GOSAT-2の検証に向けた流跡線解析による衛星データと地上観測データとのマッチアップ手法の開発
Development of a new match-up method of the satellite and ground-based greenhouse gases data by trajectory analysis for the GOSAT-2 data validation

*中津留 高広[1]、森野 勇[1]、内野 修[1]、吉田 幸生[1]、井上 誠[2]
*Takahiro Nakatsuru[1], Isamu Morino[1], Osamu Uchino[1], Yukio Yoshida[1], Makoto Inoue[2]

1.国立環境研究所、2.秋田県立大学
1.National Institute for Environmental Studies, 2.Akita Prefectural University

The GOSAT (Greenhouse gases Observing SATellite) was launched in January 2009 and has been operating jointly by MOE, JAXA and NIES. GOSAT is the world's first spacecraft designed specifically to measure the concentrations of carbon dioxide and methane, the two in the major greenhouse gases. Currently, GOSAT-2 is under development. Many satellite data have been compared to ground-based data, which have higher accuracy and precision. Satellite and ground-based instruments generally observe target quantity with different spatial scale/position and different time. Therefore, it is important to find more plausible coincidence criteria between them to validate satellite data.
The SWIR (Short Wavelength InfraRed) surface scattered solar spectra observed by the TANSO-FTS (Thermal And Near infrared Sensor for carbon Observation -Fourier Transform Spectrometer) onboard GOSAT is used to retrieve column-averaged dry-air mole fractions of carbon dioxide and methane (XCO_2 and XCH_4). TCCON (Total Carbon Column Observing Network) is a ground-based observation network using Bruker IFS 120HR/125HR high-resolution fourier transform spectrometers. The GOSAT data, XCO_2 and XCH_4, has been validated using TCCON data. However, GOSAT and TCCON data are not completely spatio-temporally matched due to characteristics of the satellite orbit.
For example, one of the co-location methods uses a geometric distance between GOSAT and TCCON data to obtain matched data (Geophysical co-location method, e.g., Morino et al., 2011). Validation of GOSAT requires statistically significant match-up number but there is not enough match-up number with geophysical co-location method. In the case of XCO_2, various methods for increasing the number of match-up data have been developed: the same potential temperature field at 700-hPa as a proxy for equivalent latitude for CO_2 gradients (Keppel-Aleks et al., 2011, Wunch et al., 2011), and the same concentration field predicted or assimilated with the atmospheric transport model (Guerlet et al., 2013). For the time gap, it has been used the same day or within the time range of GOSAT overpass time because GOSAT has three-day revisit and sun-synchronous orbit with a local time around 13h at descending. Increasing the number of match-up data in consideration of the gaps of time and space is important for advanced validation.
In this study, we develop a new match-up method utilizing the forward and backward trajectory analyses from GOSAT observation position by HYSPLIT model. The new method is applicable to other gases not only XCO_2 using flow of air masses. We show the result of analyzed bias variation with the spatio-temporal gap and the effectiveness of the developed method together with results using other match-up methods.

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