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	January – June 2015
Project Title:	The role of coupled ocean/atmosphere interactions in the tropics for seasonal and decadal prediction
Computer Project Account:	spdegrea……...
Principal Investigator(s):	Prof. Dr. Richard J. Greatbatch (GEOMAR), Prof.Dr.Thomas Jung (AWI), Prof. Dr. Katja Matthes (GEOMAR), Dr. Soumia Serrar (AWI) and Dip. Met. Gereon Gollan (GEOMAR), Dr. Sebastian Wahl (GEOMAR)
Affiliation:	GEOMAR Helmholtz Zentrum für Ozeanforschung Kiel
Name of ECMWF scientist(s) collaborating to the project (if applicable)	N/A
Start date of the project:	January 1 2015
Expected end date:	December 31 2016

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)			15255000	3198985.18
Data storage capacity	(Gbytes)			67528	not known

Summary of project objectives

(10 lines max)

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To determine factors that are important for seasonal and decadal predictions in the mid-latitudes, especially over Europe. Of particular interest are influences from the tropics and the stratosphere. But we are also interested in how the mid-latitudes influence the tropics and whether a positive feedback can sometimes exist between anomalies in the tropics and anomalies in the mid-latitudes, a possible example being during the winter of 1962/63.

Summary of problems encountered (if any)

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Following the somewhat critical comments from the reviewers we have been reconsidering our experiment strategy. For this reason we have not yet started the new experiments. Nevertheless, the following decisions have been made:

(i) That future experiments will be carried out by Dr. Felcitas Hansen. Dr. Hansen is a new postdoctoral scientist working with Prof. Dr. Richard Greatbatch in Kiel and funded by GEOMAR.

(ii) That in 2015, the focus will be on atmosphere-only experiments, with work using the coupled model starting in 2016.

(iii) A revised list of experiments is give in the tables at the end of the report, taking account of the resources for 2015 that have already been used (the explanation for this is given below).

Despite the fact we have not started the new experiments proposed for 2015/16, some of the resources for 2015 have already been used. This is because we needed these resources to carry out the experiments proposed for 2014. The reason was a decision to carry out seasonal forecasting experiments using ERA-Interim rather than ERA-40 for the companion project spdejun2, requiring the use of higher resolution and hence more resources. Some preliminary results from relaxation experiments carried out using ERA-Interim are shown below.

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

The experiments make extensive use of a relaxation technique (e.g. Jung et al., 2010; Greatbatch et al., 2012) in which certain parts of the model domain are relaxed towards reanalysis, typically the tropics within 20 degrees either side of the equator and, in separate experiments, the stratosphere or the Arctic. The new experiments use the ERA-Interim reanalysis for the relaxation, rather than ERA-40 as previously, and are based on the period 1979-2014. Figure 1 shows the trend in winter (DJF) mean Z500 over the whole analysis period. The top left panel shows the trend from the reanalysis and the number, r, for each of the model experiments is the pattern correlation between the trend in the model and that in the reanalysis. Of the experiments, OBS-NO is run using the time

series of observed sea surface temperature and sea-ice (SSTSI) at the lower boundary, CLIM-TROPICS uses relaxation in the tropics but climatological SSTSI at the lower boundary and OBS-TROPICS is the same as CLIM-TROPICS but using the observed time series of SSTSI. The difference between OBS-TROPICS and CLIM-TROPICS illustrates the impact of extratropical SSTSI. Finally, CLIM-STRAT (CLIM-ARCTIC) uses relaxation in the stratosphere (Arctic) and climatological SSTSI.

While the trend towards a weakened Aleutian low in the North Pacific is clearly captured by the tropical relaxation case (CLIM-TROPICS) and also when specifying tropical SST (OBS-NO), it is notable that the trend towards the negative NAO (weakened Icelandic low) over the Atlantic is related to extratropical SSTSI and is captured by OBS-TROPICS but not CLIM-TROPICS. That this feature is captured in CLIM-ARCTIC is not a surprise since this experiment uses relaxation over the Arctic towards the reanalysis but, interestingly, this experiment also captures something of the trend over the North Pacific despite the fact there is no forcing in this case from the tropics. The poor performance of CLIM-STRAT suggests that the stratosphere was not important for this particular trend. The importance of the extratropics in these experiments is rather surprising and is something we are currently investigating further.

List of publications/reports from the project with complete references

The list of publications given here includes several papers that have appeared in 2015 that use the model output generated from previous special projects..

Ding, H., Greatbatch, R.J., Gollan, G., 2015, Tropical impact on the interannual variability and long-term trend of the Southern Annular Mode during austral summer from 1960/61 to 2001/02, Climate Dynamics, 44 (7-8), 2215-2228, doi:10.1007/s00382-014-2299-x.

Gollan, G., and Greatbatch, R.J., 2015, On the extratropical influence of variations of the upper tropospheric equatorial zonal mean zonal wind during boreal winter J. Climate, 28 (1). pp. 168-185. DOI 10.1175/JCLI-D-14-00185.1.

Greatbatch R.J., Gollan G., Jung T., Kunz T., 2012, Factors influencing northern hemisphere winter mean atmospheric circulation anomalies during the period 1960/61 to 2001/02, Q. J. R. Meteorol. Soc., 138: 1970—1982. doi: 10.1002/qj.1947.

Greatbatch R.J., Gollan G, Jung T., Kunz T., 2015, Tropical origin of the severe European winter of 1962/63, Q. J. R. Meteorol. Soc., 141, 153-165, 10.1002/qj.2346.

Jung, T., Palmer, T.N., Rodwell, M.J., Serrar, S., 2010, Understanding the anomalously cold European winter of 2005/06 using relaxation experiments, Mon. Wea. Rev., 138, 3157–3174.

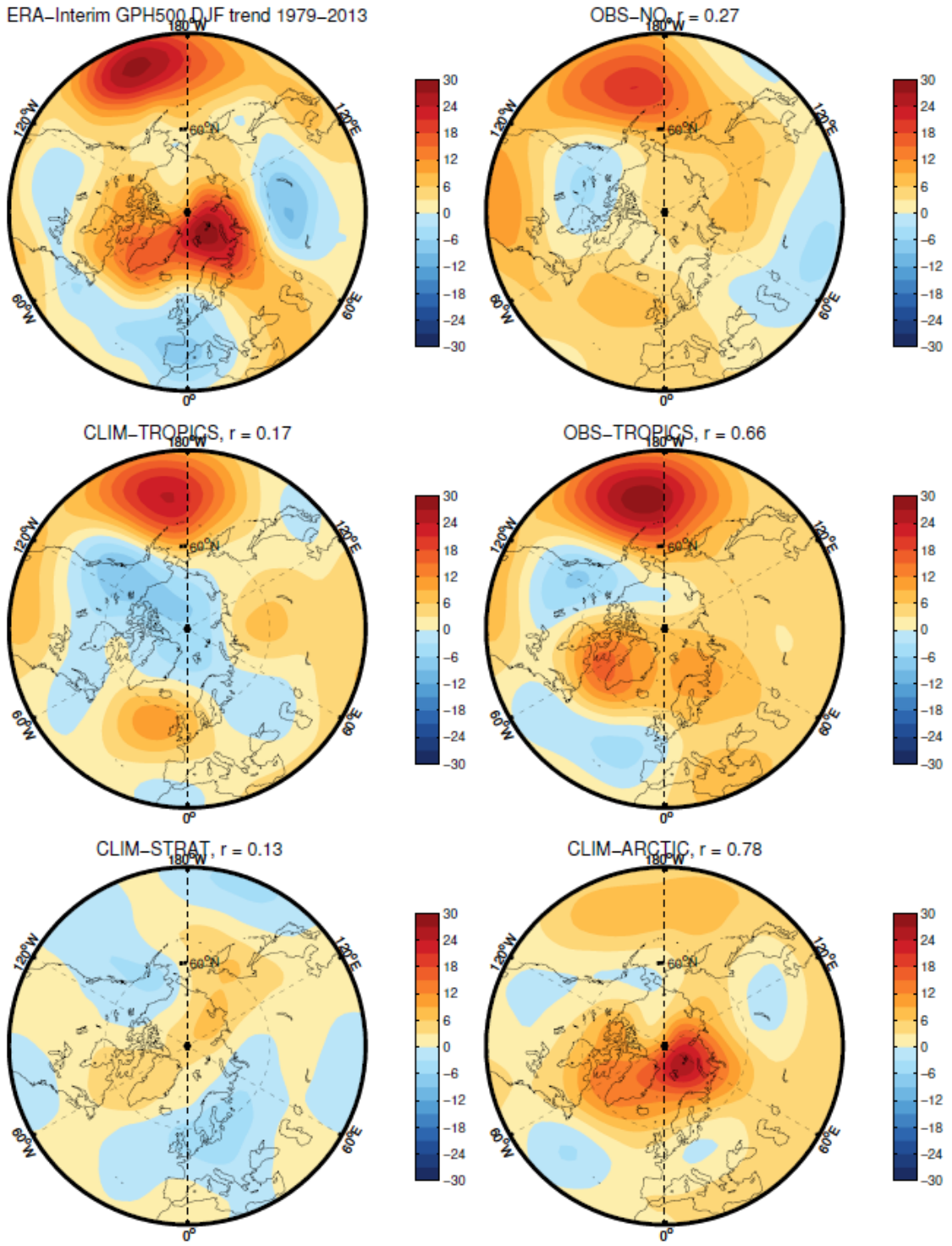

Figure 1: The trend during boreal winter (DJF) in 500 hPa geopotential height in the ERA-Interim reanalysis (top left panel) and different model experiments (see text for details). The units are metres. r refers to the pattern correlation with the reanalysis. The interesting result here is the importance of extratropical sea surface temperature and sea-ice for capturing the trend over the North Atlantic that is revealed by comparing OBS-TROPICS with CLIM-TROPICS.

Summary of plans for the continuation of the project

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We plan to continue the project basically as originally proposed but taking account of the resources used already in 2015. The details of the planned experiments are given below.

Revised list of experiments for 2015 and 2016:

Table 1: Summary of the experiments planned in 2015 along with the required computational and mass storage requirements. The experiment names are as in the request for 2015/16.

Experiment	Forecast days	SBU(units of 10^6)	Archive (Gb)
EXTRATROPICS_NORTH Atmosphere-only, ERA-40	360	1.400	5.400
EXTRATROPICS SOUTH Atmosphere-only, ERA-40	360	1.400	5.400
EXTRATROPICS_NORTH Atmosphere-only, ERA-Int	315	2.200	12.950
EXTRATROPICS_SOUTH Atmosphere-only, ERA-Int	315	2.200	12.950
STRAT_NORTH Atmosphere-only, ERA-Int	315	2.200	12.950
STRAT_SOUTH Atmosphere-only, ERA-Int	315	2.200	12.950
Total	1980	11.600	62.600

Table 2: Summary of the experiments planned in 2016 along with the required computational and mass storage requiments. The experiment names are as in the request for 2015/16.

Experiment	Forecast days	SBU (kilo units)	Archive (Gb)
STRAT_GLOBAL Atmosphere-only, ERA-Int	315	2.200	12.950
STRAT_GLOBAL Coupled, ERA-Interim	315	2.600	8.190
STRAT_NORTH Coupled, ERA-Interim	315	2.600	8.190
STRAT_SOUTH Coupled, ERA-Interim	315	2.600	8.190
CONTROL, Coupled	158	1.300	4.108
Total	1418	11.300	41.628