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Evaluating MODIS satellite versus terrestrial data driven productivity estimates in Austria

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Sensors, such as the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite, are developed for monitoring global and/or regional ecosystem fluxes like net primary production (NPP). Although these systems should allow us to assess carbon sequestration issues, forest management impacts, etc., relatively little is known about the consistency and accuracy in the resulting satellite driven estimates versus production estimates driven from ground data. In this study we compare the following NPP estimation methods: (i) NPP estimates as derived from MODIS and available on the internet; (ii) estimates resulting from the off-line version of the MODIS algorithm; (iii) estimates using regional meteorological data within the offline algorithm; (iv) NPP estimates from a species specific biogeochemical ecosystem model adopted for Alpine conditions; and (v) NPP estimates calculated from individual tree measurements. Single tree measurements were available from 624 forested sites across Austria but only the data from 165 sample plots included all the necessary information for performing the comparison on plot level. To ensure independence of satellite-driven and ground-based predictions, only latitude and longitude for each site were used to obtain MODIS estimates.
Along with the comparison of the different methods, we discuss problems like the differing dates of field campaigns (<1999) and acquisition of satellite images (2000-2005) or incompatible productivity definitions within the methods and come up with a framework for combining terrestrial and satellite data based productivity estimates. On average MODIS estimates agreed well with the output of the models self-initialization (spin-up) and biomass increment calculated from tree measurements is not significantly different from model results; however, correlation between satellite-derived versus terrestrial estimates are relatively poor. Considering the different scales as they are 9km^2 from MODIS and 1000m^2 from the sample plots together with the heterogeneous landscape may qualify the low correlation, particularly as the correlation increases when strongly fragmented sites are left out.