Geophysical Research Abstracts
Vol. 13, EGU2011-12843, 2011
EGU General Assembly 2011

Aspects of the resolution-sensitive chemical data assimilation in the upper troposphere and lower stratosphere

Valery Yudin
NCAR, ACD, Boulder, United States (vyudin@ucar.edu)

The paper discusses aspects of the resolution-dependent analysis of ozone satellite data in the UTLS region. In this region the sharp positive and negative vertical gradients of ozone (and other tracers) are frequently observed by in-situ measurements and simulated by chemistry-climate models. With sufficient vertical resolution of limb-viewing sensors, such as MLS and HIRDLS on Aura/NASA spacecraft, this information on dynamics of so-called ozone laminas can be accepted by assimilation systems constraining layered profiles of chemical tracers and their vertical fluxes across the tropopause. In the vicinity of these thin layers (laminas) the ozone-sensitive information from nadir sensors (SBUV, GOME, TES, AIRS, OMI, IASI) with restricted vertical resolutions should be properly projected from the data space to the analysis grid preserving the non-observable ozone structures. Several illustrations for negative impact of analysis of nadir-only data that can "diffuse" ozone laminas are discussed. To overcome this negative impact, the resolution-dependent analysis schemes (RDAS) of retrievals (characterized by resolution kernels) or/and radiances (characterized by weighting functions) are introduced. The inverse mapping performed by RDAS in the vertical direction ensures constraining ozone amounts only at the vertical scales observable by instruments. This feature helps to preserve the non-observable sharp vertical gradients of chemical tracers in the UTLS where amplitudes of small-scale ozone oscillations are comparable to the deep layer-averaged ozone constrained by nadir sensors. As illustrated by comparisons of MLS and HIRDLS data with analyzed ozone fields (GEOS-5 and ECMWF), the other geophysical scenes influenced by inadequate assimilation of nadir retrievals may include: a) the high-latitude ozone hole and mini-holes; b) seasonal and quasi-biennial ozone oscillations in the tropical stratosphere; c) movements of high and low ozone air masses across the transport barriers.