CHEMICAL SPECIES MAPPING ON TRAJECTORIES (CSMT): A NEW SCHEME OF CHEMICAL OZONE LOSS ANALYSIS USING A BOX MODEL ALONG TRAJECTORIES

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We propose a new scheme to create synoptic maps of stratospheric minor species from asynoptic satellite measurements by utilizing a photochemical box model and trajectory analysis. Kagawa and Hayashida [submitted to J. Geophys. Res.] named it Chemical Species Mapping on Trajectories (CSMT). The CSMT incorporates 'trajectory mapping' [Morris et al., 1995, 2000] with a photochemical box model. Minor constituents are time-integrated in a photochemical box model along trajectories that start from satellite measurement points until a target time. Combining a chemical model with trajectory mapping allows creation of synoptic maps of short-lived species as well as long-lived species. We applied CSMT to study the mechanism of Arctic ozone loss in the late winter and early spring of 1997, combined with Improved Limb Atmospheric Spectrometer (ILAS) data. The ILAS instrument was developed by the Environmental Agency of Japan (EA) on board the Advanced Earth Observing Satellite (ADEOS) that was launched in August 1996. ILAS successfully observed ozone and ozone-related species such as nitric acid, nitric dioxide, nitrous oxide, water vapor, methan and aerosols over both polar stratosphere during from November 1996 through June 1997 [Sasano et al., 1999]. The CSMT approach with initialization by ILAS-observed ozone, nitric acid, and nitrous oxide made it possible to map long- and short-lived minor species over the polar stratosphere. Comparison with ozonesonde and/or satellite data validated CSMT-derived ozone and other data, proving reliability of the scheme. The chemical ozone loss amount was estimated by using the chemical model, resulting the maximum rate of ozone loss being about 34 ppbv/day in late February, and the

integrated ozone loss from 13 January to 31 March 41 %, when averaged over the polar vortex. The derived ozone loss rates and integrated ozone loss are fairly consistent with the results of other studies. The CSMT scheme is a simple but useful method to make assimilated maps of chemical species, and has a good potential to various applications including detailed analysis of chemical mechanisms in the atmosphere.

[References]

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