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Adopting robust NDVI-LAI regressions as a means for improving water balance predictions in Mediterranean regions

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It is common in water balance simulation models to adopt some distributed framework to describe landscape processes which are solved through various data assimilation approaches enabling the inference of essential catchment features and parameters from remote sensing data. Unfortunately, in most cases the assumptions concerning the model parameters are seldom checked for their reliability, since flow discharge data are commonly adopted as the sole observations against which model performance is evaluated. Particularly in semi-arid and sub-humid Mediterranean regions, the development of reasonable models describing the seasonal dynamics of vegetation cover becomes crucial in SVAT applications. A very simple approach to the heterogeneity of vegetation cover is due to Eagleson (1982) who derived the fractional vegetation cover Fc as an exponential decay function of the Leaf Area Index (LAI). LAI values are determined by satellite data using various vegetation indices such as the NDVI. The inherent problem is that the heterogeneous vegetation covers - including soil disturbances - that are typical in the Mediterranean region, have a large influence on the spectral bands and so the relation between LAI and NDVI is not unambiguous. A simple parameterisation scheme for evapotranspiration losses has been adopted in a medium-sized river catchment in southern Italy based on a data-set of multi-temporal NDVI images. Adopting a process-based model (DREAM) with a distributed parameterisation, the influence of different NDVI-LAI regression models on main features of water balance predictions is investigated. The results show a limited influence in the prediction of flood dynamics while sensible differences in the soil water regime and evapotranspiration are determined as a consequence of the alternative LAI estimations.

The proposed method for the local calibration of the non-linear NDVI-LAI regression is based on the comparison between NDVI values, obtained by satellite data, and local LAI estimations of the vegetation cover in recognized landscape elements within the catchment. Improvements in the prediction of soil water balance are expected at scales ranging from the regional to the continental one.