New possibilities of Earth Observation for Forestry: Radar and LiDAR Applications

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Abstract

This presentation gives an overview of new possibilities of earth observation for forestry with the focus on RADAR and LiDAR applications.
During the last decade the technology of **li**ght **d**etection **a**nd **r**anging (LiDAR) has been established as one of the standard technologies for the acquisition of high precision topographic data. As an active remote sensing technology nanosecond-long laser pulses are transmitted from the sensor, which is mounted on an airborne platform. Over forested areas the laser pulses may be reflected by leaves and branches of the vegetation and the underlying terrain surface and are backscattered to the sensor. Based on the measured travelling time and the continuously recorded position and rotation of the sensor the three dimensional position of each backscattering object can be determined. Due to the fact that LiDAR data do not only provide terrain heights but also information about the horizontal and vertical distribution of forest canopies, a quantitative assessment of forest parameters, such as tree height, is possible. Furthermore, LiDAR is one the most promising techniques for downscaling sample plot based forest inventories. For Austrian test sites different case studies using LiDAR data to estimate forest parameter are presented and discussed.
Compared to LiDAR, the **ra**dio **d**etection **a**nd **r**anging (RADAR) technology uses wavelengths of 1 mm to 1 m (microwave). Typically, the sensors are mounted on satellites, which make them in combination with the all-weather applicability of microwaves and short repeat pass times to an ideal remote sensing system for monitoring high timely variable processes. In the first instance the RADAR backscatter response is affected by topography, surface roughness, amount and type of vegetation cover and soil moisture. Assuming that the first parameters are static, multitemporal RADAR images show the temporal changes in soil moisture. In particular the RADAR signal is sensitive to the soil's dielectric constant that depends on the soil moisture. The potential of derived soil moisture products for improvements in hydrological, climatological and vegetation studies is demonstrated. The spatial and temporal knowledge of soil moisture for long time periods can increase the understanding on physical causes of hydrological extremes required for example as input for forest ecosystem studies.