Weather radar online sun-monitoring in presence of leverage outliers: five or three parameter model inversion?

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The aim of this work stands for providing tools towards the performance assessment and data quality improvement of the weather radar network of the Meteorological Service of Catalonia (SMC), taking into account the OPERA EUMETNET recommendations. Within this framework, an operational implementation of the Sun monitoring algorithm for online assessment of antenna pointing and receiver chain calibration is presented. The procedure has been adapted from Huuskonen and Holleman (2007) and Holleman et al. (2010).

The method is built upon detection and robust characterization of solar interferences in raw data. The power of the detected interference is modelled considering the antenna sensitivity pattern and its scanning motion. Regarding antenna and scanning parameters, the validity range of the resulting two-dimensional Gaussian model has been established through a complete theoretical derivation. This, to our best knowledge, represents a novel approach as it provides an analytical estimate of the effective scanning beam-width directly from radar parameters.

Prior to inversion, a non-iterative methodology based on robust statistical estimators has been incorporated to remove observations that do not fit the model (e.g. RLAN interferences). The model is inverted using the interference observations to retrieve the Sun power at the top of the atmosphere and systematic antenna pointing biases in azimuth and elevation (three-parameter model) and, optionally, the beam-widths in both directions (five-parameter model). Results of this methodology for a year of daily data reveal the pointing accuracy of the antenna and sensitivity to changes in receiver calibration. Two weather radars, presenting solar observations of different qualities, serve as case studies to assess the stability and accuracy of a three-parameter fit in comparison to a full five-parameter retrieval. Outlier removal procedure proves to allow the application of the method for interferences found at all scan elevations even when only data at relatively short ranges is available.