4.071 Summertime upper tropospheric nitrous oxide (N2O) over the Mediterranean as a footprint of Asian emissions.

Presenting Author:
Philippe RICAUD, CNRM, Météo-France/CNRS UMR 3589, Toulouse, France, philippe.ricaud@meteo.fr

Co-Authors:
Yannick KANGAH, CNRM, Météo-France/CNRS UMR 3589, Toulouse, France
Jean-Luc ATTIE, Laboratoire d'Aérologie, Université de Toulouse, CNRS, UPS, Toulouse, France
Naoko SAITOH, Center for Environmental Remote Sensing, Chiba University, Japan
Didier HAUGLUSTAINE, Laboratoire des Sciences du Climat et de l'Environnement, CNRS UMR 1572, Gif-sur-Yvette, France
Rong WANG, Laboratoire des Sciences du Climat et de l'Environnement, CNRS UMR 1572, Gif-sur-Yvette, France
Laaziz EL AMRAOUI, CNRM, Météo-France/CNRS UMR 3589, Toulouse, France
Regina ZBINDEN, CNRM, Météo-France/CNRS UMR 3589, Toulouse, France
Claire DELON, Laboratoire d'Aérologie, Université de Toulouse, CNRS, UPS, Toulouse, France
Jerome VIDOT, Centre de Météorologie Spatiale, DP/Météo-France, Lannion, France
Pascal BRUNEL, Centre de Météorologie Spatiale, DP/Météo-France, Lannion, France
Samuel QUESADA-RUIZ, CNRM, Météo-France/CNRS UMR 3589, Toulouse, France

Abstract:

The aim of this study is to analyse the transport of nitrous oxide (N_2O) from the Asian surface to the eastern Mediterranean Basin (MB) using N_2O measurements from the spectrometer TANSO-FTS on board the Greenhouse gases Observing SATellite (GOSAT) and the Infrared Atmospheric Sounding Interferometer (IASI) onboard the MetOp platform, and the outputs from the chemical transport model LMDz-OR-INCA. By comparing GOSAT and IASI upper tropospheric retrievals (~300 hPa) to aircraft measurements from the HIAPER Pole-to-Pole Observations (HIPPO), we calculated a standard deviation (std) error of 0.75% (~2.0 ppbv) for a single GOSAT pixel and 0.5-1.0% (1.6-3.2 ppbv) for a single IASI pixel. This std error can be reduced to ~0.1 ppbv by regionally and monthly averaging IASI and GOSAT N_2O over the MB. The use of nitrogen fertilizer coupled with high soil humidity during summer monsoon produces high N_2O emissions which are transported from Asian surfaces to the eastern MB. This summertime enrichment over the eastern MB produces a maximum in the difference between the eastern and the western MB N_2O at ~300 hPa (east-west difference) for July both in the measurements and the model. The analysis of IASI N_2O using results from

backtrajectories exhibits the capacity of these retrievals to capture long-range transport of air masses from Asia to northern Africa via the summer monsoon anticyclone on a daily basis. N_2O over the eastern MB can therefore be considered as a footprint of Asian summertime emissions. However, the peak-to-peak amplitude of the east-west difference observed by GOSAT (~1.4 ± 0.3 ppbv) is larger than that calculated by LMDz-OR-INCA (~0.8 ppbv). This is due to an underestimation of N_2O emissions and to a relatively coarse spatial resolution of the model that tends to underestimate the N_2O accumulation into the Asian monsoon anticyclone.