多成分衛星データ同化から得られた上部対流圏・下部成層圏オゾンの評価
Evaluation of ozone in the upper troposphere and lower stratosphere derived from multi-species satellite data assimilation

*関谷 高志[1]、宮崎 和幸[2,1]、大越智 幸司[1]、須藤 健悟[3,1]、滝川 雅之[1]
*Takashi Sekiya[1], Kazuyuki Miyazaki[2,1], Koji Ogochi[1], Kengo Sudo[3,1], Masayuki Takigawa[1]

1. 国立研究開発法人　海洋研究開発機構、2. NASAジェット推進研究所／カリフォルニア工科大学、3. 名古屋大学　大学院環境学研究科
1. Japan Agency for Marine-Earth Science and Technology, 2. Jet Propulsion Laboratory/California Institute for Technology, 3. Graduate School of Environmental Studies, Nagoya University

Ozone (O_3) in the upper troposphere and lower stratosphere (UTLS) has a stronger greenhouse effect than in the lower troposphere. However, information on O_3 in the UTLS from observations with the global coverage is still limited. Multi-species satellite data assimilation of stratospheric O_3, and tropospheric O_3 and its precursors is expected to provide better constraints on O_3 in the UTLS, because O_3 in the UTLS is controlled by stratospheric O_3 intrusions, O_3 transport from middle and lower troposphere, and in-situ O_3 chemical production. In this study, we evaluate O_3 in the UTLS derived from the multi-species data assimilation with horizontal resolutions of 2.8, 1.1, and 0.56 degree using ozonesonde observations (not used for data assimilation) in April 2008. Assimilated data were obtained from the OMI, GOME-2, and SCIAMACHY for tropospheric NO_2 column, the TES for O_3 profile, the MOPITT for total CO column, the MLS for O_3 and HNO_3 profiles, and the OMI for total SO_2 column. At 200 hPa, 300 hPa, and 500 hPa, the data assimilation at 0.56-degree resolution reduced root mean square errors (RMSEs) against ozonesonde observations in the northern midlatitudes by 32%, 31%, and 13%, respectively, compared to the model simulation without data assimilation. The overall data assimilation performance for O_3 concentrations is not sensitive to horizontal resolution in the altitudes between 200 hPa and 500 hPa (i.e., the RMSEs were within 7% at all resolutions). Meanwhile, the data assimilation at 0.56-degree resolution improved agreements with ozonesonde observations at 300 hPa by up to 55% compared to 1.1- and 2.8-degree resolutions during a deep stratospheric intrusion episode at Trinidad Head (124˚W, 41˚N) through resolving small-scale transport processes. These results confirm that O_3 analyses derived from multi-species data assimilation are suitable for understanding spatial and temporal variations in O_3 in the UTLS and their controlling processes.

キーワード：衛星データ同化、オゾン、大気化学
Keywords: Satellite data assimilation, Ozone, Atmospheric chemistry

©2019. Japan Geoscience Union. All Right Reserved.