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## **Evaluation of the fast visible RT model RTTOV-MFASIS and use for model cloud validation of ICON**

MFASIS is a novel fast radiative transfer method for the simulation of visible satellite images that is fast enough to cope with the computational constraints of operational data assimilation systems and has therefore recently been implemented into RTTOV v12.2 and v12.3. First evaluation and data assimilation experiments using MFASIS in combination with regional models have demonstrated its value by improving the representation of cloud cover and precipitation.

As a further step towards using visible satellite images in operational data assimilation, we perform a detailed validation of the accuracy of MFASIS and apply it in evaluating the representation of clouds in DWD's global NWP system ICON+EnVAR in comparison to visible channel observations from the SEVIRI instruments on board MSG.

We evaluate RTTOV-MFASIS by comparing forward simulations to results from the discrete ordinate method RTTOV-DOM based on global ICON model fields which offer a large variety of atmospheric situations. This is done in a suitable test setup with controlled viewing conditions and by studying dependencies on relevant quantities, such as optical depths, to identify any systematic errors resulting from the approximations made in MFASIS. These investigations pave the way for further improvements to MFASIS, e.g., for an improved description of mixed-phase cloud situations.

Additionally, we compare reflectances simulated with RTTOV-MFASIS based on ICON model fields to real visible channel observations using geostationary satellites. This aims at validating the accuracy of the model cloud fields, also in conjunction with all-sky simulations of corresponding IR channels. Here, the visible channel information is complementary especially for the analysis of the representation of low clouds.

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