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Mapping components of the hydrologic cycle from sequential assimilation of land surface temperatures in the Arno basin (Italy)

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Land Surface Temperature (LST) maps are used as the primary input in a sequential data assimilation system to estimate fields of land surface hydrological components. The assimilation scheme allows to simultaneously retrieve determinant parameters of land surface water and energy balance (evpotranspiration, evaporative fraction, indices of soil moisture, turbulent transfer coefficient for heat fluxes) with a very limited requirement of ancillary data and empirical assumptions. Different contributions of soil and vegetation to the radiometric temperature are explicitly taken into account through a two-source formulation based on satellite vegetation indices. The model has been first tested with GOES, SSM/I and AVHRR data over the US Midwest for a four-month warm-season period (Caparrini et al., 2004). Comparison of the results with ground observations showed an overall consistency and a relevant sensitivity to the LST errors due to variable factors such as cloud cover. Infrared channels from SEVIRI on board MSG-1 are now providing high resolution LST maps at unprecedented temporal rate and quality. An application of the above assimilation scheme is here presented with reference to such an improved data rate, and with particular attention to the operational applicability of the method for monitoring surface components of the hydrological cycle. The application includes the use of MSG surface radiation products as well. The study area includes the Arno Basin (8000 Km2 size in Central Italy), where a large number of surface hydro-meteorological data are available. Hourly maps of evapotranspiration an daily maps of surface moisture and vegetation indices were produced for an extended study period including summer and fall 2005, ensuring a

large range of hydrological surface and atmospheric conditions. The sequential nature of the assimilation scheme allows the estimation of the surface hydrologic fields even during relatively prolonged periods with clouds covering the target area. The effects of different levels of LST retrieval error and cloud contamination on soil moisture and evaporative flux estimation are then discussed.

References

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