

## SPECIAL PROJECT INTERIM REPORT

Interim Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

**Reporting year** 2008-2009

**Project Title:** Modelling of Tracer Transport (MOTT)

**Computer Project Account:** SPATMOTT

**Principal Investigator(s):** Univ.-Doz. Dr. Petra Seibert

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**Name of ECMWF scientist(s) collaborating to the project (if applicable)** .....

**Start date of the project:** 2009

**Expected end date:** 2011

**Computer resources allocated/used for the current year and the previous one (if applicable)**

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
<b>High Performance Computing Facility</b>	(units)	30000		30000	
<b>Data storage capacity</b>	(Gbytes)	10		100	

## **Summary of project objectives**

(10 lines max)

Investigation of uncertainties in atmospheric dispersion models

Receptor-oriented atmospheric transport modelling based on fields of different resolution in mountainous terrain

Radon sources in Spain

Climate change and circulation patterns

## **Summary of problems encountered** (if any)

(20 lines max)

Problems with the extraction routines for FLEXPART have been encountered when extracting MARS data for the region of Australia. Problems are not yet solved.

## **Summary of results of the current year**

(from July of previous year to June of current year)

### **Investigation of uncertainties in atmospheric dispersion models and inverse modelling**

Our cooperation with NILU, Norway, for the inverse modelling of atmospheric trace constituents has been continued. A new publication is under preparation for the SO<sub>2</sub> emission from the Kasatochi volcanic eruption. Another inverse modelling approach in cooperation with NILU concerning global emission distributions of HFC gases based on station observations has already been published (Stohl et al., 2009).

Work on application to CTBT-related problems is going on (Seibert, 2009).

### **High-resolution modelling in mountainous terrain**

In the context of the ALPNAP project, conducted in the EC Interreg Programme IIIB Alpine Space, MM5 simulations centred over the Inn Valley in Tyrol are being carried out for a winter smog episode, using ECMWF analyses for initial and boundary conditions as well as nudging. MM5 simulations have been used with high temporal and spatial resolution and compared to observations. A corresponding paper has been published (Schicker and Seibert, 2009; see also Schicker et al, 2008).

### **Environmental radioactivity in Spain**

The activity started 2006 in cooperation with the Institute of Energy Technologies (INTE) from the Technical University of Catalunya (UPC) in Barcelona has been continued. ECMWF analyses have been used in Arnold (2009) to study ambient radon concentrations at the Spanish radiological surveillance network and their possible sources through atmospheric transport modelling in a receptor-oriented approach. This work has also included an evaluation of the atmospheric modelling results using different radon source emission inventories (Arnold et al., 2009b) and the study of regional transport of radon reaching the Cabauw station, in the Netherlands.

Additionally, tests on the influence of ECMWF horizontal resolution in dispersion calculations of radon in the coastal site of Barcelona have been performed (Arnold, et al 2009a ).

A new project has started in which a good radon emission inventory in the vicinity of a measurement tower in the south of Spain will be generated through an intensive measurement campaign. It will then be used to validate atmospheric transport and dispersion models in the local range using fine horizontal resolutions. In this project, ECMWF analyses shall be used for initial and boundary conditions as well as nudging in meteorological simulations with MM5.

## **Climate change and circulation patterns**

In the context of the project ClimChAlp (Climate change, impacts and adaptation strategies in the Alpine Space), carried out with funding from the EC Interreg IIIb Alpine Space Programme, ERA-40 data are used to identify Mediterranean cyclones and Vb tracks which are a major trigger of heavy rain events especially for the Alpine area and can cause large damages. The ERA-40 data are used to test the ability of cyclone detection tools to find and track such cyclones.

As a contribution to CIRCE, the FP7-IP Climate Change and Impact Research: The Mediterranean Environment, a FLEXPART global transport data set generated by A. Stohl (NILU) on the base of ECWMF data has been used to investigate circulations and transport patterns into and from the Mediterranean.

In the context of the CECILIA EC project and a national project, regional climate simulations are prepared and carried out for the Alpine region (Schicker et al., 2009). As a part of those, numerical experiments with different lateral boundary condition continue (Nadeem and Formayer, 2009). More realistic results of ERA-Interim simulations over the Alpine domain suggested to use the ERA-Interim reanalysis dataset for comparison of BATS and Sub-BATS over the Alpine Region. Two one-year simulations are compared: the control run that uses standard BATS land surface scheme and the other employs Sub-BATS scheme where the near surface variables (air temperature, water vapour, precipitation etc.) are disaggregated from coarse grid (10 km) to fine grid (1 km) using a standard lapse rate. The results were presented in 6th Working Meeting of CECILIA (Formayer and Nadeem, 2009). Two five-year simulations (one with BATS and other with SubBATS) driven with ERA-Interim are still running.

## **List of publications/reports from the project with complete references**

- D. Arnold (2009) Study of the atmospheric radon concentration dynamics at the Spanish radiological surveillance stations and its application to air mass movements. PhD dissertation at Technical University of Catalunya, Spain.
- D. Arnold, P. Seibert and A. Vargas (2009a). Influence of the meteorological spatial resolution on Radon-222 backward modelling with FLEXPART. EGU General Assembly, 19-24 April 2009, Wien.
- D. Arnold, A. Vargas, C. Grossi, C. Parages and P. Seibert (2009b) Influence of heterogeneous and distant radon sources on local and regional radon transport. IAEA/WMO Technical Meeting on Sources and measurements of radon and radon progeny applied to climate and air quality studies. 22-24 June 2009, Wien.
- H. Formayer and I. Nadeem, Influence of Sub-scale Land Surface Processes on the Simulation of RCM-Modeled Surface Climate over the Region of Complex Topography, 6th Working Meeting of CECILIA, Chalkidiki, 10-12, June 2009.
- I. Nadeem and H. Formayer (2009) Sensitivity of ICTP Regional Climate Model (RegCM3) to Initial and Lateral Boundary Conditions, European Geosciences Union General Assembly 2009, Vienna, Austria, 19– 24, April 2009.
- I. Schicker, P. Seibert (2009) Simulation of the meteorological conditions during a winter smog episode in the Inn Valley. Meteorol Atmos Phys 103, 211–222
- I. Schicker, P. Seibert, E. Mursch-Radlgruber (2008): Investigation of observed and modelled nocturnal wind and temperature oscillations in an Alpine valley. 18th AMS Symposium on Boundary Layers and Turbulence, Stockholm, 9.6.2008 - 13.6.2008.  
<http://ams.confex.com/ams/pdfpapers/139845.pdf>
- I. Schicker, I. Nadeem and H. Formayer (2009) Sensitivity Studies of Model Setup in the Alpine Region using MM5 and RegCM, 2nd Lund RCM Workshop: 21st Century Challenges in Regional-scale Climate Modelling, Lund, Sweden, 4 - 8 May 2009.

- P. Seibert (2009): Current issues in atmospheric transport modelling and source location for CTBT verification. Poster at CTBTO International Scientific Studies Conference, Vienna, 10-12 June 2009.
- A. Stohl, Seibert, P., Arduini, J., Eckhardt, S., Fraser, P., Grealley, B. R., Lunder, C., Maione, M., Mühle, J., O'Doherty, S., Prinn, R. G., Reimann, S., Saito, T., Schmidbauer, N., Simmonds, P. G., Vollmer, M. K., Weiss, R. F., Yokouchi, Y. (2009): An analytical inversion method for determining regional and global emissions of greenhouse gases: Sensitivity studies and application to halocarbons. *Atmos Chem Phys*, 9, 1597-1620

## **Summary of plans for the continuation of the project**

(10 lines max)

Atmospheric transport calculations on various scales from regional to global will be continued. It is planned to make use of the new 0.2 degree resolution data and to study their impact on dispersion calculations. MM5 simulations using ECMWF fields as initial and boundary conditions and for nudging will also continue with a focus on high-resolution simulations in mountainous terrain. We are now participants in the ESF Research Network aimed at measurement and inversion of non-CO<sub>2</sub> greenhouse gases at tall towers and mountain stations in Europe (TTORCH) and we plan to do inverse modelling work based on ECMWF-based fields as well as high-resolution fields generated with ECMWF boundary conditions. A new project will focus on quantifying risks due to nuclear power in Europe, based on FLEXPART and ECWMF reanalysis data.