Uncertainties of 3MI's polarimetric measurements over inhomogeneous cloud scenes

Souichiro Hioki*, Jérôme Riedi, Mohamed S. Djellali, and Huazhe Shang

Univ. Lille, UMR 8518 – Laboratoire d'Optique Atmosphérique, 59000 Lille, France

**Presenting author (souichiro.hioki@univ-lille.fr)*

The Multi-viewing, Multi-channel, Multi-polarization Imager (3MI) sensor is a planned space-borne sensor on the MetOp Second Generation-A (MetOp-SG-A) satellite platform. The selection of observation channels and the geometries makes it possible to infer cloud properties such as cloud phase, cloud droplet size, and ice cloud particle morphology. The nominal resolution of the sensor is 4 km at the nadir, and the 3MI will acquire polarimetric measurements in nine spectral channels. The 3MI sensor reconstructs three of the Stokes parameters (*I*, *Q*, and *U*) from three images taken sequentially within 0.5 seconds during which the instantaneous field of view (IFOV) shifts by approximately 3.5 km. This particular instrumental design can introduce bias over highly inhomogeneous cloud scenes, where cloud radiance changes significantly at the sub-pixel scale.

In this talk, we discuss the bias and variance of the 3MI's polarimetric observations over inhomogeneous cloud scenes. A nadir-view proxy data at 1 km resolution is produced from the polarimetric measurements of natural clouds by the Second Generation Global Imager (SGLI) aboard Global Change Observation Mission – Climate (GCOM-C) satellite by JAXA. Then, spatial averaging is performed in two different methods, with and without considering the geographical shift of the IFOV: (i) averaging over at the 3MI Level 1C grid scale; and (ii) averaging over the IFOV of three 3MI acquisitions and then interpolating onto the 3MI Level 1C grid. The bias and variance are evaluated by comparing these two methods of spatial averaging. The final outcome of this research is beneficial for the production of 3MI Level 1 products that are planned to provide polarimetric measurement uncertainty to users.

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