Improving weather radar measurements through synergy with digital broadcasting satellite receivers

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In the framework of the Italian project NEFOCAST [1], funded by regional administration of Tuscany, a commercial interactive digital video broadcasting receiver (referred as to SmartLNB) has been installed on the roof of the main building of the Institute of Atmospheric Sciences and Climate (ISAC) of Italian National Research Council (CNR) in Rome next to a laser-based Thies Clima (TC) optical disdrometer manufactured by Adolf Thies GmbH & Co, and the Polar 55C, a C-band dual-polarization scanning weather radar. This set up has been used to tune, test and validate the rainfall retrieval algorithm developed during the NEFOCAST project that allows to obtain rainfall rate from the signal-to-noise ratio measured by the SmartLNB. For the NEFOCAST aims, during the project, the Polar55C operated in pointing mode with the same elevation angle of the SmartLNB, so that the two devices could scan almost time continuously the same portion of the atmosphere (see Figure 1). In the metropolitan area of Florence, a similar setup, but with an X-band dual polarization radar, was operated for one year for extensive validation of NEFOCAST estimates. The X band radar was properly installed on the roof of the Institute of BioEconomy (IBE) of CNR in Florence and operated volume scans and Range Height Indicator (RHI) along the direction of the satellite link.

In the NEFOCAST project we demonstrated the capability of using SmartLNB data to retrieve precipitation [2]. However, theoretically, over the latter application, the SmartLNB data can be also useful to check and validate and possibly tune the attenuation correction algorithms adopted for C- and X-band weather radars. In fact, in case of intense precipitation, at those frequencies, both the reflectivity at horizontal polarization and differential reflectivity are attenuated and proper algorithms for compensating attenuation effects need to be adopted, such as those based on a relation between specific attenuation and differential phase shift. In the presence of precipitation along the Earth-satellite path, the SmartLNB measures lower values of the signal-to-noise ratio with respect to clear sky condition and therefore the attenuation due to rain drops and melting layer can be straightforward obtained for the frequency of the satellite link (namely the Ku-band frequency of 11.3458 GHz). As a consequence, the analysis of coincident measurements of radar and SmartLNB can provide useful information on the accuracy of the weather radar attenuation correction algorithm.

In this study, preliminary results of latter analysis described above are presented and discussed.

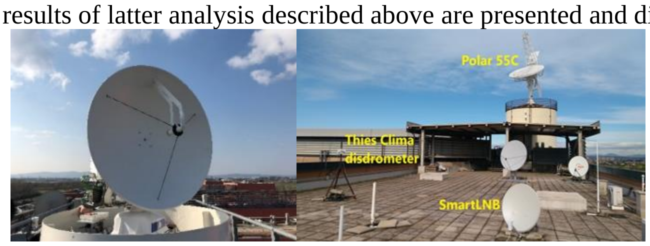

Figure 1: (left) Weather radar WR25XP in Florence; (right) set-up at ISAC-CNR during NEFOCAST.

References

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