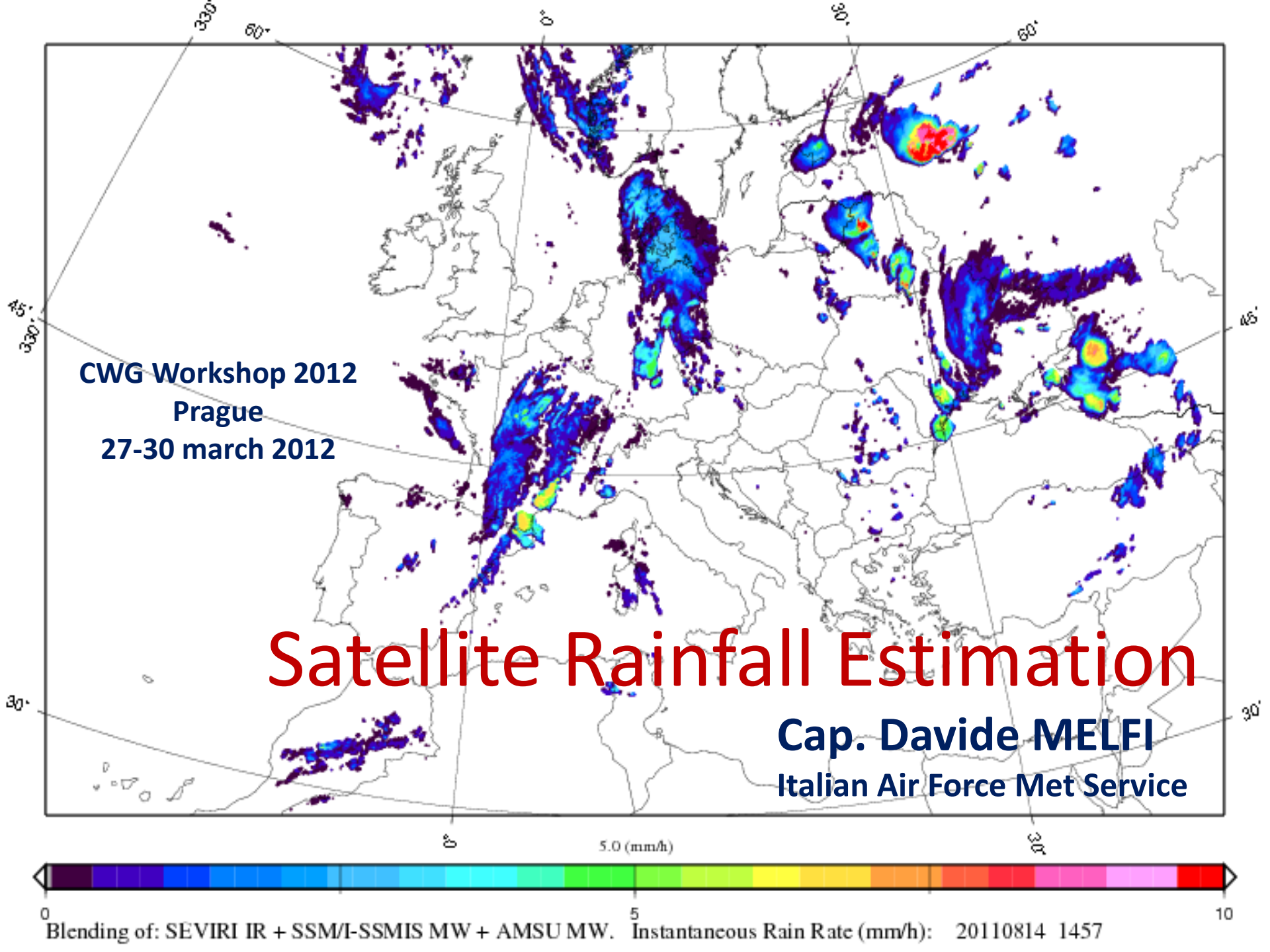
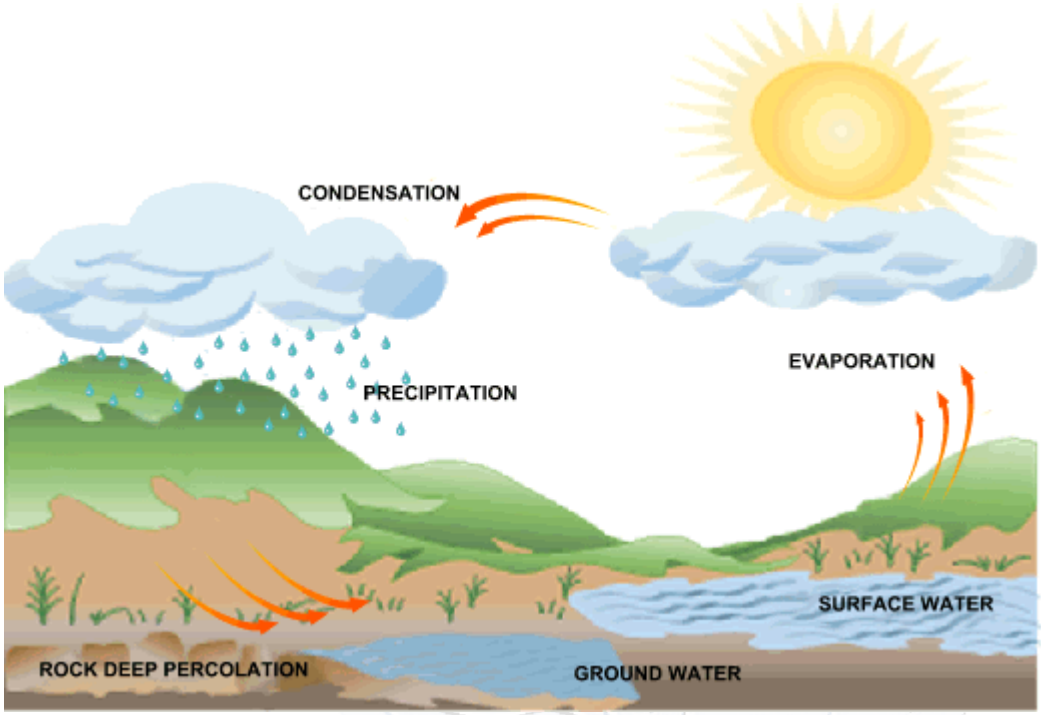

CWG Workshop 2012
Prague
27-30 march 2012
Satellite Rainfall Estimation
Cap. Davide MELFI
Italian Air Force Met Service
5.0 (mm/h)
0
5
10
Blending of: SEVIRI IR + SSM/I-SSMIS MW + AMSU MW. Instantaneous Rain Rate (mm/h): 20110814 1457

Satellite Rainfall Estimation Outline

- Why?
- From infrared and/or visible channels
- From Microwave instruments
- Satellite Rainfall Estimation multi-platform algorithm
- Outlooks

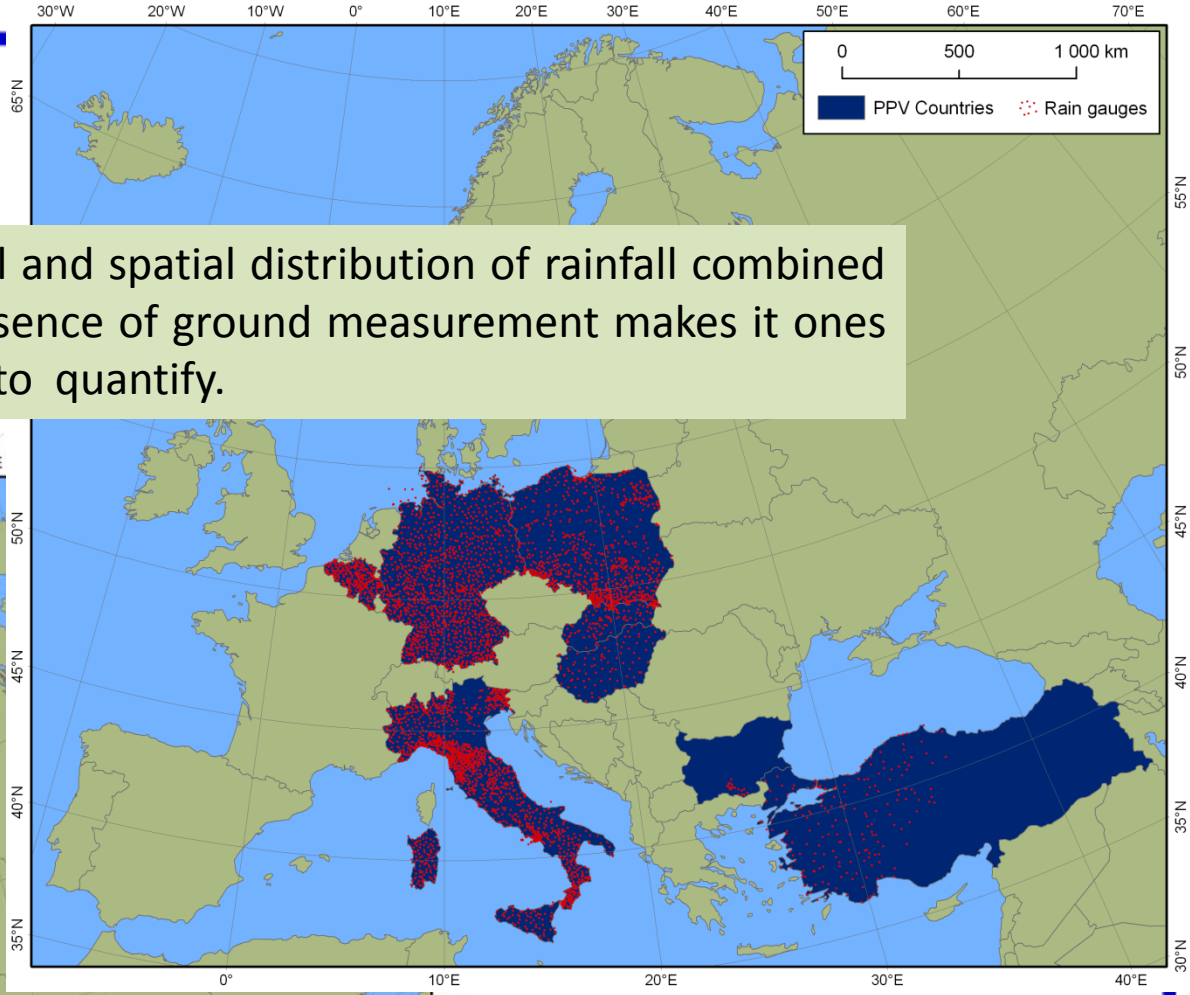
Why?

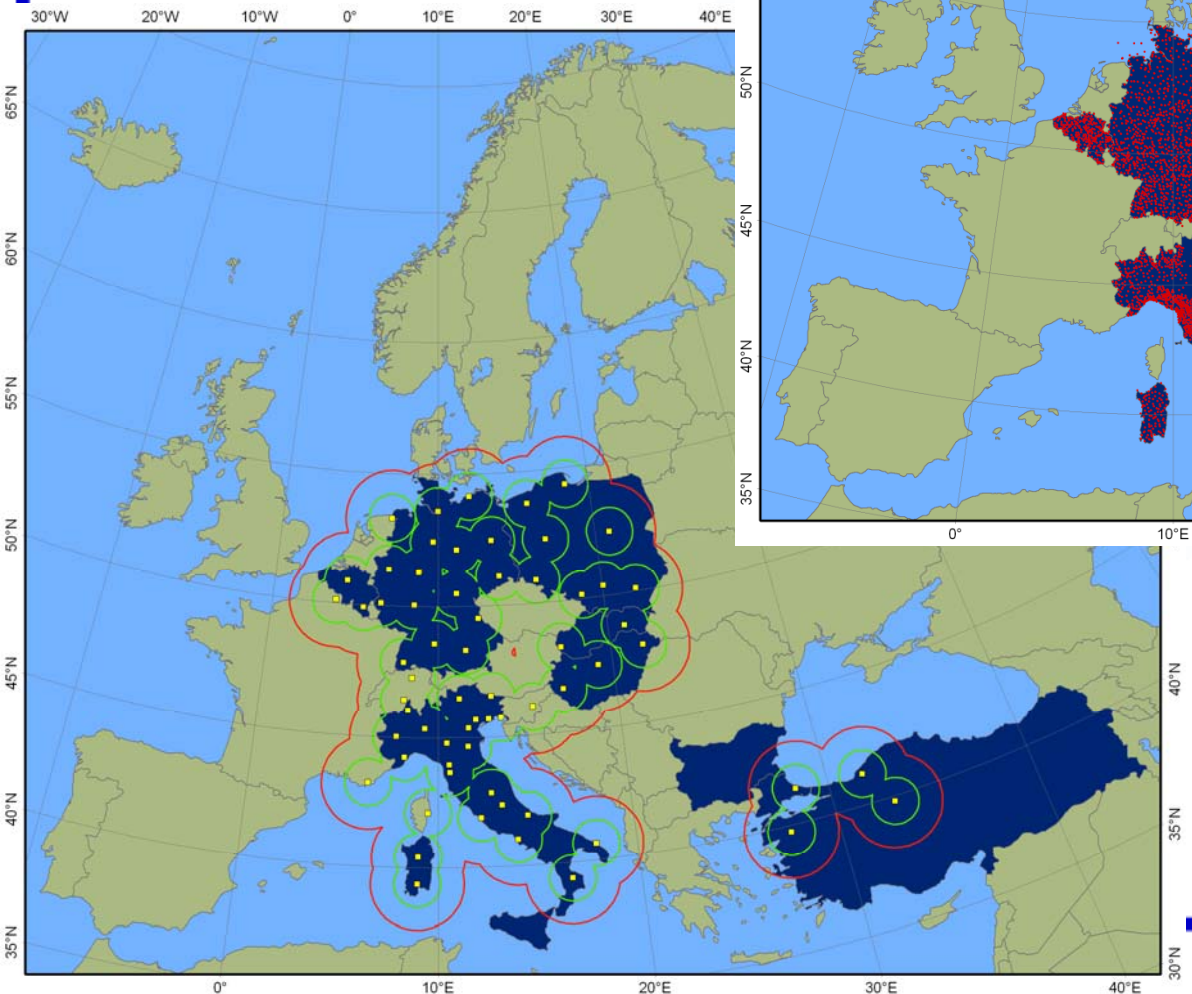


Precipitation is the most important variable in the hydrological budget of the Earth. So the better understanding of the spatial and temporal distribution of precipitation is fundamental for any hydrologic and climatic applications.

Why?

The inhomogeneity of temporal and spatial distribution of rainfall combined with the lack or the sparse presence of ground measurement makes it ones of the most difficult parameter to quantify.





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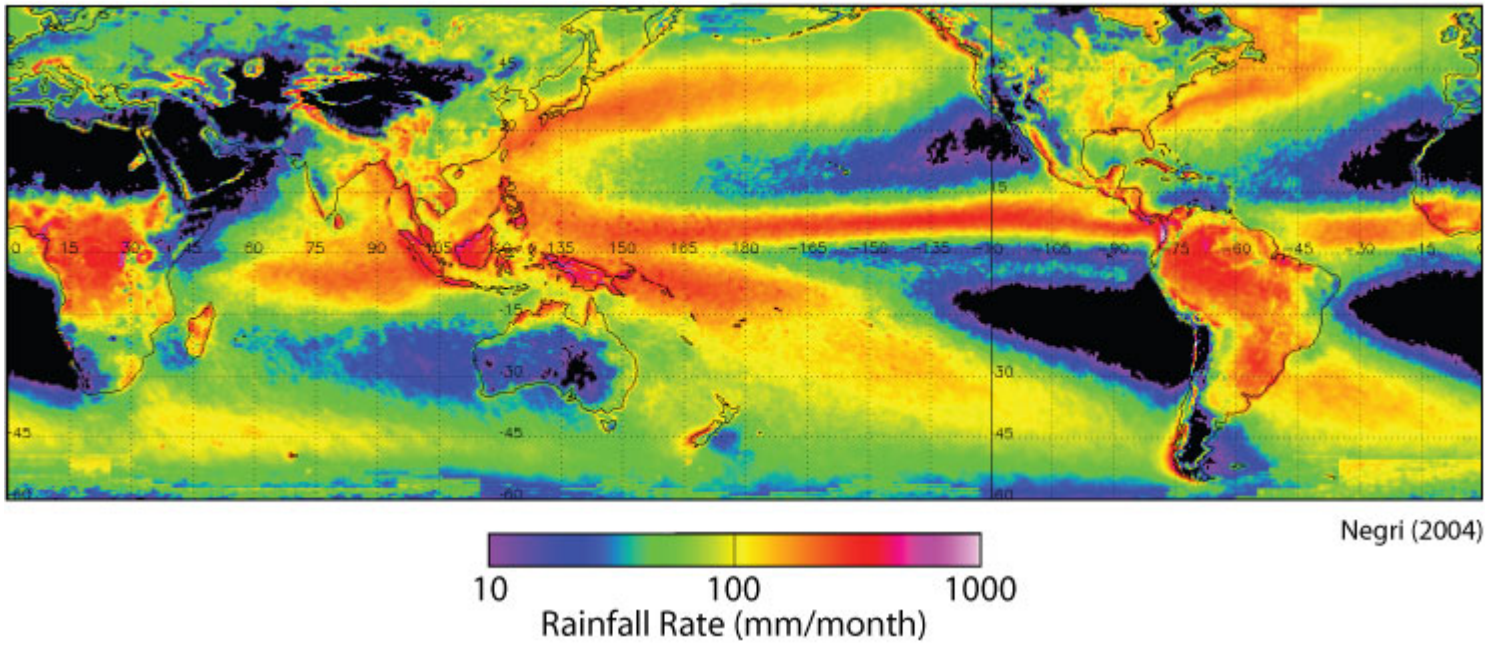
Why?

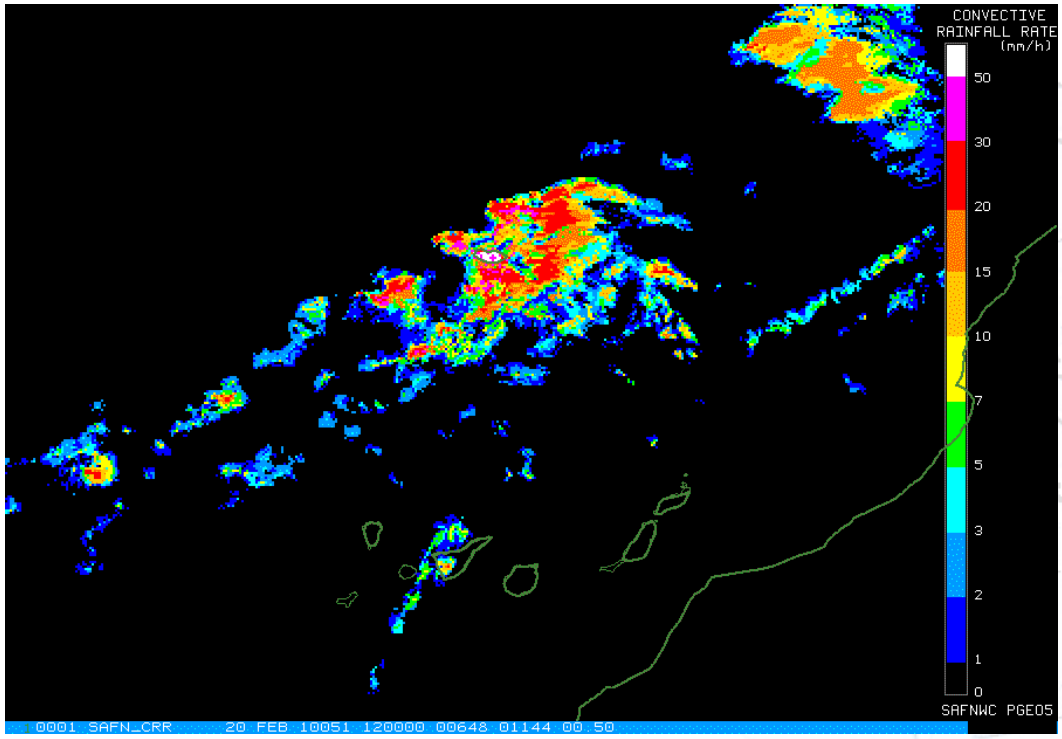
Meteorological satellite provide a unique opportunity for monitoring the precipitation for regions where ground measurement is limited and consistent with the accuracy required by hydrologists.

Global Rainfall Rate



Negri (2004)

Satellite Rainfall Estimation from infrared and/or visible channels

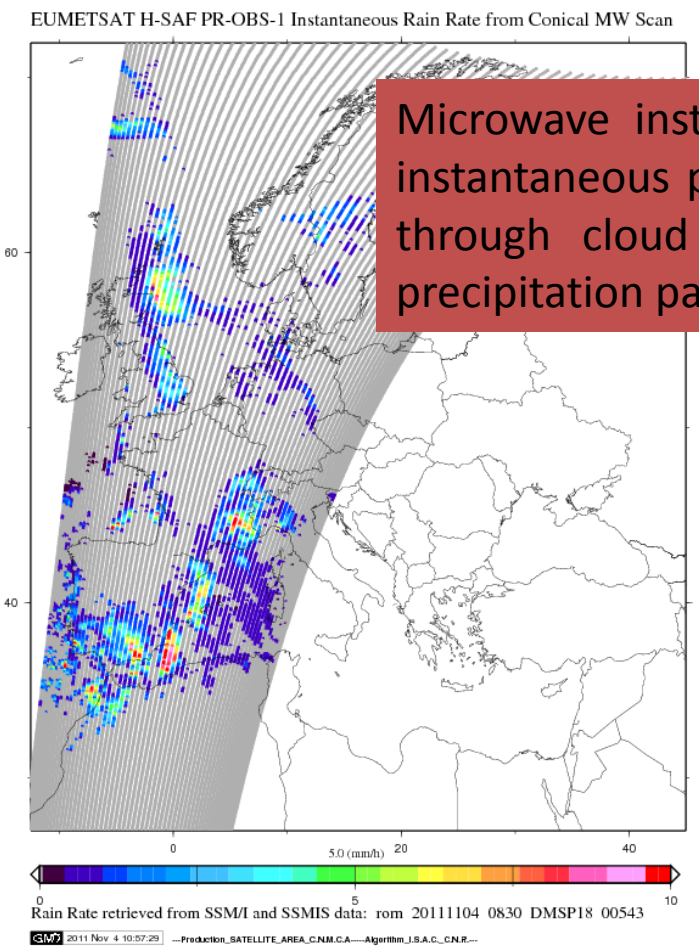


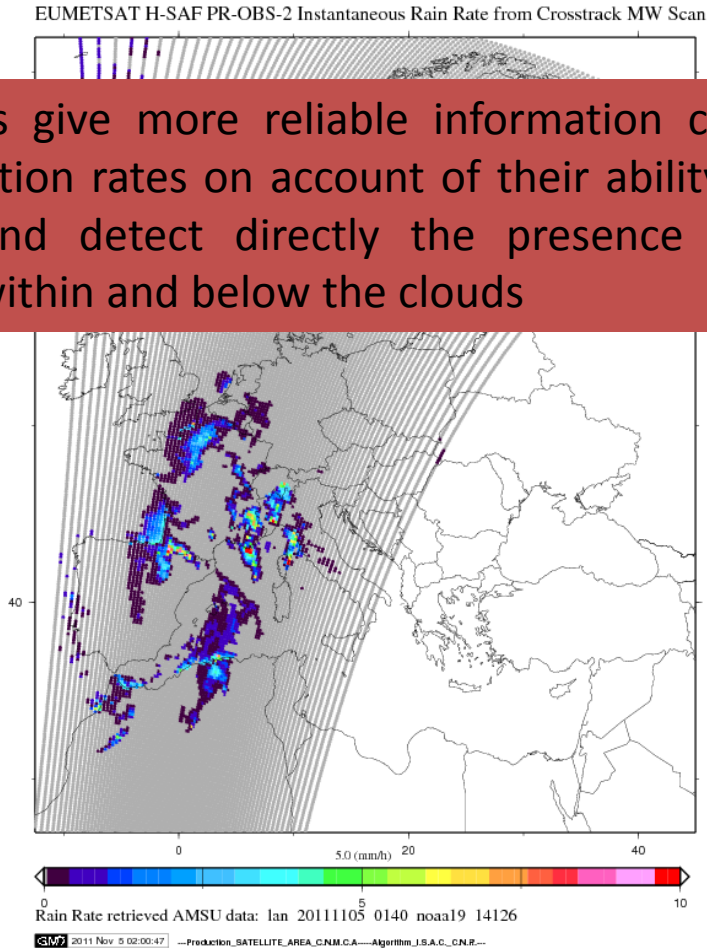
NWCSAF Convective Rainfall Rate

Rainfall rates are generally derived from cloud-top infrared (IR) brightness temperature, which is related to cloud-top height for optically thick clouds below the tropopause.

Visible cloud albedos are generally used, as supplemental information to discriminate cold clouds which are optically thin and presumably non-precipitating from those which are optically thick and therefore possibly precipitating

Satellite Rainfall Estimation from MicroWave instruments





Microwave instruments give more reliable information concerning instantaneous precipitation rates on account of their ability to "see" through cloud tops and detect directly the presence of actual precipitation particles within and below the clouds

- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Basic Document for “PR-OBS1 Precipitation rate at ground by MW conical scanners” .
- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Basic Document for “PR-OBS2 Precipitation rate at ground by MW cross-track scanners

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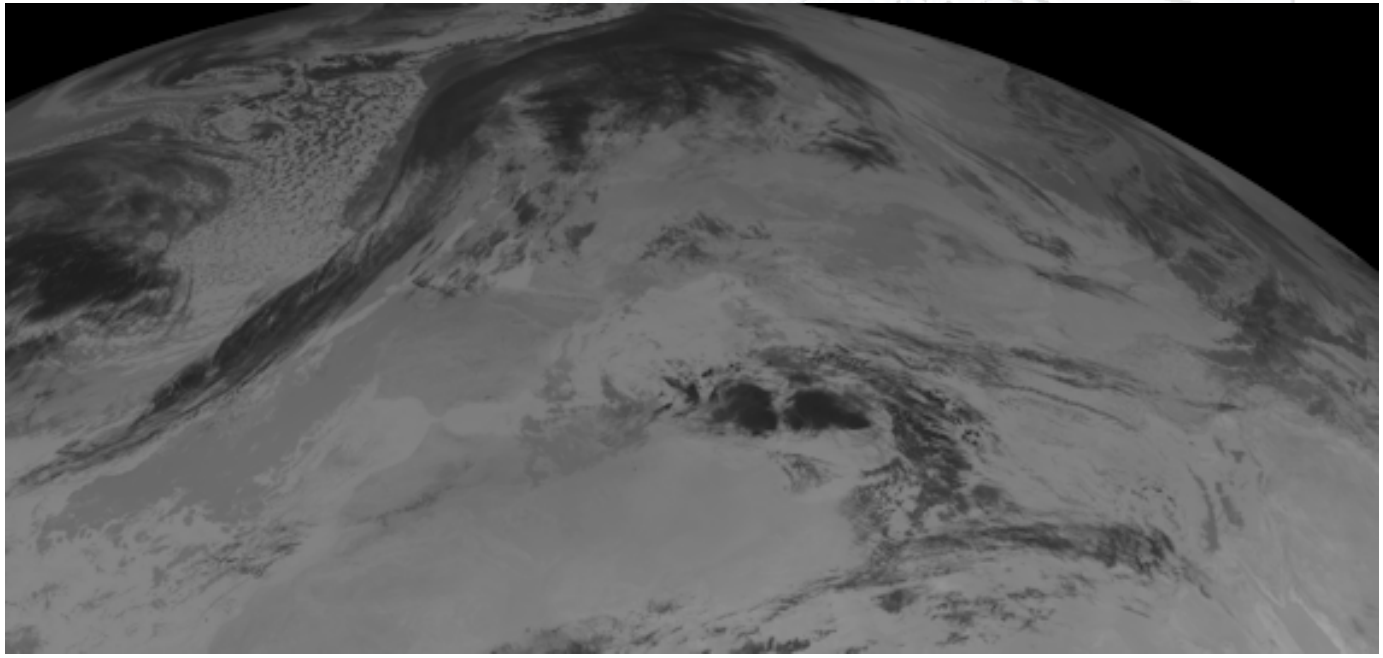
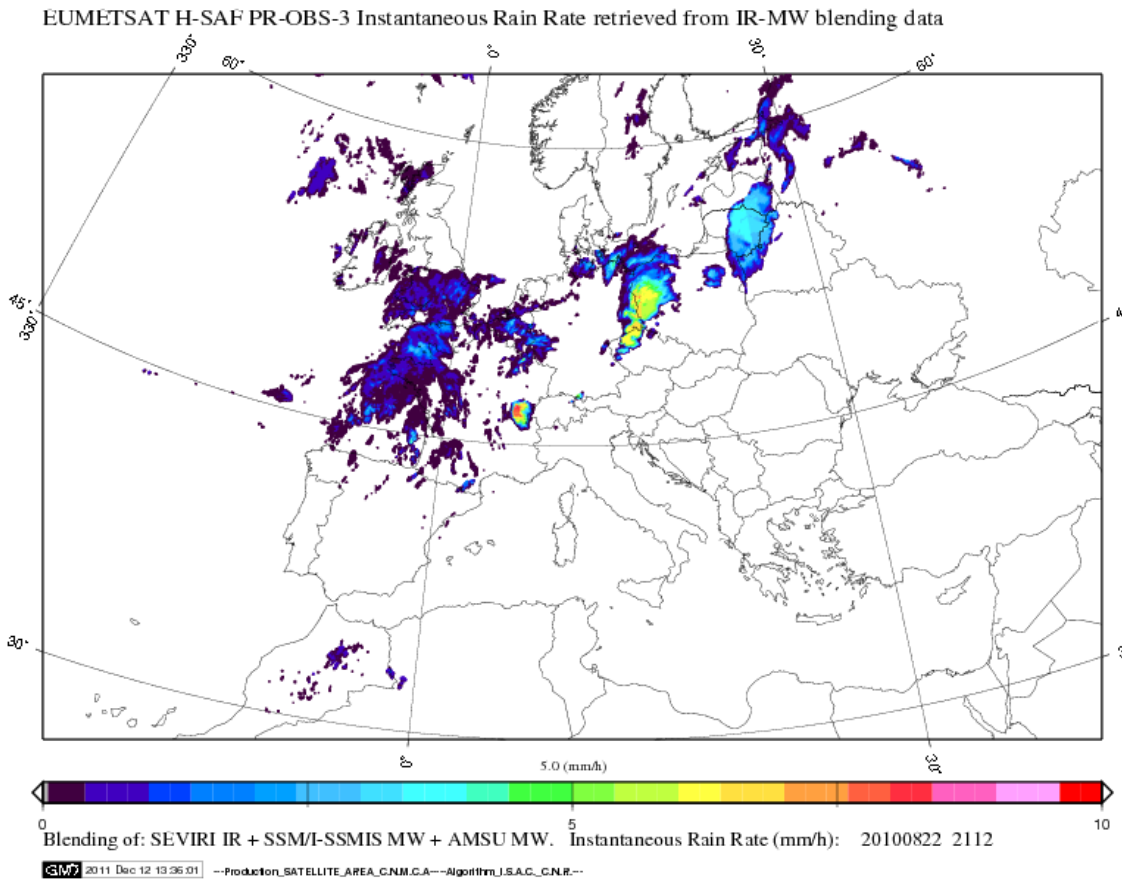
Satellite Rainfall Estimation multi-platform algorithm

So the most common approach is to combine geostationary and low orbital satellite imagery and sounder. This kind of multi-platform algorithm provides global precipitation estimation merging high-quality, sparsely sampled data from METOP, NOAA and DMSP low altitude polar-orbital satellites with the more physically direct detection with continuously sampled data from geostationary satellites



Satellite Rainfall Estimation multi-platform algorithm

HSAF PR-OBS3: BLENDING Technique



The PR-OBS3 algorithm is based on a collection of time and space overlapping SEVIRI IR images and Low Earth Orbit (LEO) MW radiometers. As a new MW swath is available, the MW-derived pixels are paired with the time and space coincident geostationary (GEO) TB at 10.8 mm. Coincident data are subsequently located in a geographical latitude-longitude grid (2.5° x 2.5°), and for each grid box the histogram of the IR TBs and that of the corresponding MW rain rates is built.

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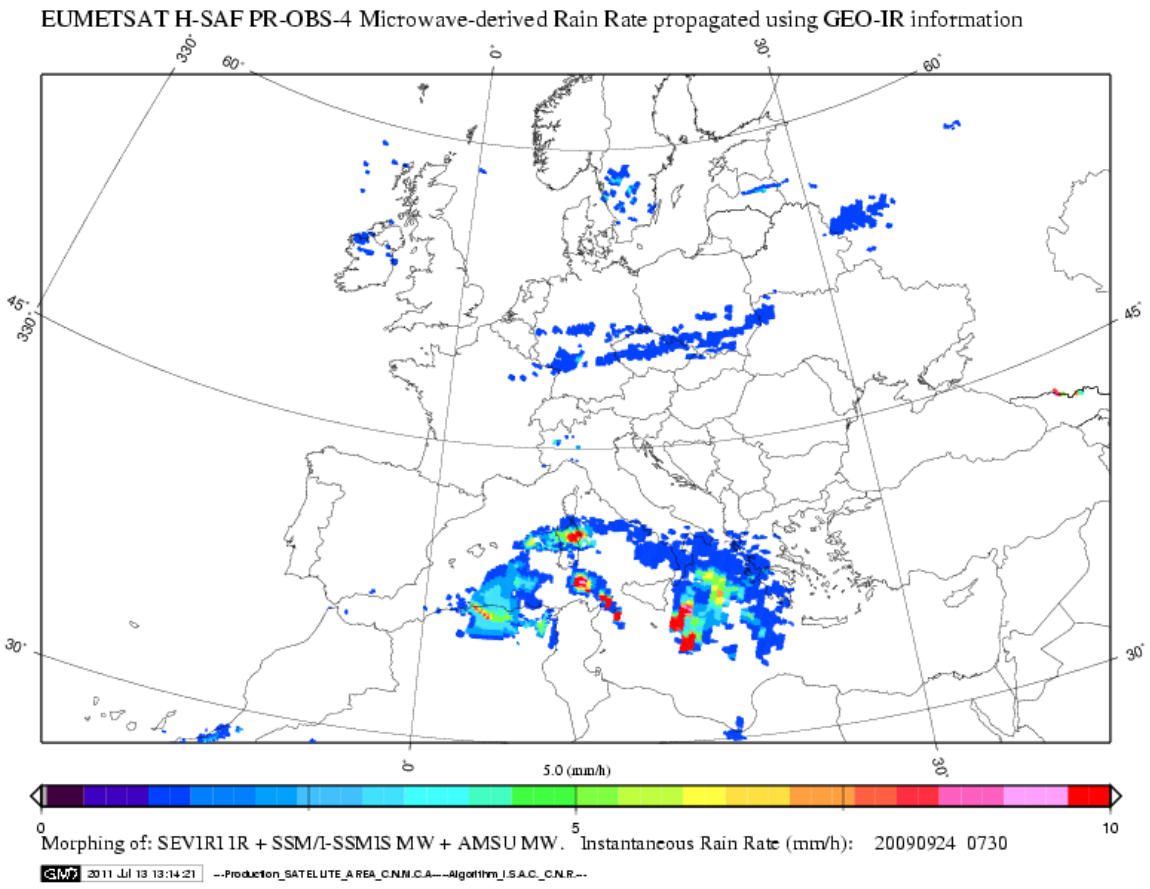
Satellite Rainfall Estimation multi-platform algorithm

HSAF PR-OBS4: MORPHING Technique



Propagation vector matrices are produced by computing spatial lag correlations over successive images of GEO/IR and then used to propagate the MW-derived precipitation estimates in time and space when updated MW data are unavailable.

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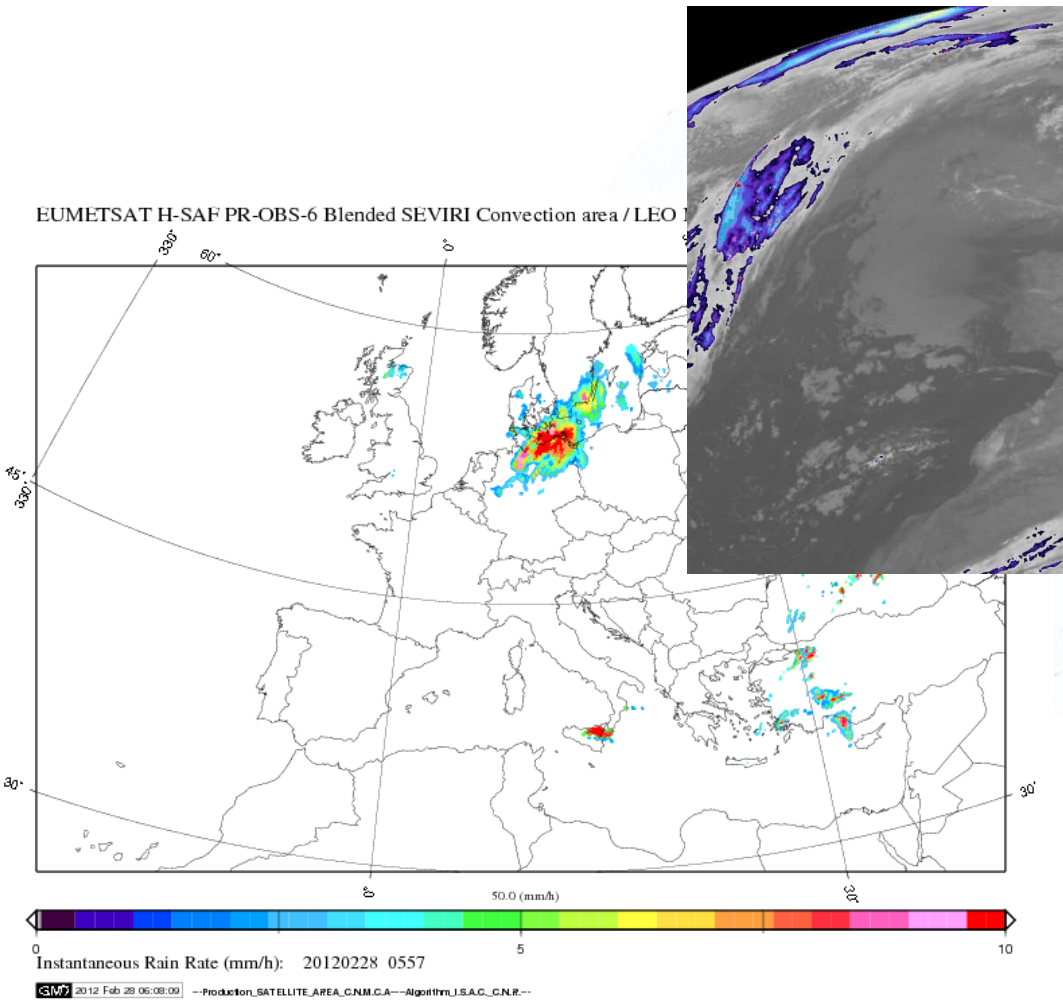
Outlook 1 – Convective Precipitation

HSAF PR-OBS15: BLENDING Technique + NEFODINA



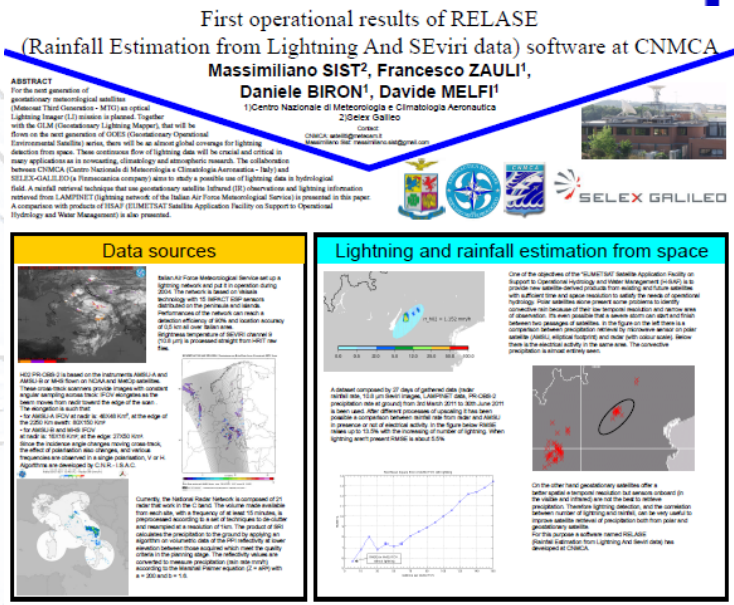
Outlook 2 – Convective Precipitation

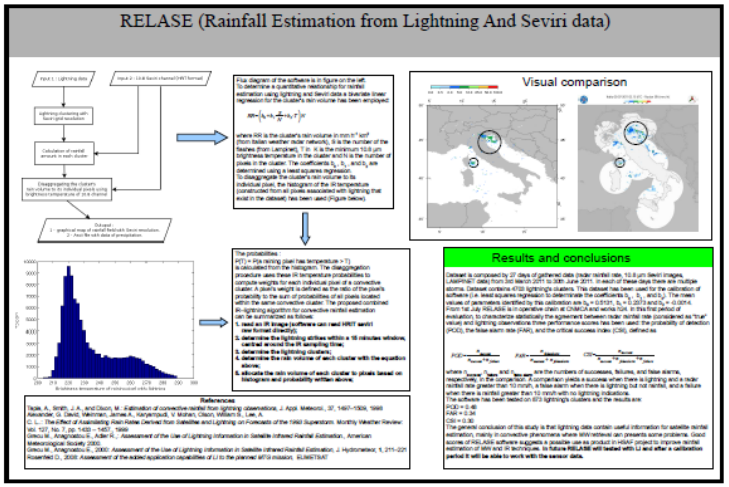
RELASE Software: Rainfall Estimation from Lightning And Seviri data

A rainfall retrieval technique that uses geostationary satellite Infrared (IR) observations and lightning information retrieved from LAMPINET (lightning network of the Italian Air Force Meteorological Service)

A quantitative relationship for rainfall estimation using lightning and Seviri data has been developed using a bivariate linear regression for the cluster's rain volume :

$$RR = (b_0 + b_1 S/N + b_2 T)N$$





ECSS 2011

6th European Conference on Severe Storms

Palma de Mallorca,
Balearic Islands, Spain
3—7 October 2011
Venue: L'Aljub, Museu Es Baluard

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- ✓ Mugnai A., Dietrich S., LevizzaniV., Precipitation Products from the Hydrology SAF, EUM/STG-SWG/30/11/DOC/07
- ✓ Rodriguez, A., and C. Marcos, 2010: Algorithm Theoretical Basis Document for "Convective Rain Rate". Available online at: http://www.nwcsaf.org/indexScientificDocumentation.html
- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Basic Document for "PR-OBS1 Precipitation rate at ground by MW conical scanners" .
- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Basic Document for "PR-OBS2 Precipitation rate at ground by MW cross-track scanners
- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Definition Document for "PR-OBS3 Precipitation rate at ground by GEO/IR supported by LEO/MW". Available online at: http://hsaf.meteoam.it/documents/ATDD/ATDD-03.pdf
- ✓ CNR-ISAC Italy, 2010: Algorithm Theoretical Basic Document for "PR-OBS4 Precipitation rate at ground by LEO/MW supported by GEO/IR".
- ✓ Petty G., Krajewski W.,1996: Satellite estimation of precipitation over land. *Hydrological Sciences Journal, 41, 433-451*

Thank you for your attention!

melfi@meteoam.it