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Use of the Ocean Surface Wind Direction Signal in Microwave Radiance Assimilation

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Ocean surface radiation observed with satellite microwave imagers has wind directional signal. Vertically and horizontally polarized microwave radiations have dependency on relative azimuth angle. The relative azimuth angle is the difference between ocean surface wind direction and sensor azimuth angle.
In the research field of geophysical parameter retrievals (e.g. sea surface temperature, sea surface wind speed and total column water vapor) from the satellite radiance data, the directional signal is one of the error sources in the retrieval process and has been removed to obtain the accurate geophysical parameters.

In the field of the satellite radiance data assimilation for numerical weather prediction (NWP), the wind directional information should be considered correctly in radiative transfer model (RTM) calculation because the signal reaches about 2K under strong wind condition in winter-hemisphere.
However, the characteristic has not been taken into account correctly in the radiance assimilation because of a lack of the sensor azimuth angle information in the real time data for operational NWP purpose.

In this study, the sensor azimuth angle are derived based on information of satellite sensors location for several microwave imagers (AMSR-E, TMI and SSMIS) and surface wind vector information from NWP model are used together for the RTM calculation.

First, we investigate performances of currently available azimuthal ocean emissivity models (FASTEM3 and FASTEM5). And then, we verify the models with real observation from ADEOS-II satellite (e.g. simultaneous measurements of microwave brightness temperature from AMSR and ocean surface wind vector from Seawinds). Finally, we propose an improved azimuthal emissivity model based on the real measurements and perform microwave radiance assimilation experiments with the improved azimuth ocean emissivity model.

The detail of the verification of the ocean surface emissivity models, the performance of the improved model, and the experimental results of the impact study are presented in the conference.