SNOWTOOLS - An European Project for Research and Developmentof Remote Sensing Methods for Snow Hydrology

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SNOWTOOLS is a European Commission Environment & Climate Program research and development project. The main objective is to develop methods for the extraction of snow parameters from optical and microwave remote sensing data. Based on interviews of various user groups, ranging from hydropower industry and water management to climatology, a set of snow products has been defined. The products include snow cover area, snow water equivalent, albedo, snow wetness, snow surface temperature and snow depth. The spatial resolution of the products is 250 and 500 m, and the required delivery time is between 2 and 24 hours for most products. The product specification is used as a "driving force" for development of algorithms.

A comparison between the products defined and the state of the art of snow mapping has resulted in recommendations for further research. For optical remote sensing of snow, research is mainly recommended for: Subpixel classification of SCA; modelling and compensation for temporal, topographic and anisotropic reflectance effects; and compensation for vegetation/forest. For SAR, more research is needed on: Capability to measure snow-covered ground and melting snow; effects of vegetation; use of polarimetry; combined use of various frequencies; and use of SAR interferometry. Similarly, for PMR: Algorithms for multitemporal and low and high frequency data; effects of mixed signatures, vegetation, atmosphere and rugged terrain; investigation of error sources; development of new algorithms for the water equivalent retrieval; and assessment of interpolation techniques.

Two dedicated remote sensing experiments, one for mountainous basins and one for boreal basins, are carried out for both the development and validation. The mountain basin field campaigns in 1997 and 1998 have established a multitemporal/multisensor data set for algorithm development, including ERS, RADARSAT, Landsat TM, and DAIS airborne spectrometer data.
SAR data from the EMAC'95 campaign is also analyzed in the project. Three combined remote sensing and ground data acquisition campaigns were conducted in March, May and July 1995. Several ERS-1 and EMISAR C- and L-band full polarimetric scenes were obtained from the test site. The extent of a wet snow cover observed by EMISAR C-VV corresponds to optical airborne measurements. Results show that C-band polarimetric data from March, when the content of free water in the snow was in the range 1-3%, are affected by the underlying vegetation. Discrimination between bare ground and snow is exceptionally good for wet snow.

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