

CWG Workshop 2012
Prague
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Satellite Rainfall Estimation

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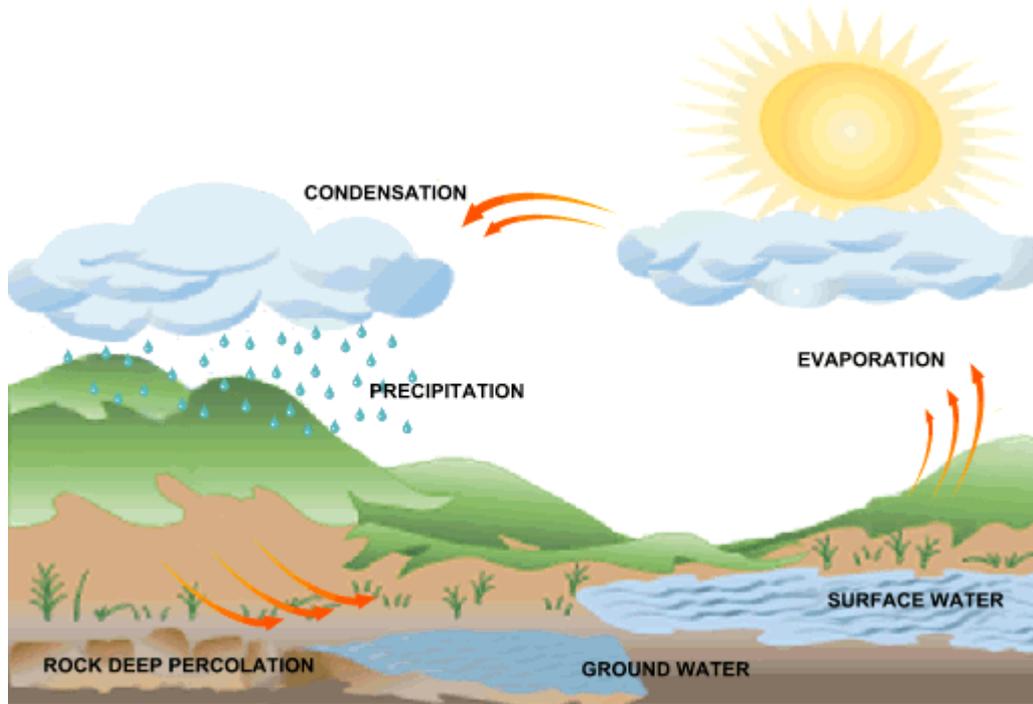


Blending of: SEVIRI IR + SSM/I-SSMIS MW + AMSU MW. Instantaneous Rain Rate (mm/h): 20110814 1457

Satellite Rainfall Estimation Outline

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

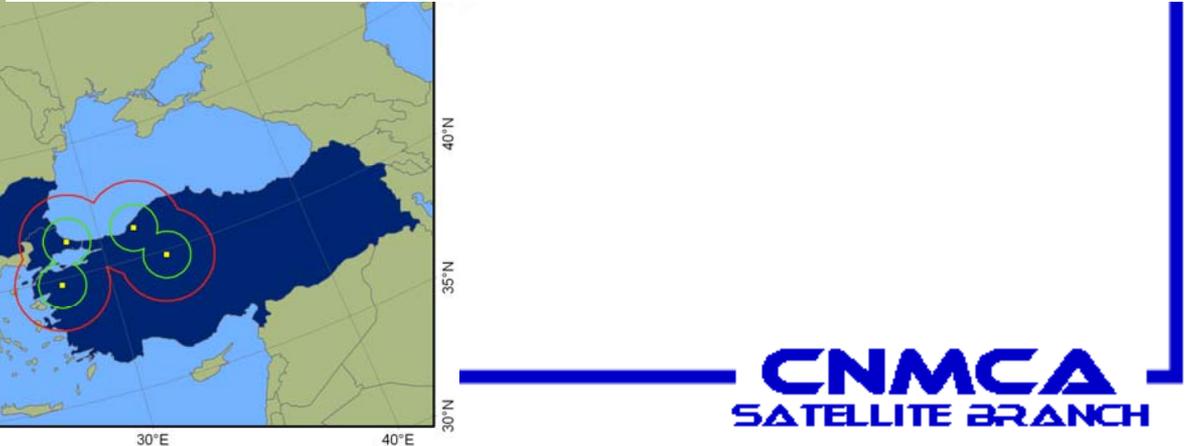
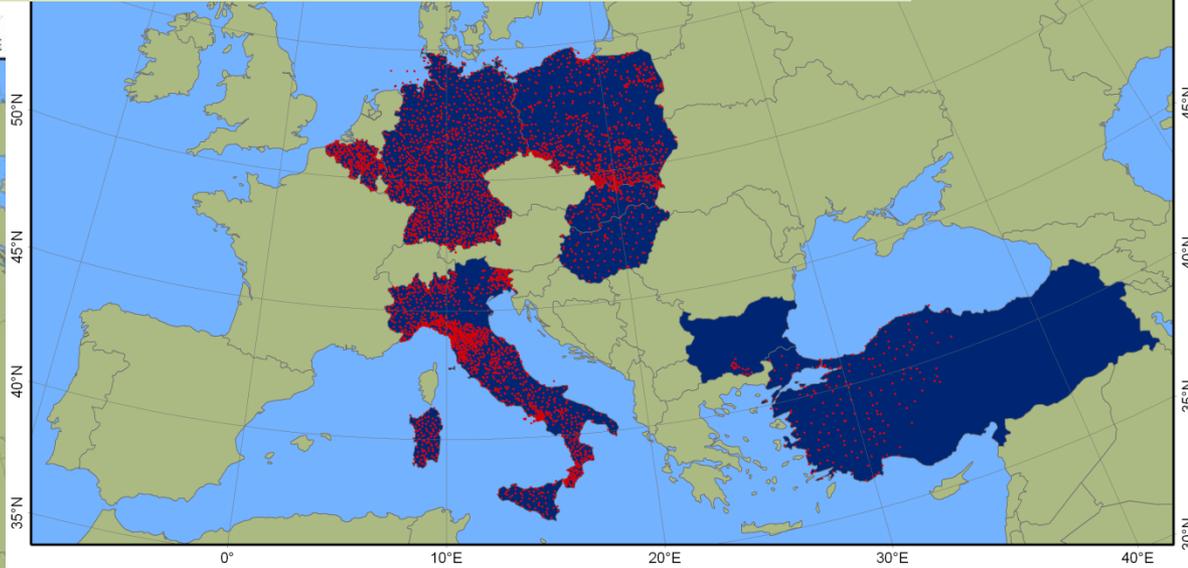
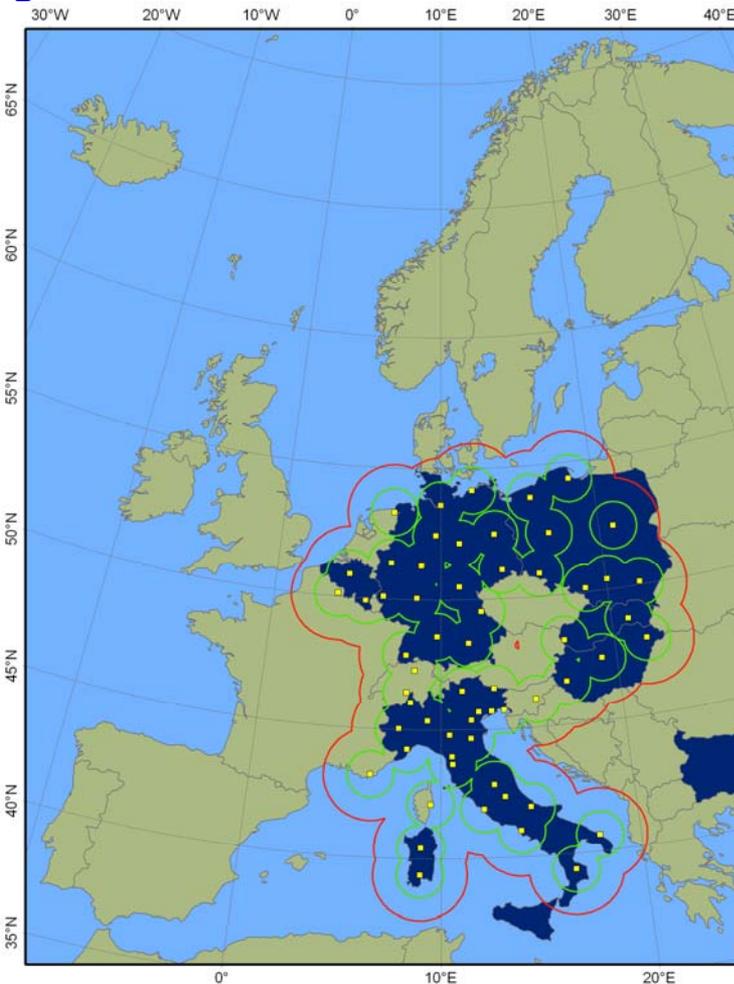
Why?



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?

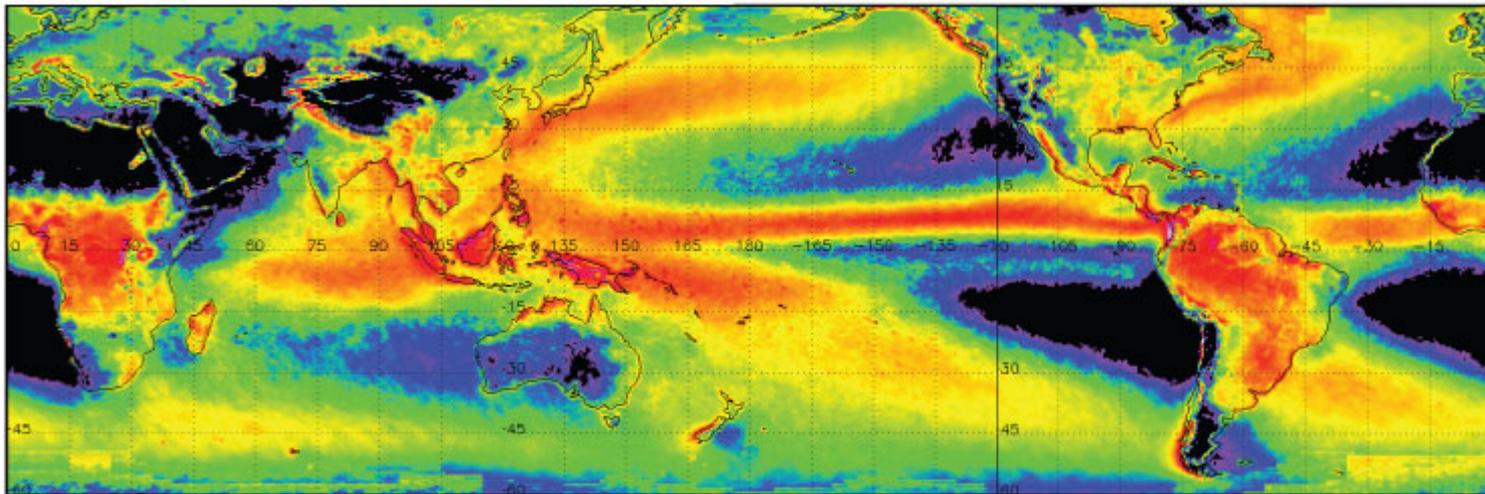
The inhomogeneity of temporal and spatial distribution of rainfall combined with the lack or the sparse presence of ground measurement makes it one of the most difficult parameter to quantify.



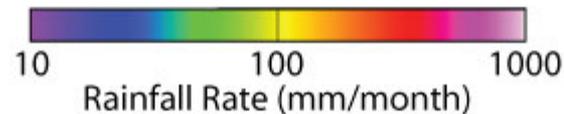
Why?

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.

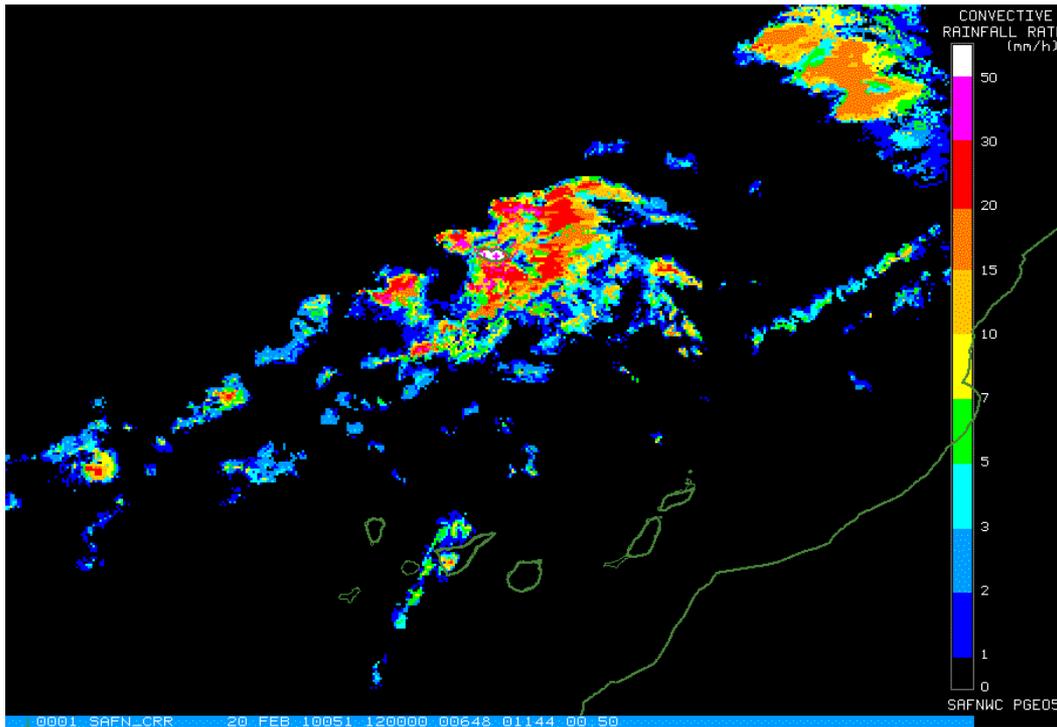
Global Rainfall Rate



Negri (2004)



Satellite Rainfall Estimation from infrared and/or visible channels



NWCSAF Convective Rainfall Rate

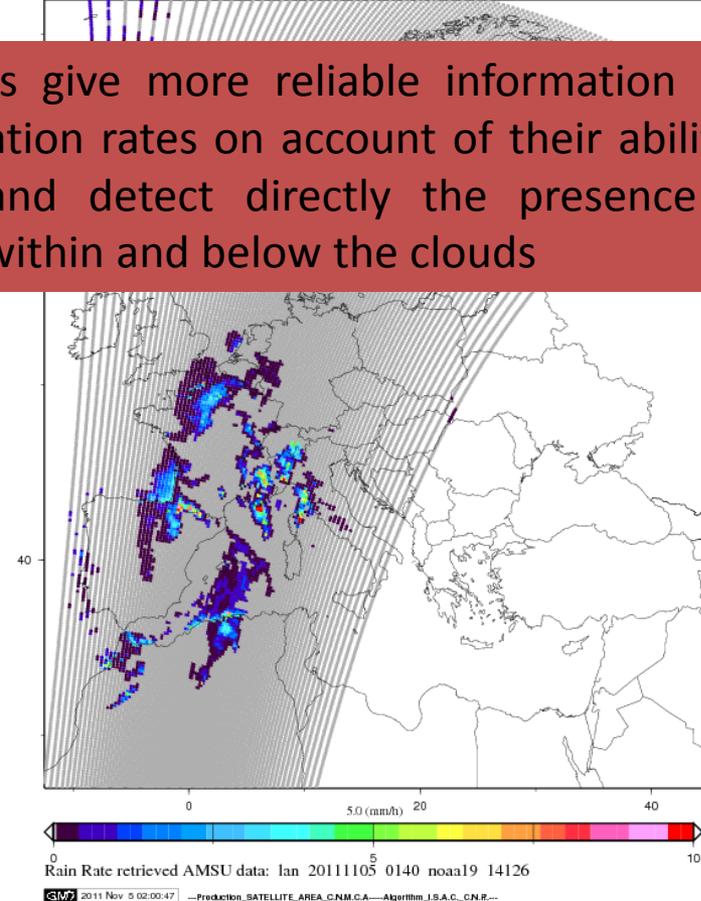
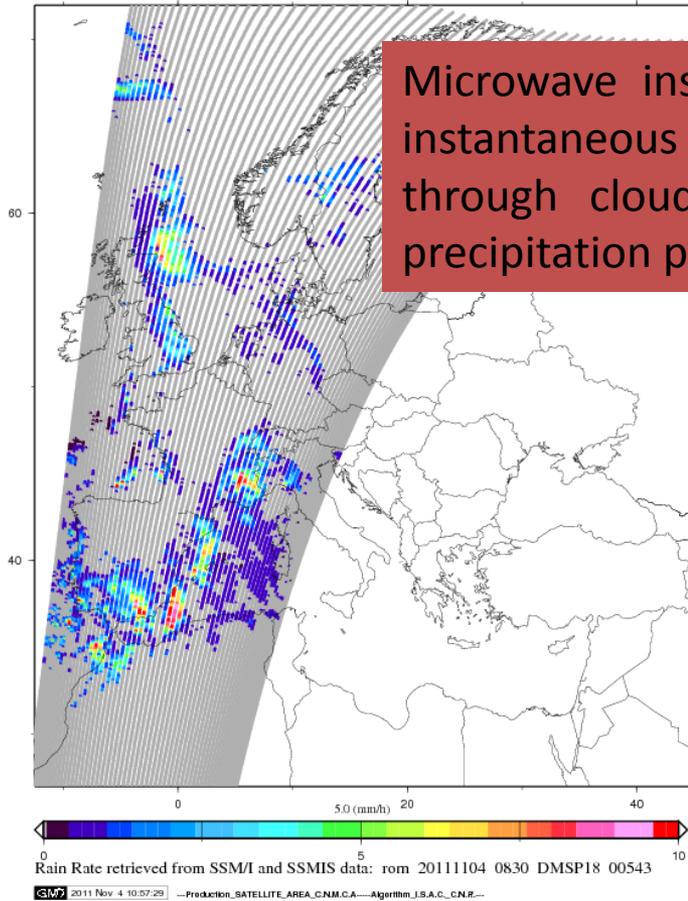
Rainfall rates are generally derived from cloud-top infrared (IR) brightness temperature, which is related to cloud-top height for optically thick clouds below the tropopause.

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

EUMETSAT H-SAF PR-OBS-1 Instantaneous Rain Rate from Conical MW Scan

EUMETSAT H-SAF PR-OBS-2 Instantaneous Rain Rate from Crosstrack MW Scan

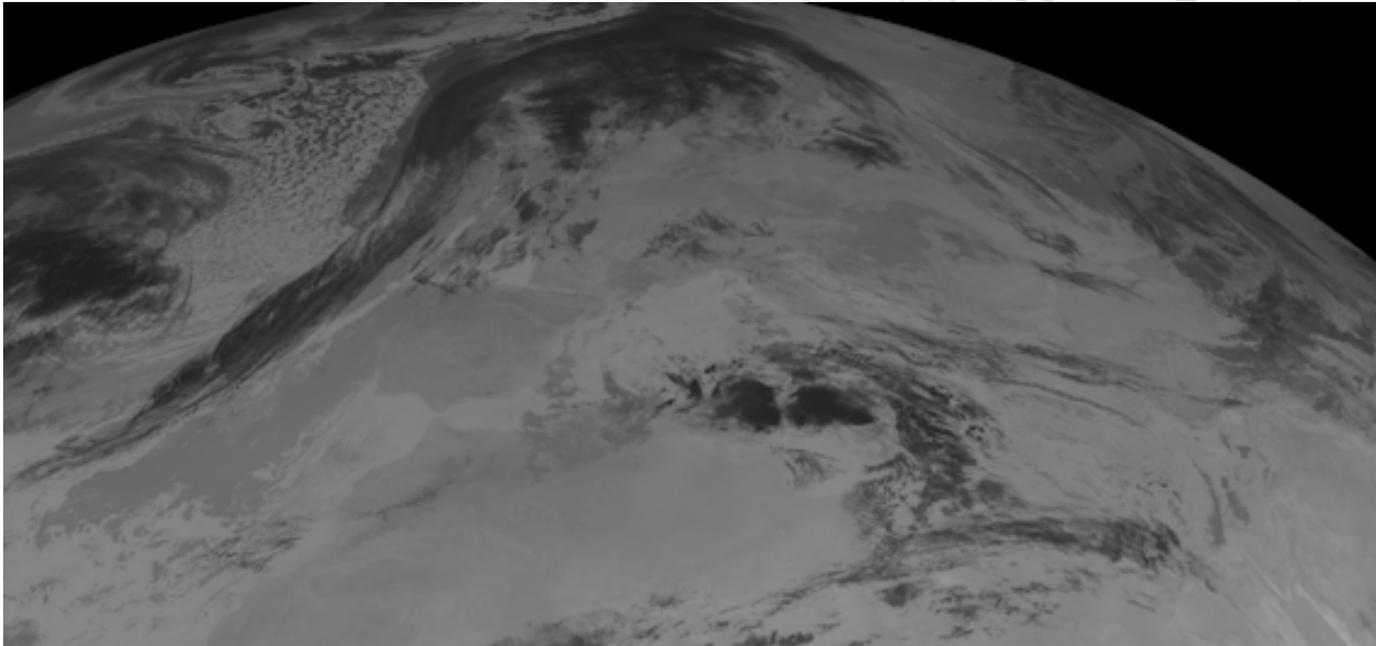


Microwave instruments give more reliable information concerning instantaneous precipitation rates on account of their ability to "see" through cloud tops and detect directly the presence of actual precipitation particles within and below the clouds

- ✓ 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"

Satellite Rainfall Estimation multi-platform algorithm

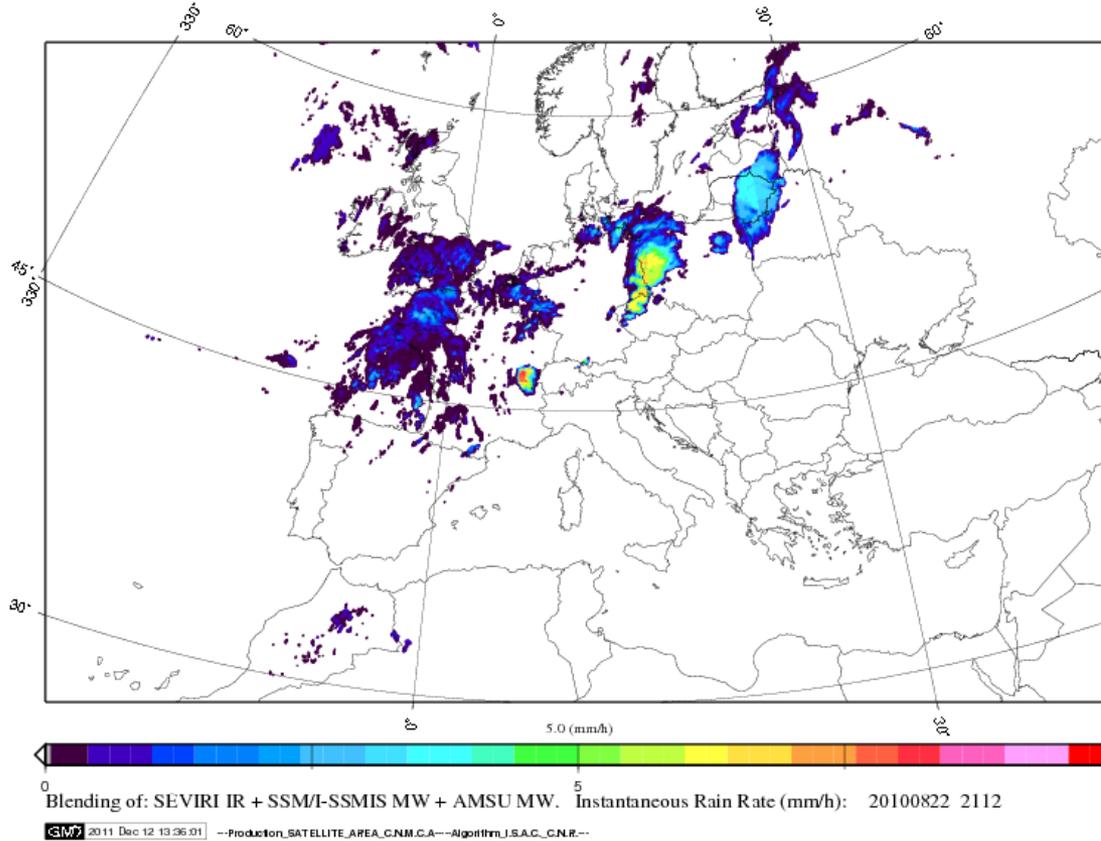
So the most common approach is to combine geostationary and low orbital satellite imagery and sounder. This kind of multi-platform algorithm provides global precipitation estimation merging high-quality, sparsely sampled data from METOP, NOAA and DMSP low altitude polar-orbital satellites with the more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



Satellite Rainfall Estimation multi-platform algorithm

HSAF PR-OBS3: **BLENDING** Technique

EUMETSAT H-SAF PR-OBS-3 Instantaneous Rain Rate retrieved from IR-MW blending data

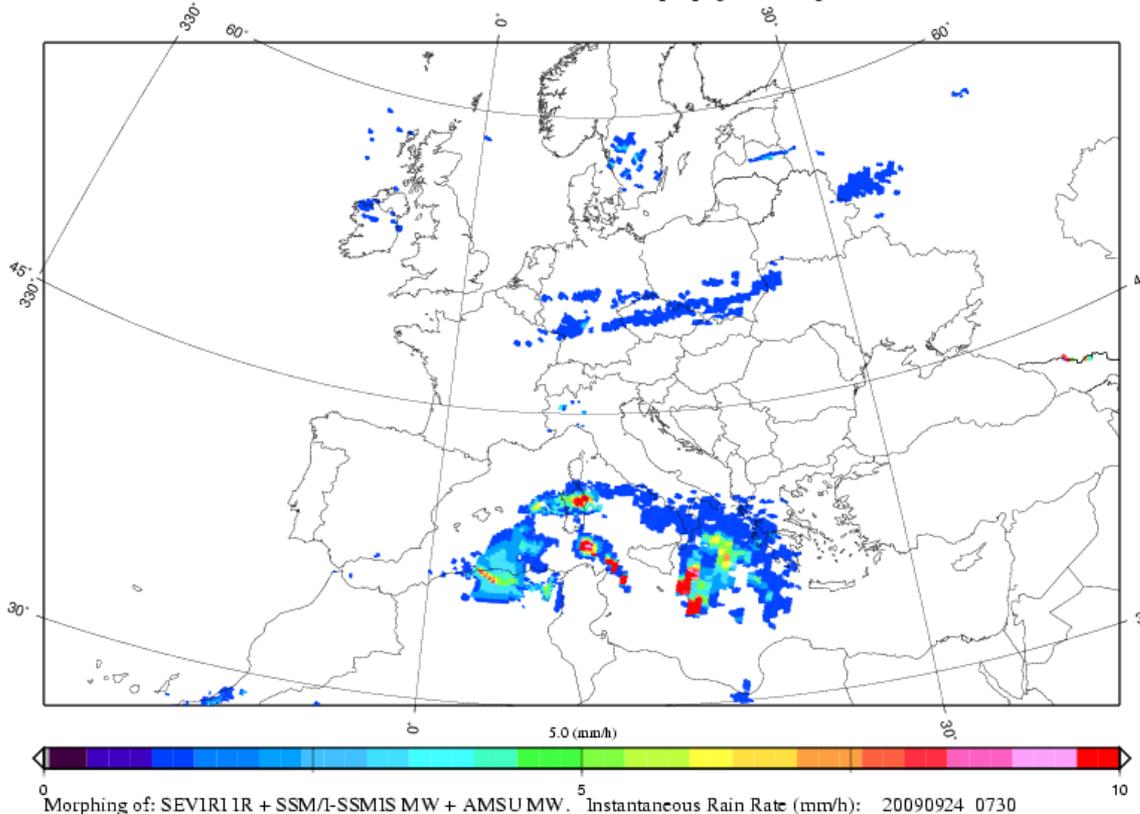


The PR-OBS3 algorithm is based on a collection of time and space overlapping SEVIRI IR images and Low Earth Orbit (LEO) MW radiometers. As a new MW swath is available, the MW-derived pixels are paired with the time and space coincident geostationary (GEO) TB at 10.8 mm. Coincident data are subsequently 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.

Satellite Rainfall Estimation multi-platform algorithm

HSAF PR-OBS4: MORPHING Technique

EUMETSAT H-SAF PR-OBS-4 Microwave-derived Rain Rate propagated using GEO-IR information



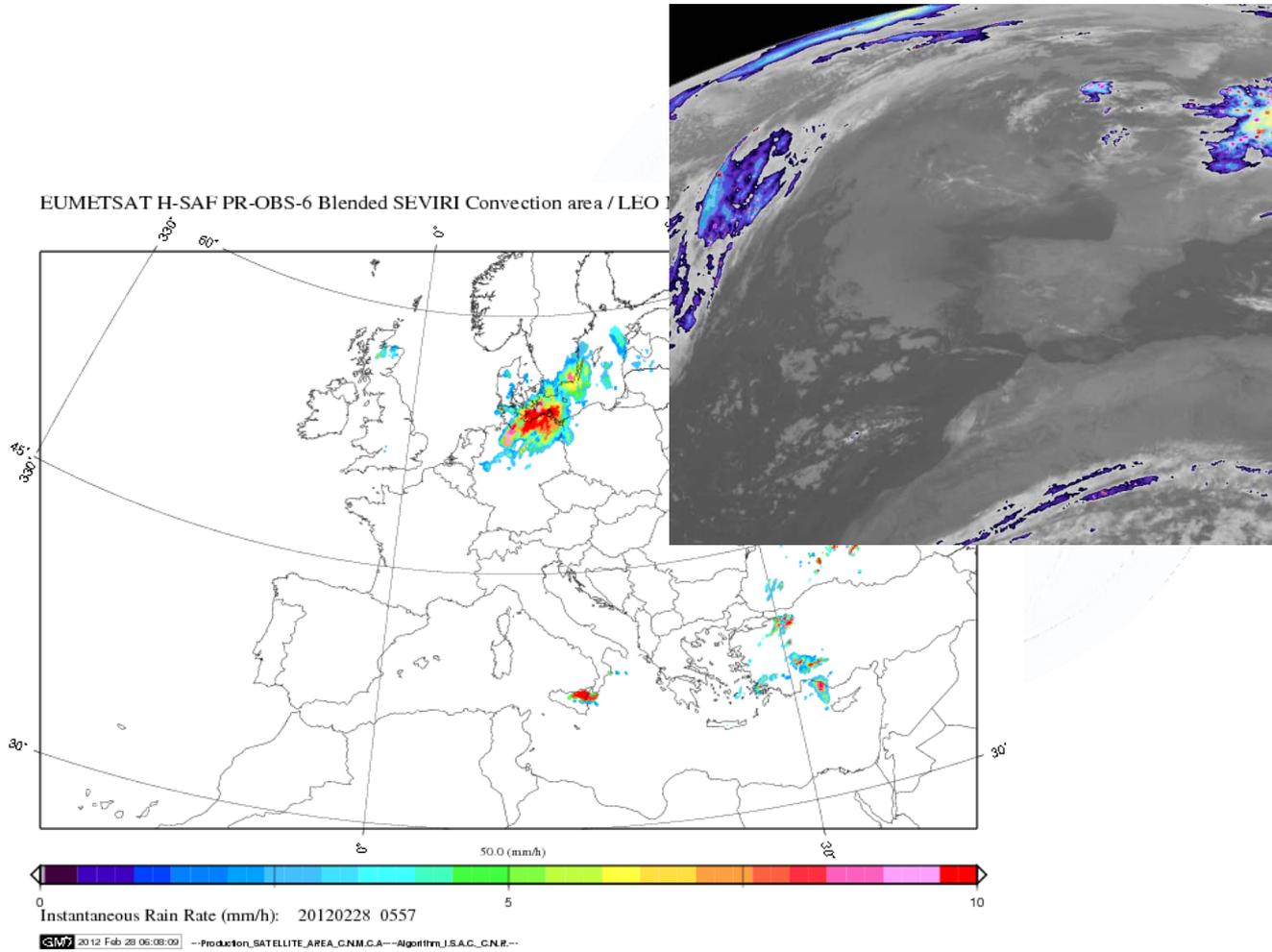
Propagation vector matrices are produced by computing spatial lag correlations over successive images of GEO/IR and then used to propagate the MW-derived precipitation estimates in time and space when updated MW data are unavailable.

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Outlook 1 – Convective Precipitation

HSAF PR-OBS15: **BLENDING** Technique + NEFODINA

EUMETSAT H-SAF PR-OBS-6 Blended SEVIRI Convection area / LEO



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AND CALL FOR PAPERS



Outlook 2 – Convective Precipitation

RELEASE 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 :

$$RR = (b_0 + b_1S/N + b_2T)N$$

First operational results of RELEASE
(Rainfall Estimation from Lightning And Seviri data) software at CNMCA

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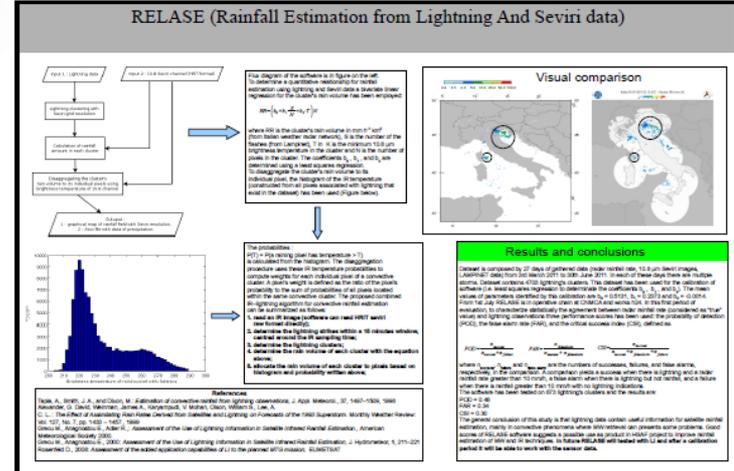
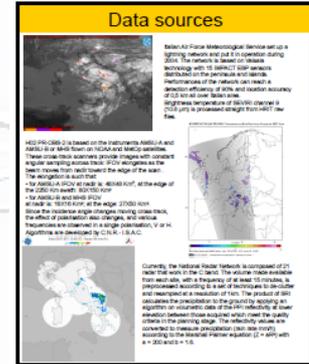
²Enit Galileo

ABSTRACT

The next generation of geostationary meteorological satellites (Meteosat Third Generation - MTCG) is operational. Lightning Imager (LI) sensor is planned. Together with the TES (Thermal Earth Radiation Imager), that will be flown on the next generation of GOES (Geostationary Operational Environmental Satellite) series, there will be an almost global coverage for lightning detection from space. These continuous flow of lightning data will be critical and crucial in many applications as in forecasting, climatology and atmospheric research. The collaboration between CNMCA (Centro Nazionale di Meteorologia e Climatologia Aeronautica - Italy) and SELUX-GALILEO (a Finmeccanica company) aims to study a possible use of lightning data in hydrological field. A neural network technique that use geostationary satellite infrared (IR) observation and lightning information retrieved from LAMPINET (lightning network of the Italian Air Force Meteorological Service) is presented in this paper. A comparison with products of SELEX (SELEXNET Satellite Applications Facility on Support to Operational Hydrology and Water Management) is also provided.

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Enit Galileo



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6th European Conference on Severe Storms
Palma de Mallorca, Balearic Islands, Spain
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Venue: L'Aljub, Museu Es Baluard

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Thank you for your
attention!



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