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Evaluation of observation-driven evaporation algorithms: results of the WACMOS-ET project

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Terrestrial evaporation (ET) links the continental water, energy and carbon cycles. Understanding the magnitude and variability of ET at the global scale is an essential step towards reducing uncertainties in our projections of climatic conditions and water availability for the future. However, the requirement of global observational data of ET can neither be satisfied with our sparse global in-situ networks, nor with the existing satellite sensors (which cannot measure evaporation directly from space). This situation has led to the recent rise of several algorithms dedicated to deriving ET fields from satellite data indirectly, based on the combination of ET-drivers that can be observed from space (e.g. radiation, temperature, phenological variability, water content, etc.). These algorithms can either be based on physics (e.g. Priestley and Taylor or Penman-Monteith approaches) or be purely statistical (e.g., machine learning).

However, and despite the efforts from different initiatives like GEWEX LandFlux (Jimenez et al., 2011; Mueller et al., 2013), the uncertainties inherent in the resulting global ET datasets remain largely unexplored, partly due to a lack of inter-product consistency in forcing data. In response to this need, the ESA WACMOS-ET project started in 2012 with the main objectives of (a) developing a Reference Input Data Set to derive and validate ET estimates, and (b) performing a cross-comparison, error characterization and validation exercise of a group of selected ET algorithms driven by this Reference Input Data Set and by in-situ forcing data. The algorithms tested are SEBS (Su et al., 2002), the Penman- Monteith approach from MODIS (Mu et al., 2011), the Priestley and Taylor JPL model (Fisher et al., 2008), the MPI-MTE model (Jung et al., 2010) and GLEAM (Miralles et al., 2011).

In this presentation we will show the first results from the ESA WACMOS-ET project. The performance of the different algorithms at multiple spatial and temporal scales for the 2005–2007 reference period will be disclosed. The skill of these algorithms to close the water balance over the continents will be assessed by comparisons to runoff data. The consistency in forcing data will allow to (a) evaluate the skill of these five algorithms in producing ET over particular ecosystems, (b) facilitate the attribution of the observed differences to either algorithms or driving data, and (c) set up a solid scientific basis for the development of global long-term benchmark ET products. Project progress can be followed on our website http://wacmoset.estellus.eu.

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