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Synergetic approach for validating satellite-retrieved cloud properties with a passive microwave radiometer and a multifilter rotating shadowband radiometer

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Bi-spectral algorithms to estimate cloud optical thickness, liquid water path and effective droplet size from reflected solar radiation at an absorbing and a non-absorbing wavelength are routinely applied to observations of meteorological satellite imagers. The underlying inversion process is highly underconstrained, and is based on the simplified view of 1D radiative transfer theory. It is therefore difficult to quantify the overall accuracy of these retrievals, and validation with independent datasets is crucial.

The combination of measurements from a multifilter rotating shadowband radiometer and a passive microwave radiometer allows us to obtain simultaneous and independent estimates of cloud optical thickness, liquid water path and effective droplet size from surface observations. In this study, a comparison of the surface-derived time series of these cloud properties for two European sites with collocated and synchronised retrievals from the geostationary METEOSAT SEVIRI satellite imager is carried out. This is done in order to test the suitability of the approach for routine quality monitoring of the cloud property products generated by the Satellite Application Facility on Climate Monitoring (CM-SAF).

A discussion of the uncertainties affecting the surface and satellite retrievals, and the matching of both measurements taking into account their different scales is given first. This allows us to assess the level of agreement of the individual time series under specific conditions. It is shown that validation statistics are highly sensitive to quality screening and case selection, as well as the spatial and temporal averaging scales used for the comparison. This finding highlights the necessity to develop standard procedures to be able to compare validation results for different retrievals and satellite platforms.