REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: Germany

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Project Title: The global circulation in various coordinate systems

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** DEDLR	
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 ☐	NO X

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)	500	500	-
Data storage capacity (total archive volume) (gigabytes)	10	10	-

*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): 22 April 2012

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

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.

Traditionally, the global mean circulation of the atmosphere is analyzed in pressure coordinates and closely related other coordinate systems. A dramatic change occurs with a shift to isentropic coordinate systems (e.g. Johnson 1989). The distinct Hadley and Ferrel cells are replaced by hemispheric cells. There is still a lively debate how to reconcile and exploit these differing results. It is planned to extend these approaches by analyzing the global circulation in coordinate systems which have not been used so far but appear to be promising. Potential vorticity (PV) is a variable which has been extensively used during the last 30 years in case studies. Hoskins (1991) discussed the general circulation in terms of PV dynamics. Stan and Randall (2007) looked into the problems of PV-coordinates and derived the prognostic equations for barotropic and also baroclinic atmospheres with PV as a meridional coordinate. So far, however, no attempt has been made to derive the basic characteristics of the general circulation on the basis the ERA data or a similar reanalysis set. We just do not know which mean mass circulation to expect and how the global angular momentum transports look like in this coordinate system. We expect to find similarly exciting results as for isentropic coordinates. On the other hand, PV is a more complicated variable than potential temperature. This makes the analysis more difficult. It is planned in this project to derive the mass circulation and the angular momentum balance for every season on the basis of ERA40 data. As a by-product we will obtain mean fields of dPV/dt. A further step would be to introduce potential temperature as a vertical coordinate in addition to PV as a meridional one. This is a rather attractive idea, because all advections in the meridional plane are then 'forced' and most of the basic characteristics of the zonal mean circulation in these coordinates can be estimated when this forcing is known. This opens the possibility for a new interpretation of this mean circulation. This work will begun after the work on PV-coordinates has been completed.