Transport and build-up of tropospheric trace gases during MINOS campaign: Comparison of GOME and insitu aircraft Falcon measurements

A. Ladstätter-Weißenmayer, J. Heland1, R. Kormann2, A. Richter, F. Wittrock, H. Ziereis1, and J. P. Burrows

Institute of Environmental Physics, University of Bremen, NW1, Kufsteiner Straße, D-28359 Bremen, Germany

1 Institute of Atmospheric Physics, DLR, Oberpfaffenhofen, Germany

2 Max-Planck-Institute for Chemistry, P.O. Box 3060, D-55020 Mainz

E-mail: lad@iup.physik.uni-bremen.de

Introduction

The aim of the international MINOS (Mediterranean Intensive Ozone Study) is to quantify the main processes involved in the Mediterranean pollution build-up. Therefore the transport of polluted air masses e.g. from the European continent, the export of pollutants to other regions, and the chemical mechanisms that contribute to the build-up have to be investigated.

During the MINOS campaign in August 2001 in-situ measurements with the DLR research aircraft Falcon over the Mediterranean region up to altitudes of about 12 km were carried out to obtain the distributions and the profiles of different trace gases, such as nitrogen dioxide (NO2) and formaldehyde (HCHO).

In this study the aircraft measurements and the satellites based GOME (Global Ozone Monitoring Experiment)-data were (a) compared in single GOME pixels to obtain a measure for the absolute uncertainties, and (b) used to test the sensitivity of the build-up of polluted air masses in order to obtain information about their influence on chemistry and climate in the Mediterranean region.

GOME and Falcon Measurements

GOME was launched in April 1995 onboard ERS-2 into a near-sun-synchronous orbit at an altitude of 795 km to monitor the atmospheric NO2 on a global scale. A mixing ratio of ~ 1.9 ppb was detected. Looking at the monthly mean value for August 2001 detected with GOME (see fig. 6) a maximum value of 1.9 can be scaled down to 1.4 regarding the mean value of all flight data for HCHO (coloured in green).

The results of GOME and of airborne based measurements were compared for NO and HCHO. For the trace gases NO and HCHO were implemented in the photostationary steady state equation [e.g. Atkinson, 2000] and the troposphere therefore the Tropospheric Excess Method (TEM) is used for the retrieval of tropospheric NOx and HCHO measurements were compared with ground measurements.

Results and Conclusion

During the MINOS campaign GOME data were compared in view to tropospheric NOx and HCHO. These case studies showed a good agreement (with the exception in the heights of the tropopause) between both measuring systems. The standard deviation of tropospheric columns of NO2 and HCHO all GOME data are in the range of the airborne measurements (regarding in addition the scatter-plots for both trace gases). The globally tropospheric e.g. HCHO amounts of GOME reflect the polluted situation over the Mediterranean region: values of ~1.5 ppb in maximum were reached in summer 2001 during the MINOS campaign.

Comparing these results with back trajectories information about the sources e.g. biomass burning can be obtained.

Acknowledgements

GOME calibrated radiances and imissibles have been provided by ESA through DFD DLR Oberpfaffenhofen, Germany.