REQUEST FOR A SPECIAL PROJECT 2010–2012

MEMBER STATE: Austria

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Project Title: Modelling of tracer transport

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** vo	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project. For projects started before 2009, please state 2009 as the start year.)		
Would you accept support for 1 year only, if necessary?	YES ☐	NO ☐

Computer resources required for 2010-2012: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2012.)	**2010**	**2011**	**2012**
High Performance Computing Facility (units)	30000	30000	30000
Data storage capacity (total archive volume) (gigabytes)	100	100	100

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 30 April 2009

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

Introduction

The group for environmental meteorology at the Institute of Meteorology (BOKU-Met) of the University of Natural Resources and Applied Life Sciences Vienna (BOKU) is involved in a number of projects related to atmospheric transport, mostly substances that can be approximately considered as passive tracers. Models are developed, improved and applied by the group. During all phases, high-quality meteorological fields from a global model like the ECMWF model are needed as input. The models used at BOKU-Met are the particle dispersion model FLEXPART (Stohl et al. 1998, Stohl et al. 2005, Forster et al. 2007), the trajectory model FLEXTRA (Stohl and Seibert,1998), the prognostic mesoscale models MM5 and WRF, and the chemistry-transport model CAMx. Dr. Haimberger (Univ. of Vienna) has updated the data extraction software needed to produce the FLEXPART input so that it runs with the T799 data and extracts 0.2 degree fields including the vertical velocity in deta/dt. This requires the use of the HPC, and therefore we are asking for 30 kunits per year, which would allow us to extract one year of data for a small domain (parts of Europe and Mediterranean). In the following some of the topics investigated presently and planned for the near future are described:

Model development

In the past, the group has developed the particle dispersion model FLEXPART, on the basis of the trajectory model FLEXTRA. Work is continuously going on to further improve these models (last publication: Forster et al., 2007). We will continue to investigate the uncertainties of long-range transport and dispersion calculations, especially as a function of the uncertainty in the meteorological input. For special case studies we will model dispersion with different horizontal resolution in the input data (e.g. 0.5°, 1°, 2°) and different temporal resolutions (e.g. 3 hours vs. 6 hours).

Inverse modelling

Methods have been developed to derive sources of atmospheric trace gases from measurements, using source-receptor relationships calculated with FLEXTRA and FLEXPART (Seibert and Frank, 2004). An important application is with respect to CTBT monitoring methods (Becker et al., 2007). Especially uncertainties as a consequence of modelling errors will be implemented in the inversion technique which has already been developed.
Achieving a better source term of the Chernobyl accident using forward and backward atmospheric dispersion calculations and applying methods of inverse modelling is still on the list of activities.
A study of the origin of air pollution in the region near Vienna using these two models is near completion.
A further study has been completed (Seibert and Skomorowski, 2007) focussing on receptor oriented modelling with FLEXPART for the background monitoring station Schauinsland (a mountain station in the Black Forest) is compared between 1 degree ECWMF fields and high-resolution fields created with MM5 (down to 0.67 km). Orographic influences can be quite important for such stations. It will be interesting to study also the effect of the increased resolution of ECMWF IPS at such mountain sites, and this may produce relevant results for chemical data assimilation. The most recent applications are the derivation of the vertical profile of SO_2 emissions from a volcanic eruption (Eckhardt et al., 2008) and a global inversion of halocarbon sources (Stohl et al., 2009).

Air pollution modelling

The model system consisting of MM5 and CAMx, which has already been applied to several studies about air quality in the Vienna region, will be further used in studies that focus on the distribution of ozone and particulate matter in Austria. Within the FP6 project CECILIA (Central and Eastern Europe Climate Change Impact and VulnerabiLIty Assessment) pollutant concentrations are calculated with CAMx based on RegCM meteorological fields driven by ERA-40 data.

Climate research

With ERA-40 data as input, we are analysing backward trajectories to investigate changes in the frequency of weather patterns associated with strong precipitation events in Austria (Seibert et al., 2007). A decision algorithm to distinguish between days with strong precipitation events and others shall be developed. We will use the ERA-40 dataset to train our model and to have the possibility to compare the results with station measurements. As a second step, we plan to extend our investigation in the future using GCM scenario runs.
RegCM3 (Pal et al. 2007) hindcast simulations runs (in two steps, with 30 km and 10 km grid distance) have been made with different reanalysis datasets as lateral boundary conditions. The datasets include ERA-Interim 0.75° grid spacing, ERA40 at 1.125° and 2.5° grid spacing, and finally the 2.5° NCEP-DOE R2 reanalysis. The sensitivity of RegCM3 to different lateral boundary conditions and impact of different one-way nesting strategies on precipitation simulations over the Alps have been studied. First results (presented in EGU2009) show that when the high resolution ERA40 and ERA-Interim boundary conditions are used, precipitation fields were closer to the observations than in the cases where the model was driven with other boundary conditions.
Furthermore, a proposal has been submitted to a national funding scheme which is focussed on very high resolution simulations of Alpine areas with MM5 and WRF, where ECMWF data shall be used for initial and boundary conditions and nudging.

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