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Assessment of the interannual variability of agricultural yields in France using satellite data and a generic land surface model

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The generic ISBA-A-gs Land Surface Model (LSM) is used to simulate the interannual variability of the maximum above-ground biomass (Bagm) of cereals and grasslands in France. Agricultural statistics are used to optimize the maximal available soil water content (MaxAWC) of the model.

For a number of administrative units, significant correlations between the simulated Bagm and the agricultural yield statistics are found over the 1994-2010 period. It is shown that the interannual variability of Bagm and of the simulated soil moisture correlate at given key periods. Significant correlations are found between ten-daily averaged simulated soil moisture and the simulated (observed) Bagm (yields). The corresponding plant growth stage is determined through the Leaf Area Index (LAI).

Moreover, it is shown that the interannual variability of the modelled LAI and of the new satellite-derived GEOLAND2 LAI are consistent. The predictive value of both simulated and observed LAI on the agricultural yield (10 to 40 days before harvest) is investigated. The scores are used to benchmark different configurations of the model. In particular two contrasting representations of the soil moisture profile are considered: (1) one root-zone layer, (2) several soil layers with an explicit representation of diffusion processes and an exponential root density profile, with or without a deep soil layer below the root-zone.