FOREST-SAGE a generalized deforestation scenario generator for studying the Congo basin tropical forest

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Deforestation has long been considered a critical issue for the future preservation of ecosystems. Many studies highlight the strong impact that land-use change can have on both the local and regional climate through albedo and surface flux changes as well as the indirect CO_2 response, using both regional and global models. Deforestation estimates are uncertain especially in remote areas such as Congo basin and vary considerably despite measurable improvements in remote sensing, but the consensus is that tropical forest systems are at risk.

We have developed a new deforestation scenario generator coupled to climate model land-surface schemes known as the deFORESTation ScenArio GEnerator (FOREST-SAGE). The model produces distributed maps of deforestation rates taking into account several factors such as proximity to roads, distance weighted population density, forest fragmentation and presence of protected areas and logging concessions and reforestation. FOREST-SAGE is based on the framework of the widely used Community Land Model (CLM), which is the land model for the Community Earth System Model (CESM), the Community Atmosphere Model (CAM) and the 4th generation ICTP regional climate model REGCM4. We show an example of potential future deforestation scenarios for Congo basin area, with the resulting climate impact as modelled by REGCM coupled to CLM. The FOREST-SAGE was initialized and validated using the MODerate Resolution Imaging Spectroradiometer (MODIS) Vegetation Continuous Field (VCF) data with 250 meters spatial resolution rescaled to the spatial resolution of the model. Despite the high cloud coverage of Congo basin over the year, we were able to validate the results with high confidence from 2001 to 2010 in a large forested area.