Analysing the Effects of Different Land-Cover Datasets on Modelling Deforestation and GHG Emissions Associated with Land-Use Changes

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Abstract

Human induced land-use changes have strong impacts on the global earth system. In particular, agricultural activities have been identified to be responsible for much of the negative impact. To evaluate future impacts of these changes, spatially explicit land-use change models (e. g. LandSHIFT) have been developed. These models use different external information like geophysical, socio-economic and climate data, as well as land-cover data derived by remote sensing satellites.

All these different types of information affect modelling results. Socio-economic and climate data are considered in modelling studies due to different scenario pathways, but geophysical and land-cover data is usually not varied this way. However different land-cover datasets like MODIS (by NASA) or CCI-LC (by ESA) have considerable discrepancies due to different sensor technologies and processing methodologies and these discrepancies will affect modelling land-use results and as a consequence also follow-up analysis like impact studies and live-cycle-assessments.

To quantify and analyse these effects we developed a method that allows using different land cover datasets in LandSHIFT. The method includes (1) a parameter estimation which determines the correlation between geophysical parameters such as slope, infrastructure and potential crop-yields, and the occurrence of arable land changes. The estimation is based on the concept of agro-ecological zones (AEZ) to deal with global variations in growing seasons and climatic conditions; (2) a model initialisation that uses a multi-criterial-analysis (MCA) to allocate country specific croptype area statistics (FAO) according to the land-cover dataset; (3) a model validation including model performance and model efficiency tests; (4) model scenarios and (5) calculations of deforestation rates and GHG emissions from land-use changes that are based on the approach of the EU Renewable Energy Directive (RED). Results for each step of each of the two mentioned land-cover datasets will be presented individually as well as compared with one another.

Keywords: CCI-LC, deforestation, GHG emissions, land-cover, land-use, LandSHIFT, modelling, MODIS

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