The effect of the surface BRDF on the measurement of tropospheric NO2 from a geostationary orbit and ISS: evaluation of AMF

Katsuyuki Noguchi[1]; Andreas Richter[2]; John Burrows[2]; Hitoshi Irie[3]; Kazuyuki Kita[4]
[1] Nara Women's Univ.; [2] Uni. Bremen; [3] CEReS, Chiba Univ.; [4] Ibaraki Univ.

BRDF (Bidirectional Reflectance Distribution Function) is the dependence of the surface reflectance on the incident and reflected directions of light. In the Earth observations, BRDF is a basic physical quantity and has been focused on for quantification. The application of BRDF to the measurements of other quantities includes the measurements of atmospheric minor gases using UV/Visible spectra, which are affected by the surface reflectance. The present study aims at measureing the tropospheric NO2, which is one of the important air pollutants. By Zhou et al. [2010], it was shown that the surface BRDF affects the retrieval of the tropospheric NO2 column density with sun-synchronous low Earth orbit (LEO) satellites, as line-of-sight angles largely change in the sun-synchronous LEO measurements.

In the present study, we have estimated the influence of BRDF on the tropospheric NO2 DOAS retrieval supposing the observations of air pollution over Tokyo from a geostationary orbit (GEO) and International Space Station (ISS). In the analysis, we used the results of actual surface measurements: the MODIS BRDF product (MCD43B1) released by NASA. The influence of BRDF on the tropospheric NO2 column density measurements can be evaluated by calculating the air mass factor (AMF), which is the ratio of the observed column density (slant column density) to the vertical column density to be estimated. The results showed that the use of the ideal surface reflectance, Lambertian equivalent reflectance (LER), instead of BRDF would cause the overestimation up to 40% in summer and 10% in winter. The results suggest that it is important to consider the effect of BRDF on the retrieval of the tropospheric NO2.