REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: The Netherlands

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Project Title:

Decadal Predictions (DECPRED)

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** NLDECP_____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2011	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2012-2014: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2014.)	**2012**	**2013**	**2014**
High Performance Computing Facility (units)	2400000	2400000	
Data storage capacity (total archive volume) (gigabytes)	2000	2000	

*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): 24-04-2012

Continue overleaf

Principal Investigator: Dr. R.J. Haarsma

[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.

Project Title: Decadal Predictions (DECPRED)

Extended abstract

Due to its chaotic character the climate is on short timescales, in the order of less than one year, dominated by its internal variability. On long time scales, in the order of 100 year, the climate is dominated by the change in external forcings. For the coming century this is the anthropogenic change in greenhouse gas concentrations. On decadal time scales anthropogenic change in greenhouse gas concentrations and internal variability of the climate system both affect the climate signal. Due to its large heat capacity the ocean is strongly affecting the decadal variability. For reliable decadal forecasts therefore the initial state of the ocean and the ocean dynamics as well as its coupling with the atmosphere should be simulated adequately. Dominant modes of variability that affect the ocean variability on decadal times are the Merdional Overturning Ciculation (MOC) and the Pacific Decadal Oscillation (PDO). Decadal fluctuations in other external forcings such as aerosols, land coverage and internal variability in the cryosphere will also affect the decadal variability of the climate.

In recent years progress has been made in decadal predictions. This is due to substantial developments in coupled ocean-atmosphere models, and in ocean observing systems. New data assimilation systems haven been developed (Zhang et al. 2007) and seasonal forecasts are being made with state-of-the-art coupled models. These developments provide the scientific basis to perform decadal predictions. Recent studies have demonstrated the potential predictability at decadal time scales and decadal prediction experiments have recently been started at several climate centers around the world (Smith et al. 2007, Keenlyside ate al. 2007) .

An important issue of these decadal predictions is to untangle the impact of the change in radiative forcing during the integrations and the effect of the slow manifold of the climate attractor. This issue will be studied by performing ensemble integrations starting from different initial conditions of the atmosphere and ocean. Due to its large heat capacity the ocean plays a key role for the long time scales in the climate system. Other components that can potentially affect the slow manifold are soil moisture, sea-ice and snow.

The KNMI participates in the FPU 7 projects THOR and COMBINE that coordinate the European efforts in decadal prediction. Within the framework of these two FPU7 projects we will make decadal predictions using EC-EARTH (Hazeleger et al. 2010) and investigate the potential impact on decadal predictability of new components and initialization procedures developed in these FPU projects. It is expected that these new components will improve the quality of the decadal predictions. The decadal predictions are also required for the “Near-Term” (decadal) part of the CMIP5 project, which will form the basis of the next IPCC AR5 report. The FPU 7 projects fund for the KNMI only the personnel costs but not the required computer resources.

EC-EARTH is based on the seasonal forecast system of ECMWF that is used for decadal and multi-decadal integrations. Currently EC-EARTH, is now ready for use and version 2.2 has been distributed among EC-EARTH partners. This version will be used for the decadal predictions. EC-EARTH v2.2 consists of IFS Cy31r1 at T159 horizontal resolution and 62 vertical levels (identical resolution to System 3 of ECMWF) and the 1 degree horizontal resolution version of NEMO v2 ocean model.

We will work closely with the Seasonal Forecast Group at ECMWF and partners in the EC-EARTH consortium in this project. The initial ocean conditions (NEMOVAR) will be provided by the Seasonal Forecast Group that also participates in those two FPU7 projects. Because of this close collaboration the results of the DECPRED project will be highly beneficial for the Seasonal Forecast Group. ECMWF will perform decadal forecasts based on a slightly different model system (that is, EC-EARTH will be tuned differently than the operational ECMWF System 3 and System 4, although the physical basis will be the same).The output of the project will be shared within the EC-EARTH consortium (see ecearth.knmi.nl; 10 member states of ECMWF are represented) and within the FPU 7 projects THOR and COMBINE, which will perform a common analysis of all runs.

Summary of experiments of last year:

A 5 member ensemble of decadal forecasts following the CMIP5 protocol has been concluded and archived in the CMIP5 database. This new ensemble of decadal forecast was made after the bug in the aerosol forcing, that was discovered last year, was fixed. According the CMIP5 protocol the start dates for the decadal predictions have a 5-year interval. However, analysis of the results by different research groups has revealed that this procedure under-samples the internal variability of the ocean state. The ensemble is therefore currently being extended with annual start dates.

Sensitivity runs to test the impact of land surface schemes and new land surface parametrizations on decadal predictions have been performed. In particular the role of the leaf area index (LAI) on decadal predictability has been investigated. An article on this topic is submitted.

Planned experiments for the coming year:

1. Continuation of extending the decadal prediction ensemble with annual start dates.

2. Decadal prediction experiments with EC-EARTH coupled to the vegetation module LPJ-Guess. This new version of EC-EARTH will be available this spring. After the investigation of the potential predictability of the land surface, this is a natural next step.

The estimated computer resources for DECPRED for the coming year are estimated to be similar as the last year: 2400000 SBU.

The coming year is the last year of DECPRED. No future experiments within the special project DECPRED are foreseen.

References

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