H SAF
Support to Operational Hydrology and Water Management

EUMETSAT Hydrological SAF
H05 product development at CNMCA

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6th IPWG Workshop
15-19 October 2012, Sao Jose dos Campos, Brazil

Outline

- Introduction
- H05 product overview
- Recent developments
- On-going activities and future work

Introduction

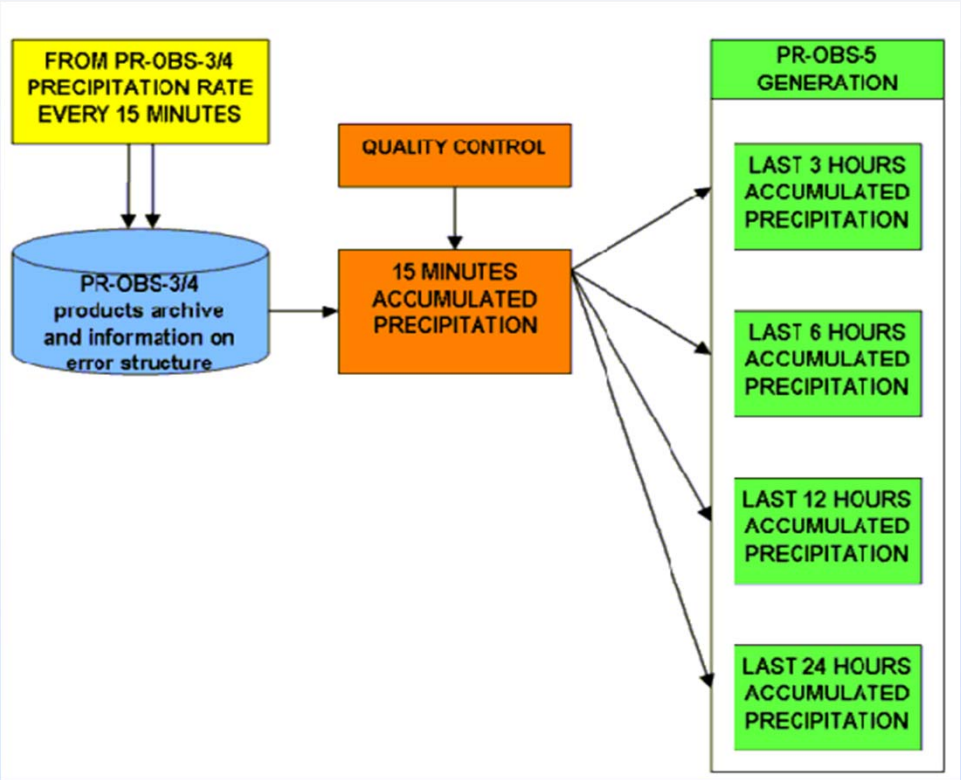
- The EUMETSAT Satellite Application Facility in support to Hydrology (H-SAF) focuses on the development of new geophysical products on precipitation, soil moisture and snow parameters and the exploitation of these parameters in operational decisions making and water management together with hydrological and numerical weather prediction models.

- In the framework of the Continuous Development and Operational Phase (former CDOP-1 and current CDOP-2) the Italian Air-Force National Meteorological and Climatological Centre (CNMCA) physically hosts the operational chain for the generation of the **precipitation products** **(SEE POSTER in Session2)**, as well as the development activities aiming to conceive, realize, validate and test the future version of the suites.

- This talk shows the recent developments about the HSAF accumulated precipitation product **(PR-OBS-5, also named H05)**, focusing in particular on a series of research activities running at CNMCA and aiming to develop a new **objective analysis system** for the accumulated precipitation at ground.

H05 product overview

- Derived from precipitation maps generated by merging MW images from operational sun-synchronous satellites and IR images from geostationary satellites (i.e., either product PR-OBS-3 or PR-OBS-4).

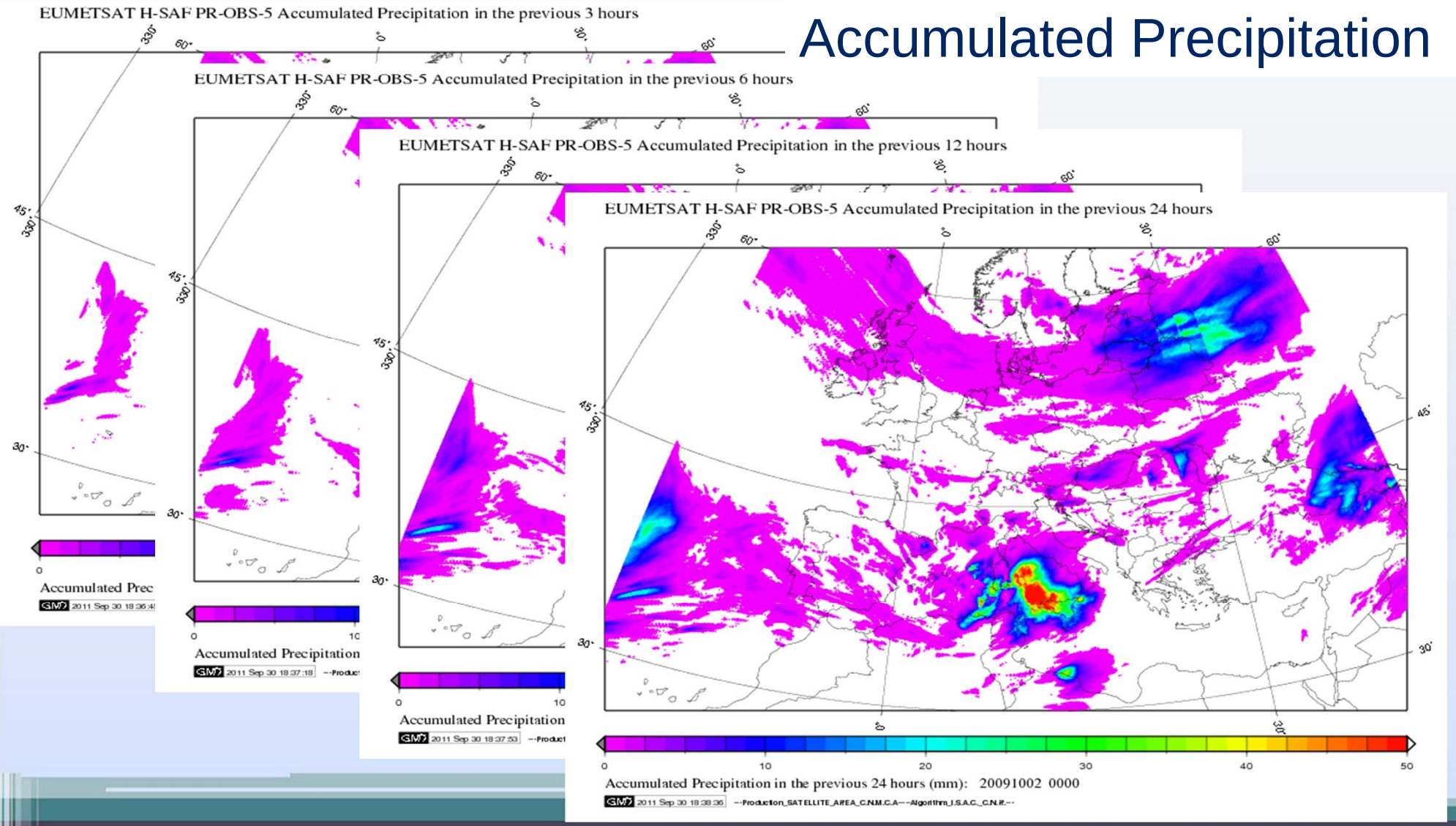


- In the **current version (v1.2)**, the product is derived by a simple time integration of product PR-OBS-3 (96 samples/day at 15-min intervals) over 3, 6, 12 and 24 hours. The alternative accumulated precipitation product derived by use of PR-OBS-4 (i.e. "Morphing") is still not operational but it is easy to be implemented.

- Climatological thresholds are applied on the final products to avoid some outliers **(quality control)**.

H05 product overview

Accumulated Precipitation



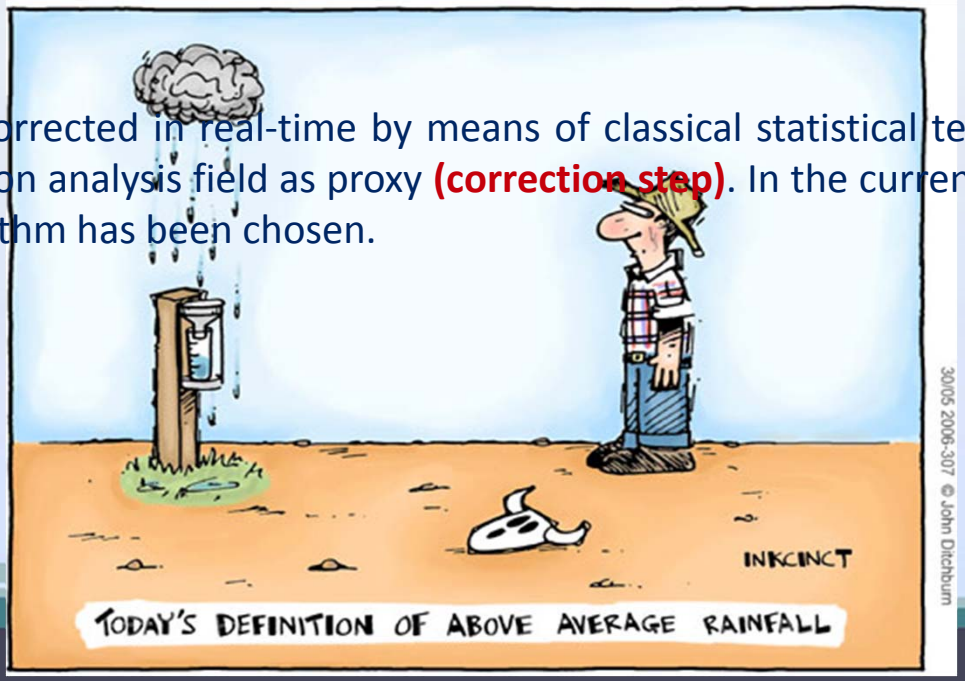
Recent developments
1 - rationale

- In order to improve the H05 product, the setup of the **new version (v2.0)** of the algorithm has been designed, taking advantage of a series of dedicated research studies, exploited within the EUMETSAT HSAF Visiting Scientists Programme.

- In detail, a **two-steps approach** has been chosen for the new version:

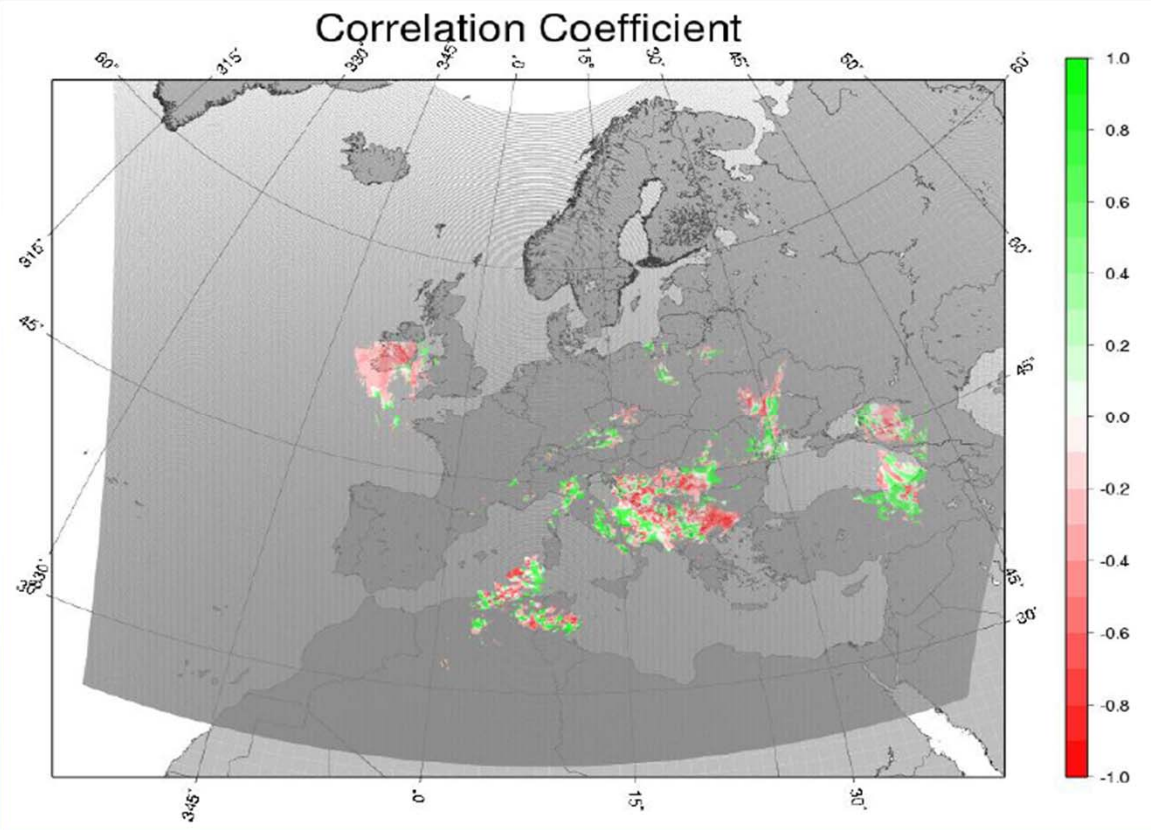
  - firstly, the algorithm makes use of independent sources of information to take into account the real-time observed precipitation data from rain-gauges and weather radars, to realize the "combined observed precipitation field". Moreover, introducing a NWP very short-term forecast, acting as first-guess, it is possible to perform a real-time objective analysis system **(analysis step)**.

  - Then, the H05 product is corrected in real-time by means of classical statistical techniques, using the accumulated precipitation analysis field as proxy **(correction step)**. In the current configuration, a simple bias removal algorithm has been chosen.



Recent developments
2 - results

- In principle, the introduction of another source of data as quantitative precipitation forecast achieved by numerical weather prediction model **improves the quality** of the merged analysis.
- Statistical learning (BIAS remove technique)
- The **linear correlation coefficient R** between PR-OBS-5 and Analysis data was computed for each point

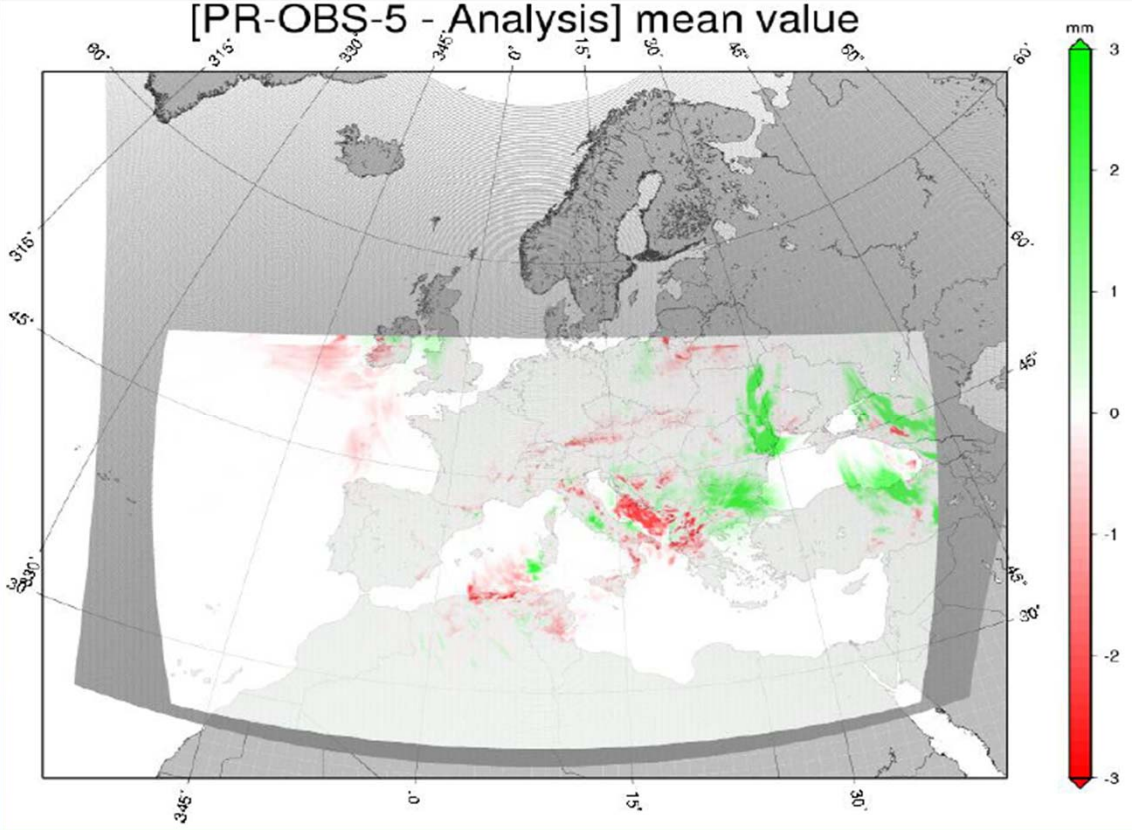


Recent developments
3 - results

- The **mean error** (or bias) between PR-OBS-5 and analysis data was also computed

- Note that in general the PR-OBS-5 tend to underestimate the precipitation on the western part of the perturbation, i.e. it tends to locate the perturbation a little more forward.

- It also noted the effect of orography in the precipitation



Recent developments
4 - results

- The results of the research activities performed at CNMCA with the support of the EUMETSAT HSAF Visiting Scientists Programme demonstrate that **the new algorithm produces better estimates** of precipitation patterns, in particular along the coastline, as well as for the orographic enhanced precipitation and in general for convective precipitation on the Mediterranean sea.

- Also the classical statistical scores (RMSE, POD, FAR, etc.), computed for the whole domain, show in general a slight improvement with the new version (→ **see the paper** in the references for more details).

Recent developments
5 – case studies

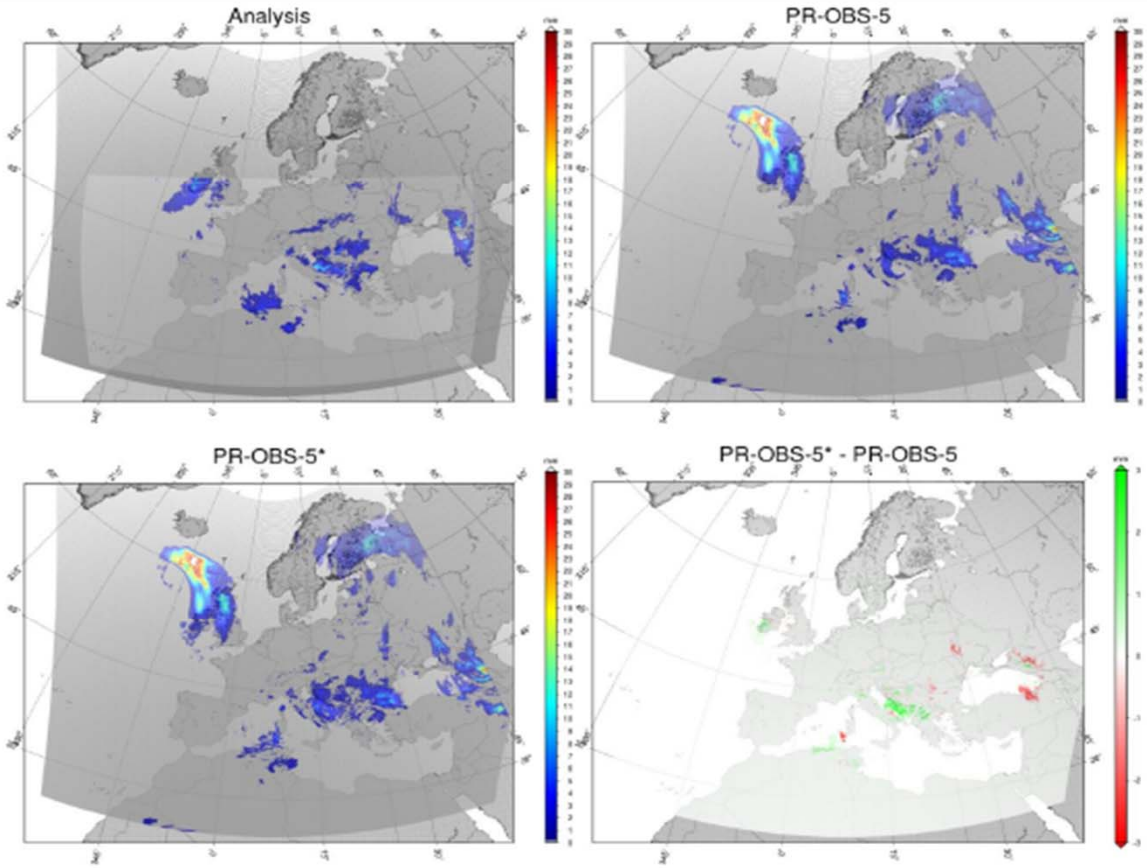


FIG. 5.6: SUMMARY PANEL OF THE IMPROVEMENTS OF PR-OBS-5 PRODUCT. AT TOP LEFT IS SHOWN THE ANALYSIS MAP, AT TOP RIGTH THE UNCORRECTED PR-OBS-5 PRODUCT. AT BOTTOM LEFT IS SHOWN THE NEW VERSION OF PR-OBS-5 PRODUCT AND ON THE RIGTH IS SHOWN THE DIFFERENCES BETWEEN THE NEW AND THE PREVIOUS VERSION OF PR-OBS-5. ALL MAPS ARE REFERRED AT THE 3 HOURS ACCUMULATED PRECIPITATION OF THE 17TH APRIL 2012 AT 00:00 UTC.

On-going activities and future work

- In order to put into operations the new version of the algorithm (v2.0), both the **optimization** (computational efficiency) and the **adaptation** (I/O data and fields, geographical domain) of the experimental suite are needed.

  [ON-GOING]

- Parallel research work aiming to investigate, in particular, alternative and **more sophisticated algorithms** for the correction step is a very crucial activity. The evaluation of correction methods by statistical learning other than the simple bias removal (currently implemented), could potentially enhance the performances of the whole system.

  [FUTURE WORK]

- By the way, large benefits are expected, in future, by use of new sources of **high-density precipitation data**, available in real-time in the framework of dedicated observation networks, well-integrated at international level or, at least, on the European scenario.

  [OUTLOOK]

References

- "Evaluation on accuracy of precipitation data" - Final Report of the EUMETSAT HSAF Visiting Scientist Activity (VS11_01).
- "Calibration and characterization of combined accumulated precipitation" - Final Report of the EUMETSAT HSAF Visiting Scientist Activity (VS11_04).
- HSAF Reference Documentation, available at *http://hsaf.meteoam.it* .

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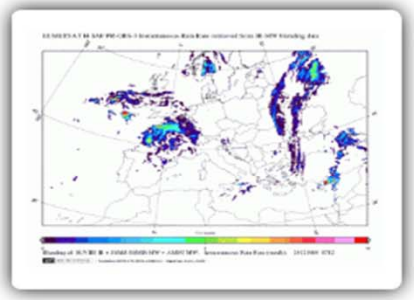

PRECIPITATION

Images Descriptions Quality Monitoring User Documents Visiting Scientist References

PR OBS 1	PR OBS 2	PR OBS 3	PR OBS 4	PR OBS 5	PR ASS 1
Precipitation rate at ground by MW conical scanners (with indication of phase)	Precipitation rate at ground by MW cross-track scanners (with indication of phase)	Precipitation rate at ground by (	Precipitation rate at ground by	Accumulated precipitation at	Instantaneous and
operational	operational				

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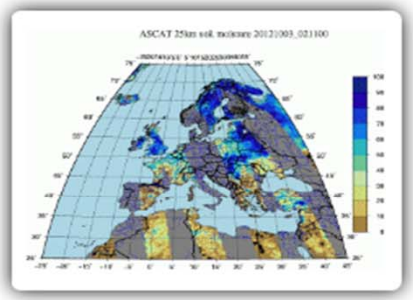
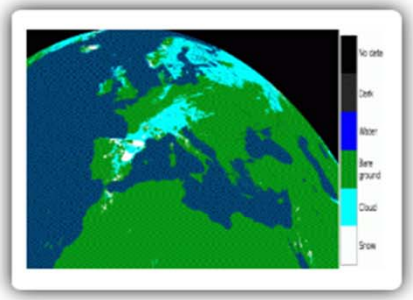


SOIL MOISTURE

Images Descriptions Quality Monitoring User Documents Visiting Scientist References

SM OBS 1	SM OBS 2	SM ASS 1	SM DAS 2
Large scale surface soil moisture by radar scatterometer	Small scale surface soil moisture by radar scatterometer	Volumetric soil moisture (roots region) by scatterometer assimilation in NWP model	Profile Index in the roots region by scatterometer data assimilation
development	pre-operational	development	development

Thank you for your attention!



SNOW

Images Descriptions Quality Monitoring User Documents Visiting Scientist References

SN OBS 1	SN OBS 2	SN OBS 3	SN OBS 4
Snow detection (snow mask) by VIS/IR radiometry	Snow status (dry/wet) by MW radiometry	Effective snow cover by VIS/IR radiometry	Snow water equivalent by MW radiometry
operational	development	development	development