



# A coherent approach to evaluating spatially precipitation forecasts with limited observations

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## Κίνητρο Διατριβής



- High resolution forecasts in ~km scale produce realistic spatial structures for precipitation.
- Objective evaluation in a demanding process that has a prerequisite detailed representation of the «reality».
- What usually is available for this domain is insufficient in-situ measurements, precipitation estimates of lower resolution (satellite) or estimates of limited coverage (radar) or unrealistic interpolated fields.
- 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

# **Precipitation Measurements/Estimates**

#### > SYNOP Precipitation stations



20.0°E 21.0°E 22.0°E 23.0°E 24.0°E 25.0°E 26.0°E 27.0°E 28.0°E

#### > 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): $Z = AR^b$













### Episode July 16-17 2017



mesoscale convective system cut off low system passed over Greece followed by a cold front combined with strong convective activity.

Extended area of precipitation over mainland









#### **Development of Gridded Obs 16.07**



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Analysis 24h preci MISH July statistical parameters SYNOP (320 σταθμοί) H-SAF-H05 (0.03°)



#### **Statistical Evaluation of Obs Spatial Interpolation**



#### Verification of COSMO-GR4 and COSMO-GR1 for 16-17.07



#### **Neighborhood Methods**







17.07

16.07

#### **Object-based: SAL**



- Low SAL values especially for day1 for both models.
- Amplitude is the parameter with best scores, thus revealing a small overestimation from COSMOGR1 on day 1.
- The structure of forecast objects for day1 are broader and smoother than the ones observed α αντικείμενα είναι πιο μεγάλα και πιο ευρεία while for day 2 due to the high convective nature of the forecasted field the objects tend to be sharper and smaller especially for COSMOGR1.
- The Location of precipitation systems/objects is slightly better forecasted for COSMOGR1 while the overall taSAL leads to more successful forecasts for COSMOGR1 for day2 and while COSMOGR4 has a small advantage for day1.

### Thoughts after first use of the System

- The resolution of precipitation observation stations of estimates are often lower than the analysis of NWP products. Necessary to exploit every form of data that can represent the truth. Techniques of downscaling or blending of data from various sources are necessary.
- The use of climate data series for precipitation and their correlation to geophysical parameters contribute to the development of more reliable high resolution gridded observations
- The additional use of background field can improve the gridded obs, mainly when precipitation estimates are available in similar resolution than the one of the obs grid and with higher impact above areas with few stations or less clustering and above sea surfaces.
- When radar data (composite) were used as background, they have often significant (negative) impact on the reliability of gridded obs fields due to the error that is associated to the mix of radars with different characteristics as well as due to the uniform formula for Z-R conversion that is used in all precipitation types. Radar data due to the high resolution information that they offer, are beneficial as background for the analysis of small areas (one radar) and with appropriate optimization of the conversion relationship.
- Convection resolving models (COSMOGR1) are more skilful in a point or in a neighborhood than a grid cell (or neighborhood) of a conversion parameterized model for the analysis of an event.
- The verification errors are never attributed to the observed gridded fields even though often can be comparable in magnitude. Important to occasionally evaluate and quantify the deviation of «reality» from reality.





ΦΛΩΡΑ ΓΚΟ

#### Thank you



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#### Κλιματολογικοί Σταθμοί για Προτυποποίηση MISH (Modeling)



 157 σταθμούς
68 σταθμοί ΕΜΥ και 89 σταθμοί ΔΕΗ
Ομογενοποιημένα μηνιαία δεδομένα 1971-2000

