EXAMINATION OF MULTI-SEASONAL ALOS PALSAR INTERFEROMETRIC COHERENCE FOR FORESTRY APPLICATIONS IN THE BOREAL ZONE

Christian Thiel, Christiane Schmullius

Department of Earth Observation, Friedrich-Schiller University, Grietgasse 6, D-07743 Jena, Germany

Project: JAXA K&C Initiative

The great potential of SAR data for forestry applications has been clearly demonstrated by a remarkable number of studies. Lower radar frequencies such as L-band proved to be of particular adequacy. While techniques aiming at forest cover and forest disturbance mapping (e.g. logging, forest fire, and wind damage) almost reached an operational stage (at least in the boreal zone), the estimation of forest biomass still struggles with problems related to saturation and considerable uncertainties. However, the incorporation of interferometric coherence as well as the extension of the timeline (multitemporal data) proved having the potential to overcome these issues.

The boreal zone is characterised by unique environmental conditions, which need to be considered throughout the SAR data exploration. During winter the trees are frozen and thus almost transparent for the incoming radar wave. The backscatter from the trees is significantly reduced, as is the contrast between forest and non-forest areas. However, the environmental conditions are very stable. Due to the very low temperatures the very dry snow hardly impacts the scattering. As the soil is also frozen, changes in soil moisture do not appear. With regards to coherence these circumstances lead to very low temporal decorrelation. Even temporal baselines of 44/46 days (JERS-1/ALOS PALSAR) do not necessarily lead to problems caused by temporal decorrelation. From a number of studies it became evident that in particular coherence images acquired during winter do have great potential for forest biomass estimation. Furthermore it was recognised, that the thawing season is the most unsuitable time. At midsummer the major sources of temporal decorrelation are changing soil moisture, movement of the trees due to wind, and precipitation (interception water). Thus, the repeat pass coherence for forest is assumed being in general much smaller compared to mid-winter. However, not much is known about mid-summer coherence in the boreal zone.

This paper investigates multi-seasonal ALOS PALSAR interferometric coherence images for forestry applications in the boreal zone. Coherence is estimated using PALSAR FBS and FBD data. The test sites are located in Russia (Siberia) and Canada. First results substantiate the great potential of midwinter coherence. With regards to midsummer coherence some of the outcomes are somewhat unexpected.