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Validation of SEBS high resolution evapotranspiration estimations using ground measurements over Europe

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Global evapotranspiration estimates are of great importance in hydrology and meteorology. Evapotranspiration plays a significant role in both the carbon, water and energy cycle. Consequently accurate estimation of evapotranspiration is required in applications such as, irrigation management, weather forecasting and climate model simulations. In respond to these needs a global evapotranspiration product with high spatial and temporal resolution is currently developed in the framework of the Water Cycle Multi Mission Observation Strategy (WACMOS) project.

A global evapotranspiration product can only be achieved on basis of observational data by using orbital satellite data. Using products from a single orbiting satellite reduces the temporal resolution of the final product. Therefore the WACMOS evapotranspiration product will be based on the synergistic use of the AATSR and MERIS sensors on board of the ENVISAT satellite and the MODIS sensor on the TERRA/AQUA satellite. The combination of these satellites will provide high spatial (1km) and temporal (daily) resolution acquisitions.

Several energy balance algorithms, like the Two Source Energy Balance model and the Surface Energy Balance Algorithm for Land, have been developed that are able estimate evapotranspiration with remote sensing data. These models are however restricted in their applicability as they are either too complex, or require local calibration. The Surface Energy balance System (SEBS) is a physically based energy balance algorithm that provides a good compromise between model complexity and input requirements. SEBS consists of a set of tools for the determination of the land surface physical parameters, such as albedo, emissivity, temperature, vegetation coverage, etc., from spectral reflectance and radiance; an extended model for the determination of the roughness length for heat transfer; and a formulation for the estimation of the evaporative fraction on the basis of the energy balance at limiting cases.

Application of the WACMOS evapotranspiration product depends greatly on the correct estimation of the uncertainties of the product. The SEBS algorithm has been validated extensively in different researches over several land surface types and using different satellite observations. However several scenarios have not been investigated yet. These scenarios are 1) tall vegetation, 2) arid conditions and 3) large water bodies. Also implementations of new parameterizations, such as the new roughness length for heat in tall vegetation, have not been validated yet. Finally the effect of the synergistic use of AATSR, MERIS and MODIS products on the evapotranspiration estimates has not been investigated.

The objective of this research is the validation of the WACMOS evapotranspiration algorithm. The validation of the WACMOS evapotranspiration algorithm over land is performed using data eddy covariance flux towers. In total seventeen data sets, obtained through the CarboEurope and Fluxnet initiatives, over different land cover types are investigated. Over large water bodies the validation consists of comparisons between the WACMOS evapotranspiration product and the flux measurements of the OceanFLUX initiative and the simulated fluxes calculated by the HOAPS algorithm. In this research the results of the validation are shown.