INSPECT: Progress Report

Task 1: Data and Models Setup

1a. Rerun of COSMO (COSMO-7, COSMO-2, COSMO-1) models for MesoVICT cases with more recent model versions (MCH) **ONGOING**

MCH: The recalculations with COSMO-1 for the first MesoVICT period (20-22 June 2007)
Comments: Rerun of COSMO1 currently available (2,7?). Provide retrieve information. Next test cases reruns

1b. Provide high resolution deterministic and ensemble runs for the Sochi region to be used in Tasks 3 and 4 (RHM) - **ONGOING**

RHM: A unified archive is prepared for deterministic and ensemble systems in the Sochi region for the evaluation period of the Sochi Olympics (15 January – 15 March 2014) (Deterministic models: COSMO-RU with grid spacing 1km, 2.2 km, 7km; GEM with grid spacing 2.5 km, 1 km, 0.25 km; NMMB – 1 km; HARMONIE – 1 km; INCA – 1 km; the ensemble systems: COSMO-S14-EPS (7km), Aladin LAEF (11km), GLAMEPS (11km), NMMB-EPS (7km), COSMO-Ru2-EPS (2.2km), HarmonEPS (2.5km)) . All forecasts in this archive are presented following TIGGE-LAM standards. The following elements are available: T2m, Tdew 2m, 10m u and v wind components, wind gusts at 10 m, pmsl, and accumulated total precipitation. All fields are in grib2 format. ***The data can be exported from http://frost2014.meteoinfo.ru (login: frost password: steam) -> Forecasts --> Export grid forecasts***.
CLOSED

1c. Perform reruns of global model ECMWF-EPS to provide boundary conditions for COSMO-LEPS. Perform reruns of and/or COSMO-E and COSMO-RU-EPS for MesoVICT test cases (ARPA-SIMC) - **ONGOING**

ARPA-SIMC: Reruns of COSMO-LEPS are performed and are available at the MesoVICT site http://www.ral.ucar.edu/projects/icp/ . They have been interpolated on the VERA grid (8km) of the VERA ensemble domain and the VERA parameters have been calculated. Data are saved in ASCII format on a Cartesian grid. The model ensemble domain is smaller than the original VERA ensemble-domain. Forecasts are provided for the period 15-22 June 2007 on a 3-hourly period.
Comments: Availability of data in GRIB format. Difference with VERA grid domain

1d. Preparation of Radar/Radar-raingauge precipitation dataset (national radar networks) for experiments (RHM) - **ONGOING**
RHM: The radar composite data of the Russian Institute of Radar Meteorology are prepared for experiments (Sochi region). The following parameters were selected: Akhun (Sochi) Vaisala radar data interpolated to a grid of 349 lons * 481 lats with 0.00833 lat-lon (about 1 km) increments. The radar analysis is compared with available station data.

Task 2: Adaptation of statistical software and techniques

2a. Policy for model output and observation data format standards before entering verification chain (preprocessing) based on existing COSMO data processing software (coordination with Fieldextra SCA). (RHM, HNMS) - **ONGOING**

RHM: Scripts are written for the interpolation of model data prepared within task 1b using GRADS onto the radar grid of 349 lons * 481 lats with 0.00833 lat-lon step (Sochi region). The data is transferred to txt format and serves as input for SpatialVx functions.
HNMS: Research on applicability of different formats and comparative advantages and limitations of using Fieldextra and LibSIM software for preprocessing for VAST and SpatialVx.
Comments: RHM contribution more appropriate for Task 2b. Necessity of a meeting with Fieldextra and VAST SCAs.

2b. Adaptation of existing free verification packages (in particular, SpatialVx and VAST) to COSMO data and development of local tools with the aim to create scripts for applying the most widely used spatial methods, that will be utilized in Tasks 3 and 4. (RHM, HNMS, ARPA-PT, IMGW-PIB) - **ONGOING**

RHM: A set of programs is written (Fortran and UNIX shell programming) for running R SpatialVx functions *hoods2d* (neighborhood methods) and *craer* (Contiguous Rain Area method) using the data of tasks 1b, 1d, and 2a. These programs can be adapted for other input data.
HNMS*:* Installation and review of SpatialVx software. Installation of VAST and first stage of Mesovict data adaptation tools
ARPA-PT: Adaptation of VAST on test cases.
IMGW-PIB: MODE test cases

Comments: All derived scripts and software to become available in a common repository

Task 3: Application of methods on deterministic models

3a: Test DIST methodology with the available MesoVICT data on the MesoVICT selected cases (at least in terms of total precipitation using the DIST spatial verification method based on catchment area or boxes of fixed size comparing different indices (mean, median, percentiles) (ARPA-SIMC) - **ONGOING**

3b: Explore the possibility to extend the DIST methodology on wind speed (in space and in time) (ARPA-SIMC) - **PENDING**

ARPA-SIMC: Data from MesoVICT is adapted as input for DIST programs.
Comments: Possibility for DIST to be available as common software. High priority by the STC Task3b.

3c. Analysis of long time series of scores (in particular: FSS, Upscaling with ETS and FBI) for precipitation. Further investigation into the most informative and compact representation of scores. (DWD, MCH) - **ONGOING**

MCH: Pending
DWD: A set of programs is written for representation of neighborhood scores.
Data sources
Precipitation forecasts of german COSMO-models and GME (with March 2015 ICON)
Precipitation observations from radar data
Method of calculations:
Getting ETS for upscaling fractions skill score as monthly values from fuzzy verification
No averaging over daily values but calculation of scores from the contingency tables of the whole month
Calculation of running means of the results over one year
Presentation of mean values and mean averages
Gridsizes and thresholds
Grid (GS) from 0.025 (resolution of COSMO-DE) to 1.625 (65 * resolution of COSMO-DE)
Thresholds: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 mm (12h) -1 or (24h) -1
The graphs enable detecting the most useful scale for different models. It is shown that the higher resolution model advantage becomes evident only for the highest window size. The programs can be adapted for other COSMO data.
Comments: Representation of scores programs availability

.

3e. Application of neighborhood (FSS, ETS) and possibly features-based (CRA) methods for deterministic models of different resolution for the Sochi region (COSMO-RU with grid spacing 1km, 2.2 km, 7km; GEM with grid spacing 2.5 km, 1 km, 0.25 km; NMMB – 1 km; HARMONIE – 1 km; INCA – 1 km) (RHM) - **ONGOING**

RHM: Different neighborhood scores for all the models (task 1b) as output from hoods2d SpatialVx function (among which are ETS, FSS, Hit rates, False alarm rates) are obtained for a number of precipitation cases in the Sochi region from 15 Jan to 15 March 2014. One-hour precipitation accumulations are analyzed. Precipitation patterns are classified into land precipitation, sea precipitation, and land-sea precipitation; several weather processes are identified and the scores are analyzed according to this classification. One of preliminary results is that COSMO-Ru2 and COSMO-Ru1 models tend to underestimate precipitation at higher thresholds.
CRA precipitation objects from model and radar data and associated measures (such as the shifts between the centers of gravity of identified objects (geometric locus)) are obtained as output of craer SpatialVx function. The analysis is still in progress.
Some recommendations concerning further development of SpatialVx functions are formulated and will be communicated to the developer of this software Eric Gilleland at the EMS-ECAM meeting in September 2015.
Comments: Application of CRA methods on MesoVICT Core Case.

3f: Application of traditional categorical scores and spatial verification methods to analyze extreme precipitation events based on MesoVICT cases (HNMS, RHM, IMGW-PIB) - **ONGOING**

HNMS; Adaptation of MesoVICT core case in appropriate format for VERSUS pointwise analysis. Forecast data from COSMO1 are utilized (produced from Task1a, 1h precipitation). Data processing in 6h accumulations and GTS Observation datasets. No results yet due to a bug encountered in verification software (VERSUS).
Review of SEEPS index, prototype of code available but extensive work will need to be given to connect it with model climatology and forecast data. Still in evaluation stage.
Comments: Usability of extreme event categorical indexes only on large datasets.

RHM; **IMGW-PIB**: pending

Task 4: Overview of spatial methods on EPS systems

4a. Verification study of COSMO-LEPS against ECMWF ENS in terms of total precipitation using the same methods (DIST method) for MesoVICT cases (ARPA-SIMC) - **ONGOING**

ARPA-SIMC: Input data from MesoVICT is being adapted for DIST software.

4b: Verification study of COSMO-Ru-EPS (2.2 km) and, possibly, COSMO-E ensemble for MesoVICT cases
Will MCH participate in this task?

4c: A study on applicability of spatial methods to ensemble systems of different resolution for the Sochi region (for individual members, probabilities, ensembles of attributes). The EPS models utilized will be: COSMO-S14-EPS (7km), Aladin LAEF (11km), GLAMEPS (11km), NNMB-EPS (7km), COSMO-RU2-EPS (2.2km), HARMON-EPS (2.5km), for the period of Sochi Olympics.

Task 5: Guidelines for relative usefulness of various spatial methods in decision-making

5a. Follow-up of the outcomes from the Tasks of INSPECT and the work accomplished in MesoVICT test cases by the international community: classification of the analysis into categories (e.g. filtering, displacement methods) followed by an intercomparison of the outcomes for each category (assessment of differences/resemblances to the MesoVICT cases applications). (MCH, HNMS, RHM) - **PENDING**

MCH; HNMS; RHM: pending**.**

The overview of MesoVICT activities will be given after the MesoVICT session at the EMS-ECAM meeting in Sofia in September 2015.

Task 5: Guidelines for relative usefulness of various spatial methods in decision-making

5b: Analysis of the usefulness of various spatial methods (**precipitation** and possibly **wind**). Overview of their characteristics with respect to: efficiency in calculation time, ability to deal with different density of observations, stability against observation errors, proving added value of high-resolution models, ability to address specific issues of interest (e.g. location errors, intensity errors, performance at different scales) etc. Pros and cons of various methods in terms of each verification questions imposed by the user.

5c: Guidelines for using spatial methods, leading to an updated strategy for decision-making. This will also include information on the tools that can be utilized and a complete set of tools to perform all the statistical methods that were proved to be more informative during the assessment of Task 5b (link to the outcome of Task 2).

5d: Guidelines for applying spatial methods on convection permitting ensemble systems.

EMS Annual Meeting Abstracts
Vol. 12, EMS2015-140, 2015
15th EMS / 12th ECAM

Intercomparison of Spatial Verification Methods for COSMO Terrain (INSPECT): Preliminary Results

Dmitry Alferov (1), Elena Astakhova (1), Dimitra Boukouvala (2), Anastasia Bundel (1), Ulrich Damrath (3), Pierre Eckert (4), Flora Gofa (2), Alexander Kirsanov (1), Xavier Lapillonne (4), Joanna Linkowska (5), Chiara Marsigli (6), Andrea Montani (6), Anatoly Muraviev (1), Elena Oberto (7), Maria Stefania Tesini (6), Naima Vela (7), Andrzej Wyszogrodzki (5), and Mikhail Zaichenko (1)

(1) RHM (a.bundel@gmail.com), (2) HNMS, (3) DWD, (4) MCH, (5) IMGW-PIB, (6) ARPA-SIMC, (7) ARPA-PT

A COSMO consortium project devoted to spatial verification methods (INSPECT) has been created to follow MesoVICT activities and to summarize the experience of applying spatial verification methods to high and very high resolution models (deterministic and EPS) comprising COSMO forecast systems. In addition to targeting the objectives of MesoVICT, INSPECT has been designed with the aim of providing COSMO users with more choice of verification domains and reference data, and encouraging the participation of the COSMO community in the development and improvement of spatial verification methods. It is planned to propose a set of Guidelines by the end of the project to facilitate decision-making about which methods are best suited to particular applications.

Some first results concern applications at DWD, where the FSS and ETS for the upscaling method are calculated for 6-hr precipitation data over the entire German territory since 2007, providing plots of long-term trend of these indices. It is shown that a lower threshold and larger window give the highest skill in all cases. Such plots allow compact representation of the neighborhood scores.

Application of neighborhood (FSS, ETS) and possibly features-based (CRA) methods for deterministic models of different resolution for the Sochi region (COSMO-Ru with grid spacing 1km, 2.2 km, 7km; GEM with grid spacing 2.5 km, 1 km, 0.25 km; NMMB – 1 km; HARMONIE – 1 km; INCA – 1 km) will provide some indication of the ability to compare high and very high resolution models in complex terrain.

Critical (or less critical) Issues

➢In the recent SMC webconf (29.7.2015), SMC accepted and recommended the document of the revised PP plan for approval by STC with necessary clarifications. It was required that the goal definition should be more emphasized to reflect the **COSMO strategy focused on ensemble methods**. It was pointed out that the new aspects of the project are the **applications of spatial methods to ensemble and to other that precipitation parameters (wind speed)**.

➢Current Participation in Task4 cannot guarantee the fulfillment of this goal of the project.
ARPA-SIMC, MCH (end 2016)

➢Priority to apply each methodology on **MesoVICT cases (Core)** and secondary on national datasets. This will facilitate the Task 5 in the analytic evaluation of all methods

➢Avoid duplication of efforts :
Data preprocessing (COSMO model data on MesoVICT cases adapted files in a common db)
Outcome of Task2b in a common repository
Application of a methodology from one user for each MesoVICT case

➢Regular reporting from contributors for Task work progress (end of each semester) – short summary and FTE attribution

➢ Organization of meetings (web) to discuss results, problems, MesoVICT news (email exchange through inspect-mailing list)

➢ VAST software related problems/bugs can be reported in VERSUS forum

PP: INSPECT

FTEs used in 2015

	INSPECT			
	SON	DJF	MAM	JJA
Germany			0.050	0.050
Switzerland			0.040	0.020
Italy			0.100	0.100
Greece			0.050	0.050
Poland			0.020	0.050
Romania				
Russia			0.220	0.220
Israel				
Total			**0.480**	**0.490**

FTEs planned for 2015-2016

	INSPECT			
	SON	DJF	MAM	JJA
Germany				0.020
Switzerland	0.020	0.020	0.020	0.030
Italy	0.170	0.170	0.210	0.230
Greece	0.070	0.090	0.120	0.160
Poland	0.080	0.100	0.100	0.100
Romania				
Russia	0.200	0.210	0.155	0.185
Israel				
Total	**0.540**	**0.590**	**0.605**	**0.725**

Additional Slides

INSPECT Participants

PL: A. Bundel and F.Gofa

- ARPA-SIMC: Maria Stefania Tesini, Andrea Montani, Chiara Marsigli
- ARPA-PT: Elena Oberto and Naima Vela
- DWD: Uli Damrath
- HNMS: Flora Gofa, Dimitra Boukouvala
- MCH: Xavier Lapillonne, Pierre Eckert.
- RHM: Anastasia Bundel, Elena Astakhova, Anatoly Muraviev, Alexander Kirsanov, Mikhail Zaichenko, Dmitry Alferov
- IMGW-PIB: Joanna Linkowska, Andrzej Wyszogrodzki

Estimated Resources

- Estimated needs in FTE-years:

  Total 5.2 FTEs for two years:

  2015-2016: 2.25 FTEs

  2016-2017: 2.95 FTEs