Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Evaluating the use of passive microwave products (soil moisture and vegetation optical depth) to monitor drought impacts on forests

Project ID: 102

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Abstract
Our objective is the development of new indices combining microwave and optical remote sensing observations to monitor the vegetation water status of forests and the impact of severe droughts on the forest structure. The ICP data base will be a key to evaluate the interest and the performance of these new indicators. Applications to the analysis of trends will be developed.

Project

There is an increase in the frequency and intensity of severe drought impacts on trees in the context of climate change. These impacts include modification in crown leaf structure, defoliation, forest dieback, mortality. Some data bases have been developed to monitor these impacts, but they are generally limited to the sampling of a few trees in large regional areas. Here, we propose to analyze the use of microwave remotely sensed products (soil moisture and optical depth) indices to monitor the changes in the water status / structure of trees, resulting from severe drought impacts.

Our work will be based on passive and active microwave observations made in the low frequency domain (~1-20 GHz). In this domain, there is a very low sensitivity of the observations to both atmospheric and solar effects. More specifically, we will focus on the evaluation of long term data set over the period from 1980 to now of surface soil moisture (SSM) , root zone soil moisture (RZSM) and vegetation optical depth retrieved from the AMSR-E, ASCAT and SMOS sensors (Alyaari et al., 2014ab). These data have a rather coarse resolution (sensor footprint ~20-30 km), but they provide a daily global coverage. Their low sensitivity to atmospheric and solar effects, make these products very well suited for long term analysis of vegetation in the context of climate change (Tian et al., 2016).

Even though the spatial resolution of these data is coarse, recent analyses have demonstrated the interest of these observations to monitor the vegetation water stress induced by summer droughts in the Mediterranean regions. Good correlation has been found between microwave indices and local in situ measurement of the LFMC (Live Fuel Moisture Content) of several shrub species, made in the context of monitoring forest fires

risks (Fan et al., 2016). The possibility to combine microwave data with optical observations (obtained at a finer spatial resolution, but with a larger sensitivity to atmospheric and solar effects, and sensor calibration issues) will be investigated too (Samalens et al., 2012).
Based on statistical methods (mainly correlation analysis), the present project will evaluate the possibility to use microwave and optical observations to monitor changes in the forest structure as detected by the ICP data base (visual observations of crown, Leaf Area Index, litterfall, Foliage). If the results of the first step of the analysis are positive, statistical analysis will also be applied to detect trends from the microwave observations as performed by Tian et al. (2016) in dryland regions.