Geophysical Research Abstracts, Vol. 9, 03635, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03635

Novel 4DVAR System for Inverse Modelling of Atmospheric CH_4

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We present a novel 4DVAR system based on the atmospheric transport model TM5 for inverse modelling of atmospheric CH_4. The main advantage of the new system is that it allows to optimize emissions of individual model grid cells (compared to optimization of larger geographical regions in classical synthesis inversions). At the same time very large observational data sets can be used, such as high frequency in situ measurements and global satellite data (e.g. from SCIAMACHY).

Comparison of first 4DVAR inversions with synthesis inversions show general broad consistency, but demonstrate also clearly the advantages of the 4DVAR system. In particular, due to the much higher number of degrees of freedom of the 4DVAR system, the so-called aggregation error is significantly reduced. Specific features of the new 4DVAR system are the possibility to optimize also emissions from different source categories and to provide estimates of the a posteriori uncertainties.

We will present applications of global inversions and coupled global-regional inversions, utilizing the zooming capability of the TM5 model.