Geophysical Research Abstracts
Vol. 21, EGU2019-16164, 2019
EGU General Assembly 2019

Combining Global Biomass and Forest Cover to generate dynamic maps of Above Ground Forest Biomass for the Period 2000-2017

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In recent years increased attention has been paid to the role of Biomass to understand terrestrial carbon cycle. Most of the recent research effort has focused on the Above Ground Biomass (AGB) mainly related to the forest ecosystem that represents the most dominant and dynamic component of the terrestrial carbon pool at global level. The AGB dynamism due to forest losses and gain (e.g. fires, deforestation, land use changes and afforestation/reforestation) requires a continuous monitoring. With the increased availability of space-borne data products related to the structure and function of terrestrial vegetation coupled with the cloud-based platforms for planetary-scale geospatial analysis, an accurate mapping of the terrestrial carbon cycle from space is becoming possible. However, our current understanding of AGB dynamics is limited and there is still no single technology for direct and continuous monitoring. For this reason, multiple satellite based dataset have to be integrated to support the generation of global and dynamic AGB mapping. Specifically, two dataset are currently in existence describing AGB and forest dynamics. On the one hand the ESA's GlobBiomass dataset provides a "static" map of AGB from remote sensing data (i.e. SAR, LiDAR and optical observations) acquired for the year 2010 with a spatial resolution of 100m. On the other hand the Hansen's Global Forest Change dataset provides "dynamic" maps of global tree cover, forest extent and change from time-series analysis of Landsat images from 2000 to 2017 with a spatial resolution of 30m. Here we present a retrieval methodology combining ESA's GlobBiomass and Hansen's Global Forest Change dataset to generate annual maps of AGB. The merging scheme consists of propagating through time a AGB map that refers to 2010 only using information of forest change. Different methods to translate forest change (i.e. gain and loss) to AGB have been tested and implemented. The main hypothesis is that there is a relationship between the change in AGB and the change in tree cover. Our maps represent only the variations in AGB due to forest cover change. The final dynamic AGB dataset has a spatial resolution of 100m and a temporal resolution of one year from 2000 to 2017. The dynamic AGB dataset is here presented and reviewed with emphasis on achievements and limitations. This study has been greatly facilitated by Google Earth Engine, which provides both image access and a cloud computing infrastructure for advanced analysis techniques. An outlook towards estimation of AGB with new orbiting instruments such as JEDI is also given.