The ESA RainCast Study For Global Snowfall Monitoring: New Concepts And Perspectives in view of the Arctic Weather Satellite mission

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The ESA Raincast study is a multi-platform and multi-sensor study to address the requirement from the research and operational communities for global precipitation measurements. It aims at identifying and consolidating the science requirements for a satellite mission that could complement the existing space-based precipitation observing system and that could optimally liaise with efforts currently made by other agencies in this area. One objective in the study is to provide criteria and guidelines in the design of future missions dedicated to global snowfall quantification.
Improvement in both the monitoring of high latitude precipitation and in our understanding on microphysical and dynamical processes that influence high latitude precipitation patterns, intensity and type must be driven by concerted observations of active radars and passive microwave radiometers. This has been recently demonstrated through the development of machine learning-based algorithms for snowfall detection and retrieval, exploiting global observational datasets built from passive and active microwave spaceborne sensors. In particular, the CloudSat/Calipso-based machine learning snowfall retrieval methodology developed for the GPM Microwave Imager (GMI) (SLALOM), which has been developed within the EUMETSAT Hydrology SAF in preparation for the EPS-SG Microwave Imager (MWI) mission, has proven to be very suitable for snowfall detection and retrieval. SLALOM is able to reproduce CloudSat snowfall climatology, but with better coverage (up to 65°N/S for GMI), and it outperforms other state-of-the-art GPM products.
The increasing number of operational cross-track scanning radiometers in the future (e.g., EPS-SG Microwave Sounder (MWS) misson) requires dedicated efforts to study the potentials of these radiometers to improve snowfall global monitoring. Moreover, the Arctic Weather Satellites (AWS) mission, carrying a cross-track scanning microwave radiometer covering the frequency range 50–325 GHz, will provide unprecedented spatial and temporal coverage at high latitudes. In this context, SLALOM has been recently adapted and applied to the currently available most advanced cross-track scanning Advanced Technology Microwave Sounder (ATMS), on board Suomi NPP, NOAA-20, and the future JPSS platforms. Dedicated studies have been carried out to assess ATMS snowfall observation capabilities at high latitudes (> 60°N). The study is based on the use of a ATMS/CloudSat-Calipso coincidence dataset. The main findings from the study will be presented by: 1) critically reporting on the different scientific aspects and on the complexity related to snowfall detection and quantification in extreme dry/cold conditions (e.g., frozen background surface variability), 2) analyzing in detail and providing evidence of such complexity, and 3) proposing observation and retrieval strategies to be adopted in the future to improve detection and quantification of snowfall in the Arctic, also in view of the AWS mission. These findings pave the way towards the definition of synergistic approaches exploiting the future European AWS, EarthCare and CIMR missions.