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The influence of forest canopy on satellite observations in northern boreal forests

Title of the dissertation	The effect of forest canopy on remote sensing observations in the boreal region Latvuston vaikutus kaukokartoitushavaintoihin havumetsävyöhykkellä
Contents of the dissertation	Satellite observations are frequently used for the monitoring of northern boreal environments. However, forest canopy influences the electromagnetic signals and hinders the visibility of the ground surface. In this thesis, a model was used to separate the signals originating from the ground surface and from the canopy, thus enabling e.g. the monitoring of the ground beneath the canopy. Thanks to the relative simplicity and the good accuracy of the model, it can be used in near real-time mapping and monitoring of wide areas from space. The influence of the canopy on the satellite observations was further investigated through two practical applications: Spring flood mapping and monitoring of the freeze-thaw state of the terrain in Finland. The research of this thesis increases the understanding on the influence of the forest canopy in remote sensing, advancing the development of new remote sensing products. The Earth surface can be mapped with optical and microwave instruments. Optical instruments operate on infra-red and visual wavelengths, whereas microwave instruments on microwave frequencies. The model was applied on the optical and the microwave observations, but the research was generally more focused on radar satellites operating on microwave frequencies. The main advantages of the radar satellites are their ability to collect images also during the night, beneath the clouds and with a relatively high spatial resolution. Floods were successfully detected in open areas and under forest canopies. The first operational satellite-based flood mapping product, currently used by the Finnish Flood Center, was developed on the basis of this thesis. The approach proposed in this thesis enabled the detection of frozen and thawed terrain in forests. This contributes to the development of a soil freeze-thaw product, which could e.g. help in assessing the soil carrying capacity for forest machinery and other heavy equipment.
Field of the dissertation	Geoinformatics, Remote Sensing
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