

A method for atmospheric temperature profile estimation by Himawari-8/AHI limb-sounding

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Himawari-8 is the Japanese Geostationary Earth Orbit (GEO) meteorological satellite, that is equipped with Advanced Himawari Imager (AHI). Himawari-8/AHI provides full disk images every 10 min in 16 observation bands, including three visible bands: blue (0.47 μ m), green (0.51 μ m), and red (0.64 μ m). These full disk images are normally used as nadir observations mainly for meteorological purposes. On the other hand, the full disk images by Himawari-8/AHI can also provide near-global limb-sounding data as the edges of images. As an example, there are a couple of reports on polar mesospheric cloud (PMC) observations by Himawari-8/AHI limb-sounding.

In the present work, we consider temperature estimations in the middle atmosphere as a further application using Himawari-8/AHI limb-sounding data. In the limb-sounding, Rayleigh scattering of the sunlight can be observed, and thus we can obtain height profiles of line-of-sight (LOS) integrated Rayleigh scattering signals. Extinction effects in the signals can be corrected based on a simulation in the Rayleigh scattering. After that, by inversion methods, such as the Abel transforms, the LOS-integrated signals can be converted into local signals, which could be considered to be proportional to the local number densities of the atmospheric molecules. Then, applying the Rayleigh scattering temperature lidar technique, height profiles of temperature can be derived from height profiles of the local signals under an assumption of the hydrostatic equilibrium. There are a couple of previous works demonstrating this kind of temperature estimation using limb-sounding data from low-Earth-orbit (LEO) satellites. On the other hand, there is no previous example of GEO satellites, which have an advantage in providing continuous observations from a fixed point in space. In the presentation, we will show our results for temperature estimations by Himawari-8/AHI limb-sounding, and discuss the potential of the estimated temperature data.