Geophysical Research Abstracts
Vol. 18, EGU2016-13506, 2016
EGU General Assembly 2016

ESA SnowLab project

Andreas Wiesmann, Rafael Caduff, Othmar Frey, and Charles Werner
GAMMA Remote Sensing AG, Gümligen, Switzerland (wiesmann@gamma-rs.ch)

Retrieval of the snow water equivalaent (SWE) from passive microwave observations dates back over three decades to initial studies made using the first operational radiometers in space. However, coarse spatial resolution (25 km) is an acknowledged limitation for the application of passive microwave measurements. The natural variability of snow cover itself is also notable; properties such as stratigraphy and snow microstructure change both spatially and over time, affecting the microwave signature. To overcome this deficit, the satellite mission COld REgions Hydrology High-resolution Observatory ($CoReH_2O$) was proposed to the European Space Agency (ESA) in 2005 in response to the call for Earth Explorer 7 candidate missions. $CoReH_2O$ was a dual frequency (X- and Ku-band) SAR mission aimed to provide maps of SWE over land and snow accumulation on glaciers at a spatial resolution of 200 to 500 meters with an unprecedented accuracy. Within the frame of preparatory studies for $CoReH_2O$ Phase A, ESA undertook several research initiatives from 2009 to 2013 to study the mission concept and capabilities of the proposed sensor. These studies provided a wealth of information on emission and backscattering signatures of natural snow cover, which can be exploited to study new potential mission concepts for retrieval of snow cover properties and other elements of the cryosphere. Currently data related to multi-frequency, multi-polarisation, multitemporal of active and passive microwave measurements are still not available. In addition, new methods related to e.g. tomography are currently under development and need to be tested with real data. Also, the potential of interferometric and polarimetric measurements of the snow cover and its possible impact for novel mission/retrieval concepts must be assessed. .

The objective of the SnowLab activity is to fill this gap and complement these datasets from earlier campaigns by acquiring a comprehensive multi-frequency, multi-polarisation, multitemporal, tomographic dataset of active and passive microwave measurements over snow-covered alpine grounds. The investigation will cover 3 winter seasons and different high alpine locations.

In the winter season 2015/16 the focus is on X to Ku band tomography on a test site in the Bernese Alps, close to Grimselpass, Switzerland. The ESA SnowScat device was set up together with an automated weather station and cameras. The SnowScat device is a ground-based stepped-frequency continuous-wave (SFCW) scatterometer supporting fully-polarimetric measurements within a frequency band from 9.2 to 17.8 GHz. Recently, the SnowScat hardware has been enhanced to also provide a tomographic profiling mode which allows to obtain high-resolution 2-D vertical profiles. Snow characterisation is done on a regular base using the WSL-SLF snow micropen (SMP) and traditional snow characterisation. During selected phases, snow samples will be extracted for microstructural analysis in the computer tomograph (CT).

Further campaign objectives are:
- Effects of snow accumulation (SWE) and temporal evolution of snow morphology on multi-frequency and polarimetric backscatter signatures
- Temporal variability of the polarimetric and interferometric radar signatures as a function of environmental conditions
- Characteristics and information content of X to Ku-Band tomograms of the snow-pack
- Contribution of microwaves observations to the description and understanding of the snow-ground compartment.

In our presentation we will give a project overview and status and discuss first results from winter 2015/16.