REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: Norway……………………………….

Principal Investigator[1]: Nina Iren Kristiansen…………………………………….…

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Other researchers: Sabine Eckhardt, John Burkhart, Andreas Stohl, Massimo Cassiani, Rona Thompson, Henrik Grythe (to be applied), Arve Kylling (to be applied)
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Project Title: FLEXPART transport simulations of volcanic ash clouds and gas tracer for the Norwegian community Earth System Model validations

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP**NOFLEX_____
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2012

Would you accept support for 1 year only, if necessary?	YES X	NO ☐

Computer resources required for 2013-2015: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2015.)	**2013**	**2014**	**2015**
High Performance Computing Facility (units)	50000	50000	
Data storage capacity (total archive volume) (gigabytes)	150	150	

*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):

……………27.04.2012…………

Continue overleaf

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[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

It is expected that Special Projects requesting large amounts of computing resources (500,000 SBU or more) should provide a more detailed abstract/project description (3-5 pages) including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used. The Scientific Advisory Committee and the Technical Advisory Committee review the scientific and technical aspects of each Special Project application. The review process takes into account the resources available, the quality of the scientific and technical proposals, the use of ECMWF software and data infrastructure, and their relevance to ECMWF's objectives. - Descriptions of all accepted projects will be published on the ECMWF website.

Introduction

-Volcanic ash

Volcanic ash is recognised as a serious threat to aviation, as the ash particles can block and stall the air craft's engines. The focus on this hazard was extensively highlighted during the 2010 Eyjafjallajökull eruption on Iceland, which caused airspace closure over most of Europe for several days in April and May 2010. This event provided valuable information on the current state of the crisis response system and clearly demonstrated that more research is needed related to volcanic eruptions. As a part of this, a better understanding of the dispersion of the volcanic ash clouds and particularly the injection of ash into the atmosphere is needed for improving future responses to these hazards. The FLEXPART model, based on ECMWF meteorological data, will be used for simulating the transport of volcanic ash in the atmosphere in case of future volcanic eruptions, and also as a part of case studies of previous eruptions. There exists an extensive dataset of observations which will enable validation of the model results.

-Climate modelling validation

Central to the understanding of climate processes is the development and validation of climate models. The current development activity of the Norwegian community Earth System Model (ESM) NorESM focuses on processes that are of particular importance for polar climate. The FLEXPART model will be coupled with the NorESM model to investigate the simulated transport processes and validate the NorESM model comparing the results against the transport processes resulting from the use of FLEXPART driven by the ECMWF re-analyses data.

Model

FLEXPART is a Lagrangian particle dispersion model developed and updated within this working group (Stohl et al., 1998; Stohl and Thomson, 1999; Stohl et al., 2005) (see http://zardoz.nilu.no/~andreas/flextra+flexpart. html) and used by at least 37 international research institutes. FLEXPART was validated with data from continental scale tracer experiments (Stohl et al., 1998) and was used previously to study the transport of BB emissions into the Arctic (Stohl et al., 2006), as well as the transport of anthropogenic emissions between continents (Stohl et al., 2003) and into the Arctic (Eckhardt et al., 2003). FLEXPART can be driven with analyses from the European Centre for Medium-Range Weather Forecasts (ECMWF)

Application and model development

-Volcanic ash clouds

The Support to Aviation for Volcanic Ash Avoidance (SAVAA) project aims to improve the supporting services to the aviation community related to volcanic ash hazards. Within this project the FLEXPART model will be run and coupled with satellite observations of the volcanic clouds in order to estimate the so-called source term of the eruption. That is the ash release as a function of altitude and time, which is a crucial piece of information required to accurately simulate the fate of the ash injected into the atmosphere. With the source-term estimations, more accurate simulations of the dispersion of the ash cloud can be made, and together with accurate and timely satellite-based information, will provide an extended support to the existing volcanic ash avoidance centres (VAACs) for the issuing of volcanic ash alerts. The model simulations of the volcanic emission clouds will be based on ECMWF re-analysis data, and also compared to simulations driven with other meteorological data (e.g., NCEP GFS), and with simulations with other models (e.g., the NAME model operational at the UK Met Office / London VAAC). The model comparisons allow for an evaluation of the uncertainty related to the model predictions of the ash cloud transport.   Further evaluation of the Eyjafjallajökull eruption and also significant future eruptions are of relevance to the project. More information on the SAVAA project is available from http://savaa.nilu.no, and relevant case studies of volcanic eruptions are found in Eckhardt et al. (2008), Kristiansen et al. (2010), Stohl et al. (2011) and Kristiansen et al. (2012)

-Climate modelling validation

FLEXPART will be coupled with the NorESM climate model and the *NorESM-FLEXPART* will be a community tool but this tool need to be validated to be useful for the community, therefore a comparison will be done between *NorESM-FLEXPART and* multi-decadal simulations obtained driving FLEXPART with the re-analysis data (ECMWF ERA-Interim). The *NorESM-FLEXPART* and ECMWF driven FLEXPART will be used to diagnose transport of short-lived climate forcers (SLCFs), source regions for water vapor contributing to cloudiness and precipitation, biases in regional flow regimes responsible for meridional transport to the Arctic, and strato-tropospheric exchange. The relevant diagnostics are described in James *et al.* (2003), Stohl (2006) and Stohl & James (2004).

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