



Linking the fPAR, forest albedo and biomass in the northern biomes of Europe

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Land surface albedo and the fraction of photosynthetically active radiation (fPAR) absorbed by plant canopies are two of the essential climate variables controlling the planetary radiative energy budget. Albedo is directly related to the energy exchange between land and the atmosphere as it is the reflectivity of the surface – the higher the albedo, the more incoming solar radiation is reflected and the less absorbed by the surface. The fPAR is related to plant productivity, quantifying the amount of absorbed light available for photosynthesis. It is a key parameter in the modelling of net primary production (NPP) of terrestrial ecosystems. Global climate scenarios are very sensitive to albedo and fPAR estimates, and thus, the effect of changes in canopy structure and density (biomass) on these two variables needs to be quantified reliably. Both parameters are routinely retrieved from current Earth Observation sensors using specialized algorithms. To date, these satellite products have not been linked to extensive forest inventory data sets due to the lack of ground reference data. Data availability for Finland has significantly improved in December 2012, when National Forest Inventory (NFI) data became freely available to the public. The dataset covers the geographical area of Finland (26.1 million hectares) at a spatial resolution of 20 meters including several forest structural variables.

In this study, we use the NFI data to study the links between forest albedo, fPAR and forest structure and density during the green vegetation season. More specifically, we investigated the seasonal trends in fPAR and albedo of different spectral regions of northern forests. Empirical relationships between forest albedo, fPAR and total aboveground biomass were established for selected days within the vegetation growing period and across a latitudinal transect of Finland.