management of DataBase - MAN_DB

This set of functional requirements is related to the management of database, core of VERSUS system.

3.3.3 FUNCTIONAL REQUIREMENTS

3.3.3.1 ACQUISITION OF OBSERVATIONS - ACQ_OBS

VERSUS2-ACQ_OBS-1

[Priority: A] The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from TEMP parts B, C, D of temperature, wind (speed, direction, u-v component), humidity, geopotential, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-2

[Priority: A] The **Front End** for the acquisition and the decoding of TEMP parts B, C, D shall be the extension of the present **Front End** for TEMP part A of VERSUS**.**

VERSUS2-ACQ_OBS-3

[Priority: A] The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** SYNOP, special care have to taken to verify all cloud cover levels, wind gusts, different cumulations of precipitation and to calculate u-v component for wind, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-4

[Priority: A] The **Front End** for the acquisition and decoding of new parameters for SYNOP shall be the extension of the present **Front End** for **SYNOP** of VERSUS**.**

VERSUS2-ACQ_OBS-5

[Priority: A] The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from raingauges in grid and **NETCDF** format**.**

VERSUS2-ACQ_OBS-6

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from satellite in grid Lat/Lon (regular or rotated) and **NETCDF** format.

VERSUS2-ACQ_OBS-7

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR for precipitation and wind, in particular **VAD** and later radial, in grid Lat/Lon (regular or rotated) and **NETCDF** format.

VERSUS2-ACQ_OBS-8

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR using different grids related to the models to verify.

VERSUS2-ACQ_OBS-9

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of observations from high-resolution precipitation network and/or composition with radar and/o satellite data in grid Lat/Lon (regular or rotated) and **NETCDF** format.

VERSUS2-ACQ_OBS-10

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations LIDAR** in grid Lat/Lon (regular or rotated) and **NETCDF** format.

VERSUS2-ACQ_OBS-11

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations SATOB** for wind, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-12

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PILOT** parts A,B,C,D for wind in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-13

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** Satellite **RADIANCES** in grid and **NETCDF** format.

VERSUS2-ACQ_OBS-14

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations GPS** humidity from **E-GVAP**, in **BUFR** and **NETCDF** format .

VERSUS2-ACQ_OBS-15

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations WINDPROFILER** of wind, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-16

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PAOB**, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-17

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations DRIBU** for pressure and wind, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-18

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations BUOY** in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-19

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AIREP**, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-20

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AMDAR**, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-21

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from ship, **SHIP**, in **BUFR** and **NETCDF** format.

VERSUS2-ACQ_OBS-22

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations SCATTEROMETER**, in grid Lat/Lon (regular or rotated) and **NETCDF** format.

VERSUS2-ACQ_OBS-23

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** Satellite **RADIO OCCULTATIONS**, in **BUFR** and **NETCDF** format..

VERSUS2-ACQ_OBS-24

[Priority: A] All **Front Ends** verify the wind shall be capable to manage it like u-v component and strength-intensity.

VERSUS2-ACQ_OBS-25

[Priority: A] The System shall have a **Front End** for the acquisition of **FeedBack Files** in raw format and **NETCDF** format.

3.3.3.2 ACQUISITION OF FORECASTS - ACQ_FCS

VERSUS2-ACQ_FCS-1

[Priority: A] The System shall have a **Front End** for the acquisition and the decoding of **deterministic forecast** in **GRIB2** and **NETCDF** format.

VERSUS2-ACQ_FCS-2

[Priority: A] The **Front End** for the acquisition and the decoding of **deterministic forecast** shall be the extension of the present **Front End** for **deterministic forecast** of VERSUS in **GRIB1** format.

VERSUS2-ACQ_FCS-3

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.

VERSUS2-ACQ_FCS-4

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-LEPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.

VERSUS2-ACQ_FCS-5

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **ECMWF-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.

VERSUS2-ACQ_FCS-6

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-SREPS** model in **GRIB1**, **GRIB2** and **NETCDF** format .

VERSUS2-ACQ_FCS-7

[Priority: B] The System shall have a **Front End** for the acquisition, the decoding and the updating of climatology in **ASCII** format.

VERSUS2-ACQ_FCS-8

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of subjective forecasts in **XML** format.

VERSUS2-ACQ_FCS-9

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts MOS** in **XML** format.

VERSUS2-ACQ_FCS-10

[Priority: B] The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts** with Kalman filter in **XML** format.

3.3.3.3 MANAGEMENT OF VERIFICATION - MAN_VER

VERSUS2-MAN_VER-1

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on RADAR observations for precipitations and wind.

VERSUS2-MAN_VER-2

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on satellite observations.

VERSUS2-MAN_VER-3

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on high-resolution precipitation network and/or composition with RADAR and/or satellite data.

VERSUS2-MAN_VER-4

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on **LIDAR** observations.

VERSUS2-MAN_VER-5

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on satellite **RADIANCES** observations.

VERSUS2-MAN_VER-6

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on gridded precipitation data obtained from raingauges network data.

VERSUS2-MAN_VER-7

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on **SCATTEROMETER** observations.

VERSUS2-MAN_VER-8

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on **PILOT** observations like extension of current Upper air verifications of VERSUS.

VERSUS2-MAN_VER-9

[Priority: A] The System shall manage **deterministic standard and conditional verifications** based on **TEMP** observations parts B,C,D like extension of current Upper air verifications of VERSUS.

VERSUS2-MAN_VER-10

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using new parameters for **SYNOP** observations like extension of current Surface verifications of VERSUS.

VERSUS2-MAN_VER-11

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **WINDPROFILER** observations like extension of current Surface verifications of VERSUS.

VERSUS2-MAN_VER-12

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **PAOB** observations like extension of current Surface verifications of VERSUS.

VERSUS2-MAN_VER-13

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **DRIBU** observations like extension of current Surface verifications of VERSUS.

VERSUS2-MAN_VER-14

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **AIREP** observations.

VERSUS2-MAN_VER-15

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **SHIP** observations.

VERSUS2-MAN_VER-16

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **AMDAR** observations.

VERSUS2-MAN_VER-17

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using **BUOY** observations.

VERSUS2-MAN_VER-18

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using satellite **RADIO OCCULTATIONS** like extension of current Surface verifications of VERSUS.

VERSUS2-MAN_VER-19

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using climatology.

VERSUS2-MAN_VER-20

[Priority: B] The System shall manage **deterministic standard and conditional verifications** using subjective forecasts.

VERSUS2-MAN_VER-21

[Priority: B] The System shall manage **deterministic standard and conditional verifications** using post processed forecasts **MOS**.

VERSUS2-MAN_VER-22

[Priority: B] The System shall manage **deterministic standard and conditional verifications** using post processed forecasts with Kalman filter.

VERSUS2-MAN_VER-23

[Priority: B] All new **deterministic standard and conditional verifications** shall have seasonal, weekly, daily frequency and for a generic number of days.

VERSUS2-MAN_VER-24

[Priority: B] All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall have seasonal, weekly, daily frequency and for a generic number of days.

VERSUS2-MAN_VER-25

[Priority: A] All new **deterministic standard and conditional verifications** shall manage cumulations of precipitations over varying time intervals.

VERSUS2-MAN_VER-26

[Priority: A] All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall manage cumulations of precipitations over varying time intervals.

VERSUS2-MAN_VER-27

[Priority: A] All new **deterministic standard and conditional verifications** shall be defined on periods separated (**weather type verification**).

VERSUS2-MAN_VER-28

[Priority: A] All **deterministic standard and conditional verifications** of VERSUS shall be extended on periods sepated (**weather type verification**).

VERSUS2-MAN_VER-29

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using all new types of observations inside an **area stratification**.

VERSUS2-MAN_VER-30

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using all parameters for observations data present in the **DB**.

VERSUS2-MAN_VER-31

[Priority: A] The System shall manage **deterministic standard and conditional verifications** using all parameters for forecasts data present in the **DB**.

VERSUS2-MAN_VER-32

[Priority: A] The conditions for new **deterministic conditional verifications** shall be defined using conditions on models on its errors other than the model to verify.

VERSUS2-MAN_VER-33

[Priority: A] The conditions for **deterministic conditional verifications** of VERSUS shall be defined using conditions on models on its errors other than the model to verify.

VERSUS2-MAN_VER-34

[Priority: A] The conditions for new **deterministic conditional verifications** shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.

VERSUS2-MAN_VER-35

[Priority: A] The conditions for **deterministic conditional verifications** of VERSUS shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.

VERSUS2-MAN_VER-36

[Priority: A] The System shall manage **deterministic conditional verifications** where it is possible to define the area or the station where you want to set the condition. For example, to verify the temperature with the condition that for nearby stations it was cloudy.

VERSUS2-MAN_VER-37

[Priority: B] The System shall manage **probabilistic standard verifications** using all **in-situ observations** that the system can verify.

VERSUS2-MAN_VER-38

[Priority: B] The System shall manage **probabilistic standard verifications** using all **remote sensing observations** that the system can verify.

VERSUS2-MAN_VER-39

[Priority: B] The System shall manage **probabilistic standard verifications** using all types of observations inside an **area stratification**.

VERSUS2-MAN_VER-40

[Priority: A] For **Area Verifications,** the System shall do upscaling observations using grid related to the model to verify.

VERSUS2-MAN_VER-41

[Priority: B] The System shall manage **probabilistic standard verifications** using all parameters for observations data present in the **DB**.

VERSUS2-MAN_VER-42

[Priority: B] The System shall manage **probabilistic standard verifications** using all parameters for forecast data present in the **DB**.

VERSUS2-MAN_VER-43

[Priority: B] New **conditional and standard verifications** for **in-situ observations** shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.

VERSUS2-MAN_VER-44

[Priority: B] The **conditional and standard verifications** of VERSUS shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.

VERSUS2-MAN_VER-45

[Priority: B] The System shall manage **standard and conditional verifications** for **area observations** where matching minimum, maximum, average, percentile of observations and minimum, maximum, average, percentile of forecasts within an area.

VERSUS2-MAN_VER-46

[Priority: C] The System shall manage **Object Oriented verifications** for **gridded observations** within an **area stratification**.

VERSUS2-MAN_VER-47

[Priority: C] The System shall manage **Object Oriented verifications** using **deterministic forecasts**.

VERSUS2-MAN_VER-48

[Priority: C] The System shall manage **Object Oriented verifications** using parameters for observations data present in the **DB**.

VERSUS2-MAN_VER-49

[Priority: C] The System shall manage **Object Oriented verifications** using parameters for forecasts data present in the **DB**.

VERSUS2-MAN_VER-50

[Priority: A] The System shall manage **Fuzzy verifications** for **gridded observations** within an **area stratification**.

VERSUS2-MAN_VER-51

[Priority: A] The System shall manage **Fuzzy verifications** using **deterministic forecasts**.

VERSUS2-MAN_VER-52

[Priority: A] The System shall manage **Fuzzy verifications** using parameters for observations data present in the **DB**.

VERSUS2-MAN_VER-53

[Priority: A] The System shall manage **Fuzzy verifications** using parameters for forecasts data present in the **DB**.

VERSUS2-MAN_VER-54

[Priority: A] The System shall manage **standard verifications** with Bootstrap method and confidence intervals.

VERSUS2-MAN_VER-55

The System shall manage verifications of **CAPE**.

VERSUS2-MAN_VER-56

The System shall manage verifications of convection indexes**.**

3.3.3.4 GENERATION OF NUMERICAL SCORES - GEN_NSC

VERSUS2-GEN_NSC-1

[Priority: A] The System shall calculate statistics of continous variables for **deterministic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-2

The System shall calculate statistics of discrete variables for **deterministic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-3

The System shall calculate **EDS** score for **deterministic verifications** using all types of observations present in the **DB.**

VERSUS2-GEN_NSC-4

[Priority: B] The System shall calculate Score Brier Skill for **probabilistic verifications** using all types of observations present in the **DB.**

VERSUS2-GEN_NSC-5

[Priority: B] The System shall calculate Score Decomposition Brier Skill for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-6

[Priority: B] The System shall calculate Score Reliability/Attribute Diagram for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-7

[Priority: B] The System shall calculate Score Relative Operating Characteristic curve (ROC curve) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-8

[Priority: B] The System shall calculate Score Relative Operating Characteristic area (ROC area) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-9

[Priority: B] The System shall calculate Score Relative Value Score (Cost/Loss Ratio), for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-10

[Priority: B] The System shall calculate Score Rank Histogram (Talagrand Diagram) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-11

[Priority: B] The System shall calculate Score Continuous Ranked Probability (RPSS) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-12

[Priority: B] The System shall calculate Score Ignorance (Logarithmic scoring rule) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-13

[Priority: B] The System shall calculate Score Debiased Continuous Ranked Probability (RPSSD) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-14

[Priority: B] The System shall calculate Score Ranked Probability for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-15

[Priority: B] The System shall calculate Score Spread-Skill Relation: **EPS**-Spread vs. **RMSE** (EPS media - Osservazioni) for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-16

[Priority: B] The System shall calculate statistics for continuous variables for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-17

[Priority: B] The System shall calculate statistics for discrete variables for **probabilistic verifications** using all types of observations present in the **DB**.

VERSUS2-GEN_NSC-18

[Priority: A] The System shall calculate all scores defined in the **DB** using all information into **FeedBack Files**.

VERSUS2-GEN_NSC-19

[Priority: A] The System shall calculate **COSI** Cosmo global score for **deterministic verifications.**

VERSUS2-GEN_NSC-20

[Priority: A] For **COSI** score**,** the system shall calculate all scores, related to **deterministic verifications,** if they were not previuously calculated.

VERSUS2-GEN_NSC-21

[Priority: A] The System shall inherit from VERSUS the scores calculation (continuous and dicotomuous).

3.3.3.5 GENERATION OF GRAPHICAL SCORES - GEN_GSC

VERSUS2-GEN_GSC-1

[Priority: B] The System shall create graphs for Brier Skill Score.

VERSUS2-GEN_GSC-2

[Priority: B] The System shall create graphs for Decomposition Brier Skill Score.

VERSUS2-GEN_GSC-3

[Priority: B] The System shall create graphs for Reliability/Attribute Diagram.

VERSUS2-GEN_GSC-4

[Priority: B] The System shall create graphs for Relative Operating Characteristic curve (ROC curve).

VERSUS2-GEN_GSC-5

[Priority: B] The System shall create graphs for Relative Operating Characteristic curve (ROC area).

VERSUS2-GEN_GSC-6

[Priority: B] The System shall create graphs for Relative Value Score (Cost/Loss Ratio).

VERSUS2-GEN_GSC-7

[Priority: B] The System shall create graphs for Rank Histogram (Talagrand Diagram).

VERSUS2-GEN_GSC-8

[Priority: B] The System shall create graphs for Continuous Ranked Probability Score (RPSS).

VERSUS2-GEN_GSC-9

[Priority: B] The System shall create graphs for Ignorance Score.

VERSUS2-GEN_GSC-10

[Priority: A] The System shall create graphs for **COSI** global score.

VERSUS2-GEN_GSC-11

[Priority: B] The System shall create graphs for **EDS** score.

VERSUS2-GEN_GSC-12

[Priority: B] The System shall create the graphs for **Cross Model** between **deterministic standard and conditional verifications** inside a common **area stratification** and different models.

VERSUS2-GEN_GSC-13

The System shall create the graphs using **deterministic standard and conditional verifications** inside a common **area stratification** and different parameters.

VERSUS2-GEN_GSC-14

[Priority: B] The System shall create graphs for probabilistic scores inside an **area stratification**.

VERSUS2-GEN_GSC-15

[Priority: A] The System shall create graphs for fuzzy scores inside an **area stratification**.

VERSUS2-GEN_GSC-16

[Priority: C] The System shall create graphs for object oriented scores inside an **area stratification**.

VERSUS2-GEN_GSC-17

[Priority: A] **Time Series** graphs of VERSUS shall be extended for all new observations.

VERSUS2-GEN_GSC-18

[Priority: A] **Daily Cycle** graphs of VERSUS shall be extended for all new observations.

VERSUS2-GEN_GSC-19

The System shall create **map graphs** for scores calculated.

3.3.3.6 MANAGEMENT OF GRAPHICAL USER INTERFACE - MAN_GUI

VERSUS2-MAN_GUI-1

[Priority: A] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage new types of observations.

VERSUS2-MAN_GUI-2

[Priority: A] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage **FeedBack Files**.

VERSUS2-MAN_GUI-3

[Priority: B] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage **probabilistic forecasts**.

VERSUS2-MAN_GUI-4

[Priority: B] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage climatology information.

VERSUS2-MAN_GUI-5

[Priority: B] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage subjective forecasts.

VERSUS2-MAN_GUI-6

[Priority: B] The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage post processed forecast with **MOS** and Kalman filter.

VERSUS2-MAN_GUI-7

[Priority: B] The **GUI** of VERSUS, that manage the stratification configuration, shall be extended using special features like distance from sea, lee stations, marine stations.

VERSUS2-MAN_GUI-8

The System shall have a **GUI** to configure **area stratifications** through a **GIS** system.

VERSUS2-MAN_GUI-9

The **GUI** to configure **area stratifications** shall give tools to define a geometrical shape (regular or irregular) on a map.

VERSUS2-MAN_GUI-10

[Priority: A] The **GUI** of VERSUS, that manage the parameter (for observations and for forecasts) configuration, shall be extended to manage new parameters.

VERSUS2-MAN_GUI-11

[Priority: B] The System shall have a **GUI** to configure new **probabilistic models**.

VERSUS2-MAN_GUI-12

[Priority: B] The System shall have a **GUI** to configure new scores.

VERSUS2-MAN_GUI-13

[Priority: A] The System shall have a **GUI** to configure new methods to manage verifications using gridded observations.

VERSUS2-MAN_GUI-14

[Priority: B] The **GUI** to configure new methods for gridded observations shall have a field to define the area through n grid points and a selection of average, maximum, minimum, percentile to calcolate within the area.

VERSUS2-MAN_GUI-15

[Priority: A] The System shall have a **GUI** to manage new **Area Standard Verifications**.

VERSUS2-MAN_GUI-16

[Priority: A] The System shall have a **GUI** to manage new **Area Conditional Verifications**.

VERSUS2-MAN_GUI-17

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose an **area stratification** .

VERSUS2-MAN_GUI-18

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a method for observations and forecasts.

VERSUS2-MAN_GUI-19

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose **in-situ observations** to verify within an area.

VERSUS2-MAN_GUI-20

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose new **remote sensing observations** to verify within an area.

VERSUS2-MAN_GUI-21

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a set of **remote sensing** or **in-situ observations** within the selected **area stratification**.

VERSUS2-MAN_GUI-22

[Priority: A] The **GUI** to manage new **Area Standard Verifications** shall have a option to choose a **deterministic** or **probabilistic model**, a run, a start, a stop and an interval step.

VERSUS2-MAN_GUI-23

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a generic interval for parameters with cumulation.

VERSUS2-MAN_GUI-24

[Priority: A] The **GUI** of VERSUS to manage **Area Standard and Conditional Verifications** shall be extended to choose a generic interval for parameters with cumulation.

VERSUS2-MAN_GUI-25

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose subjective forecasts.

VERSUS2-MAN_GUI-26

[Priority: A] The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use subjective forecasts.

VERSUS2-MAN_GUI-27

[Priority: B] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose post processed forecasts **MOS** and Kalman filter.

VERSUS2-MAN_GUI-28

[Priority: B] The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use post processed forecasts **MOS** and Kalman filter.

VERSUS2-MAN_GUI-29

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose climatology information.

VERSUS2-MAN_GUI-30

[Priority: A] The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use climatology information.

VERSUS2-MAN_GUI-31

[Priority: B] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.

VERSUS2-MAN_GUI-32

[Priority: B] The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.

VERSUS2-MAN_GUI-33

[Priority: A] The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure verifications on periods separated (**weather type verification**).

VERSUS2-MAN_GUI-34

[Priority: A] The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure verifications on periods separated (**weather type verification**).

VERSUS2-MAN_GUI-35

[Priority: A] The **GUI** to manage new **Area Conditional Verifications** shall have the shall have a option to choose a **deterministic model**, a run, a start, a stop and an interval step.

VERSUS2-MAN_GUI-36

[Priority: A] The **GUI** to manage new **Area Conditional Verifications** shall have a option to choose a condition on a model other than to verify.

VERSUS2-MAN_GUI-37

[Priority: A] The **GUI** of VERSUS to manage **Conditional Verifications** shall extend to choose a condition on a model other than to verify.

VERSUS2-MAN_GUI-38

[Priority: A] The System shall have a **GUI** to configure graphics for **COSI** related to **deterministic verifications.**

VERSUS2-MAN_GUI-39

[Priority: A] The System shall have a **GUI** to manage verifications on **FeedBack Files**.

VERSUS2-MAN_GUI-40

[Priority: C] The System shall have a **GUI** to manage **Object Oriented Verifications**.

VERSUS2-MAN_GUI-41

[Priority: A] The System shall have a **GUI** to manage **Fuzzy Verifications**.

VERSUS2-MAN_GUI-42

The **GUI** of VERSUS related to score visualization shall be extended to new scores.

VERSUS2-MAN_GUI-43

The System shall have new **GUIs** to configure graphs on maps.

VERSUS2-MAN_GUI-44

[Priority: A] The **GUIs** of VERSUS to configure graphs shall be extended to new scores.

VERSUS2-MAN_GUI-45

[Priority: B] The System shall have a **GUI** to configure graphs between **deterministic standard and conditional verifications** within a common stratification and different parameters.

VERSUS2-MAN_GUI-46

[Priority: B] The System shall have a **GUI** to configure **Cross Model** graphs between **deterministic standard and conditional verifications** within a common stratification and different models.

VERSUS2-MAN_GUI-47

[Priority: A] The System shall have a **GUI** to configure **Cross Model** graphs between **fuzzy verifications** within a common **area stratification.**

VERSUS2-MAN_GUI-48

[Priority: C] The System shall have a **GUI** to configure **Cross Model** graphs between **object oriented verifications** within a common **area stratification** .

VERSUS2-MAN_GUI-49

The System shall have a **GUI** to configure **Monthly Graphics** for **deterministic standard and conditional verifications** within a common **area stratification**.

VERSUS2-MAN_GUI-50

[Priority: A] The System shall have a **GUI** to configure **Monthly graphics** for **Fuzzy Verifications** within a common **area stratification**.

VERSUS2-MAN_GUI-51

[Priority: C] The System shall have a **GUI** to configure **Monthly graphics** for **Object Oriented Verifications** within a common **area stratification**.

VERSUS2-MAN_GUI-52

[Priority: A] The **GUI** of VERSUS to configure **Times Series graphics** shall be extended to new observations.

VERSUS2-MAN_GUI-53

[Priority: A] The **GUI** of VERSUS to configure **Daily Cycle graphics** shall be extended to new observations.

3.3.3.7 MANAGEMENT OF DATABASE - MAN_DB

VERSUS2-MAN_DB-1

[Priority: A] The System shall store **in-situ observations** in raw format and decoded to station level.

VERSUS2-MAN_DB-2

[Priority: A] The System shall store **remote sensing observations** in raw format.

VERSUS2-MAN_DB-3

[Priority: A] The System shall store **FeedBack files** in raw format.

VERSUS2-MAN_DB-4

[Priority: A] The raw observations shall be classified for type, source, parameters and input format.

VERSUS2-MAN_DB-5

[Priority: A] The System shall store **deterministic forecasts** in raw format and classified for model, run, parameter, data validity, step.

VERSUS2-MAN_DB-6

[Priority: B] The System shall store **probabilistic forecasts** in raw format and classified for model, run, parameter, data validity, step, member.

VERSUS2-MAN_DB-7

[Priority: B] The System shall store climatology information.

VERSUS2-MAN_DB-8

[Priority: B] The System shall store subjective forecasts.

VERSUS2-MAN_DB-9

[Priority: B] The System shall store post processed forecasts.

VERSUS2-MAN_DB-10

[Priority: A] The System shall store new **Front Ends** configurations.

VERSUS2-MAN_DB-11

[Priority: A] The System shall store **area stratifications** configurations.

VERSUS2-MAN_DB-12

[Priority: B] The System shall store **probabilistic models** configurations.

VERSUS2-MAN_DB-13

[Priority: A] The System shall store new methods configurations.

VERSUS2-MAN_DB-14

[Priority: A] The System shall store new scores configurations.

VERSUS2-MAN_DB-15

[Priority: A] The System shall store **Area Standard Verifications** configurations.

VERSUS2-MAN_DB-16

[Priority: A] The System shall store **Area Conditional Verifications** configurations.

VERSUS2-MAN_DB-17

[Priority: A] The System shall store **Fuzzy Verifications** configurations.

VERSUS2-MAN_DB-18

[Priority: C] The System shall store **Object Oriented Verifications** configurations

VERSUS2-MAN_DB-19

[Priority: A] The System shall store new calculated numerical scores.

VERSUS2-MAN_DB-20

[Priority: A] The System shall store all graphs related to scores.

VERSUS2-MAN_DB-21

[Priority: A] The System shall classify all numerical scores and graphics related to types of verifications.

3.2.4 NON-FUNCTIONAL REQUIREMENTS

CONSTRAINT PROJECT (CP)

VERSUS2-CP-1

The System shall use a multiplatform **DB** version.

INTERFACE (INT)

VERSUS2_INT-1

The System shall use modules from other applications through the use of a standard data format.

VERSUS2_INT-2

The System shall use extra **R** applications using data already loaded in the database.

VERSUS2_INT-3

The System shall use modules from **MET** software.

VERSUS2_INT-4

The System shall store results from **MET** modules on local system and possibly in the database.

OPERATIVE (OPR)

VERSUS2_OPR-1

[Priority: A] The System shall have an installation package.

VERSUS2_OPR-2

[Priority: A] The System shall use Phoenix libraries to decode input data.

VERSUS2_OPR-3

[Priorità: A] The System shall include Fuzzy Tool Box.

CHAPTER 4 – PROJECT

4.1 INTRODUCTION

In this chapter it will be presented system project through these activities:

1. Decomposition of the System in Configuration Items (CI) (paragraph "4.3 SYSTEM CONFIGURATION");
2. Definition of CI to Develop, To Extend (paragraph "4.4 CI TO DEVELOP AND TO EXTEND") and External (paragraph "4.5 EXTERN CI").

4.2 DEFINITIONS

This paragraph will present all acronyms used in this charter.

CI	Configuration Item
CI SW	Software Configuration Item

4.3 SYSTEM CONFIGURATION

The decomposition of the system in CI is derived from assessments of aspects of engineering and economics of production during the development cycle. To identify each Configuration Item, it needs

- bring together all homogeneous functions;
- identify simple interfaces between other CIs;
- reduce the interaction between CIs.

In VERSUS 2 each Configuration Item will be identified through:

- a code, to use during this document
- the information if CI has to be developed, extended or external

VERSUS 2 extends VERSUS for:

- input data (observations, forecasts and assimilation cycle)
  - **observations**: point and area
  - **forecasts**: deterministic models and probabilistic models
  - **assimilation cycle**
- Deterministic standard and conditional verifications for new data observations
- Probabilistic verifications using new probabilistic models
- Object Oriented Verifcations
- Fuzzy Verifications
- Continuous and dicotomuous scores for deterministic verifications using new observations
- Probabilistic scores for probabilistic verifications
- Object Oriented scores for object oriented verifications
- Fuzzy scores for fuzzy verifications
- Graphs for new scores.
- Integration of modules from other applications (**MET**).

For VERSUS 2 it will define a CI SW list classified like to Develop, To Extend e External.

CI SW Acronym	CI SW - Description	CI To Develop	CI To Extend	CI External
CI_DB	**CI associated to database**	**X**	**X**	
CI_AUX_DB	**CI to manage database comunication**	**X**		
CI_ACQ	**CI for acquisition data**	**X**	**X**	
CI_SCORE	**CI to calculate scores**	**X**	**X**	
CI_GRAPH	**CI to generate plots**	**X**	**X**	
CI_GEN_VER	**CI to generate verifications**	**X**	**X**	
CI_WEB_GUI	**CI to manage graphical user interface**	**X**	**X**	
CI_INSTALL	**CI for system installation**		**X**	
CI_MET	**MET external tool for verifications**			**X**
CI_R	**R application**			**X**
CI_FUZZY	**Fuzzy Tool box**			**X**
CI_WEB_GIS	**API for GIS functions**			**X**
CI_PHOENIX	**API to decode input data**			**X**
CI_JPGRAPH	**Graphic libraries to create classic plots**			**X**

Table 1 – List of Configuration Items (CI)

4.4 CI TO DEVELOP AND TO EXTEND

Now it will be present all CIs to Develop and to Extend, if they are present in VERSUS.

CI_DB

This CI is the core of the system because it manages the VERSUS 2 database.

CI_AUX_DB

This CI manages the comunication between CI_DB and others CIs.

CI_ACQ

This CI manages all functions related to the acquisition data (observations and forecasts), special care this CI has for decoding data before to put them in the **DB**.

CI_GEN_VER

This CI manages the data retrieving and uses them to generate configurated verifications in the VERSUS 2 database.

CI_SCORE

The CI_ SCORE manages scores calculation for each verification in the **DB**.

CI_GRAPH

This CI manages the graphs creation. With VERSUS 2 it shall be possibile to create classic graphics and additionally graphs with maps in background to represent geolocation data.

CI_WEB_GUI

CI_WEB_GUI manages graphical user interface through which user interacts with VERSUS 2 system.

CI_INSTALL

This CI manages the installation package for VERSUS 2.

4.5 EXTERN CI

This paragraph will present all external CIs, for them it is not necessary the development but it is important the integration with the internal CIs that use their functions.

CI_MET

MET - The Model Evaluation Tools (MET) verification package has been developed to provide this capability and to aid the Developmental Testbed Center (DTC) in testing and evaluation of the Weather Research and Forecasting (WRF) model.

Version 1.0 of MET was released in January 2008. MET version 1.1 followed in July 2008, and we expect to announce the release of version 2.0 in late winter 2009.
MET development was initiated by the DTC in 2006 in response to the needs of the forecasting and research communities and the DTC for forecast evaluation tools that are appropriate for assessing the performance of forecasts produced by high-resolution NWP models. The major goals considered in the design of MET focused on (i) incorporating state-of-the-art capabilities; (ii) making the tools freely available to the operational, research, model development, verification, and user communities (hereafter, referred to as “the community”); (iii) enabling the community to help create the tools through contributed methods and display capabilities.
MET is designed to be modular so that new tools can be incorporated with relative ease. The tools generally are written in the C++ programming language. However, they are highly configurable through the use of ASCII configuration files and command-line arguments.

For documentation: *http://www.dtcenter.org/met/users/docs/overview.php*

CI_R

R is an integrated suite of software facilities for data manipulation, calculation and graphical display. It includes

- an effective data handling and storage facility,
- a suite of operators for calculations on arrays, in particular matrices,
- a large, coherent, integrated collection of intermediate tools for data analysis,
- graphical facilities for data analysis and display either on-screen or on hardcopy, and
- a well-developed, simple and effective programming language which includes conditionals, loops, user-defined recursive functions and input and output facilities.

The term "environment" is intended to characterize it as a fully planned and coherent system, rather than an incremental accretion of very specific and inflexible tools, as is frequently the case with other data analysis software.
For documentation: *http://www.r-project.org/other-docs.html*

CI_PHOENIX

Phoenix (PHP Object Environment for Numerical Integration with Xml) has been created by CNMCA-Operational Suite Section, and has PHP objects that use GribApi and Bufrdcto code and decode GRIB and BUFR input data.

CI_FUZZY

It is a tool for fuzzy verifications management, it is created using IDL. IDL is the preferred computing environment for understanding complex data through interactive visualization and analysis. For documentation:

http://www.bom.gov.au/bmrc/wefor/staff/eee/Ebert_Fuzzy_MetApps2008.pdf

CI_WEB_GIS

To use GIS functions, this CI shall be OpenLayers.

OpenLayers makes it easy to put a dynamic map in any web page. It can display map tiles and markers loaded from any source. MetaCarta developed the initial version of OpenLayers and gave it to the public to further the use of geographic information of all kinds. OpenLayers is completely free, Open Source JavaScript, released under a BSD-style License.

For documentation: *http://openlayers.org*

4.6 SOFTWARES REQUIREMENTS

In this paragraph you can find the system configuration and all softwares used by VERSUS 2.

Kernel	2.6.21
RDBMS	MySQL v.5.x with engine INNODB
Interpreter	PHP v.5.5.1 with these additional modules: • MYSQL • gd v.2.0 graphic library • XML DOM • Apache
Web Server	Apache 2.x
Gis Server	MapServer
Tools for Plots Generation	JPgraph, R (with package Spatial)

Tools for Scores Calculation	R project with these additional packages: • DBI v 0.2.3 • RMYSQL 0.6.0 • CircStats v. 0.2.3 • WaveSlim v. 1.6 • Fields v. 3.5 • Verification v 1.20
Data Decoding	BUFR LIB GRIB API SWIG v.1.3.31 or upper NetCDF library

CHAPTER 5 CI SW

This chapter will present all CI SW to be developped and extended already defined in the paragraph "4.3 SYSTEM CONFIGURATION".

5.1 CI_DB

5.1.1 Description

This configuration item manages the database, core of the VERSUS system.

In the database it shall be store all input data (observations and forecasts), verifications, scores and their graphs. For verifications configuration it will be necessary to store other information about stratifications, methods, parameters and forecast models. All these information shall be stored and updated through graphical user interface.

5.1.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

CODE	DESCRIPTION
VERSUS2-MAN_DB-1	**[Priority: A]** The System shall store **in-situ observations** in raw format and decoded to station level.
VERSUS2-MAN_DB-2	**[Priority: A]** The System shall store **remote sensing observations** in raw format.
VERSUS2-MAN_DB-3	**[Priority: A]** The System shall store **FeedBack files** in raw format.
VERSUS2-MAN_DB-4	**[Priority: A]** The raw observations shall be classified for type, source, parameters and input format.
VERSUS2-MAN_DB-5	**[Priority: A]** The System shall store **deterministic forecasts** in raw format and classified for model, run, parameter, data validity, step.
VERSUS2-MAN_DB-6	**[Priority: B]** The System shall store **probabilistic forecasts** in raw format and classified for model, run, parameter, data validity, step, member.
VERSUS2-MAN_DB-7	**[Priority: B]** The System shall store climatology information.
VERSUS2-MAN_DB-8	**[Priority: B]** The System shall store subjective forecasts.
VERSUS2-MAN_DB-9	**[Priority: B]** The System shall store post processed forecasts.
VERSUS2-MAN_DB-10	**[Priority: A]** The System shall store new **Front Ends** configurations.
VERSUS2-MAN_DB-11	**[Priority: A]** The System shall store **area stratifications** configurations.
VERSUS2-MAN_DB-12	**[Priority: B]** The System shall store **probabilistic models** configurations.
VERSUS2-MAN_DB-13	**[Priority: A]** The System shall store new methods configurations.
VERSUS2-MAN_DB-14	**[Priority: A]** The System shall store new scores configurations.
VERSUS2-MAN_DB-15	**[Priority: A]** The System shall store **Area Standard Verifications** configurations.
VERSUS2-MAN_DB-16	**[Priority: A]** The System shall store **Area Conditional Verifications** configurations.

VERSUS2-MAN_DB-17	**[Priority: A]** The System shall store **Fuzzy Verifications** configurations.
VERSUS2-MAN_DB-18	**[Priority: C]** The System shall store **Object Oriented Verifications** configurations
VERSUS2-MAN_DB-19	**[Priority: A]** The System shall store new calculated numerical scores.
VERSUS2-MAN_DB-20	**[Priority: A]** The System shall store all graphs related to scores.
VERSUS2-MAN_DB-21	**[Priority: A]** The System shall classify all numerical scores and graphics related to types of verifications.

5.1.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

Actors are users and/or external systems (to VERSUS 2) and/or internal subsystems (CI) interact with current CI and give and/or take information to/from current CI.

For CI_DB there are these actors:

- CI_AUX_DB, it is subsystem that manages the communication between database and all others configuration items. This subsystem manages all query (select, insert, dolete) and the notification for the executed query.

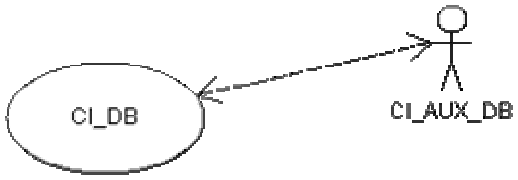


Figure 3. Context Diagram CI_DB

5.1.4 Project

5.1.4.1 Description

The design of this CI will present the static and the dynamic view. For static view, it will be presented the set of local areas into database. For dynamic view, it will be presented data flows between CIs.

5.1.4.2 Static View

This paragraph will present static view and all logical areas that shall be into VERSUS 2 database. 'Logical Area' is an area where there are similar data for type or source. In VERSUS 2 shall be:

- **Observations Area:** it contains all information about observations data**.** It can be divided in:
    - **Area Observations**: gridded observations stored in **GRIB** or/and **NetCDF** format. VERSUS 2 shall ingest data from Radar, Satellite, **LIDAR**, gridded precipitation data obtained from raingauges network, **RADIANCES, RADIO OCCULTATIONS**, **SCATTEROMETER**. This area shall be developed ex-novo.

  - **Point Observations:** VERSUS 2 shall ingest: **Synop**, Temp, **PILOT**, **SATOB**, **E-GVAP**, **WINDPROFILER**, **PAOB**, **DRIBU**, **BUOY**. This area shall be extended to new types of observations.
  - **Route Observations**: observations from aircrafts or ships. VERSUS 2 shall ingest: **AIREP**, **SHIP**, **AMDAR**. This area shall be developed ex-novo.
  - **Reference Climatology**. This area shall be developed ex-novo.
- **Forecasts and Assimilation Cycle Area:** it contains all information about forecasts and assimilation cycle data. It can be divided in:
  - **Grib**: forecasts from **deterministic** and **probabilistic models**. In VERSUS the Grib Area manages only forecasts from determinist models to point level. For each configurated station, the system stores in the db the best values in accordance with the method chosen. This technique shall be extended to probabilistic models. In VERSUS 2 it shall be possible to store deterministic and probabilistic forecsts in raw format.
  - **Post-Processing**: file **XML** files from **MOS** and Kalman filter. This area shall be developed ex-novo.
  - **FeedBack files**: these files shall be stored in raw format into a special area, this area shall be developed ex-novo. These data are decoded only when they are used for scores calculation.
  - **Subjective Forecasts:** these files shall be stored into a special area, this area shall be developed ex-novo.
- **Verifications Configuration Area:** it contains all information related to verifications to execute. It can be divided in:
  - **Point Verifications Configuration:** this area shall be extended to new point observations and new requirements.
  - **Area and Fuzzy Verifications Configuration**: this area manages area and fuzzy verifications. This area shall be developed ex-novo.
  - **Object Oriented Verifications Configurations**: this area manages area and object oriented verifications. This area shall be developed ex-novo.
- **Score Area:** it contains all information related to numerical scores and their graphical rappresentations. It can be divided in:
  - **Numerical Scores**: this area manages the numerical scores storage. This area shall be extended for new point scores while shall be created ex-novo for area scores.
  - **Graphical Scores:** : this area manages the graphs related to numerical scores. This area shall extended for new point scores while shall be created ex-novo for area scores.
- **Registry Area:** it contains all information for system configuration. It can be divided in:
  - **Stations:** this area shall not change.
  - **Users:** this area shall not change.
  - **Sources:** it contains the information about the sources that are not meterological stations, so RADAR, satellite, ships, aircrafts, etc… This area shall be develop ex-novo.

- **Stratifications**: this area shall not change for point stratifications while shall be created ex-novo for area stratifications.
- **Front End**: this area shall be extended to new data to acquire.
- **Models and Products**: this area shall be extended to new types of probabilistic forecasts.

5.1.4.3 Dynamic View

For CI_DB it is not possibile to define a dynamic view because only the processes that interact with it define data flows and a dynamic view.

5.1.4.4 Operational Architecture

This CI is the VERSUS 2 database created with RDBMS Mysql and engine INNODB because this system needs foreign keys. User can use this database through graphical user interface or using mysql commands line. To consult database you can use this command:

mysql –u versus –p

USE versus

After you have choosen the database 'versus', you can do all queries using commands line in standard SQL.

5.2 CI_AUX_DB

5.2.1 Description

The CI_AUX_DB is the configuration item that manages the access to database from other components; this CI creates a connection between different functional areas and data stored into database.

The design of this CI provides an interface that realizes the physical data independence, it means the ability to change the physical schema without changing the logical schema. The main functions that CI_AUX_DB manages are:

- connection/disconnection,
- inserting,
- updating,
- retrieving.

5.2.2 Requirements

Almost all functional requirements for VERSUS 2 need to access to DB, so to this CI will be assigned all requirements that access to the database.

5.2.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

For CI_AUX_DB there are these actors:

- CI_WEB_GUI, it is the subsystem that manages data into database through graphical user interface.

- CI_ACQ, it is the subsystem that manages data acquisition using Front Ends configuration in the database.
- CI_SCORE, it is the subsystem that manages scores calculation and stores them in the database.
- CI_GEN_VER, it is the subsystem that manages retrieving data from database to verifications generation.
- CI_GRAPH, it is the subsystem that manages graphs generation and stores them in the database.
- CI_DB, it is the subsystem that manages the communication between database and others VERSUS 2 CIs.

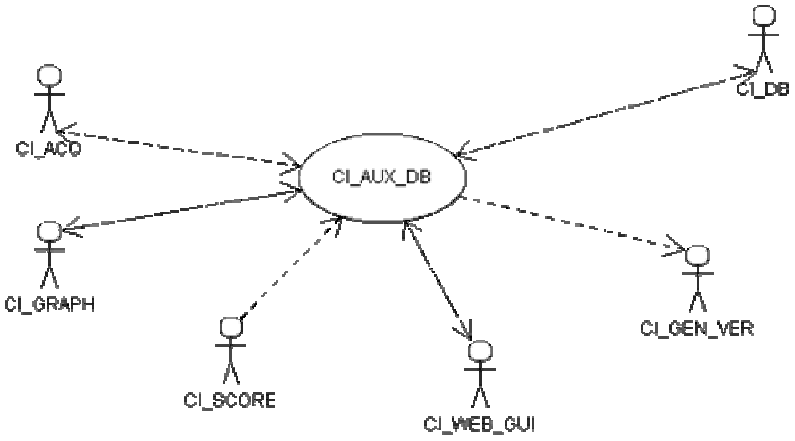


Figure 4. Context Diagram CI_AUX_DB

5.2.4 Project

5.2.4.1 Description

The CI_AUX_DB gives a library services for database access. All processes will use these services to comunicate with database.

5.2.4.2 Static View

This paragraph will present the current CI_AUX_DB using the types of operations it can do.Services manage connection/disconnection to MySQL database are:

- **ConnectionOpen**: creates a physic-logic connection using a name and others parameters and returns a ConnectionHandle. This handle will be used by other services that have to communicate with database;
- **ConnectionClose**: closes the connection and obtains the handle previously created;

For data retrieving:

- **QueryPrepare**, it allocates all necessary structures for the query, it prepares the select statement and generates QueryHandle;
- **FetchAllInFile**, from QueryHandle it returns dataset found in a file.
- **FetchAll**, from QueryHandle it returns dataset found in the memory.
- **QueryDispose**, it deallocates the structures previously allocated.

For execution SQL statements (statements different from SELECT, so INSERT, UPDATE and DELETE) it uses StatementExec.

5.2.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

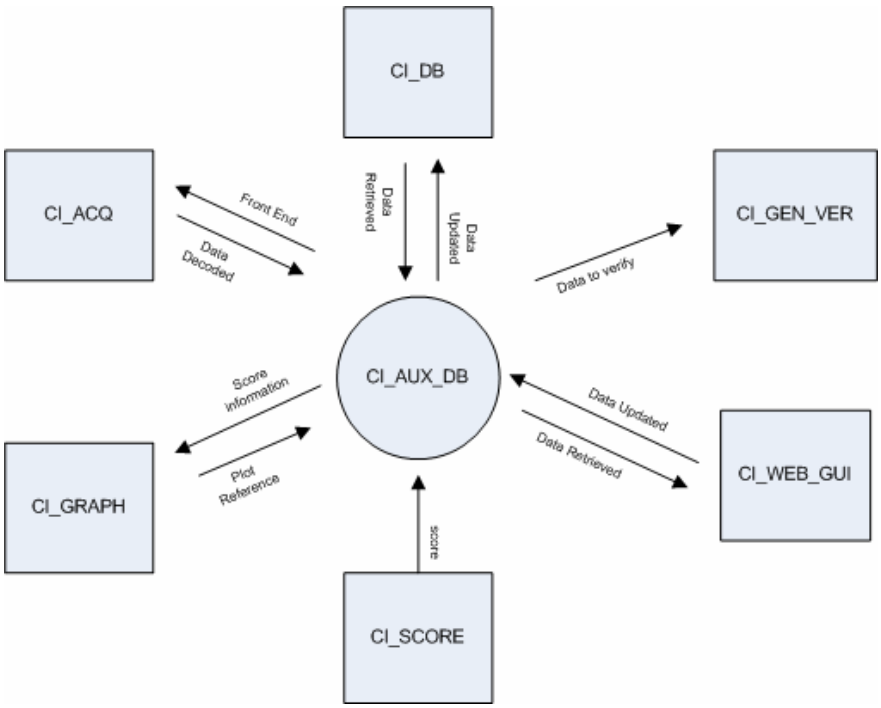


Figure 5. DFD Level 0 – CI_AUX_DB

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_AUX_DB	**CI_DB**	**Data Updated**	CI_AUX_DB send to CI_DB all updated data from GUI or other CIs.
CI_DB	**CI_AUX_DB**	**Data Retrieved**	CI_DB send to CI_AUX_DB all data necessary for others CIs.
CI_AUX_DB	**CI_GEN_VER**	**Data to Verify**	CI_AUX_DB send to CI_GEN_VER all information used for verifications generation.
CI_AUX_DB	**CI_WEB_GUI**	**Data Retrieved**	CI_AUX_DB send to CI_WEB_GUI all data to

			show.
CI_WEB_GUI	**CI_AUX_DB**	**Data Updated**	CI_WEB_GUI send to CI_AUX_DB all updated data from GUI to insert in the DB.
CI_SCORE	**CI_AUX_DB**	**Score**	After scores calculation, CI_SCORE send them to CI_AUX_DB to insert them in the database.
CI_AUX_DB	**CI_GRAPH**	**Score Information**	CI_AUX_DB send to CI_GRAPH all information to graphics generation (data and graphic configuration)
CI_GRAPH	**CI_AUX_DB**	**Plot reference**	CI_GRAPH send to CI_AUX_DB all reference to created graphics.
CI_AUX_DB	**CI_ACQ**	**Front End**	CI_AUX_DB send to CI_ACQ all information about Front End.
CI_ACQ	**CI_AUX_DB**	**Decoded Data**	CI_ACQ send to CI_AUX_DB decoded data to insert them in the database.

5.2.4.4 Operational Architecture

This CI is a package with libraries to manage all activities with database using php objects (PDO - PHP Data Object). PDO provides a data-access abstraction layer, which means that, regardless of which database you're using, you use the same functions to issue queries and fetch data. PDO does not provide a database abstraction; it doesn't rewrite SQL or emulate missing features. You should use a full-blown abstraction layer if you need that facility.

PDO ships with PHP 5.1, and is available as a PECL extension for PHP 5.0; PDO requires the new OO features in the core of PHP 5, and so will not run with earlier versions of PHP.

5.3 CI_ACQ

5.3.1 Description

The CI_ACQ manages acquisition and decoding input data (observations and forecasts).

VERSUS 2 shall ingest these observations data:

- **Remote sensing observations**: Radar, **LIDAR**, Satellite data (**RADIANCES**, **RADIO OCCULTATIONS), SCATTEROMETER, E-GVAP**.
- **In-situ observations:** data like **Synop**, Temp, **PILOT**, **SATOB**, **WINDPROFILER**, **PAOB**, **DRIBU**, **BUOY, raingauges network, AIREP, SHIP, AMDAR**.
- **Reference Climatology**: data from climatology.

VERSUS 2 shall ingest these forecasts and assimilation cycle data:

- **Grib**: forecasts from deterministic and probabilist models.
- **Post Processed Forecast**: **XML** files from **MOS** and Kalman filter.
- **FeedBack files**, these files containes traditional observations, the deviation of forecasts and information on data quality and status.
- **Subjective Forecasts**.

5.3.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_ACQ_OBS-1	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from TEMP parts B, C, D of temperature, wind (speed, direction, u-v component), humidity, geopotential, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-2	**[Priority: A]** The **Front End** for the acquisition and the decoding of TEMP parts B, C, D shall be the extension of the present **Front End** for TEMP part A of VERSUS**.**
VERSUS2_ACQ_OBS-3	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** SYNOP, special care have to taken to verify all cloud cover levels, wind gusts, different cumulations of precipitation and to calculate u-v component for wind, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-4	**[Priority: A]** The **Front End** for the acquisition and decoding of new parameters for SYNOP shall be the extension of the present **Front End** for **SYNOP** of VERSUS**.**
VERSUS2_ACQ_OBS-5	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from raingauges in grid and **NETCDF** format**.**
VERSUS2_ACQ_OBS-6	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from satellite in grid Lat/Lon (regular or rotated) and **NETCDF** format.
VERSUS2_ACQ_OBS-7	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR for precipitation and wind, in particular **VAD** and later radial, in grid Lat/Lon (regular or rotated) and **NETCDF** format.
VERSUS2_ACQ_OBS-8	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR using different grids related to the models to verify.
VERSUS2_ACQ_OBS-9	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of observations from high-resolution precipitation network and/or composition with radar and/o satellite data in grid Lat/Lon (regular or rotated) and **NETCDF** format.
VERSUS2_ACQ_OBS-10	**[Priority: A]** The System shall have a **Front End** for the

	acquisition and the decoding of **remote sensing observations LIDAR** in grid Lat/Lon (regular or rotated) and **NETCDF** format.
VERSUS2_ACQ_OBS-11	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations SATOB** for wind, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-12	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PILOT** parts A,B,C,D for wind in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-13	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** Satellite **RADIANCES** in grid and **NETCDF** format.
VERSUS2_ACQ_OBS-14	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations GPS** humidity from **E-GVAP**, in **BUFR** and **NETCDF** format .
VERSUS2_ACQ_OBS-15	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations WINDPROFILER** of wind, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-16	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PAOB**, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-17	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations DRIBU** for pressure and wind, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-18	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations BUOY** in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-19	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AIREP**, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-20	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AMDAR**, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-21	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from ship, **SHIP**, in **BUFR** and **NETCDF** format.
VERSUS2_ACQ_OBS-22	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations SCATTEROMETER**, in grid Lat/Lon (regular or rotated) and **NETCDF** format.
VERSUS2_ACQ_OBS-23	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** Satellite **RADIO OCCULTATIONS**, in **BUFR** and **NETCDF** format..
VERSUS2_ACQ_OBS-24	**[Priority: A]** All **Front Ends** verify the wind shall be capable to manage it like u-v component and strength-intensity.
VERSUS2_ACQ_OBS-25	**[Priority: A]** The System shall have a Front End for the acquisition of **FeedBack Files** in raw format and **NETCDF** format.

VERSUS2_ACQ_FCS-1	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **deterministic forecast** in **GRIB2** and **NETCDF** format.
VERSUS2_ACQ_FCS-2	**[Priority: A]** The **Front End** for the acquisition and the decoding of **deterministic forecast** shall be the extension of the present **Front End** for **deterministic forecast** of VERSUS in **GRIB1** format.
VERSUS2_ACQ_FCS-3	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.
VERSUS2_ACQ_FCS-4	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-LEPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.
VERSUS2_ACQ_FCS-5	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **ECMWF-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.
VERSUS2_ACQ_FCS-6	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-SREPS** model in **GRIB1**, **GRIB2** and **NETCDF** format .
VERSUS2_ACQ_FCS-7	**[Priority: B]** The System shall have a **Front End** for the acquisition, the decoding and the updating of climatology in **ASCII** format.
VERSUS2_ACQ_FCS-8	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of subjective forecasts in **XML** format.
VERSUS2_ACQ_FCS-9	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts MOS** in **XML** format.
VERSUS2_ACQ_FCS-10	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts** with Kalman filter in **XML** format.

Non-functional Requirements

Code	Text
VERSUS2_OPR-2	The System shall use Phoenix libraries to decode input data

5.3.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

CI_ACQ has these actors:

- CI_AUX_DB, it is the subsystem that provides all information about Front End, Stations, Sources, Models and Method and put decoded data in the database after the acquisistion process.
- CI_WEB_GUI, it is the subsystem that start the acquisition process through graphical user interface.
- CI_PHOENIX, it is the external subsystem used to decode input data.
- CI_MET, it is the external system used to decode input data in NETCDF format.

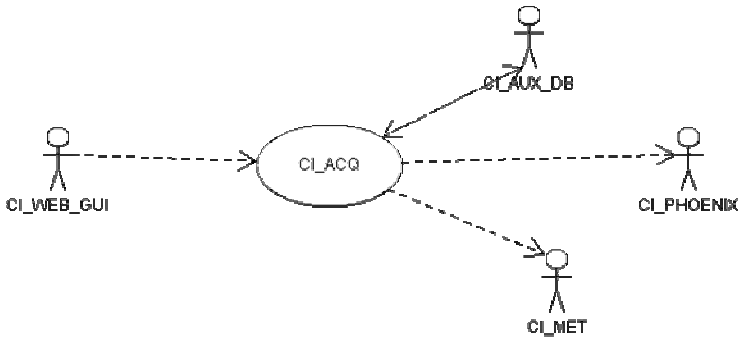


Figure 6. Context Diagram CI_ACQ

5.3.4 Project

5.3.4.1 Description

CI_ACQ works through Loader Front End that manages the acquisition data (observations and forecasts), the decoding and the storage in the database.

5.3.4.2 Static View

This paragraph will present the static view so the association between data and logic areas into database where these data are stored.

Observations:

- Gridded Observations in **GRIB** or/and **NetCDF** format. VERSUS 2 will ingest: Radar, Satellite, **LIDAR**, raingauges network, **RADIO OCCULTATIONS, RADIANCES**, **SCATTEROMETER.** These data shall be stored in "Observations Area– Area Observations". For them it shall be developed new **Front Ends** ex-novo. For **GRIB** decoding it shall be integrated Phoenix library, while for **NETCDF** it shall be integrated **MET** system.
- Point Observations
    - from on-site stations. VERSUS 2 will ingest: **Synop**, Temp, **PILOT**, **SATOB**, **E-GVAP**, **WINDPROFILER**, **PAOB**, **DRIBU**, **BUOY.** These data shall be stored in "Observations Area– Point Observations". For Synop and TEMP part C, VERSUS functions shall be extended while for other data types it shall be developed new **Front Ends** ex-novo. For decoding point observations it shall integrated Phoenix libraries.
    - from aircrafts and ships. VERSUS 2 will ingest: **AIREP**, **SHIP**, **AMDAR**. These data shall be stored in "Observations Area – Route Observations". For them it shall be developed new **Front Ends** ex-novo. For decoding point observations it shall integrated Phoenix libraries.
- Climatology Observations, these data shall be stored in "Observations Area– Climatology". For them it shall be developed new **Front Ends** ex-novo.

Forecasts:

- Forecasts from deterministic and probabilistic models. These data shall be stored in "Forecasts and Assimilation Cycle Area – Grib". VERSUS manages only deterministic point forecasts, so VERSUS 2 shall manage probabilistic point forecasts, additionally for deterministic and probabilistic forecasts new **Front Ends** shall be developed to acquire and store data in raw format.

- Post Processed Forecasts. These data shall be stored in “Forecasts and Assimilation Cycle Area – Post-Processing” and new **Front Ends** shall be developed ex-novo.
- Subjective Forecasts. These data shall be stored in “Forecasts and Assimilation Cycle Area – Subjective Forecasts and new **Front Ends** shall be developed ex-novo.

FeedBack files:

These data contains observations, information about data quality and devation of forecasts so they shall be stored in “Forecasts and Assimilation Cycle Area – FeedBack files” and new **Front Ends** shall be developed ex-novo.

5.3.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

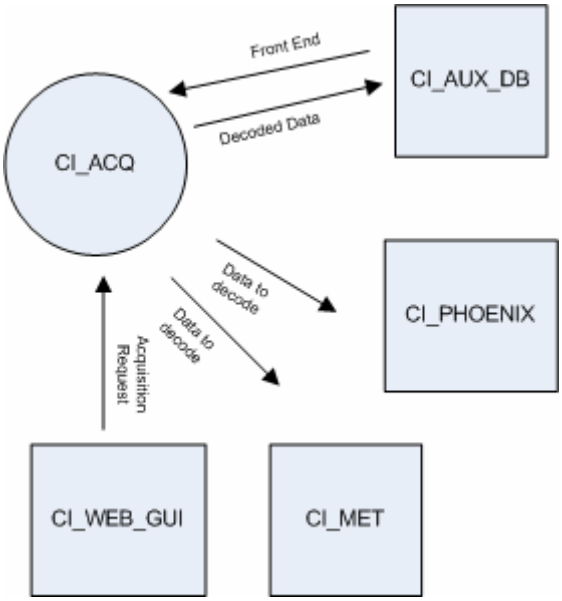


Figure 7. DFD Level 0 – CI_ACQ

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_WEB_GUI	**CI_ACQ**	**Acquisition Request**	CI_WEB_GUI send to CI_ACQ the request of acquisition data.

CI_AUX_DB	**CI_ACQ**	**Front End**	CI_AUX_DB send to CI_ACQ all information about Front End.
CI_ACQ	**CI_AUX_DB**	**Decoded Data**	CI_ACQ send to CI_AUX_DB decoded data to insert them in the database.
CI_ACQ	**CI_PHOENIX**	**Data to decode**	CI_ACQ uses CI_PHOENIX to decode data input
CI_ACQ	**CI_MET**	**Data to decode**	CI_ACQ uses CI_MET to decode data input NETCDF

5.3.4.4 Operational Architecture

CI_ACQ works through the 'loader.php' process. User can activate it through user interface or in batch model using this command line:

php loader.php

This command starts the process that decodes data and inserts decoded data in the database. For each Front End, the process checks if the input directory is empty or not. If there are new files in input directory it means that the process has to start the acquisition. The current process in VERSUS shall be extended to new Front Ends.

5.4 CI_GEN_VER

5.4.1 Description

CI_GEN_VER retrieves data from database and uses them for verifications generation. VERSUS 2 shall manage these verification types:

- **Point Verifications**: they are generated from point observations.
- **Area Verifications,** they are generated from gridded observations.
- **Fuzzy Verifications,** they are generated from gridded observations using fuzzy methods.
- **Object Oriented Verifications,** they are generated from gridded observations using special methods to identify entities to compare.

5.4.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_MAN_VER-1	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on RADAR observations for precipitations and wind.
VERSUS2_MAN_VER-2	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on satellite observations.
VERSUS2_MAN_VER-3	**[Priority: A]** The System shall manage **deterministic**

	standard and conditional verifications based on high-resolution precipitation network and/or composition with RADAR and/or satellite data.
VERSUS2_MAN_VER-4	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **LIDAR** observations.
VERSUS2_MAN_VER-5	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on satellite **RADIANCES** observations.
VERSUS2_MAN_VER-6	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on gridded precipitation data obtained from raingauges network data.
VERSUS2_MAN_VER-7	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **SCATTEROMETER** observations.
VERSUS2_MAN_VER-8	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **PILOT** observations like extension of current Upper air verifications of VERSUS.
VERSUS2_MAN_VER-9	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **TEMP** observations parts B,C,D like extension of current Upper air verifications of VERSUS.
VERSUS2_MAN_VER-10	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using new parameters for **SYNOP** observations like extension of current Surface verifications of VERSUS.
VERSUS2_MAN_VER-11	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **WINDPROFILER** observations like extension of current Surface verifications of VERSUS.
VERSUS2_MAN_VER-12	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **PAOB** observations like extension of current Surface verifications of VERSUS.
VERSUS2_MAN_VER-13	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **DRIBU** observations like extension of current Surface verifications of VERSUS.
VERSUS2_MAN_VER-14	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **AIREP** observations.
VERSUS2_MAN_VER-15	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **SHIP** observations.
VERSUS2_MAN_VER-16	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **AMDAR** observations.
VERSUS2_MAN_VER-17	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **BUOY**

	observations.
VERSUS2_MAN_VER-18	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using satellite **RADIO OCCULTATIONS** like extension of current Surface verifications of VERSUS.
VERSUS2_MAN_VER-19	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using climatology.
VERSUS2_MAN_VER-20	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using subjective forecasts.
VERSUS2_MAN_VER-21	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using post processed forecasts **MOS**.
VERSUS2_MAN_VER-22	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using post processed forecasts with Kalman filter.
VERSUS2_MAN_VER-23	**[Priority: B]** All new **deterministic standard and conditional verifications** shall have seasonal, weekly, daily frequency and for a generic number of days.
VERSUS2_MAN_VER-24	**[Priority: B]** All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall have seasonal, weekly, daily frequency and for a generic number of days.
VERSUS2_MAN_VER-25	**[Priority: A]** All new **deterministic standard and conditional verifications** shall manage cumulations of precipitations over varying time intervals.
VERSUS2_MAN_VER-26	**[Priority: A]** All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall manage cumulations of precipitations over varying time intervals.
VERSUS2_MAN_VER-27	**[Priority: A]** All new **deterministic standard and conditional verifications** shall be defined on periods separated (**weather type verification**).
VERSUS2_MAN_VER-28	**[Priority: A]** All **deterministic standard and conditional verifications** of VERSUS shall be extended on periods sepated (**weather type verification**).
VERSUS2_MAN_VER-29	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all new types of observations inside an **area stratification**.
VERSUS2_MAN_VER-30	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all parameters for observations data present in the **DB**.
VERSUS2_MAN_VER-31	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all parameters for forecasts data present in the **DB**.
VERSUS2_MAN_VER-32	**[Priority: A]** The conditions for new **deterministic conditional verifications** shall be defined using conditions on models on its errors other than the model to verify.
VERSUS2_MAN_VER-33	**[Priority: A]** The conditions for **deterministic conditional verifications** of VERSUS shall be defined using conditions on models on its errors other than the model to verify.
VERSUS2_MAN_VER-34	**[Priority: A]** The conditions for new **deterministic**

	conditional verifications shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.
VERSUS2_MAN_VER-35	**[Priority: A]** The conditions for **deterministic conditional verifications** of VERSUS shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.
VERSUS2_MAN_VER-36	**[Priority: A]** The System shall manage **deterministic conditional verifications** where it is possible to define the area or the station where you want to set the condition. For example, to verify the temperature with the condition that for nearby stations it was cloudy.
VERSUS2_MAN_VER-37	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all **in-situ observations** that the system can verify.
VERSUS2_MAN_VER-38	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all **remote sensing observations** that the system can verify.
VERSUS2_MAN_VER-39	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all types of observations inside an **area stratification**.
VERSUS2_MAN_VER-40	**[Priority: A]** For **Area Verifications,** the System shall do upscaling observations using grid related to the model to verify.
VERSUS2_MAN_VER-41	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all parameters for observations data present in the **DB**.
VERSUS2_MAN_VER-42	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all parameters for forecast data present in the **DB**.
VERSUS2_MAN_VER-43	**[Priority: B]** New **conditional and standard verifications** for **in-situ observations** shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.
VERSUS2_MAN_VER-44	**[Priority: B]** The **conditional and standard verifications** of VERSUS shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.
VERSUS2_MAN_VER-45	**[Priority: B]** The System shall manage **standard and conditional verifications** for **area observations** where matching minimum, maximum, average, percentile of observations and minimum, maximum, average, percentile of forecasts within an area.
VERSUS2_MAN_VER-46	**[Priority: C]** The System shall manage **Object Oriented verifications** for **gridded observations** within an **area stratification**.
VERSUS2_MAN_VER-47	**[Priority: C]** The System shall manage **Object Oriented verifications** using **deterministic forecasts**.
VERSUS2_MAN_VER-48	**[Priority: C]** The System shall manage **Object Oriented verifications** using parameters for observations data present in the **DB**.
VERSUS2_MAN_VER-49	**[Priority: C]** The System shall manage **Object Oriented**

	verifications using parameters for forecasts data present in the **DB**.
VERSUS2_MAN_VER-50	**[Priority: A]** The System shall manage **Fuzzy verifications** for **gridded observations** within an **area stratification**.
VERSUS2_MAN_VER-51	**[Priority: A]** The System shall manage **Fuzzy verifications** using **deterministic forecasts**.
VERSUS2_MAN_VER-52	**[Priority: A]** The System shall manage **Fuzzy verifications** using parameters for observations data present in the **DB**.
VERSUS2_MAN_VER-53	**[Priority: A]** The System shall manage **Fuzzy verifications** using parameters for forecasts data present in the **DB**.
VERSUS2_MAN_VER-54	**[Priority: A]** The System shall manage **standard verifications** with Bootstrap method and confidence intervals.
VERSUS2_MAN_VER-55	The System shall manage verifications of **CAPE**.
VERSUS2_MAN_VER-56	The System shall manage verifications of convection indexes**.**

Non-Functional Requirements

Code	Text
VERSUS2_INT-6	The System shall use modules from **MET** software.
VERSUS2_INT-7	The System shall store results from **MET** modules on local system and possibly in the database
VERSUS2_OPR-3	System shall include **Fuzzy Tool Box**

5.4.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

CI_GEN_VER has these actors:

- CI_AUX_DB, it is the subsystem that gives data for verifications generation.
- CI_SCORE, it is the subsystem that manages scores calculation related to verifications generated by current CI.
- CI_WEB_GUI, it is the subsystem that starts the process for verifications generation through graphical user interface.
- CI_GRAPH, it is the subsystem that manages the graphs creation for caculated scores.
- CI_MET, it is the external system that manages gridded and object oriented verifications.
- CI_FUZZY, it is the external system that manages fuzzy verifications.

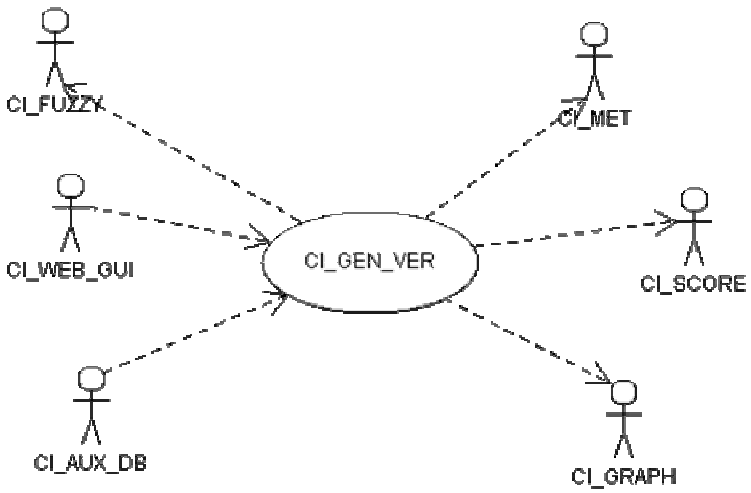


Figure 8. Context Diagram CI_GEN_VER

5.4.4 Project

5.4.4.1 Description

CI_GEN_VER manages the verifications generation using data present in VERSUS 2 database (observations and forecasts) and all verifications configuration defined by user.

5.4.4.2 Static View

In this paragraph i twill be presented the association between verifications and logic areas into database. VERSUS 2 shall manage:

- **Point Verification**, this type of verification for VERSUS 2 shall be developed like extension of VERSUS about:
  - selection of new observations types;
  - selection of new forecasts types, in particular for probabilistic type it will be used the member of model;
  - selection of new periods: daily, weekly, every n days and separated periods;
  - selection of cumulated period for a generic hour.

  This verification will be stored in the logic area “Point Verification configuration”.
- **Area Verification**, this verification type will be stored in the logic area “Area and Fuzzy Verification configuration” and shall be developed ex-novo using these guidelines:
  - selection of verification configuration from database;
  - retrieving data (observations and forecasts) in **GRIB** and **NETCDF** format;
  - selection of score type to calculate;
  - configuration of CI_MET (Grid-Stat) for scores calculation;
  - CI_MET scores will be in ASCII format so it will need to interpret them by CI_GEN_VER and put them into database;

- CI_GRAPH will create the graphics.

- **Fuzzy verification**, this verification type will be stored in the logic area “Area and Fuzzy Verification configuration” and shall be developed ex-novo through Fuzzy tool box integration.
- **FeedBack files Verification,** for this verification type it need a special treatment because these files have observations and forecasts, so the guidelines to follow are:
  - selection of verification configuration from database;
  - retrieving raw data from database related to FeedBack Files;
  - decoding data using the verification configuration (area verification or point verification);
  - numerical scores production;
  - graphical scores production.
- **Object Oriented Verification**, this verification type will be stored in the logic area “Object Oriented Verification configuration” and shall be developed ex-novo using the guidelines presented for “Area Verification” and CI_MET with the module MODE.

5.4.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

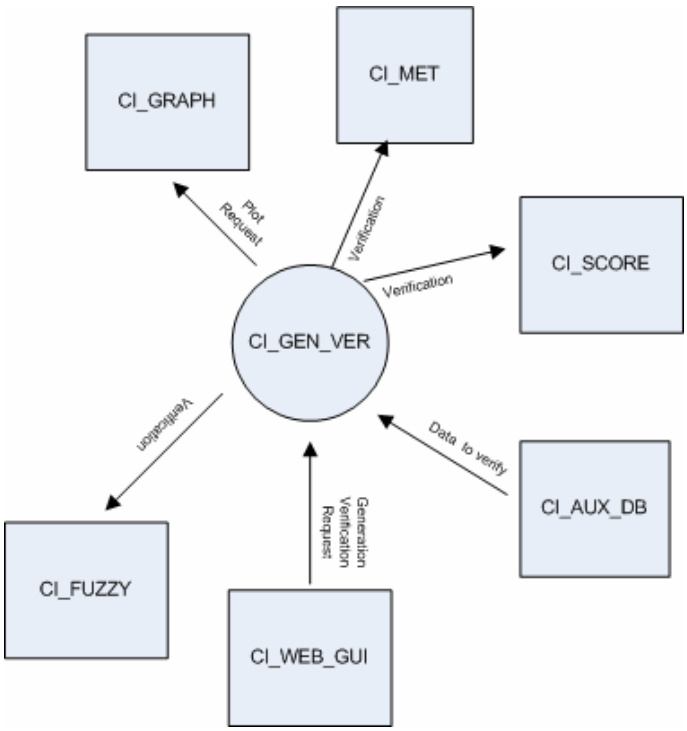


Figure 9. Level 0 – CI_GEN_VER

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_WEB_GUI	**CI_GEN_VER**	**Generation Verification Request**	CI_WEB_GUI send to CI_GEN_VER the request for verification generation.
CI_AUX_DB	**CI_GEN_VER**	**Data to verify**	CI_AUX_DB send to CI_GEN_VER all information used for verifications generation.
CI_GEN_VER	**CI_SCORE**	**Verification**	CI_GEN_VER send to CI_SCORE all information used for scores calculation.
CI_GEN_VER	**CI_GRAPH**	**Plot Request**	CI_GEN_VER send to CI_GRAPH the request for graph creation if into db it is present a graphic configuration.
CI_GEN_VER	**CI_MET**	**Verification**	CI_GEN_VER send to CI_MET all information used for scores related to gridded and object oriented verifications.
CI_GEN_VER	**CI_FUZZY**	**Verification**	CI_GEN_VER send to CI_FUZZY all information used for scores related to fuzzy verifications.

5.4.4.4 Operational Architecture

CI_GEN_VER works through a process that user can activate in batch mode using this command line: ***php verification_configuration.php***

This process is activated once a day, it checks if there are scores to be executed and if related data (forecast and observation) are loaded into DB, then compute the numerical scores and after the related graphical, seasonable configured into DB. The process in VERSUS shall be extended new configurated verifications. The scores calculation and graphics creation can be activated through graphical user interface.

5.5 CI_SCORE

5.5.1 Description

VERSUS 2 shall calcolate different types of scores (paragrafo “5.4 CI_GEN_VER 5.4.4.2 Static View”).

- **Area Scores**, they are scores related to area verifications. The system shall use external modules for scores calculation, after that it shall decode the results in ASCII format.
- **Point Scores**, they are scores related to point verifications. The system shall extend current functions in VERSUS.

5.5.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_GEN_NSC-1	**[Priority: A]** The System shall calculate statistics of continous variables for **deterministic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-2	The System shall calculate statistics of discrete variables for **deterministic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-3	The System shall calculate **EDS** score for **deterministic verifications** using all types of observations present in the **DB.**
VERSUS2_GEN_NSC-4	**[Priority: B]** The System shall calculate Score Brier Skill for **probabilistic verifications** using all types of observations present in the **DB.**
VERSUS2_GEN_NSC-5	**[Priority: B]** The System shall calculate Score Decomposition Brier Skill for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-6	**[Priority: B]** The System shall calculate Score Reliability/Attribute Diagram for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-7	**[Priority: B]** The System shall calculate Score Relative Operating Characteristic curve (ROC curve) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-8	**[Priority: B]** The System shall calculate Score Relative Operating Characteristic area (ROC area) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-9	**[Priority: B]** The System shall calculate Score Relative Value Score (Cost/Loss Ratio), for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-10	**[Priority: B]** The System shall calculate Score Rank Histogram (Talagrand Diagram) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-11	**[Priority: B]** The System shall calculate Score Continuous Ranked Probability (RPSS) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-12	**[Priority: B]** The System shall calculate Score Ignorance (Logarithmic scoring rule) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-13	**[Priority: B]** The System shall calculate Score Debiased Continuous Ranked Probability (RPSSD) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-14	**[Priority: B]** The System shall calculate Score Ranked Probability for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-15	**[Priority: B]** The System shall calculate Score Spread-Skill Relation: **EPS**-Spread vs. **RMSE** (EPS media - Osservazioni) for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-16	**[Priority: B]** The System shall calculate statistics for continuous variables for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-17	**[Priority: B]** The System shall calculate statistics for discrete variables for **probabilistic verifications** using all types of observations present in the **DB**.
VERSUS2_GEN_NSC-18	**[Priority: A]** The System shall calculate all scores defined in the **DB** using all information into **FeedBack Files**.

VERSUS2_GEN_NSC-19	**[Priority: A]** The System shall calculate **COSI** Cosmo global score for **deterministic verifications.**
VERSUS2_GEN_NSC-20	**[Priority: A]** For **COSI** score**,** the system shall calculate all scores, related to **deterministic verifications,** if they were not previuously calculated.
VERSUS2_GEN_NSC-21	**[Priority: A]** The System shall inherit from VERSUS the scores calculation (continuous and dicotomuous).

Non-Functional Requirements

Code	Text
VERSUS2_INT-5	The System shall use extra **R** applications using data already loaded in the database.

5.5.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

For CI_SCORE there are these actors:

- CI_AUX_DB, it is the subsystem that manages the inserting scores in the database.
- CI_GEN_VER, it is the subsystem that manages verifications generation.
- CI_R, it is the subsystem that gives statistical libreries for scores calculation.

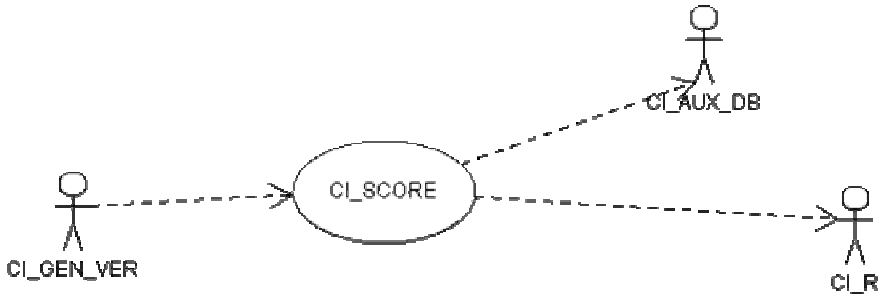


Figure 10. Context Diagram CI_SCORE

5.5.4 Project

5.5.4.1 Description

CI_SCORE manages numerical scores generation associated to verifications into database.

5.5.4.2 Static View

This paragraph will present all functions that CI_SCORE shall do for scores. VERSUS 2 manages two scores types:

- **Point Scores**, they are statistics on verifications with point observations. These data are stored into “Score Area – Numerical Score”. For:
    - **Deterministic scores,** the functions in VERSUS shall be extended to new system requirements.
    - **Probabilistic scores,** these functions shall be developed ex-novo**.**
- **Area Scores,** they are statistics on verifications with gridded observations. VERSUS 2 shall work following these guidelines:
        - Area scores shall be calculated through external tools that shall return ASCII files with the results to CI_GEN_VER;
        - CI_GEN_VER will start CI_SCORE to decode external results results.

    The system will create:

    - **Tradictional scores,** they are tradictional statistics (contingency table and continuous statistics) on area observations. This CI shall decode the results from CI_MET (Grid-Stat).
    - **Fuzzy,** they are fuzzy information on area observations. This CI shall decode the results from CI_FUZZY.
    - **Object Oriented,** they are object oriented diagnostic evaluations on area observations. This CI shall decode the results from CI_MET (MODE).

5.5.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

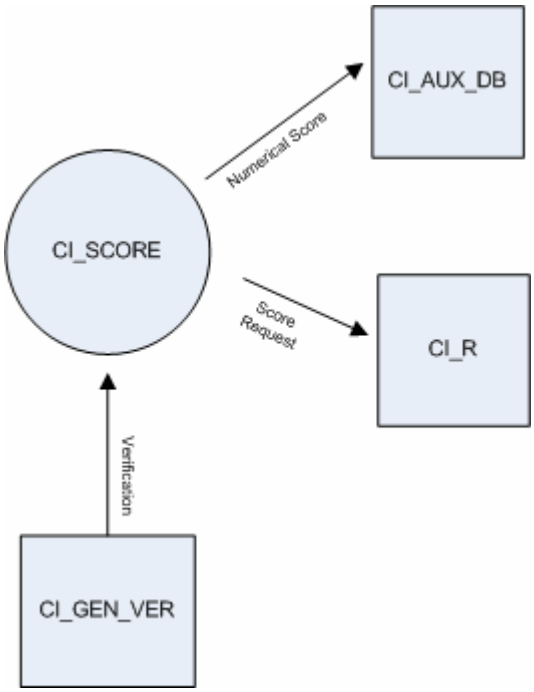


Figure 11. DFD Level 0 – CI_SCORE

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_SCORE	**CI_AUX_DB**	**Data to verify**	CI_SCORE send to CI_AUX_DB all numerical scores to store.
CI_GEN_VER	**CI_SCORE**	**Verification**	CI_GEN_VER send to CI_SCORE all information for scores calculation associated to verifications.
CI_SCORE	**CI_R**	**Score Request**	CI_SCORE send CI_R a request for score generation with all necessari information.

5.5.4.4 Operational Architecture

This CI is activated by 'verification_generation.php' process, it is common with CI_GEN_VER. This process, infact, manages verifications generation and scores calculation.

5.6 CI_GRAPH

5.6.1 Description

CI_GRAPH manages the graphics generation associated to numerical scores previously calculated. VERSUS 2 shall create two types of graphics:

- **Graph**: they are traditional graph that represent data like diagram.
- **Map Graph**: they are graphics that use maps in background to represent geolocated data.

5.6.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_GEN_GSC-1	**[Priority: B]** The System shall create graphs for Brier Skill Score.
VERSUS2_GEN_GSC-2	**[Priority: B]** The System shall create graphs for Decomposition Brier Skill Score.
VERSUS2_GEN_GSC-3	**[Priority: B]** The System shall create graphs for Reliability/Attribute Diagram.
VERSUS2_GEN_GSC-4	**[Priority: B]** The System shall create graphs for Relative Operating Characteristic curve (ROC curve).
VERSUS2_GEN_GSC-5	**[Priority: B]** The System shall create graphs for Relative Operating Characteristic curve (ROC area).
VERSUS2_GEN_GSC-6	**[Priority: B]** The System shall create graphs for Relative Value Score (Cost/Loss Ratio).
VERSUS2_GEN_GSC-7	**[Priority: B]** The System shall create graphs for Rank Histogram (Talagrand Diagram).
VERSUS2_GEN_GSC-8	**[Priority: B]** The System shall create graphs for Continuous Ranked Probability Score (RPSS).
VERSUS2_GEN_GSC-9	**[Priority: B]** The System shall create graphs for Ignorance Score.
VERSUS2_GEN_GSC-10	**[Priority: A]** The System shall create graphs for **COSI** global score.
VERSUS2_GEN_NSC-11	**[Priority: B]** The System shall create graphs for **EDS** score.
VERSUS2_GEN_GSC-12	**[Priority: B]** The System shall create the graphs for **Cross Model** between **deterministic standard and conditional verifications** inside a common **area stratification** and different models.
VERSUS2_GEN_GSC-13	The System shall create the graphs using **deterministic standard and conditional verifications** inside a common **area stratification** and different parameters.
VERSUS2_GEN_GSC-14	**[Priority: B]** The System shall create graphs for probabilistic scores inside an **area stratification**.
VERSUS2_GEN_GSC-15	**[Priority: A]** The System shall create graphs for fuzzy scores inside an **area stratification**.
VERSUS2_GEN_GSC-16	**[Priority: C]** The System shall create graphs for object oriented scores inside an **area stratification**.
VERSUS2_GEN_GSC-17	**[Priority: A]** **Time Series** graphs of VERSUS shall be extended for all new observations.
VERSUS2_GEN_GSC-18	**[Priority: A]** **Daily Cycle** graphs of VERSUS shall be extended for all new observations.
VERSUS2_GEN_GSC-19	The System shall create **map graphs** for scores calculated.

5.6.3 Context Diagram

This paragraph will present all actors communicate with current CI.

CI_GRAPH has these actors:

- CI_AUX_DB, it is the subsystem that retrieves all information used for graphic generation and stores it in the database.
- CI_WEB_GUI, it is the subsystem that starts graphics generation process through user interface.
- CI_GEN_VER, it is the subsystem that starts graphics generation process in batch mode after numerical scores calculation.
- CI_JPGRAPH, it is the extern subsystem that gives graphical libraries for classic graphics creation.
- CI_R, it is the extern subsystem that gives graphical libraries for spatial graphics creation.

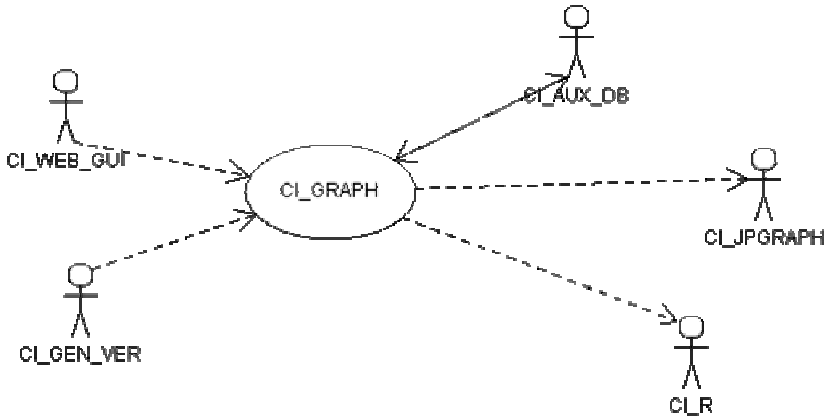


Figure 12. Context Diagram CI_GRAPH

5.6.4 Project

5.6.4.1 Description

CI_GRAPH manages traditional graphs related to new scores and map graphs, they are graphics that use geolocated information to represent data using a map and a projection.

5.6.4.2 Static View

This paragraph will present the static view, it means the association between graphs created by the system and logic areas into database. VERSUS 2 manages these graphs types:

- **Classic graphs**, they represent data and scores symbolically using compact format. For example: graphs with lines or bars. They shall be stored in the logic area “Area Score – Graphical Scores”. For this graph type it shall be extended functions in VERSUS.
- **Map graphs**, they represent data and scores symbolically using compact format on a map projection. They shall be stored in the logic area “Area Score –

Graphical Scores". For this graph type new functions shall be developed ex-novo using R project.

5.6.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

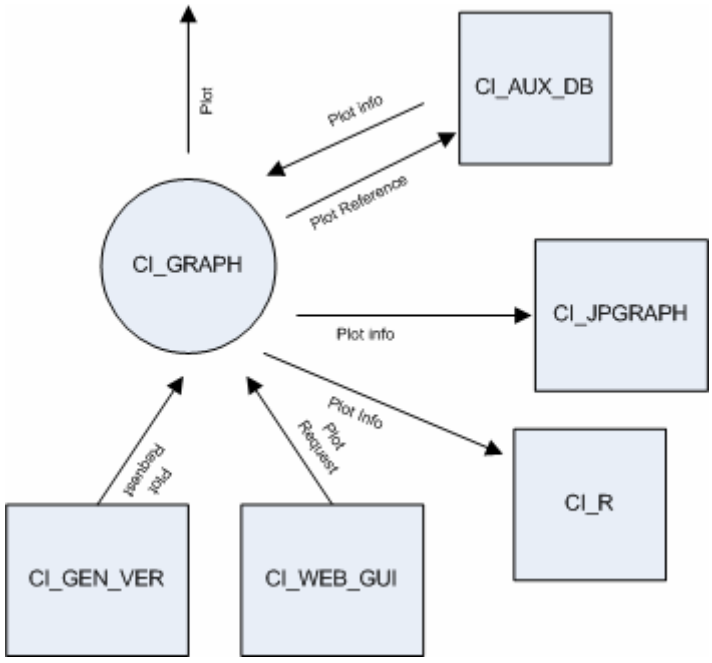


Figure 13. DFD Level 0 – CI_GRAPH

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_GRAPH	**CI_AUX_DB**	**Plot Reference**	CI_GRAPH send to CI_AUX_DB the refernce to created graph
CI_AUX_DB	**CI_GRAPH**	**Plot Info**	CI_AUX_DB send to CI_GRAPH all information used for graph creation (data and graphic configuration).
CI_WEB_GUI	**CI_GRAPH**	**Plot Request**	CI_WEB_GUI send to CI_GRAPH the request for graph creation.
CI_GEN_VER	**CI_GRAPH**	**Plot Request**	CI_GEN_VER send to CI_GRAPH the request for graph creation after it has calculated the score to

			represe□ossible possibile only if int the dataase there is a graphic configuration.
CI_GRAPH	**CI_JPGRAPH**	**Plot Info**	CI_GRAPH send to CI_JPGRAPH all information used for classic graph creation (data and graphic configuration).
CI_GRAPH	**CI_R**	**Plot Info**	CI_SCORE send to CI_R all information used for spatial graph creation (data and graphic configuration).

5.6.4.4 Operational Architecture

CI_GRAPH works through the process 'verification_generation.php', it is common with CI_GEN_VER and CI_SCORE. This process, infact, manages the verifications generation, the scores calculation and the graphics generation. The process shall be extended for both types of graphs.

VERSUS 2 will use JPGRAPH for classic graphics because gives the total compatibility with the rest of the system while it will use R for new special plots (spatial graphics) using new package 'sp'.

5.7 CI_WEB_GUI

5.7.1 Description

This CI has the aim to manage graphical user interface. Through GUI user can easly interact with the system.

5.7.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_MAN_GUI-1	**[Priority: A]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage new types of observations.
VERSUS2_MAN_GUI-2	**[Priority: A]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage **FeedBack Files**.
VERSUS2_MAN_GUI-3	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage **probabilistic forecasts**.
VERSUS2_MAN_GUI-4	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage climatology information.
VERSUS2_MAN_GUI-5	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage subjective forecasts.

VERSUS2_MAN_GUI-6	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage post processed forecast with **MOS** and Kalman filter.
VERSUS2_MAN_GUI-7	**[Priority: B]** The **GUI** of VERSUS, that manage the stratification configuration, shall be extended using special features like distance from sea, lee stations, marine stations.
VERSUS2_MAN_GUI-8	The System shall have a **GUI** to configure **area stratifications** through a **GIS** system.
VERSUS2_MAN_GUI-9	The **GUI** to configure **area stratifications** shall give tools to define a geometrical shape (regular or irregular) on a map.
VERSUS2_MAN_GUI-10	**[Priority: A]** The **GUI** of VERSUS, that manage the parameter (for observations and for forecasts) configuration, shall be extended to manage new parameters.
VERSUS2_MAN_GUI -11	**[Priority: B]** The System shall have a **GUI** to configure new **probabilistic models**.
VERSUS2_MAN_GUI-12	**[Priority: B]** The System shall have a **GUI** to configure new scores.
VERSUS2_MAN_GUI-13	**[Priority: A]** The System shall have a **GUI** to configure new methods to manage verifications using gridded observations.
VERSUS2_MAN_GUI-14	**[Priority: B]** The **GUI** to configure new methods for gridded observations shall have a field to define the area through n grid points and a selection of average, maximum, minimum, percentile to calcolate within the area.
VERSUS2_MAN_GUI-15	**[Priority: A]** The System shall have a **GUI** to manage new **Area Standard Verifications**.
VERSUS2_MAN_GUI-16	**[Priority: A]** The System shall have a **GUI** to manage new **Area Conditional Verifications**.
VERSUS2_MAN_GUI-17	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose an **area stratification** .
VERSUS2_MAN_GUI-18	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a method for observations and forecasts.
VERSUS2_MAN_GUI-19	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose **in-situ observations** to verify within an area.
VERSUS2_MAN_GUI-20	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose new **remote sensing observations** to verify within an area.
VERSUS2_MAN_GUI-21	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a set of **remote sensing** or **in-situ observations** within the selected **area stratification**.
VERSUS2_MAN_GUI-22	**[Priority: A]** The **GUI** to manage new **Area Standard Verifications** shall have a option to choose a **deterministic** or **probabilistic model**, a run, a start, a stop and an interval step.
VERSUS2_MAN_GUI-23	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a generic interval for parameters with cumulation.
VERSUS2_MAN_GUI-24	**[Priority: A]** The **GUI** of VERSUS to manage **Area Standard and Conditional Verifications** shall be extended to choose a generic interval for parameters with cumulation.

VERSUS2_MAN_GUI-25	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose subjective forecasts.
VERSUS2_MAN_GUI-26	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use subjective forecasts.
VERSUS2_MAN_GUI-27	**[Priority: B]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose post processed forecasts **MOS** and Kalman filter.
VERSUS2_MAN_GUI-28	**[Priority: B]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use post processed forecasts **MOS** and Kalman filter.
VERSUS2_MAN_GUI-29	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose climatology information.
VERSUS2_MAN_GUI-30	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use climatology information.
VERSUS2_MAN_GUI-31	**[Priority: B]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.
VERSUS2_MAN_GUI-32	**[Priority: B]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.
VERSUS2_MAN_GUI-33	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure verifications on periods separated (**weather type verification**).
VERSUS2_MAN_GUI-34	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure verifications on periods separated (**weather type verification**).
VERSUS2_MAN_GUI-35	**[Priority: A]** The **GUI** to manage new **Area Conditional Verifications** shall have the shall have a option to choose a **deterministic model**, a run, a start, a stop and an interval step.
VERSUS2_MAN_GUI-36	**[Priority: A]** The **GUI** to manage new **Area Conditional Verifications** shall have a option to choose a condition on a model other than to verify.
VERSUS2_MAN_GUI-37	**[Priority: A]** The **GUI** of VERSUS to manage **Conditional Verifications** shall extend to choose a condition on a model other than to verify.
VERSUS2_MAN_GUI-38	**[Priority: A]** The System shall have a **GUI** to configure graphics for **COSI** related to **deterministic verifications.**
VERSUS2_MAN_GUI-39	**[Priority: A]** The System shall have a **GUI** to manage verifications on **FeedBack Files**.
VERSUS2_MAN_GUI-40	**[Priority: C]** The System shall have a **GUI** to manage **Object Oriented Verifications**.
VERSUS2_MAN_GUI-41	**[Priority: A]** The System shall have a **GUI** to manage **Fuzzy Verifications**.

VERSUS2_MAN_GUI-42	The **GUI** of VERSUS related to score visualization shall be extended to new scores.
VERSUS2_MAN_GUI-43	The System shall have new **GUIs** to configure graphs on maps.
VERSUS2_MAN_GUI-44	**[Priority: A]** The **GUIs** of VERSUS to configure graphs shall be extended to new scores.
VERSUS2_MAN_GUI-45	**[Priority: B]** The System shall have a **GUI** to configure graphs between **deterministic standard and conditional verifications** within a common stratification and different parameters.
VERSUS2_MAN_GUI-46	**[Priority: B]** The System shall have a **GUI** to configure **Cross Model** graphs between **deterministic standard and conditional verifications** within a common stratification and different models.
VERSUS2_MAN_GUI-47	**[Priority: A]** The System shall have a **GUI** to configure **Cross Model** graphs between **fuzzy verifications** within a common **area stratification.**
VERSUS2_MAN_GUI-48	**[Priority: C]** The System shall have a **GUI** to configure **Cross Model** graphs between **object oriented verifications** within a common **area stratification** .
VERSUS2_MAN_GUI-49	The System shall have a **GUI** to configure **Monthly Graphics** for **deterministic standard and conditional verifications** within a common **area stratification**.
VERSUS2_MAN_GUI-50	**[Priority: A]** The System shall have a **GUI** to configure **Monthly graphics** for **Fuzzy Verifications** within a common **area stratification**.
VERSUS2_MAN_GUI-51	**[Priority: C]** The System shall have a **GUI** to configure **Monthly graphics** for **Object Oriented Verifications** within a common **area stratification**.
VERSUS2_MAN_GUI-52	**[Priority: A]** The **GUI** of VERSUS to configure **Times Series graphics** shall be extended to new observations.
VERSUS2_MAN_GUI-53	**[Priority: A]** The **GUI** of VERSUS to configure **Daily Cycle graphics** shall be extended to new observations.

5.7.3 Context Diagram

This paragraph will present all actors comunicate with current CI.

CI_WEB_GUI will have these actors:

- CI_ACQ, it is the subsystem that starts the acquisition data process (for observations and forecasts) through graphical user interface.
- CI_GEN_VER, it is the subsystem that starts verification generation through graphical user interface.
- CI_GRAPH, it is the subsystem that starts graphs generation through graphical user interface.
- CI_WEB_GIS, it is the external subsystem that manages communication with GIS server.
- CI_AUX_DB, it is the subsystem that manages the communication between graphical user interface and database.
- USER**,** it is the user that interacts with the graphical interface.

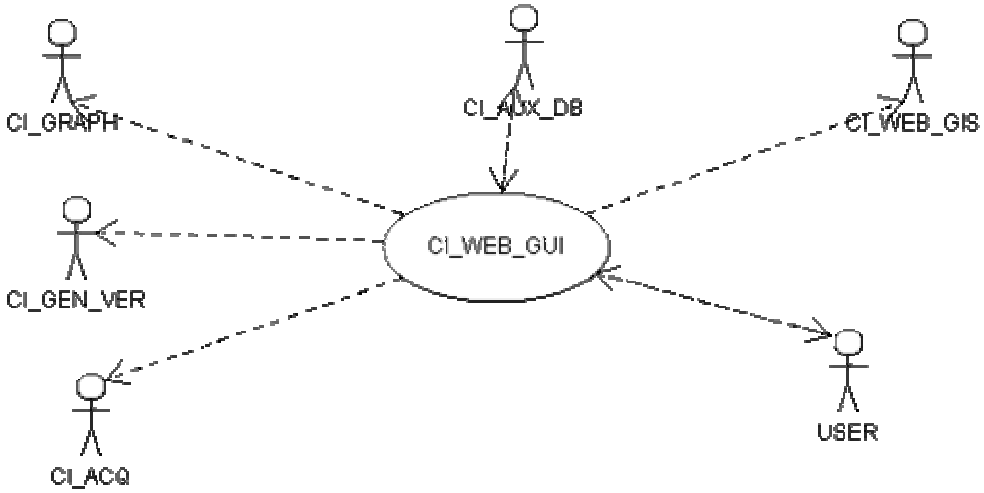


Figure 14. Context Diagram CI_WEB_GUI

5.7.4 Project

5.7.4.1 Description

CI_WEB_GUI manages graphical user interface of the system. GUI makes very simple the interaction between user and system. VERSUS is a web-based application so its design has to define all web pages associated to all system functions.

5.7.4.2 Static View

This paragraph will present the static view of the project, it means the web pages organization. In this paragraph 'Logic Area' manages web pages with homogeneous functions.

VERSUS 2 shall have same logic areas of VERSUS because they are associated to type user (Administrator, Operator, Consultant). VERSUS 2 has not changes for user management. Each user type will access to a set of functions (web pages). VERSUS has these logic area 'Administration Area', 'Configuration Area' and 'Results Area'.

- 'Administrator': user is able to manage acquisition and scores Front End, errors, users , numerical and graphical scores. This user has the higher level of user privileges, so he shall access all logic area.
- 'Operator': user is able to create scores on the base of data loaded into VERSUS DB, examine the results, make the suitably re-run of the score, delete them. This user has the
  medium level of user privileges so he shall access 'Configuration and Result Area'.
- 'Consultant': user can only examine the score results. This user has the lower level of user privileges so he shall access 'Results Area'.

For each logic area this paragraph will present the association between logic area of database and logic area of GUI. Also it will present new web pages to create and VERSUS web pages to extend.

- **Administration Area**, this area manages all web pages associated to Administrator's privileges.
  - **Users Management**, all web pages to manage system users. These pages shall access to database in "Registry Area – Users" and shall not be changed.

- **Logs Management,** all web pages to manage logs files associated to process (loader.php and score.php). These pages shall not be changed.
- **Front End Management**, all web pages to manage Front End. They shall access to database in “Registry Area - Front End”. These pages shall be extended to new observations and forecasts data.

- **Configuration Area,** this area manages all web pages associated to Administrator’s and Operator’s privileges. In this area there are all web pages to manage the system configuration.
  - **Standard and Conditional Verification Configuration,** all web pages to manage verifications.
    - For verifications using **point observations,** the web pages shall be extended to new requirements and shall access to database in “Verification Configuration Area – Point Verification Configuration”.
    - For verifications using **area observations,** the web pages shall be developed ex-novo and shall access to database in “Verification Configuration Area – Fuzzy and Area Verification Configuration”.
  - **Object Oriented Verification Configuration,** web pages to manage object oriented verifications. These pages shall be develop ex-novo and shall access to database “Area Verification Configuration Area – Object Oriented Verification Configuration”.
  - **Daily Cycle and Time Series Configuration,** web pages to manage Daily Cycle and Time Series graphs.
    - For verifications using **point observations,** the web pages shall be extended new requirements and shall access to database in “Verification Configuration Area – Point Verification Configuration”.
    - For verifications using **area observations,** the web pages shall be developed ex-novo and shall access to database in “Verification Configuration Area – Fuzzy and Area Verification Configuration”.
    - For **object oriented verifications**, the web pages shall be developed ex-novo and shall access to database in “Verification Configuration Area – Object Oriented Verification Configuration”.
  - **Stratification Configuration,** all web pages to manage stratifications. VERSUS 2 shall manage area and point stratifications.
    - For **point stratifications,** the web pages shall be extended new requirements.
    - For **area stratifications,** the web pages shall be developed ex-novo

    All web pages shall access to database “Registry Area – Stratification”.
  - **Station Configuration,** all web pages to manage in-situstations. These pages shall not changed and shall access to “Registry Area – Stations”.
  - **Index Configuration,** all web pages to manage all indexes to calculate. These pages shall be extended new indexes and shall access to database “Registry Area – Models and Products”.

- **Run Configuration,** all web pages to manage runs. These pages shall not changed and shall access to “Registry Area – Models and Products”.
- **Parameter Configuration,** all web pages to manage parameters. These pages shall be extended new parameters and shall access to database “Registry Area – Models and Products”.
- **Method Configuration,** all web pages to manage methods:
  - Forecasts methods, these pages shall not changed.
  - Obsevations methods for verifications on gridded observations. These pages shall be developed ex-novo.

  These pages shall access to database in “Registry Area – Models and Products”.
- **Model Configuration,** all web pages to manage models:
  - Deterministic models, these pages shall not changed.
  - Probabilistic models, these pages shall be developed ex-novo.

  These pages shall access to database in “Registry Area – Models and Products”.
- **Suspect Value Configuration,** all web pages to manage suspect values on observations data. These pages shall not changed and shall access to database in “Registry Area – Models and Products”.

- **Results Area,** this area manages all web pages associated to all users’ profile. In this area there are all web pages to manage data, numerical scores, graphical scores.
  - **Data Report,** all web pages to show and download data.
    - For **point observations,** web pages shall be extended to new data.
    - For **area observations,** web pages shall be developed ex-novo.
    - For **probabilistic forecasts,** web pages shall be developed ex-novo.
    - For **deterministic forecasts,** web pages shall be extended to new data.

    These pages shall access to database in “Observations Area” and “Forecasts Area”.
  - **Standard and Conditional Report,** all web pages to show verifications configurations, numerical scores, graphical scores.
    - For verifications with **Point Observations**, the web pages shall be extended.
    - For verifications with **Area Observations (fuzzy, object oriented)**, the web pages shall be developed ex-novo.

    These pages shall access to database in “Score Area” and “Configuration Area”.
  - **Time Series and Daily Cycle Report,** all web pages to show daily cycle and time series graphs.
    - For **Point Observations**, the web pages shall be extended.

- For **Area Observations**, the web pages shall be developed ex-novo.

These pages shall access to database in “Score Area” and “Configuration Area”.

- **Cross Model Graphic,** all web pages to manage graphs with different models.
  - For **Cross Model** using verifications with **Point Observations**, the web pages shall be extended.
  - For **Cross Model** verifications with **Area Observations (fuzzy, object oriented)**, the web pages shall be developed ex-novo.

These pages shall access to database in “Score Area” and “Configuration Area”.

- **Monthly Graphic,** all web pages to manage graphs to show the trend analysis for the monthly scores.
  - For **Monthly Graphic** using verifications with **Point Observations**, the web pages shall be extended.
  - For **Monthly Graphic** verifications with **Area Observations (fuzzy, object oriented)**, the web pages shall be developed ex-novo.

These pages shall access to database in “Score Area” and “Configuration Area”.

5.7.4.3 Dynamic View

This paragraph will present the diagram with functions and data flows, Data Flow Diagram (DFD). The DFD Level 0, or contextual model, represents the current CI like a single item; input data are information that others CIs send to current CI, while output data are information that current CI send to others CIs. In the figure current CI is shown like component that communicates with others CIs represented like external entities.

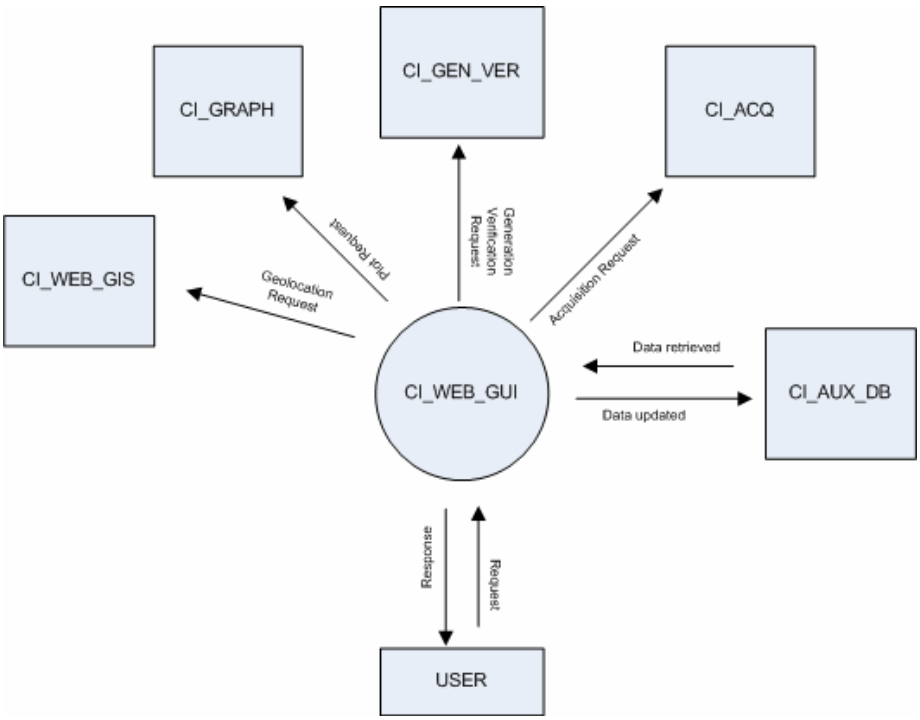


Figure 15. DFD Level 0 – CI_WEB_GUI

This table will be present data flows between current CI and the others.

From	To	Data Flow	Description
CI_AUX_DB	**CI_WEB_GUI**	**Data Retrieved**	CI_AUX_DB send to CI_WEB_GUI all data to show through user interface.
CI_WEB_GUI	**CI_AUX_DB**	**Data Updated**	CI_WEB_GUI send to CI_AUX_DB all updated data to insert into database.
CI_WEB_GUI	**CI_GRAPH**	**Plot Request**	CI_WEB_GUI send to CI_GRAPH the request for graphic creation.
CI_WEB_GUI	**CI_ACQ**	**Acquisition Request**	CI_WEB_GUI send to CI_ACQ the request for acquisition input data.
CI_WEB_GUI	**CI_GEN_VER**	**Generation Verification Request**	CI_WEB_GUI send to CI_GEN_VER the request for verification generation.
CI_WEB_GUI	**CI_WEB_GIS**	**Geolocation Request**	CI_WEB_GUI send to CI_WEB_GIS the request to transform x,y coordinates in geolocation lat,lon.
USER	**CI_WEB_GUI**	**Request**	USER is the user that

			interact with graphical user interface. User send a request.
CI_WEB_GUI	**USER**	**Response**	USER is the user that interact with graphical user interface. User riceve a response.

5.7.4.4 Operational Architecture

CI_WEB_GUI works through dynamic web pages. Some web pages shall be extended others shall be developed ex-novo like web gui using web **GIS**.

This CI shall work on server machine if it is active the Apache service '*httpd'* and in the apache 'doc' root it is present a symbolic link to the directory with all web pages.

5.8 CI_INSTALL

5.8.1 Description

This CI manages the VERSUS 2 installation package.

5.8.2 Requirements

This paragraph will present the functional and non-functional requirements assigned to this CI.

Functional Requirements

Code	Text
VERSUS2_OPR-1	The System shall have an installation package

5.8.3 Project

5.8.3.1 Static View

This paragraph will present all activities thet current CI shall make to install whole system, some activities are the same of VERSUS, some activities have to be extended, others are new. The installation shall have these steps/activities:

- Check software requirements. This activity shall be extended to new software requirements.
- Check configuration file 'install_VERSUS.conf'. This activity shall be extended to new software requirements.
- Copy directories tree into HOME directory defined into configuration file. This activity shall not change.
- Install new database structure. This activity shall be extended to new database structure.
- Configuration and installation for new web pages. This activity shall be extended to new software requirements.
- Phoenix Installation. This activity shall not change.

5.8.3.2 Operational Architecture

CI_INSTALL is a shell script that makes all activities to install VERSUS 2 system. To install Phoenix libreries it is necessary to start the script like root.

To start VERSUS 2 installation it needs the command line: **./install_VERSUS2.sh**

The system shall be installed into the directory defined in configuration file 'install_VERSUS2.conf'

APPENDIX 1 – PRIORITY LIST OF REQUIREMENTS

Priority list of requirements (as from VERSUS2 workshop in Langen March 2009)

"A" Priorities

Type	Description
Observation data	use of all standard obs
	use of feedback files where availabla and appropriate, especially for non standard observation and upper air
	use of gridded files for precipitation (use of both radar data and raingauges)
	weather type verification
Forecasts Data	None
Statistical Features	Fuzzy toolbox has to be included
	Implementation and refinements of COSI COSMO global score
	Statistical features like confidence intervals and the Bootstrap method
General Features	Cumulative precipitation has to be calculated on any interval and also on a non-fixed window. Verification has to be carried out on intervals up to one hour and for the COSMO 2km on even higher frequency
	Upper air verification should be carried out on any number of levels through the use of flexible bins (variable) (see feedback files)
	Conditional Verification on different space/time
	Conditional Verification on models errors: the more general request for conditional model comparison can be to verify one model under the conditions of the other model or its error having certain values. E.g., what were the errors of an experimental forecast when the operational forecast showed large errors, or vice versa;

“B” Priorities

Type	Description
Observation data	**GPS humidity** (in BUFR) from E-GVAP (EUMETNET GPS water vapour programme)
	Need to assign attributes to stations to create special stratifications (lee stations or marine stations or by distance from sea for example
Forecasts Data	Post Processing point forecasts (MOS, Kalman filter and subjective)
	Information from Probabilistic Forecasts
	Output from Probabilistic Post Processing
Statistical Features	Other Scores for probabilistic forecasts
	Main Scores for probabilistic forecasts: Brier Skill Score, Relative Operating Characteristic. FAR and POD
	Other methods for probabilistic scores: scale dependent verification, specification of boxes (e.g. 5x5 grid points of forecast) and take average/maximum/minimum/percentile of forecasts/obs within the box
General Features	Comparison between different models or different model versions only on the same sample size: when comparing two models, make sure the same sample is used for verification, which is not automatically ensured if some forecasts are missing from either system
	Verification for predefined periods (e.g. previous 1 day for COSMO-DE or COSMO-2, resp. previous 3 days for COSMO-EU or COSMO-7). Shorter periods run daily for monitoring of the model with the actual situation for the verification of (a) the last day, (b) the 3 last days, e.g.

	Verifications for boxes/basins/predefined areas of assigned geometrical shapes: observations and forecasts inside these boxes should be also upscaled and compared

“C” Priorities

Type	Description
Observation data	None
Forecasts Data	None
Statistical Features	Implementation of Object-oriented and SAL-like methods for verification of precipitation: this can be regarded as a tentative of producing more “user-oriented” verification along with the opportunity to have a state-of-the-art verification software
General Features	Interpolation methods on station locations

Traceability matrix

A traceability matrix is a table that correlates any two baselined documents that require a many to many relationship to determine the completeness of the relationship. It is used with high-level requirements (sometimes known as marketing requirements) and detailed requirements of the software product to the matching parts of high-level design, detailed design, test plan, and test cases.

Now it will be used the document 'VERSUS 2 COSMO - Priority Project' to create the traceability matrix and to check all user requirements have at least a software requirements.

For each group of software requirements in 3.3.3 FUNCTIONAL REQUIREMENTS it will be presented a table with the reference to the text in the document and to the priority definition in the Appendix 1.

Some software requirements are related to contextualisation of the problem to resolve so in the column 'Priority Project' it will be used the sentence *'Contextualised'.*

Non Functional Requirements

VERSUS2-MAN_DB.

Management of DataBase - MAN_DB

This set of functional requirements is related to the management of database, core of VERSUS system.

Each software requirements about database is necessary to show the connection between VERSUS and its extension VERSUS 2, so in the document 'VERSUS 2 COSMO - Priority Project" it will be used the reference

Chapter 2.

2.1 VERSUS Architectural Design

Versus consists of an RDBMS (MySQL)…

CODE	DESCRIPTION	Priority Project	Priority
VERSUS2-MAN_DB-1	**[Priority: A]** The System shall store **in-situ observations** in raw format and decoded to station level.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data PILOT, TEMP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2-MAN_DB-2	**[Priority: A]** The System shall store **remote sensing observations** in raw format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data RADAR…p.15*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2-MAN_DB-3	**[Priority: A]** The System shall store **FeedBack files** in raw format.	**Chapter 3.** **3.2.1.3 FeedBack Files From Data Assimilation and the**	**Appendix 1.** **"A" PRIORITY - Observation Data**

		model *These files could be seen as another basis to perform…p.17*	
VERSUS2-MAN_DB-4	**[Priority: A]** The raw observations shall be classified for type, source, parameters and input format.	*Contextualised*	
VERSUS2-MAN_DB-5	**[Priority: A]** The System shall store **deterministic forecasts** in raw format and classified for model, run, parameter, data validity, step.	*Contextualised*	
VERSUS2-MAN_DB-7	**[Priority: B]** The System shall store climatology information.	**Chapter 3.** **3.2.1.2 Forecast Data** *-different reference forecasts:… Often climatology…p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2-MAN_DB-10	**[Priority: A]** The System shall store new **Front Ends** configurations.	*Contextualised*	
VERSUS2-MAN_DB-11	**[Priority: A]** The System shall store **area stratifications** configurations.	*Contextualised*	
VERSUS2-MAN_DB-13	**[Priority: A]** The System shall store new methods configurations.	*Contextualised*	
VERSUS2-MAN_DB-14	**[Priority: A]** The System shall store new scores configurations.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation and refiments of COSI COSMO global score; …p18* *-Statistical features like confidence intervals and the Bootstrap method.. p.18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2-MAN_DB-15	**[Priority: A]** The System shall store **Area Standard Verifications** configurations.	*Contextualised*	
VERSUS2-MAN_DB-16	**[Priority: A]** The System shall store **Area Conditional Verifications** configurations.	*Contextualised*	
VERSUS2-MAN_DB-17	**[Priority: A]** The System shall store **Fuzzy Verifications** configurations.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of results and recommendations … (fuzzy verification)…; p.18*	

VERSUS2-MAN_DB-19	**[Priority: A]** The System shall store new calculated numerical scores.	*Contextualised*	
VERSUS2-MAN_DB-20	**[Priority: A]** The System shall store all graphs related to scores.	*Contextualised*	
VERSUS2-MAN_DB-21	**[Priority: A]** The System shall classify all numerical scores and graphics related to types of verifications.	*Contextualised*	
VERSUS2-MAN_DB-6	**[Priority: B]** The System shall store **probabilistic forecasts** in raw format and classified for model, run, parameter, data validity, step, member.	**Chapter 3.** **3.2.1.2 Forecast Data** -*Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16*	**Appendix 1.** **"B" PRIORITY – Forecast Data**
VERSUS2-MAN_DB-8	**[Priority: B]** The System shall store subjective forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** -*Post Processed Forecasts – subjective and objective…p16*	**Appendix 1.** **"B" PRIORITY – Forecast Data**
VERSUS2-MAN_DB-9	**[Priority: B]** The System shall store post processed forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** -*Post Processed Forecasts – subjective and objective….p16*	**Appendix 1.** **"B" PRIORITY – Forecast Data**
VERSUS2-MAN_DB-12	**[Priority: B]** The System shall store **probabilistic models** configurations.	**Chapter 3.** **3.2.1.2 Forecast Data** - *Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16*	**Appendix 1.** **"B" PRIORITY – Forecast Data**
VERSUS2-MAN_DB-18	**[Priority: C]** The System shall store **Object Oriented Verifications** configurations	**Chapter 3.** **3.2.2 Functional Requirements** -*Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**

VERSUS2-ACQ_OBS

Acquisition of Observations - ACQ_OBS

This set of functional requirements is related to the observations data acquisition that VERSUS 2 shall manage.

Code	Description	Priority Project	Priority

VERSUS2_ACQ_OBS-1	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from TEMP parts B, C, D of temperature, wind (speed, direction, u-v component), humidity, geopotential, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data TEMP…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-2	**[Priority: A]** The **Front End** for the acquisition and the decoding of TEMP parts B, C, D shall be the extension of the present **Front End** for TEMP part A of VERSUS**.**	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data TEMP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-3	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** SYNOP, special care have to taken to verify all cloud cover levels, wind gusts, different cumulations of precipitation and to calculate u-v component for wind, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data SYNOP…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-4	**[Priority: A]** The **Front End** for the acquisition and decoding of new parameters for SYNOP shall be the extension of the present **Front End** for **SYNOP** of VERSUS**.**	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data SYNOP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-5	**[Priority: A]** The System shall have a **Front End** for the acquisition and decoding of **in-situ observations** from raingauges in grid and **NETCDF** format**.**	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data Raingauges Network…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-6	**[Priority: A]** The System shall have a **Front End** for the acquisition	**Chapter 3.** **3.2.1.1 Observation Data**	**Appendix 1.** **"A" PRIORITY -**

	and the decoding of **remote sensing observations** from satellite in grid Lat/Lon (regular or rotated) and **NETCDF** format.	*The following are the observation data Gridded data from high-resolution…p.15* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Observation Data**
VERSUS2_ACQ_OBS-7	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR for precipitation and wind, in particular **VAD** and later radial, in grid Lat/Lon (regular or rotated) and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data RADAR…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-8	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** from RADAR using different grids related to the models to verify.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data RADAR…p.15*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-9	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of observations from high-resolution precipitation network and/or composition with radar and/o satellite data in grid Lat/Lon (regular or rotated) and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data Gridded data from high-resolution…p.15* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-10	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations LIDAR** in grid Lat/Lon (regular or rotated) and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the Lidar…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-11	**[Priority: A]** The System shall	**Chapter 3.**	**Appendix 1.**

	have a **Front End** for the acquisition and the decoding of **in-situ observations SATOB** for wind, in **BUFR** and **NETCDF** format.	**3.2.1.1 Observation Data** *The following are the SATOB…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-12	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PILOT** parts A,B,C,D for wind in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the PILOT…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-13	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations** Satellite **RADIANCES** in grid and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the RADIANCES…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-15	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations WINDPROFILER** of wind, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the WINDPROFILER…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-16	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations PAOB**, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the PAOB…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**

VERSUS2_ACQ_OBS-17	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations DRIBU** for pressure and wind, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the DRIBU…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-18	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations BUOY** in **BUFR** and **NETCDF** format.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations..*
VERSUS2_ACQ_OBS-19	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AIREP**, in **BUFR** and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the AIREP…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-20	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from aircraft, **AMDAR**, in **BUFR** and **NETCDF** format.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations..*
VERSUS2_ACQ_OBS-21	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **in-situ observations** from ship, **SHIP**, in **BUFR** and **NETCDF** format.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations..*
VERSUS2_ACQ_OBS-22	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations SCATTEROMETER**, in grid Lat/Lon (regular or rotated) and **NETCDF** format.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the SCATTEROMETER…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-23	**[Priority: A]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing**	**Chapter 3.** **3.2.1.1 Observation Data**	**Appendix 1.** **"A" PRIORITY -**

	observations Satellite **RADIO OCCULTATIONS**, in **BUFR** and **NETCDF** format..	*The following are the RADIO OCCULATIONS…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Observation Data**
VERSUS2_ACQ_OBS-24	**[Priority: A]** All **Front Ends** verify the wind shall be capable to manage it like u-v component and strength-intensity.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation and refiments of COSI COSMO global score; …p18*	**Appendix 1.** **"A" PRIORITY - Statistical Features**
VERSUS2_ACQ_OBS-25	**[Priority: A]** The System shall have a Front End for the acquisition of **FeedBack Files** in raw format and **NETCDF** format.	**Chapter 3.** **3.2.1.3 FeedBack Files From Data Assimilation and the model** *These files could be seen as another basis to perform…p17* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_ACQ_OBS-14	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **remote sensing observations GPS** humidity from **E-GVAP**, in **BUFR** and **NETCDF** format .	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the GPS humidity…p.14* **3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19*	**Appendix 1.** **"B" PRIORITY - Observation Data**

VERSUS2-ACQ_FCS

Acquisition of Forecasts - ACQ_FCS

This set of functional requirements is related to the forecast data acquisition that VERSUS 2 shall manage.

Code	Description	Priority Project	Priority
VERSUS2_ACQ_FCS-1	**[Priority: A]** The System shall	**Chapter 3.**	

	have a **Front End** for the acquisition and the decoding of **deterministic forecast** in **GRIB2** and **NETCDF** format.	**3.2.3 Non-functionsl System Requirements** *Possibility to import NETCDF data…p.19* *Use of GRIB2 for forecasts…p.19*	
VERSUS2_ACQ_FCS-2	**[Priority: A]** The **Front End** for the acquisition and the decoding of **deterministic forecast** shall be the extension of the present **Front End** for **deterministic forecast** of VERSUS in **GRIB1** format.	*Contextualised*	
VERSUS2_ACQ_FCS-3	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16* **3.2.3 Non-functionsl System Requirements** *Use of GRIB2 for forecasts…p.19*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-4	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-LEPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16* **3.2.3 Non-functionsl System Requirements** *Use of GRIB2 for forecasts…p.19*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-5	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **ECMWF-EPS** model in **GRIB1**, **GRIB2** and **NETCDF** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**

		3.2.3 Non-functionsl System Requirements *Use of GRIB2 for forecasts…p.19*	
VERSUS2_ACQ_FCS-6	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **probabilistic forecast** from **COSMO-SREPS** model in **GRIB1**, **GRIB2** and **NETCDF** format .	**Chapter 3.** **3.2.1.2 Forecast Data** *-Information from Probabilistic Forecasts … p.15* *-Forecasts to be used for probabilistic verifications... p.16* **3.2.3 Non-functionsl System Requirements** *Use of GRIB2 for forecasts…p.19*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-7	**[Priority: B]** The System shall have a **Front End** for the acquisition, the decoding and the updating of climatology in **ASCII** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Often, climatology is taken.... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-8	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of subjective forecasts in **XML** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed-subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-9	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts MOS** in **XML** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed-subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_ACQ_FCS-10	**[Priority: B]** The System shall have a **Front End** for the acquisition and the decoding of **post processed forecasts** with Kalman filter in **XML** format.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed-subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**

VERSUS2-MAN_VER

Management of Verifications - MAN_VER

This set of functional requirements is related to the management verifications.

Code	Text	Priority Project	Priority

VERSUS2_MAN_VER-1	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on RADAR observations for precipitations and wind.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data RADAR…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-2	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on satellite observations.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data Gridded data from high-resolution…p.15*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-3	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on high-resolution precipitation network and/or composition with RADAR and/or satellite data.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data Gridded data from high-resolution…p.15*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-4	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **LIDAR** observations.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the Lidar…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-5	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on satellite **RADIANCES** observations.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the Radiances…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-6	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on gridded precipitation data obtained from raingauges network data.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data Raingauges Network…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-7	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **SCATTEROMETER** observations.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data SCATTEROMETER…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-8	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **PILOT** observations like extension of current Upper air verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data PILOT…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-9	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** based on **TEMP** observations parts B,C,D like extension of current Upper air verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data TEMP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**

VERSUS2_MAN_VER-10	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using new parameters for **SYNOP** observations like extension of current Surface verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data SYNOP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-11	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **WINDPROFILER** observations like extension of current Surface verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data WINDPROFILER…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-12	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **PAOB** observations like extension of current Surface verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data PAOB…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-13	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **DRIBU** observations like extension of current Surface verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data DRIBU…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-14	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **AIREP** observations.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data AIREP…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-15	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **SHIP** observations.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations*
VERSUS2_MAN_VER-16	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **AMDAR** observations.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations*
VERSUS2_MAN_VER-17	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using **BUOY** observations.		**Appendix 1.** **"A" PRIORITY - Observation Data** *Use all observations*
VERSUS2_MAN_VER-18	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using satellite **RADIO OCCULTATIONS** like extension of current Surface verifications of VERSUS.	**Chapter 3.** **3.2.1.1 Observation Data** *The following are the observation data RADIO OCCULTATION…p.14*	**Appendix 1.** **"A" PRIORITY - Observation Data**
VERSUS2_MAN_VER-19	**[Priority: A]** The System shall manage **deterministic standard and**	**Chapter 3.**	

	conditional verifications using climatology.	**3.2.1.2 Forecast Data** *-different reference forecasts:…* *Often climatology…p.16*	
VERSUS2_MAN_VER-23	**[Priority: B]** All new **deterministic standard and conditional verifications** shall have seasonal, weekly, daily frequency and for a generic number of days.	**Chapter 3.** **3.2.2 Functional Requirements** *-Verification for predefined periods…p.17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_VER-24	**[Priority: B]** All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall have seasonal, weekly, daily frequency and for a generic number of days.	**Chapter 3.** **3.2.2 Functional Requirements** *-Verification for predefined periods…p.17*	**Appendix 1.** **"B" PRIORITY - General Features**
VERSUS2_MAN_VER-25	**[Priority: A]** All new **deterministic standard and conditional verifications** shall manage cumulations of precipitations over varying time intervals.	**Chapter 3.** **3.2.2 Functional Requirements** *-Cumulative precipitation has to be calculated on any interval…p.17*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-26	**[Priority: A]** All **deterministic standard and conditional verifications** of VERSUS shall be extended so additionally they shall manage cumulations of precipitations over varying time intervals.	**Chapter 3.** **3.2.2 Functional Requirements** *-Cumulative precipitation has to be calculated on any interval…p.17*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-27	**[Priority: A]** All new **deterministic standard and conditional verifications** shall be defined on periods separated (**weather type verification**).	**Chapter 3.** **3.2.2 Functional Requirements** *-Wheather type dependent…p.18*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_VER-28	**[Priority: A]** All **deterministic standard and conditional verifications** of VERSUS shall be extended on periods sepated (**weather type verification**).	**Chapter 3.** **3.2.2 Functional Requirements** *-Wheather type dependent…p.18*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_VER-29	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all new types of observations inside an **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Verification for boxes/basins…p.17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_VER-30	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all parameters for observations data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Any parameter can be verified…p17*	**Appendix 1.** **"A" PRIORITY – Observation Data**

VERSUS2_MAN_VER-31	**[Priority: A]** The System shall manage **deterministic standard and conditional verifications** using all parameters for forecasts data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Any parameter can be verified…p17*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_VER-32	**[Priority: A]** The conditions for new **deterministic conditional verifications** shall be defined using conditions on models on its errors other than the model to verify.	**Chapter 3.** **3.2.2 Functional Requirements** *Conditional verification on models error…p18*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-33	**[Priority: A]** The conditions for **deterministic conditional verifications** of VERSUS shall be defined using conditions on models on its errors other than the model to verify.	**Chapter 3.** **3.2.2 Functional Requirements** *Conditional verification on models error…p18*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-34	**[Priority: A]** The conditions for new **deterministic conditional verifications** shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.	**Appendix 1.** **General Features** *Conditional verification on differente space/time…p23*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-35	**[Priority: A]** The conditions for **deterministic conditional verifications** of VERSUS shall define conditions on a number of days preceding the day to examine. For example, to verify the temperature with the condition that 3 days ago it was cloudy.	**Appendix 1.** **General Features** *Conditional verification on differente space/time…p23*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-36	**[Priority: A]** The System shall manage **deterministic conditional verifications** where it is possible to define the area or the station where you want to set the condition. For example, to verify the temperature with the condition that for nearby stations it was cloudy.	**Appendix 1.** **General Features** *Conditional verification on differente space/time…p23*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_VER-40	**[Priority: A]** For **Area Verifications,** the System shall do upscaling observations using grid related to the model to verify.	**Chapter 3.** **3.2.2 Functional Requirements** *Verifications for boxes/basins/predefined…p17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_VER-50	**[Priority: A]** The System shall manage **Fuzzy verifications** for **gridded observations** within an **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy*	**Appendix 1.** **"A" PRIORITY – Statistical Features**

		verification…) …p18	
VERSUS2_MAN_VER-51	**[Priority: A]** The System shall manage **Fuzzy verifications** using **deterministic forecasts**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-52	**[Priority: A]** The System shall manage **Fuzzy verifications** using parameters for observations data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-53	**[Priority: A]** The System shall manage **Fuzzy verifications** using parameters for forecasts data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-54	**[Priority: A]** The System shall manage **standard verifications** with Bootstrap method and confidence intervals.	**Chapter 3.** **3.2.2 Functional Requirements** *Statistical features like confidence …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-20	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using subjective forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed Forecasts – subjective and objective…p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-21	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using post processed forecasts **MOS**.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed Forecasts – subjective and objective…p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-22	**[Priority: B]** The System shall manage **deterministic standard and conditional verifications** using post processed forecasts with Kalman filter.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed Forecasts – subjective and objective…p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-37	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all **in-situ observations** that the system can verify.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Observations to be used for probabilistic verifications…p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-38	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all **remote sensing observations** that the system can verify.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Observations to be used for probabilistic verifications…p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-39	**[Priority: B]** The System shall manage **probabilistic standard**	**Chapter 3.** **3.2.1.2 Forecast Data**	**Appendix 1.** **"B" PRIORITY – Statistical Features**

	verifications using all types of observations inside an **area stratification**.	-*information from probabilistic forecasts…p16*	**Statistical Features**
VERSUS2_MAN_VER-41	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all parameters for observations data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Any parameter can be verified…p17*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-42	**[Priority: B]** The System shall manage **probabilistic standard verifications** using all parameters for forecast data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *Any parameter can be verified…p17*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-43	**[Priority: B]** New **conditional and standard verifications** for **in-situ observations** shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.	**Chapter 3.** **3.2.2 Functional Requirements** *Need to assign to stations to create special stratification…p17*	**Appendix 1.** **"B" PRIORITY – Observation Data**
VERSUS2_MAN_VER-44	**[Priority: B]** The **conditional and standard verifications** of VERSUS shall be defined on **point stratifications** using special features like distance from sea, lee stations, marine stations.	**Chapter 3.** **3.2.2 Functional Requirements** *Need to assign to stations to create special stratification…p17*	**Appendix 1.** **"B" PRIORITY – Observation Data**
VERSUS2_MAN_VER-45	**[Priority: B]** The System shall manage **standard and conditional verifications** for **area observations** where matching minimum, maximum, average, percentile of observations and minimum, maximum, average, percentile of forecasts within an area.	**Chapter 3.** **3.2.1.2 Forecast data** *Other scores and methods* *-take average/maximum/* *Minimum/percentile within box … p17*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-46	**[Priority: C]** The System shall manage **Object Oriented verifications** for **gridded observations** within an **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** -*Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-47	**[Priority: C]** The System shall manage **Object Oriented verifications** using **deterministic forecasts**.	**Chapter 3.** **3.2.2 Functional Requirements** -*Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**

VERSUS2_MAN_VER-48	**[Priority: C]** The System shall manage **Object Oriented verifications** using parameters for observations data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-49	**[Priority: C]** The System shall manage **Object Oriented verifications** using parameters for forecasts data present in the **DB**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_MAN_VER-55	The System shall manage verifications of **CAPE**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation of more user-oriented verification …p18*	
VERSUS2_MAN_VER-56	The System shall manage verifications of convection indexes**.**	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation of more user-oriented verification …p18*	

VERSUS2-GEN_NSC

Generation of Numerical Scores - GEN_NSC

This set of functional requirements is related to the generation of numerical scores that VERSUS 2 shall calculate using all verifications.

Code	Text	Priority Project	Priority
VERSUS2_GEN_NSC-1	**[Priority: A]** The System shall calculate statistics of continous variables for **deterministic verifications** using all types of observations present in the **DB**.	*Contextualised*	
VERSUS2_GEN_NSC-2	**[Priority: A]** The System shall calculate statistics of discrete variables for **deterministic verifications** using all types of observations present in the **DB**.	*Contextualised*	
VERSUS2_GEN_NSC-3	The System shall calculate **EDS** score for **deterministic verifications** using all types of observations present in the **DB.**	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation of more user-oriented verification …p18*	
VERSUS2_GEN_NSC-4	**[Priority: B]** The System shall calculate Score Brier Skill for **probabilistic verifications** using all types of observations present in the **DB.**	**Chapter 3.** **3.2.1.2 Forecast Data** *Brier Skill Score…p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**

VERSUS2_GEN_NSC-5	**[Priority: B]** The System shall calculate Score Decomposition Brier Skill for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Brier Skill …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-6	**[Priority: B]** The System shall calculate Score Reliability/Attribute Diagram for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Reliability/Attribute …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-7	**[Priority: B]** The System shall calculate Score Relative Operating Characteristic curve (ROC curve) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *ROC curve …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-8	**[Priority: B]** The System shall calculate Score Relative Operating Characteristic area (ROC area) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *ROC Area …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-9	**[Priority: B]** The System shall calculate Score Relative Value Score (Cost/Loss Ratio), for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Relative Value Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-10	**[Priority: B]** The System shall calculate Score Rank Histogram (Talagrand Diagram) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Rank Histogram …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-11	**[Priority: B]** The System shall calculate Score Continuous Ranked Probability (RPSS) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Continuous Ranked Probability …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-12	**[Priority: B]** The System shall calculate Score Ignorance (Logarithmic scoring rule) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Ignorance …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-13	**[Priority: B]** The System shall calculate Score Debiased Continuous Ranked Probability (RPSSD) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Debiased Score Continuous Ranked Probability …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-14	**[Priority: B]** The System shall calculate Score Ranked Probability for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Ranked Probability …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-15	**[Priority: B]** The System shall calculate Score Spread-Skill Relation: **EPS**-Spread vs. **RMSE** (EPS media - Osservazioni) for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Score Spread-skill Relation …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-16	**[Priority: B]** The System shall calculate statistics for continuous variables for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Single member*	**Appendix 1.** **"B" PRIORITY – Statistical Features**

		verification .., selection of ensemble forecast …p16	
VERSUS2_GEN_NSC-17	**[Priority: B]** The System shall calculate statistics for discrete variables for **probabilistic verifications** using all types of observations present in the **DB**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Single member verification .., selection of ensemble forecast …p16*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-18	**[Priority: A]** The System shall calculate all scores defined in the **DB** using all information into **FeedBack Files**.	**Chapter 3.** **3.2.1.3 FeedBack Files From Data Assimilation and the model** *These files could be seen as another basis to perform…p17*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_GEN_NSC-19	**[Priority: A]** The System shall calculate **COSI** Cosmo global score for **deterministic verifications.**	**Chapter 3.** **3.2.1.2 Forecast Data** *Debiased Score Continuous Ranked Probability …p16*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-20	**[Priority: A]** For **COSI** score**,** the system shall calculate all scores, related to **deterministic verifications,** if they were not previuously calculated.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation and refinements of COSI COSMO …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_GEN_NSC-21	**[Priority: A]** The System shall inherit from VERSUS the scores calculation (continuous and dicotomuous).	*Contextualised*	

VERSUS2-GEN_GSC

Generation of Graphical Scores - GEN_GSC

This set of functional requirements is related to the generation of graphical scores that VERSUS 2 shall create using all scores previously calculated.

Code	Text	Priority Project	Priority
VERSUS2_GEN_GSC-1	**[Priority: B]** The System shall create graphs for Brier Skill Score.	**Chapter 3.** **3.2.1.2 Forecast Data** *Brier Skill Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-2	**[Priority: B]** The System shall create graphs for Decomposition Brier Skill Score.	**Chapter 3.** **3.2.1.2 Forecast Data** *Decomposition Brier Skill Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-3	**[Priority: B]** The System shall create graphs for Reliability/Attribute Diagram.	**Chapter 3.** **3.2.1.2 Forecast Data** *Reliability/Attribute Diagram …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**

VERSUS2_GEN_GSC-4	**[Priority: B]** The System shall create graphs for Relative Operating Characteristic curve (ROC curve).	**Chapter 3.** **3.2.1.2 Forecast Data** *ROC curve…p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-5	**[Priority: B]** The System shall create graphs for Relative Operating Characteristic curve (ROC area).	**Chapter 3.** **3.2.1.2 Forecast Data** *ROC Area …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-6	**[Priority: B]** The System shall create graphs for Relative Value Score (Cost/Loss Ratio).	**Chapter 3.** **3.2.1.2 Forecast Data** *Relative Value Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-7	**[Priority: B]** The System shall create graphs for Rank Histogram (Talagrand Diagram).	**Chapter 3.** **3.2.1.2 Forecast Data** *Rank Histogram …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-8	**[Priority: B]** The System shall create graphs for Continuous Ranked Probability Score (RPSS).	**Chapter 3.** **3.2.1.2 Forecast Data** *Continuous Ranked Probability Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-9	**[Priority: B]** The System shall create graphs for Ignorance Score.	**Chapter 3.** **3.2.1.2 Forecast Data** *Ignorance Score …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-10	**[Priority: A]** The System shall create graphs for **COSI** global score.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation and refinements of COSI COSMO …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-11	**[Priority: B]** The System shall create graphs for **EDS** score.	**Chapter 3.** **3.2.1.2 Functional Requirements** *Implementation of new scores specialised EDS …p18*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-12	**[Priority: B]** The System shall create the graphs for **Cross Model** between **deterministic standard and conditional verifications** inside a common **area stratification** and different models.	**Chapter 3.** **3.2.2 Functional Requirements** *Comparison between different models …p18*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_GEN_GSC-13	The System shall create the graphs using **deterministic standard and conditional verifications** inside a common **area stratification** and different parameters.	**Chapter 3.** **3.2.2 Functional Requirements** *4d-verification …p18*	
VERSUS2_GEN_GSC-14	**[Priority: B]** The System shall create graphs for probabilistic scores inside an **area stratification**.	**Chapter 3.** **3.2.1.2 Forecast Data** *Main Scores …p15*	**Appendix 1.** **"B" PRIORITY – Statistical Features**

VERSUS2_GEN_GSC-15	**[Priority: A]** The System shall create graphs for fuzzy scores inside an **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *-fuzzy verification…; p.18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-16	**[Priority: C]** The System shall create graphs for object oriented scores inside an **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_GEN_GSC-17	**[Priority: A]** **Time Series** graphs of VERSUS shall be extended for all new observations.	*Contextualised*	
VERSUS2_GEN_GSC-18	**[Priority: A]** **Daily Cycle** graphs of VERSUS shall be extended for all new observations.	*Contextualised*	
VERSUS2_GEN_GSC-19	The System shall create **map graphs** for scores calculated.	**Chapter 3.** **3.2.2 Functional Requirements** *Scores should also have geographical map represantation…p18*	

VERSUS2-MAN_GUI

Management of Graphical User Interface - MAN_GUI

This set of functional requirements is related to the management of graphical user interface of the system.

Each software requirements about GUI is necessary to show the connection between VERSUS and its extension VERSUS 2, so in the document 'VERSUS 2 COSMO - Priority Project" it will be used the reference

Chapter 2.

2.1 VERSUS Architectural Design

Versus consists of a Web-based GUI for man-machine interface

Code	Text	Priority Project	Priority
VERSUS2_MAN_GUI-1	**[Priority: A]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage new types of observations.	*Contextualised*	
VERSUS2_MAN_GUI-2	**[Priority: A]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisistion data, shall be extended to manage **FeedBack Files**.	**Chapter 3.** **3.2.1.3 FeedBack Files From Data Assimilation and the model** *These files could be seen as another basis to*	**Appendix 1.** **"A" PRIORITY - Observation Data**

		perform…p.17	
VERSUS2_MAN_GUI-4	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisition data, shall be extended to manage climatology information.	**Chapter 3.** **3.2.1.2 Forecast Data** *-different reference forecasts:… Often climatology…p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_MAN_GUI-5	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisition data, shall be extended to manage subjective forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed-subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY - Forecast Data**
VERSUS2_MAN_GUI-3	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisition data, shall be extended to manage **probabilistic forecasts**.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Forecasts to be used... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-6	**[Priority: B]** The **GUI** of VERSUS, that manages all **Front Ends** for acquisition data, shall be extended to manage post processed forecast with **MOS** and Kalman filter.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed-subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-7	**[Priority: B]** The **GUI** of VERSUS, that manage the stratification configuration, shall be extended using special features like distance from sea, lee stations, marine stations.	**Chapter 3.** **3.2.2 Functional Requirements** *Need to assign to stations to create special stratification…p17*	**Appendix 1.** **"B" PRIORITY – Observation Data**
VERSUS2_MAN_GUI-8	The System shall have a **GUI** to configure **area stratifications** through a **GIS** system.	**Chapter 3.** **3.2.2 Functional Requirements** *Verifications for basins/boxes…p17*	
VERSUS2_MAN_GUI-9	The **GUI** to configure **area stratifications** shall give tools to define a geometrical shape (regular or irregular) on a map.	**Chapter 3.** **3.2.2 Functional Requirements** *Verifications for basins/boxes…p17*	
VERSUS2_MAN_GUI-10	**[Priority: A]** The **GUI** of VERSUS, that manage the parameter (for observations and for forecasts) configuration, shall be extended to manage new parameters.	*Contextualised*	
VERSUS2_MAN_GUI -11	**[Priority: B]** The System shall have a **GUI** to configure new **probabilistic models**.	**3.2.1.2 Forecast Data** *-Information from Probabilistic Forecasts... p.15*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-12	**[Priority: B]** The System shall		

	have a **GUI** to configure new scores.		
VERSUS2_MAN_GUI-13	**[Priority: A]** The System shall have a **GUI** to configure new methods to manage verifications using gridded observations.		**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_GUI-14	**[Priority: B]** The **GUI** to configure new methods for gridded observations shall have a field to define the area through n grid points and a selection of average, maximum, minimum, percentile to calcolate within the area.	**Chapter 3.** **3.2.1.2 Forecast data** *Other scores and methods* *-take average/maximum/* *Minimum/percentile within box* *… p17*	**Appendix 1.** **"B" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-15	**[Priority: A]** The System shall have a **GUI** to manage new **Area Standard Verifications**.	**Chapter 3.** **3.2.1.2 Observation data** *The following are the observation data…p14*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_GUI-16	**[Priority: A]** The System shall have a **GUI** to manage new **Area Conditional Verifications**.	*Contextualised*	
VERSUS2_MAN_GUI-17	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose an **area stratification** .	*Contextualised*	
VERSUS2_MAN_GUI-18	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a method for observations and forecasts.	*Contextualised*	
VERSUS2_MAN_GUI-19	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose **in-situ observations** to verify within an area.	*Contextualised*	
VERSUS2_MAN_GUI-20	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose new **remote sensing observations** to verify within an area.	*Contextualised*	
VERSUS2_MAN_GUI-21	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a set of **remote sensing** or **in-situ observations** within the selected **area stratification**.	*Contextualised*	
VERSUS2_MAN_GUI-22	**[Priority: A]** The **GUI** to manage new **Area Standard Verifications** shall have a option to choose a **deterministic** or **probabilistic model**, a run, a start, a stop and an interval step.	*Contextualised*	

VERSUS2_MAN_GUI-23	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose a generic interval for parameters with cumulation.	**Chapter 3.** **3.2.2 Functional Requirements** *-Cumulative precipitation has to be calculated on any interval…p.17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_GUI-24	**[Priority: A]** The **GUI** of VERSUS to manage **Area Standard and Conditional Verifications** shall be extended to choose a generic interval for parameters with cumulation.	**Chapter 3.** **3.2.1.2 Forecast data** *Other scores and methods* *-take average/maximum/ Minimum/percentile within box* *… p17*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_GUI-25	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose subjective forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed- subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-26	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use subjective forecasts.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed- subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-29	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose climatology information.	**Chapter 3.** **3.2.1.2 Forecast Data** *-different reference forecasts:… Often climatology…p.16*	
VERSUS2_MAN_GUI-30	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use climatology information.	**Chapter 3.** **3.2.1.2 Forecast Data** *-different reference forecasts:… Often climatology…p.16*	
VERSUS2_MAN_GUI-27	**[Priority: B]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to choose post processed forecasts **MOS** and Kalman filter.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed- subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**
VERSUS2_MAN_GUI-28	**[Priority: B]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to use post processed forecasts **MOS** and Kalman filter.	**Chapter 3.** **3.2.1.2 Forecast Data** *-Post Processed- subjective and objective... p.16*	**Appendix 1.** **"B" PRIORITY – Forecasts data**

VERSUS2_MAN_GUI-31	**[Priority: B]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.	**Chapter 3.** **3.2.2 Functional Requirements** *-Verification for predefined periods…p17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_GUI-32	**[Priority: B]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure seasonal, monthly, weekly, daily verifications or defined on a generic number of days.	**Chapter 3.** **3.2.2 Functional Requirements** *-Verification for predefined periods…p17*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_GUI-33	**[Priority: A]** The **GUI** to manage new **Area Standard and Conditional Verifications** shall have a option to configure verifications on periods separated (**weather type verification**).	**Chapter 3.** **3.2.2 Functional Requirements** *-Weather type dependent verification…p18*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_GUI-34	**[Priority: A]** The **GUI** of VERSUS to manage **Standard and Conditional Verifications** shall be extended to configure verifications on periods separated (**weather type verification**).	**Chapter 3.** **3.2.2 Functional Requirements** *-Weather type dependent verification…p18*	**Appendix 1.** **"A" PRIORITY – Observation Data**
VERSUS2_MAN_GUI-35	**[Priority: A]** The **GUI** to manage new **Area Conditional Verifications** shall have the shall have a option to choose a **deterministic model**, a run, a start, a stop and an interval step.	*Contextualised*	
VERSUS2_MAN_GUI-36	**[Priority: A]** The **GUI** to manage new **Area Conditional Verifications** shall have a option to choose a condition on a model other than to verify.	**Chapter 3.** **3.2.2 Functional Requirements** *-Conditional verification on models errors…p18*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_GUI-37	**[Priority: A]** The **GUI** of VERSUS to manage **Conditional Verifications** shall extend to choose a condition on a model other than to verify.	**Chapter 3.** **3.2.2 Functional Requirements** *-Conditional verification on models errors…p18*	**Appendix 1.** **"A" PRIORITY – General Features**
VERSUS2_MAN_GUI-38	**[Priority: A]** The System shall have a **GUI** to configure graphics for **COSI** related to **deterministic verifications.**	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation and refinements of COSI COSMO …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-39	**[Priority: A]** The System shall have a **GUI** to manage verifications on **FeedBack Files**.	**Chapter 3.** **3.2.1.3 FeedBack Files From Data**	**Appendix 1.** **"A" PRIORITY - Observation Data**

		Assimilation and the model *These files could be seen as another basis to perform…p.17*	
VERSUS2_MAN_GUI-41	**[Priority: A]** The System shall have a **GUI** to manage **Fuzzy Verifications**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-42	The **GUI** of VERSUS related to score visualization shall be extended to new scores.	*Contextualised*	
VERSUS2_MAN_GUI-43	The System shall have new **GUIs** to configure graphs on maps.	**Chapter 3.** **3.2.2 Functional Requirements** *Scores should also have geographical map represantation…p18*	
VERSUS2_MAN_GUI-44	**[Priority: A]** The **GUIs** of VERSUS to configure graphs shall be extended to new scores.	*Contextualised*	
VERSUS2_MAN_GUI-45	**[Priority: B]** The System shall have a **GUI** to configure graphs between **deterministic standard and conditional verifications** within a common stratification and different parameters.	**Chapter 3.** **3.2.2 Functional Requirements** *Comparison between different models…p18*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_GUI-46	**[Priority: B]** The System shall have a **GUI** to configure **Cross Model** graphs between **deterministic standard and conditional verifications** within a common stratification and different models.	**Chapter 3.** **3.2.2 Functional Requirements** *Comparison between different models…p18*	**Appendix 1.** **"B" PRIORITY – General Features**
VERSUS2_MAN_GUI-47	**[Priority: A]** The System shall have a **GUI** to configure **Cross Model** graphs between **fuzzy verifications** within a common **area stratification.**	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-50	**[Priority: A]** The System shall have a **GUI** to configure **Monthly graphics** for **Fuzzy Verifications** within a common **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-49	The System shall have a **GUI** to configure **Monthly Graphics** for **deterministic standard and conditional verifications** within a common **area stratification**.	*Contextualised*	
VERSUS2_MAN_GUI-52	**[Priority: A]** The **GUI** of VERSUS to configure **Times Series graphics** shall	*Contextualised*	

	be extended to new observations.		
VERSUS2_MAN_GUI-53	**[Priority: A]** The **GUI** of VERSUS to configure **Daily Cycle graphics** shall be extended to new observations.	*Contextualised*	
VERSUS2_MAN_GUI-40	**[Priority: C]** The System shall have a **GUI** to manage **Object Oriented Verifications**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-48	**[Priority: C]** The System shall have a **GUI** to configure **Cross Model** graphs between **object oriented verifications** within a common **area stratification** .	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**
VERSUS2_MAN_GUI-51	**[Priority: C]** The System shall have a **GUI** to configure **Monthly graphics** for **Object Oriented Verifications** within a common **area stratification**.	**Chapter 3.** **3.2.2 Functional Requirements** *-Implementation of Object-oriented and SAL-like methods…; p.18*	**Appendix 1.** **"C" PRIORITY – Statistical Features**

Non Functional Requirements

Code	Text	Priority Project	Priority
VERSUS2_CP-1	The System shall use a multiplatform **DB** version	**Chapter 3.** **3.2.2 Non-Functional Requirements** *Multiplatform DB version.. …p19*	
VERSUS2_INT-1	The System shall use modules from other applications through the use of a standard data format.	**Chapter 3.** **3.2.2 Non-Functional Requirements** *Different modules should be connected and exchange.. …p19*	
VERSUS2_INT-2	The System shall use extra **R** applications using data already loaded	**Chapter 3.**	

	in the database.	**3.2.2 Non-Functional Requirements** *Modularity of VERSUS1.. …p19*	
VERSUS2_INT-3	The System shall use modules from **MET** software.	**Chapter 3.** **3.2.2 Non-Functional Requirements** *Modules from other applications,e.g.MET …p19*	
VERSUS2_INT-4	The System shall store results from **MET** modules on local system and possibly in the database	**Chapter 3.** **3.2.2 Non-Functional Requirements** *Modules from other applications,e.g.MET …p19*	
VERSUS2_OPR-3	System shall include **Fuzzy Tool Box**	**Chapter 3.** **3.2.2 Functional Requirements** *Implementation…(fuzzy verification…) …p18*	**Appendix 1.** **"A" PRIORITY – Statistical Features**