Towards strategic acquisition planning for the mapping of wet snow extent us-ing spaceborne SAR sensors: An initiative of the WMO Polar Space Task Group

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Mapping wet snow extent with satellite SAR sensors can be integrated into models of snow melt processes, and contribute to many hydrological applications, including flood forecasting and snow-runoff modeling. Because the snow melt period is often restricted to a relatively short time, the temporal resolution of repeated SAR observations is critical for monitoring changes to the snow wetness state. Monitoring the seasonally dynamic snow melt period in various regions around the world requires coordination of satellite measurements during the main melt seasons, while not unduly placing demands on satellite resources during the snow free and dry snow seasons. The challenges posed by coordination and image acquisition conflict-resolution with other applications has been formidable in the past, which has negatively influenced the success of large scale snow melt monitoring efforts. A significant step forward in C-band SAR coverage will be made in 2014 with the launch of the first Sentinel-1 satellite (S1A). Land acquisitions (e.g. over Europe) will mainly be in the Interferometric wide swath (IW) mode, initially at VV or VV/VH polarisations, a configuration well-suited to wet-snow mapping. A revisit interval in Europe of less than 6 days is foreseen, and less than 3 days after S1B is launched in 2015. Much shorter revisit intervals are possible at high latitudes. Global high resolution daily coverage will for some time remain a challenge, as less data will be acquired in regions outside of Europe. Even so, an average global revisit interval of 10 days (with S1A), and 5 days (with S1A & S1B) is generally foreseen for land surfaces outside of Europe and Canada.

Wider swath modes are preferred in general when optimizing for a minimum revisit interval. However, systematic radiometric trends within and between swaths must be adequately compensated to allow meaningful multi-track backscatter comparisons. For alpine regions with high topographic variability (important areas for snow applications) the effects of topography on the SAR radiometry need to be modeled and corrected, with systematic combination of ascending and descending orbits yielding optimal results. The Sentinel-1 interferometric wide swath (IW) and extra-wide swath (EW) modes offer 250km and 400km swath widths respectively. The Radarsat-2 (RS2) ScanSAR modes SCNB and SCWA offer 300km and 500km swaths. Each of these S1 and RS2 modes is able to provide dual-polarisation backscatter observations, either VV/VH or HH/HV. The cross-polarisation backscatter appears even more sensitive to wetness than do the co-polarised channels. Research on inter-mixing S1/RS2 C-band wet-snow backscatter with observations based on X-band TSX/TDX/PAZ data will become increasingly relevant as experience is gained with the new 200km swath width mode recently introduced by DLR and with Cosmo-Skymed ScanSAR data, with research

ongoing into robustly differentiating between dry/wet/no snow and wet soil.

It is important that the snow community make a recommendation on preferred imaging modes to avoid introducing unnecessary polarimetric "noise" into wet snow extent estimates. Arguments for coordinated acquisitions across space agencies would be helpful in further optimizing the use of available sensors. We present tentative results from our call for contributions from the community, asking for evidence-based suggestions on acquisition start and finish dates by region in order to prepare a draft set of high priority acquisition periods and revisit requirements and recommended modes.