The International Snow Products Intercomparison and Evaluation Exercise – SnowPEx

Thomas Nagler (thomas.nagler@enveo.at), Gabriele Schwaizer, Elisabeth Ripper, Chris Derksen, Richard Fernandes, Kari Luojus, Oli-Pekka Mattila, Sari Metsämäki, Lawrence Murdryk, Rune Solberg, Bojan Bojkov, Michael Kern
ENVEO IT GmbH, Austria

Seasonal snow is a main element of the global water cycle and climate system. Due to its strong influence on the radiation and energy balance, changes in snow extent tend to amplify climate fluctuations. Terrestrial snow covers up to 50 million km² of the Northern Hemisphere in winter. It is characterized by high spatial and temporal variability. Therefore, satellite observations provide the only means for timely and complete observations of the global snow cover. SnowPEx is an international collaborative effort, funded by the European Space Agency (ESA) under the Quality Assurance framework for Earth Observation (QA4EO) that intercompares and evaluates satellite-based seasonal snow cover products of hemispheric to global extent, assesses the product accuracy, and identifies discrepancies between the various products. Furthermore, in support of climate studies, trends in the hemispheric seasonal snow coverage and snow mass have been documented, based on an ensemble of satellite based snow products. SnowPEx focuses on two parameters of the seasonal snow pack, the snow extent (SE) from medium resolution optical satellite data (MODIS, AVHRR, VIIRS, etc.) and the snow water equivalent (SWE) from passive microwave data (SSM/I, AMSR, etc.). Overall 14 continental to global satellite snow extent products (including fractional snow cover products) and three SWE products are participating in the intercomparison and validation experiment, with test areas spreading over different environments and climate zones. For the intercomparison daily SE products from 5 years have been transformed to a common map projection and standardized protocols, developed in the project, are applied. The SE product evaluation applies statistical measures for quantifying the agreement between the various products, including the analysis of the spatial patterns. Extensive validation of snow extent products is carried out using high resolution snow maps, generated from about 450 Landsat scenes in different snow zones and over various land surface types. Additionally, an in-situ snow reference data set is used, including station data from various organisations in Europe, North America and Asia. Validations with high resolution Landsat based snow products and in-situ data reveal statistical differences between various snow extent products of up to 30%, depending on the land surface type and complexity of the terrain. For the coarse resolution SWE products from passive microwave sensors, sites with dense networks of in-situ measurements are used for validation. The SWE products are also inter-compared with gridded snow products from land surface models driven by atmospheric reanalysis. In addition, the multi-year trends of the various SWE and Snow Extent products are intercompared and evaluated. We provide an overview on the contributing snow products, the evaluation protocols, and the results of QA4EO SnowPEx and report on multi-decadal trends in the various snow products.