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Evaluation and attribution of vegetation contribution to seasonal climate predictability

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The land surface model of EC-Earth has been modified to include dependence of vegetation densities on the Leaf Area Index (LAI), based on the Lambert-Beer formulation. Effective vegetation fractional coverage can now vary at seasonal and interannual time-scales and therefore affect biophysical parameters such as the surface roughness, albedo and soil field capacity.

The modified model is used to perform a real predictability seasonal hindcast experiment. LAI is prescribed using a recent observational dataset based on the third generation GIMMS and MODIS satellite data. Hindcast setup is: 7 months forecast length, 2 start dates (1st May and 1st November), 10 members, 28 years (1982-2009). The effect of the realistic LAI prescribed from observation is evaluated with respect to a control experiment where LAI does not vary. Hindcast results demonstrate that a realistic representation of vegetation significantly improves the forecasts of temperature and precipitation. The sensitivity is particularly large for temperature during boreal winter over central North America and Central Asia. This may be attributed in particular to the effect of the high vegetation component on the snow cover. Summer forecasts are improved in particular for precipitation over Europe, Sahel, North America, West Russia and Nordeste. Correlation improvements depends on the links between targets (temperature and precipitation) and drivers (surface heat fluxes, albedo, soil moisture, evapotranspiration, moisture divergence) which varies from region to region.