



## **Rainfall estimations and characterization of snow-covered terrains: Validation of the new version of the 183-WSL retrieval method**

Sante Laviola, Elsa Cattani, and Vincenzo Levizzani  
ISAC-CNR, Bologna, Italy (s.laviola@isac.cnr.it, +39 051 639 9658)

The computational scheme of the 183-WSL (Laviola and Levizzani, 2009, 2011) has been recently improved with a new module for the identification and classification of snow covered terrain. The 183-WSL rainfall retrieval method is physically based on the absorption signal in the 183.31 GHz band. The original version of the algorithm was mostly devoted to rainfall estimation and classification among convective and stratiform rainfall type on the basis of scattering signatures. One the clear weaknesses of the method was its application over snow cover during mid-latitude winter or generally at high-latitudes. Thus, the initial version of the 183-WSL suffered from large overestimations during winter precipitation events or from non-classified areas. This misclassification was fundamentally due to the similarity between the scattering effects of frozen soils and the signal coming from ice hydrometeors located at the top of winter clouds.

The 183-WSL snow cover module, currently still in the testing stage, produces a snow cover mask per each satellite overpass, distinguishing between regions of wet and dry snow. The high sensitivity to the ice crystals on the surface of the window frequencies at 90 and 150 GHz combined with the scattered radiation at 190 GHz, which is typically observed over frozen soils, allows for an accurate identification of snowy terrain. Moreover, the variation of surface emissivity due to the different water content of snow make it possible to classify the snow cover according to its wetness.

The 183-WSL new rain rate and snow cover products are compared with ground data. Two datasets are exploited for a validation of the algorithm. The validation of rainfall rates is carried out by using 1 year worth of data of the European Radar Network NIMROD while the snow cover product is compared with 6 months of maps from the Interactive Multisensor Snow and Ice Mapping System (IMS) operational product over the Baltic Regions. The analysis reveals that the 183-WSL new computational scheme skillfully matches up radar data especially during the warm season. In the winter season a significant reduction of false alarms is observed. Similarly, the snow cover module shows good performances compared with the ground truth.

New sensitivity studies are planned to further improve the algorithm also with the additions of a snowfall detection module.

### References

- Laviola, S., and V. Levizzani, 2009: Observing precipitation by means of water vapor absorption lines: A first check of the retrieval capabilities of the 183-WSL rain retrieval method. *Italian J. Remote Sensing*,41(3), 39-49.
- Laviola S, and Levizzani V., 2011: The 183-WSL fast rain rate retrieval algorithm. Part I: Retrieval design. *Atmos. Res.*, doi: 10.1016/j.atmosres.2010.11.013