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# Spatial heterogeneity of leaf area index across scales from simulation and remote sensing

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Leaf area index (LAI, single sided leaf area per ground area) influences mass and energy exchange of vegetated surfaces. Therefore LAI is an input variable for many land surface schemes of coupled large scale models, which do not simulate LAI. Since these models typically run on rather coarse resolution grids, LAI is often inferred from coarse resolution remote sensing. However, especially in agriculturally used areas, a grid cell of these products often covers more than a single land-use. In that case, the given LAI does not apply to any single land-use. Therefore, the overall spatial heterogeneity in these datasets differs from that on resolutions high enough to distinguish areas with differing land-use. Detailed process-based plant growth models simulate LAI for separate plant functional types or specific species. However, limited availability of observations causes reduced spatial heterogeneity of model input data (soil, weather, land-use).

Since LAI is strongly heterogeneous in space and time and since processes depend on LAI in a nonlinear way, a correct representation of LAI spatial heterogeneity is also desirable on coarse resolutions. The current study assesses this issue by comparing the spatial heterogeneity of LAI from remote sensing (RapidEye) and process-based simulations (DANUBIA simulation system) across scales. Spatial heterogeneity is assessed by analyzing LAI frequency distributions (spatial variability) and semivariograms (spatial structure). Test case is the arable land in the fertile loess plain of the Rur catchment near the Germany-Netherlands border.