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ESA WACMOS multi satellite water vapour products

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Water vapour is a key variable in the earth's water and energy cycles. The latent heat flux from the surface to the atmosphere that is associated with evaporation or condensation of water vapour plays a major role in the energy cycle. In addition, water vapour is the most effective greenhouse gas and due to a strongly positive climate feedback, it plays an amplifying role in global warming.

Water vapour strongly varies in space and time leading to the necessity of its global monitoring from satellites. Today, a large number of scientific and operational satellites are capable of providing information on atmospheric water vapour. Various spectral ranges and retrieval techniques are utilized, each having its own particular advantages and disadvantages. Employed are passive microwave sensors (e.g., SSM/I), infrared sounders (e.g., MetOp IASI) and imagers (e.g., MSG SEVIRI), near-infrared imagers (e.g. Envisat MERIS) and radio occultation measurements (e.g., MetOp GRAS).

The basis concept of ESA's Water Cycle Multimission Observation Strategy (WACMOS) is the exploitation of synergies of satellite observations with the aim to optimise the temporal and spatial sampling of variables governing the water cycle. The four WACMOS priorities comprise evapotranspiration, soil moisture, clouds and water vapour. In the framework of WACMOS, two merged water vapour products from three different sensors are developed. The first water vapour product combines the high vertical sampling and expected high quality of MetOp IASI measurements with the high temporal sampling of MSG SEVIRI. The merged SEVIRI+IASI product will provide tropospheric water vapour profiles for 3 layers at the full MSG disc with a spatial resolution of 0.25° for the time period from June 2008 to May 2009. The second WACMOS water vapour product is based on MSG/SEVIRI measurements with high temporal sampling and Envisat MERIS data featuring a high spatial resolution. It will provide the total column water vapour for Europe on a 0.025° grid for the time period between June and November 2008. A three-hourly temporal resolution was proposed for both cases.
Both WACMOS products utilize the new SEVIRI Physical Retrieval of temperature and moisture profiles, developed by the Satellite Application Facility on support to Nowcasting and Very Short-Range Forecasting. Before the merging can be applied, the swath-based satellite data are remapped to a common grid and quality flags are analysed. Systematic differences between the two datasets are eliminated prior to the merging process. We are planning to calculate the monthly mean of the individual data sets and subtract the bias between SEVIRI and IASI and between SEVIRI and MERIS from the SEVIRI measurements, since IASI and MERIS are expected to provide better quality water vapour information. Subsequent, the spatial and temporal correlation functions are determined.
For both WACMOS water vapour products a kriging method is applied to obtain the optimum water vapour field together with an error map. The operational CM-SAF kriging approach described in Lindau (2009) will be combined with the approach of Lindenbergh et al. (2008).

This presentation discusses the merging approach used and presents first results for the SEVIRI + IASI and the SEVIRI + MERIS water vapour fields.