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	2014
Project Title:	The role of the tropics and the stratosphere for seasonal and decadal prediction
Computer Project Account:	SPDEGREA
Principal Investigator(s):	Prof. Dr. Richard J. Greatbatch (PI)
	Prof. Dr. Thomas Jung (AWI), Dr. Soumia Serrar(AWI), Dip.Met. Gereon Gollan(GEOMAR)
Affiliation:	GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
Name of ECMWF scientist(s) collaborating to the project (if applicable)	
Start date of the project:	January 1 2014
Expected end date:	December 31, 2014

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)			3450000	0
Data storage capacity	(Gbytes)			18576	0

Summary of project objectives

(10 lines max)

To determine how seasonal and decadal predictions in the mid-latitudes, especially over Europe, will benefit from improved predictions in the tropics and the stratosphere.

Summary of problems encountered (if any)

(20 lines max)

Due to the switch to a new supercomputer at ECMWF, we have been unable to start the model runs planned for 2014. After migrating the relaxation code to the new model cycle we expect to be able to start experimentation in July 2014.

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 planned 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. Despite being unable to start the model runs planned for 2014 we have, nevertheless, been busy working with output from previous relaxation experiments that used ERA-40 data. In Greatbatch et al. (2014) we use relaxation experiments to show that the tropics were a major player in the dynamics of the severe European winter of 1962/63. Interestingly, the Madden Julian Oscillation (MJO) was suppressed that winter, perhaps due to a feedback from the anomalous atmospheric circulation in middle latitudes, a topic for future investigation. A particular feature of winter 1962/63 was the zonal mean zonal wind in the upper equatorial troposphere, [u_150]. [u_150] was in an extreme easterly phase during winter 1962/63 (in fact, the most extreme easterly of any winter during the ERA-40 period), almost certainly related to the suppression of the MJO . Gollan and Greatbatch (2014) have investigated [u_150] in some detail and have noted that there is an associated teleconnection to Europe that has potential use for seasonal forecasting. Apart from

winter 1962/63, we think the strong westerly phase of [u_150] played a role in the dynamics of the recent mild and stormy winter of 2013/14 over the British Isles and Europe. Given that the decorrelation time scale associated with [u_150] is several months we think that seasonal forecast models should be able to capture something of the extratropical impact of [u_150]. This impact is, in turn, mediated by the change in the wave guide from the North Pacific to the North Atlantic associated with the changes in [u_150].

We have also used existing output from relaxation experiments using ERA-40 to investigate tropical influence on the austral summer Southern Annular Mode (SAM). The SAM is the most important mode of variability in the southern hemisphere atmospheric circulation on time scales of months and longer. Using the relaxation experiments, we found that tropical influence other than ENSO is important for the SAM on both interannual and longer time scales (Ding et al., 2014a). Using data analysis, Ding et al. (2014b) show further that tropical influence independent of ENSO accounts for 75% of the upward trend in the austral summer SAM since 1960. This appears to differ from the more common view that the upward trend of the austral summer SAM is being driven by ozone depletion in the southern hemisphere stratosphere. Ding et al. (2014b) nevertheless note the similarity between the tropical mode they identify and the extratropical influence arising from global warming in the tropics that has been noted in models.

List of publications/reports from the project with complete references

Ding, H., Greatbatch, R.J., Gollan, G., 2014a, 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, submitted.

Ding, H., Greatbatch, R.J., Gollan, G., 2014b, Tropical influence independent of ENSO on the austral summer Southern Annular Mode, Geophys. Res. Lett.,41, doi:10.1002/2014GL059987.

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., 2014, Tropical origin of the severe European winter of 1962/63, Q. J. R. Meteorol. Soc.. 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.

Summary of plans for the continuation of the project

(10 lines max)

We plan to continue the project with a new proposal for 2015.

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