

SPECIAL PROJECT PROGRESS REPORT

Progress 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 2011

Project Title: Storm Tracks in a Warmer Climate

Computer Project Account: SPNLSTRM

Principal Investigator(s): Dr. Reindert Haarsma

Affiliation: Royal Netherlands Meteorological Institute (KNMI)
The Netherlands

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

Start date of the project: 1 January 2008

Expected end date: 31 Dec 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
High Performance Computing Facility	(units)	201.00	0	80000	0
Data storage capacity	(Gbytes)				

Summary of project objectives

(10 lines max)

The main project objective is to investigate the change in atmospheric circulation over Europe in a warmer climate. This will be done with EC-EARTH. We will use EC-Earth v2.0, which 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. The focus is on change in extreme events. During the progress of the project the focus has been narrowed to the occurrence of extreme winters that are related to long lasting blocking episodes

Summary of problems encountered (if any)

(20 lines max)

In the first phase of the blocking project the focus was on the ERA-Interim data set. This took longer than expected. The consequence is that simulations with EC-EARTH have not yet been started and no further results with respect to EC-EARTH have been obtained. Analysis of blocking in EC-EARTH has been done, but these runs although also performed at ECMWF have been used the SBU units of different projects.

Summary of results of the current year (from July of previous year to June of current year)

This section should comprise 1 to 8 pages and can be replaced by a short summary plus an existing scientific report on the project

Analysis of the blocking index of EC-EARTH using the Pelly and Hoskins index have been done for the present and 2*CO2 climate.

The blocking frequencies in the control run are compared with the ERA-Interim in Fig. 1. The two "classical" maxima are observed downstream of the stormtracks, with small differences in blocking frequencies. Over Atlantic and a large part of Europe, Sector blocking event (SBE) frequencies are up to 6% lower, while the Pacific maximum shows a increase of blocking frequencies of a few %.

The blocking frequencies in the 2xC02 run are compared with the control run in Fig. 2. Only small differences in blocking frequencies are visible, with an increase of blocking over Europe and a decrease of blocking occurrence over the Pacific. Since there is a considerable decadal and yearly variability in blocking it is questionable if these differences are due to the increase of C02.

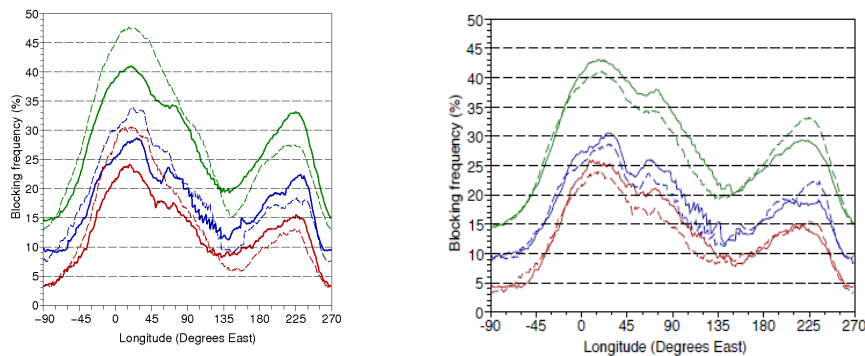


Figure 1 (left panel). Blocking frequencies in control run (solid lines) compared with the blocking frequencies in ERA-Interim (dashed lines). Blue line: LIB frequencies, Green line: SB frequencies and Red line: SBE frequencies.

Figure 2 (right panel): Blocking frequencies in 2xC02 run (solid lines) compared with the blocking frequencies in the control run (dashed lines). Blue line: LIB frequencies, Green line: SB frequencies and Red line: SBE frequencies.

These results contrasts with the results of changes in blocking frequency when the Tibaldi and Molteni index is used. A significant difference is that Tibaldi and Molteni use a constant reference latitude whereas Pelly and Hoskins use the location of the stormtracks as indicated by the maximum in the total kinetic energy (TKE) as reference latitude. The location of the TKE shifts poleward during the doubling of CO2. This will be further investigated.

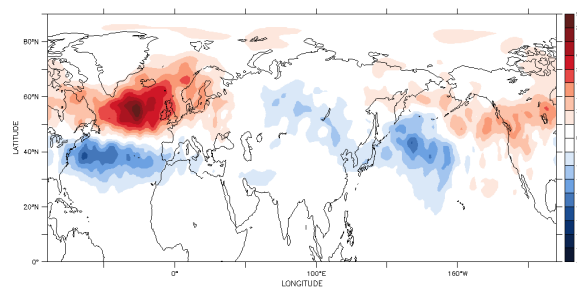


Figure 3. Anomalies, with respect to control run, of annual mean 300 hPa high pass TEKE (in $m^2 s^{-2}$) in the 2xC02 run.

List of publications/reports from the project with complete references

Haarsma, R.J., F.M. Selten, B.J.J.M. van den Hurk, W. Hazeleger and X. Wang., 2009: *Drier Mediterranean soils due to greenhouse warming bring easterly winds over summertime central Europe*. Geophys. Res. Lett. 36, L04705, doi: 10.1029/GL036617

Hazeleger, W. et al., 2010: *EC-Earth: A Seamless Earth System Prediction Approach in Action* Accepted, Bull. Amer. Meteor. Soc.

C. Weijenborg 2011. Blocking of the storm tracks by breaking Rossby waves. *Master Thesis*. 80pp. University of Utrecht. Institute for Marine and Atmospheric research.

Summary of plans for the continuation of the project

(10 lines max)

The analysis of ERA-Interim will continue for the coming months. SPNLSTRM will end this year. We do not foresee that we will use the allocated units before the end of this year.