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Coupling the global CTM MOZART3 to ECMWF operational forecasts via the OASIS4 coupler

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In the EU project GEMS (Global and regional Earth system Modelling using Space and in-situ data) work has begun to couple the ECMWF IFS operational forecast model to an optimised chemical transport model in order to enable, for the first time, routine forecasts of the chemical weather constrained by data assimilation. Chemical weather is here defined as the short-term variability of trace gas concentrations, in particular those contributing to air pollution and climate change, such as ozone, nitrogen oxides, carbon monoxide, or formaldehyde. For the time being it is not feasible to include the chemical mechanisms in the forecast model itself as this would severely slow down the forecast process.

MOZART3 is one out of three global CTMs which are coupled to the IFS system. Version 3 of the MOZART model covers both the troposphere and the stratosphere. It requires as input data meteorological 3D fields of temperature, humidity, and winds, as well as surface fields of pressure, heat flux, and surface stress. Output variables can be enquired for up to 106 species (mixing ratios, production and loss terms, deposition, reaction rates). All I/O variables are usually stored as netcdf files.

For coupling with IFS we decided to use the OASIS4 coupler which appears sufficiently powerful and mature to be implemented in the IFS-CTM coupling applications. Presently IFS and MOZART3 are running with a T63L60 spatial resolution and we have to pass five 3D fields and 11 surface fields from IFS to MOZART3 and twenty 3D fields from MOZART3 to IFS (chemical production and loss, production rates from emissions, loss rates from deposition, and mixing ratios for the species mentioned above). Both IFS and MOZART3 are running on one to several nodes of the IBM power4+ system installed at ECMWF. MOZART3 uses both MPI and OpenMP parallelization strategies and requires about 15 min wall clock time per simulation day

when running on 32 CPUs.

We will present first results from the coupled IFS-MOZART system including some preliminary performance analysis, and we will review the GEMS coupling strategy in light of these results. A 1-year reanalysis for the year 2003 has been performed with an improved data assimilation system compared to ERA-40. The results indicate a much better age-of-air spectrum in the lower stratosphere and should consequently lead to more reliable estimates of the stratosphere-troposphere exchange flux.