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Evaluation of the uncertainty due to land cover observation and conversion into plant functional types

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Land surface processes represented in the latest generation of climate models (IPCC AR5) use the concept of Plant Functional Types (PFTs) to group different vegetation types and species according to similar physiological, biochemical and structural characteristics. The 5th IPCC Assessment Report recognizes the role of the Land Surface Models (LSMs) as one of the key contributors to uncertainty in climate change impacts projections.

In the frame of the European Space Agency (ESA) Climate Change Initiative (CCI), a new global land cover (LC) data set was derived. We aim to investigate two sources of uncertainties in LSMs and their ranges: (i) uncertainty of ESA-CCI state of the art satellite observation of LC classes, and (ii) uncertainty due to LC conversion ("cross-walking (CW) procedure") into PFTs. Therefore, we have derived 5 perturbations of PFTs maps: (i) reference map (REF), (ii) map that minimizes biomass in LC observation and CW procedure (MinLC MinCW), (iii) map that minimizes biomass in LC observation with reference CW procedure (MinLC RefCW), (iv) map that maximizes biomass in LC observation with reference CW procedure (MaxLC RefCW), and (v) map that maximizes biomass in LC observation and CW procedure (MaxLC MaxCW).

Our analysis demonstrates that there is still considerable uncertainty in the methods used to convert LC classes into the PFTs used by LSMs. Furthermore, uncertainty in the labelling of LC classes has an equal magnitude compared to the cross-walking uncertainty.

In the next phase, we aim to quantify the sensitivity of the carbon, hydrological and energy cycles to LC and CW uncertainty with 3 LSMs (JSBACH, JULES, and ORHCIDEE). This work will enable us to both advice the land cover mapping community about the accuracy requirements for land cover maps, and to provide insights to the earth system modelling community on the implications of decisions taken when converting from land cover classes to PFTs.