

Air mass factor calculation for deriving NO₂ column amounts from GOSAT-GW/TANSO-3 observation

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The Global Observing SATellite for Greenhouse Gases and Water Cycle (GOSAT-GW) was launched in June 2025. It is the third satellite in the GOSAT series for observations of greenhouse gases (GHGs) from space. One of the two sensors equipped in GOSAT-GW is Total Anthropogenic and Natural emissions mapping SpectrOMeter-3 (TANSO-3). The TANSO-3 sensor observes nitrogen dioxide (NO₂) to increase the accuracy to monitor emission source of GHGs. The GOSAT-GW/TANSO-3 could represent the world's first satellite-based observation to capture the distributions of these gases as imagery within a single field of view and at the same time.

The NO₂ retrieval algorithm for the GOSAT-GW (GORAL-NO2) consists of three main steps as follows. First, the total slant column density (SCD) of NO₂ is derived using the differential optical absorption spectroscopy (DOAS) method from the radiance spectrum observed by Band 1 of the TANSO-3. Second, the tropospheric SCD is derived by subtracting the stratospheric SCD from the total one using the NO₂ profile calculated by the chemical transport model. Third, the tropospheric vertical column density (VCD) of NO₂ is derived by dividing the slant column density (SCD) by the air mass factor (AMF).

In this data processing, the AMF is a major source of error in NO₂ VCD derivation and is generally calculated using radiative transfer models. In GORAL-NO2, AMFs are pre-computed for expected observation conditions and stored in a Look-Up Table (LUT), since radiative transfer model is computationally expensive. The AMF values are derived by interpolating nearby values in the LUT based on the actual observation conditions. We prepared 12 LUTs for calculating AMFs, i.e., five types of aerosols and clouds for land and ocean conditions. In this presentation, we report the evaluation of the errors of AMF calculation for GOSAT-GW/TANSO-3 NO₂ observation.

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