ΕΘΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΚΗ ΥΠΗΡΕΣΙΑ
HELLENIC NATIONAL METEOROLOGICAL SERVICE

CONSORTIUM FOR SMALL SCALE MODELING COSMO

# Priority Project: APOCS - HNMS

## Application of Personal Weather Station and Opportunistic Sensor Data CrowdSourcing

### TASK 3: Adaptation of private/citizen datasets for verification purposes over Greece

**SubTask 3.1: Titan lib applied to meteorological data in the Greek domain**

- Installation testing and application of TITAN software for a quality control of **Temp** and **Preci** over the Greek domain.
- Gather meteorological datasets from private networks and crowdsourced data, focusing on areas with inadequate coverage of the HNMS network is. The terms of operational/research use of such data will be identified.
- Application of TITAN software package for a quality control of ground measurements from the "official" network of stations of HNMS, and "non-official" network
- Set up an optimized methodology for production of a reliable - quality controlled - homogenenized dataset of point measurements

*Participants: Dimitra Boucouvala, HNMS. 0.2FTEs, Dates: April 2025 - February 2026*

**Performed since May 2025**

- Contact with private networks and owners of PWS stations around Greece
- Problems with availability of precipitation data, averaging/reporting times for 2mT data.
- **TITAN** was installed and some sample programs for precipitation (sent by E. Oberto) for buddy check and buddy event check were tested for the Italian domain with sample data input. Some clarifications on the parameters (such as deviation and thresholds) may be needed and discussed.

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### TASK 3: Adaptation of private/citizen datasets for verification purposes over Greece

**SubTask 3.2: Climatology based Interpolation methodology of precipitation data from various sources**

A verification procedure must be based on equally realistic and detailed observations as high-resolution model forecasts Precipitation observations from “official” and “unofficial” networks together with remote sensing data can only increase the accuracy of the “true” location of rainfall events.

- An approach to create precipitation gridded datasets for areas with complex terrain as Greece, which is based on an interpolation method that uses long climate data series to determine the geographical characteristics that this parameter is best correlated with, as well as remote sensing estimates as background information to cover the areas where observations are insufficient.
- The methodology will be applied on the datasets that are resulted from SubTask 3.1, with the addition of H-SAF precipitation estimates mainly to over sea areas that ground observations are not available.

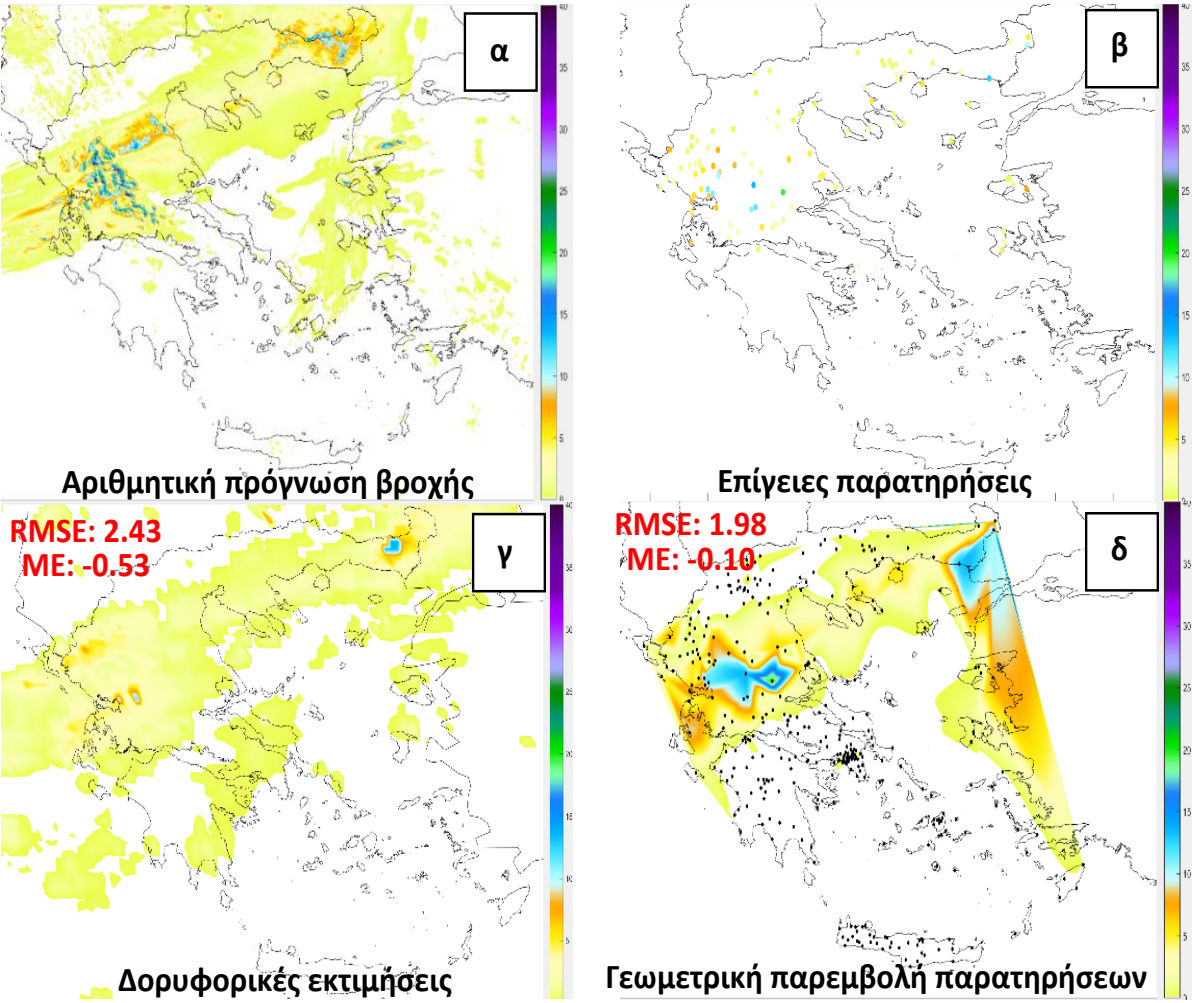
*Participants: Flora Gofa, HNMS, 0.5FTEs, June 2025 - June 2026*

**Performed since June 2025**

- Install MISH software to local machine
- Use of homogenized long time series of precipitation data from HNMS network
- (1970-2010) to calculate best correlations with geophysical data – In process

# 3.2 Reasoning of study

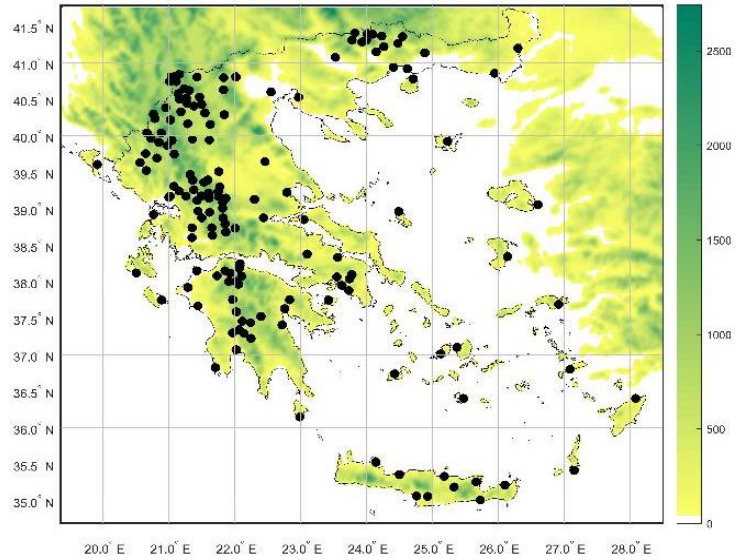
## *PWS data to support gridded obs*




- High resolution forecasts in ~km scale produce realistic spatial structures for precipitation and an objective evaluation has a prerequisite detailed representation of the «reality».
- What usually is available for this domain is insufficient in-situ measurements over Greece , precipitation estimates of lower resolution (satellite) or estimates of limited coverage (radar).
- Greek terrain is characterized by steep slopes in mainland and large areas covered by water, all important factors for rainfall formation and demanding in terms of appropriate representativity in measurements
- PWS is a promising source of precipitation obs

# Precipitation Estimates

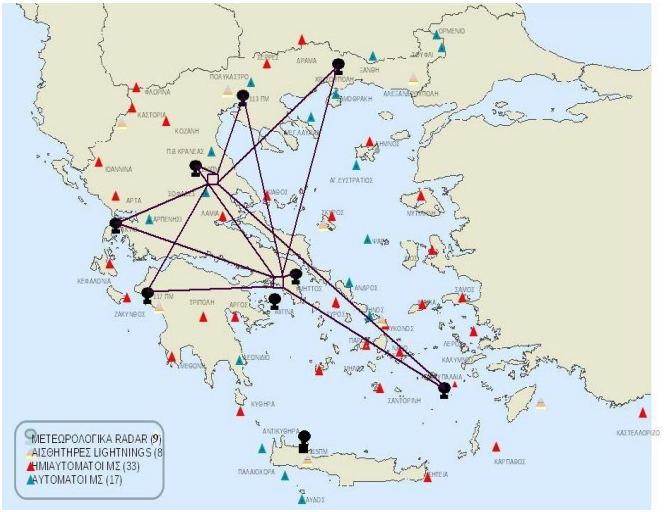
- **SYNOP Precipitation stations**




- **Satellite estimates: VIS/IR/MW**

| Dataset | Ανάλυση | Συχνότητα | Περίοδος | Πηγή | Αναφορά |
|---|---|---|---|---|---|
| TRNM 3842 | 0.25° | 3h/Daily | 1998-παρόν | TMI, TRMM, SSM/I, SSMIS, AMSR-E, AMSU-B, GEO-IR | Huffman et al., 2007 |
| PERSIAN-CCS | 0.04 ° | 30min/3.6h | 2003-παρόν | Meteosat.GOES, GSM. SSM/I, TMI, AMSR | Sorooshian, et al., 2002 |
| CMORPH | 0.25°/8km | 30min/3h/Daily | 2002-παρόν | TMI, SSM/I, AMSR-E, AMSU-B, Meteosat, GOES, MTSAT | Joyce et al., 2004 |
| IMERG | 0.1 ° | 30min/3h/Daily | 2015-παρόν | GMI, AMSR-2, SSMIS, MHS, Microwave Sounder | Hou et al., 2008 |
| H-SAF | 5-8km | 3, 6, 12, 24 h | 2012-παρόν | LEO MW, GEO IR imagery (P-IN-SEVIRI) | Mugnai et al., 2013a |

- **Radar estimates (C, S, X-band):** $Z = AR^b$



# Main (Semi) Private Weather Station Networks in Greece

**1. National Observatory of Athens (NOA / meteo.gr)** with ~350 automatic stations.

- Coverage across all of Greece, real-time updates every 10 minutes.
- Data available to the public with a lag of 6 months via meteo.gr

**2. Universities & Research Institutes**

- **Aristotle University of Thessaloniki (AUTH)** – network of stations in Northern Greece.
- **National & Kapodistrian University of Athens (NKUA)** – stations in Attica and elsewhere.
- **Universities of Patras, Crete, Aegean** – operate smaller research networks.

**3. National Agrometeorological Network**

- Run by **ELGO-DIMITRA** and the **Ministry of Rural Development**.
- Purpose: **agricultural applications** (crop disease prediction, irrigation scheduling, etc.).
  ~400 stations (depending on the year)

**4. Civil Protection / Municipal / Regional Networks**

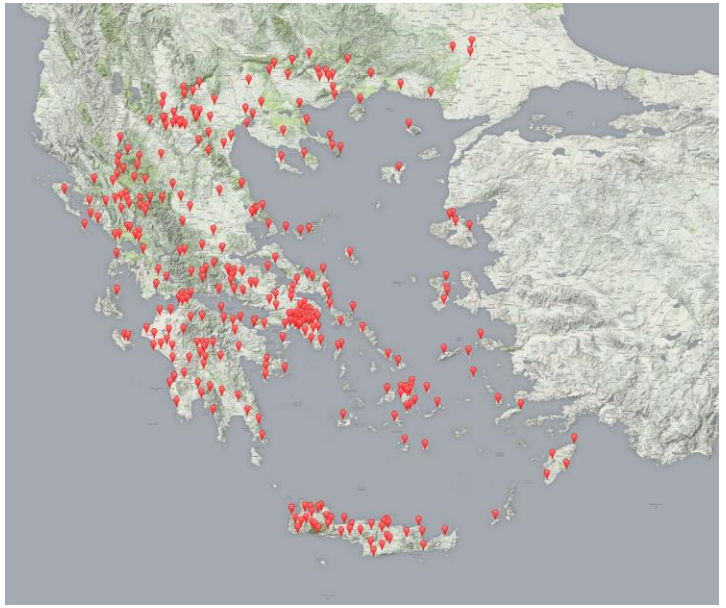
- Many municipalities and regional authorities have **local automatic networks** to monitor severe weather (storms, floods, etc.). Not easily accesible data.

**5. Private & Crowd-Sourced Networks**

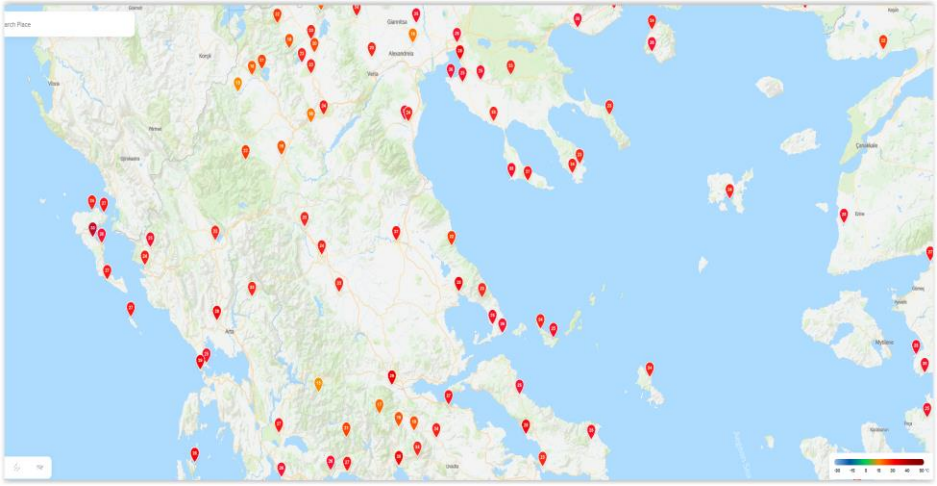
- **Netatmo Weathermap** – consumer stations (hundreds active across Greece).

**6. International / Specialized Networks**

- **Maritime Networks** – stations on ships and ports (e.g., HCMR, port authorities).



**National Observatory of Athens weather station network ~380**



**Netatmo** test data available in near-real time for many European stations. The procurement of the data has been done by EUMETNET and Norway will distribute the data. Planned start is 1st of July for a period of 6 months.The data should be available for EUMETNET members without further payment.

HOMOGENIZED CLIMATE DATA SERIES

# Analysis Software

QC Crowdsourced+Official Network precipitation data + (monthly, daily, hourly)

Background data
H-SAF, Radar

## Model
0.0083333 deg

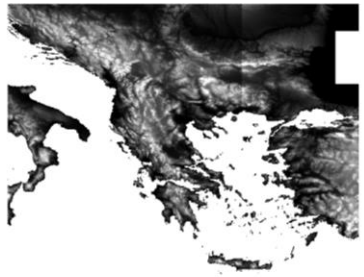
Monthly Statistical Parameters

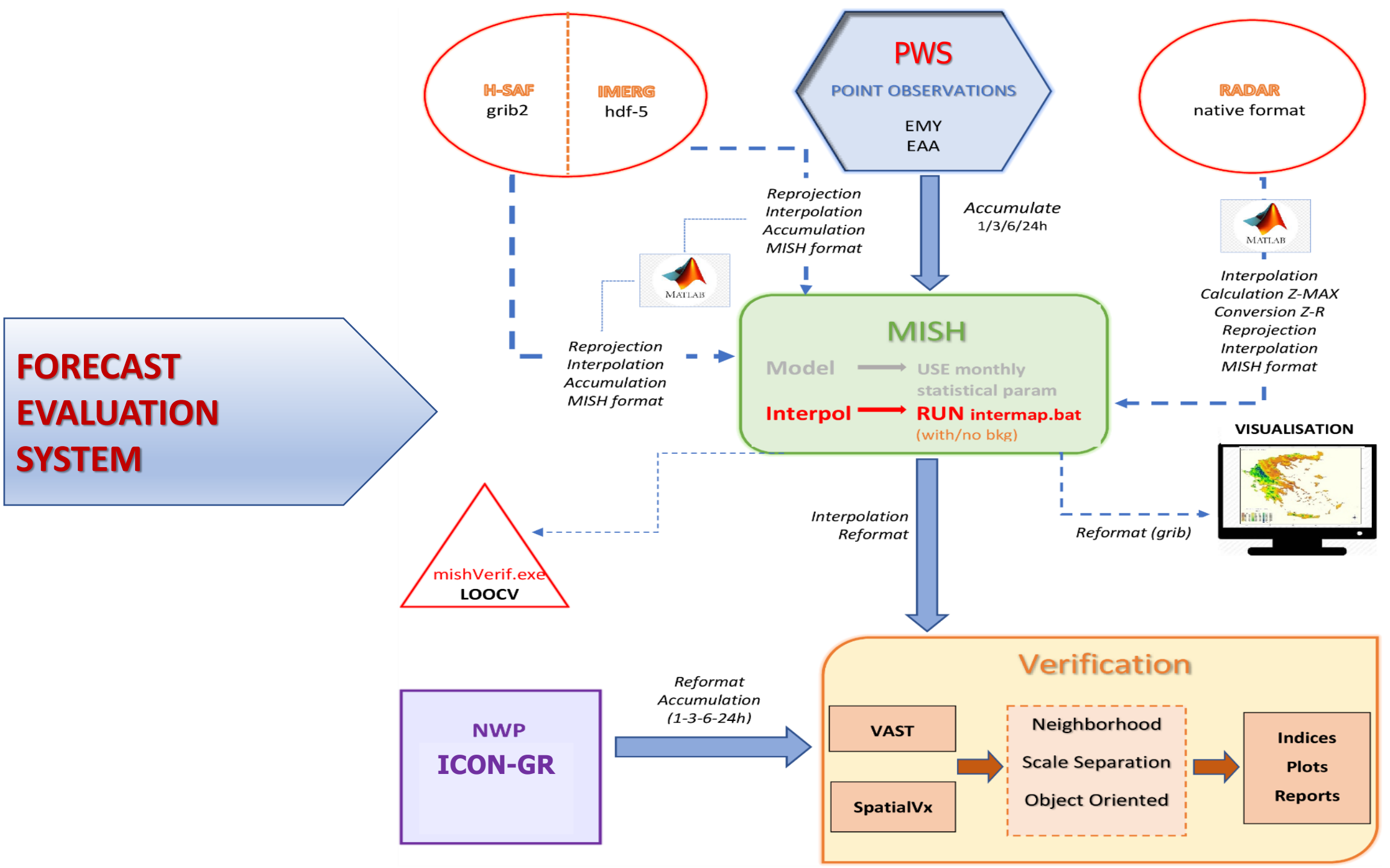
## Interpol
0.5’ ή 0.0083333 deg

## Gridded Obs

TOPOGRAPHY 90x90m
(digital surface model DEM/NASA
20 GEOPHYSICAL PARAMETERS:

Shuttle Radar Topography Mission




FORECAST EVALUATION SYSTEM
H-SAF
grib2
IMERG
hdf-5
PWS
POINT OBSERVATIONS
EMY
EAA
RADAR
native format
Reprojection
Interpolation
Accumulation
MISH format
Accumulate
1/3/6/24h
MATLAB
Interpolation
Calculation Z-MAX
Conversion Z-R
Reprojection
Interpolation
MISH format
Reprojection
Interpolation
Accumulation
MISH format
MISH
Model
USE monthly
statistical param
Interpol
RUN intermap.bat
(with/no bkg)
VISUALISATION
mishVerif.exe
LOOCV
Interpolation
Reformat
Reformat (grib)
NWP
ICON-GR
Reformat
Accumulation
(1-3-6-24h)
Verification
VAST
SpatialVx
Neighborhood
Scale Separation
Object Oriented
Indices
Plots
Reports