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Leaf Area Index specification for use in mesoscale weather prediction systems

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The energy budget at the surface is strongly influenced by the presence of vegetation which alters the partitioning of thermal energy between sensible and latent heat fluxes. Despite its relevance, Numerical Weather Prediction (NWP) systems only use two parameters to describe the vegetation cover: the fractional area of vegetation occupying a given pixel and the leaf area index (LAI). In this study a limited area forecast model (COSMO) is used to investigate the sensitivity of regional predictions to LAI assumptions over the Italian peninsula. Three different approaches are compared: a space and time invariant LAI data set, a LAI specification based on CORINE land classes and a MODIS satellite retrieved data set.

The three approaches resolve increasingly higher moments both in time and space of LAI probability density functions. Forecast scores employing the three datasets can therefore be used to assess the required degree of accuracy needed for this parameter. The MODIS dataset is the only one able to capture the expected vegetative cycle typical of the Mediterranean soil and sensibly improves the 850 hPa temperature and humidity forecast scores up to + 72 hrs forecast time. This suggests that accounting for LAI temporal and spatial variability could potentially improve the prevision of lower level variables. Nevertheless, model biases of 2m screen temperatures are not substantially reduced by the more detailed LAI specification when comparison to synop stations is performed. Using long term measurements collected by the CARBOEUROPE project, a detailed verification of sensible and latent heat fluxes predictions is also presented. It shows that the desirable positive impact arising from a better LAI specification is nullified by the large uncertainties in the initialization of the soil moisture which remains a crucial parameter for the reduction of screen level biases.