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SPARC SOLARIS & HEPPA intercomparison activities: Odd nitrogen descent during the 2009 NH winter and its implication on stratospheric chemistry (HEPPA-II exercise)

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The High Energy Particle Precipitation in the Atmosphere (HEPPA) model vs. data inter-comparison initiative, as part of the SPARC SOLARIS & HEPPA joint activities, has recently launched a new inter-comparison exercise (HEPPA-II) which focuses on the evaluation of energetic particle precipitation-induced indirect effects (EPP-IE), that is, the descent of EPP-generated odd nitrogen from the MLT into the stratosphere during polar winters. This is motivated, on the one hand, by the higher potential of EPP-IE to influence middle atmospheric composition on longer time scales compared to direct effects (i.e., solar proton events) and, on the other hand, by its large variability related to dynamical modulations, making its representation in current atmospheric models challenging. Particularly, during the dynamically active 2009 NH winter, large amounts of NOx were transported downwards despite the low level of geomagnetic activity and hence, upper atmospheric odd nitrogen production. The new exercise will focus on the assessment of (i) the EPP source (and its spatial distribution) by analyzing observed and modeled NOx distributions from the mesosphere up to the thermosphere (60-150 km) during October 2008 - May 2009, (ii) the vertical coupling mechanisms by inter-comparison of observed and modeled tracer and temperature fields with particular emphasis on the MLT region, and (iii) stratospheric mid-term composition changes induced by EPP indirect effects during 2009 with particular emphasis on ozone and NOy repartitioning. Spatially resolved observational data is available from a large number of instruments (e.g., ACE-FTS; GOMOS, MIPAS, and SCIAMACHY on Envisat; MLS/Aura; SMR/Odin; SABER/TIMED), including temperature, O3, NO, NO2, HNO3, N2O5, N2O, and CH4. The expected outcome of this new inter-comparison exercise is (i) the validation of EPP implementations in atmospheric models, (ii) a better understanding of the EPP source distribution and vertical coupling mechanisms, and (iii) the quantification (and model validation) of EPP indirect effects on stratospheric chemistry.