Geophysical Research Abstracts,
Vol. 11, EGU2009-6047, 2009
EGU General Assembly 2009


# Evaluation of CLaMS, KASIMA and ECHAM5/MESSy1 simulations in the lower stratosphere using observations of Odin/SMR and ILAS/ILAS-II

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1-year data sets of monthly averaged nitrous oxide ($N_2O$) and ozone ($O_3$) derived from satellite measurements were used as a tool for the evaluation of atmospheric photochemical models. Two 1-year data sets, one derived from the Improved Limb Atmospheric Spectrometer (ILAS and ILAS-II) and one from the Odin Sub-Millimetre Radiometer (Odin/SMR) were employed. Here, these data sets are used for the evaluation of two Chemical Transport Models (CTMs), the Karlsruhe Simulation Model of the Middle Atmosphere (KASIMA) and the Chemical Lagrangian Model of the Stratosphere (CLaMS) as well as for one Chemistry-Climate Model (CCM), the atmospheric chemistry general circulation model ECHAM5/MESSy1 (E5M1) in the lower stratosphere with focus on the northern hemisphere. Since the Odin/SMR measurements cover the entire hemisphere, the evaluation is performed for the entire hemisphere as well as for the low latitudes, midlatitudes and high latitudes using the Odin/SMR 1-year data set as reference. To assess the impact of using different data sets for such an evaluation study we repeat the evaluation for the polar lower stratosphere using the ILAS/ILAS-II data set. Only small differences were found using ILAS/ILAS-II instead of Odin/SMR as a reference, thus, showing that the results are not influenced by the particular satellite data set used for the evaluation. The evaluation of CLaMS, KASIMA and E5M1 shows that all models are in good agreement with Odin/SMR and ILAS/ILAS-II. Differences are generally in the range of $\pm 20\%$. Larger differences (up to $-40\%$) are found in all models at $500 \pm 25$ K for $N_2O$ mixing ratios greater than 200 ppb. Generally, the largest differences were found for the tropics and the lowest for the polar regions. However, an underestimation of polar winter ozone loss was found both in KASIMA and E5M1 both in the northern and southern hemisphere.