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 2013

Project Title: Analysis of the coupling between the ocean and atmosphere large scale circulation regimes from annual to decadal time scales.

Computer Project Account: SPDEIFMB

Principal Investigator(s): Univ.-Prof. Dr. Ulrich Cubasch
Dr. Ingo Kirchner

Affiliation: Freie Universität Berlin, Institut für Meteorologie

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

Start date of the project: January 2012

Expected end date: December 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)	20000	0.04	20000	224.90
Data storage capacity	(Gbytes)	3000	200	4000	20

Summary of project objectives
(10 lines max)

Global and regional models are used in many projects at FUB to study different aspects of these interactions, the coupling of stratosphere, troposphere and ocean, the interaction of Indian monsoon and extreme events in Europe, the evolution of Rossby waves and it's interaction with planetary waves. The combination of our model data with reanalysis and observations (e.g. ERA40, ERA-INTERIM), which are available at the ECMWF archive system, will help to analyse the processes behind the climate variability over Europe. The aim is to include observation based data sets into a framework for the standardised evaluation of the used model system. This will enable a direct and comprehensive evaluation of simulations. The integrated application of the evaluation system within the model system will guarantee the efficient use of computer resources. Furthermore, the use of standardised evaluation methods will support the development process and optimisation of the used model system.

Related ongoing scientific projects

- MiKlip (Medium range climate prediction) funded by BMBF

Summary of problems encountered (if any)
(20 lines max)

In the previous project period no relevant ressources at ECMWF were used.

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

Hydrological forecast with statistical methods (Gerd Bürger)

We used the XDS method to downscale 5-day atmospheric forecasts of the IFS ensemble prediction system. The corresponding ensembles of local temperature and precipitation forecasts were used to drive a hydrologic model for a 50km^2 catchment in Germany, to test the ability for an early warning flood forecasting system. The main result (see Figure attached) is that for lead times larger than 24h the full ensemble forecast is superior to all single-valued forecasts.

Related projects

a) SeRAC-CC: Sensitivity of the Runoff Characteristics of Small Alpine Catchments to Climate Change (http://www.uibk.ac.at/geographie/serac-cc)

b) COMTESS - Sustainable Coastal Land Management: Trade-offs in Ecosystem Services (http://www.comtess.uni-oldenburg.de)

Decadal prediction (MiKliP, Tim Kruschke)

Access to MARS archive was used to effectively download ECMWF reanalysis data. In particular, SLP and 10m-wind data from ERA40 and ERA-Interim was considered. Based on these reanalysis fields, two different objective event identification schemes were applied to analyze the occurrence of extra-tropical cyclones and wind storms over the Northern Hemisphere in boreal winter (ONDJFM). The results were used for evaluating GCM simulations of MPI-ESM-LR (see Giorgetta et al., 2013), that were conducted within the framework of *Mittelfristige Klimaprognosen* (MiKlip), the German initiative for decadal climate prediction,

The cyclone identification scheme (see Murray and Simmonds, 1991) is based on the laplacian of SLP. A climatological comparison of cyclone frequencies from model simulations and reanalysis revealed a too zonal orientation of the model's North Atlantic storm track and a northward shift of its North Pacific counterpart, which also extends too far over North America. However, verification of probabilistic three-category (decreased, normal, increased) hindcasts, annually initialized 1961-2001, showed significant skill of the first two development stages of the MiKlip system for both storm tracks and 1y, 2y, and 2-5y (average cyclone frequency) lead time. The respective results are to be found in the study of Kruschke et al. (2014a).

A similar analysis, considering a total number of five MiKlip hindcast sets (again 41 initializations 1961-2001) and several combinations of these is currently in preparation (Kruschke et al. 2014b). This study is dedicated to the more impact-oriented event identification approach of Leckebusch et al. (2008, tracking meso-alpha to synoptic scale fields of potentially damaging wind speeds), evaluates an alternative approach to adjust the model results for potential bias, deviating long-term trends and drifts over lead time and systematically analyzes the available hindcasts with respect to the question of optimal initialization strategies. A climatological comparison of winter wind storm frequencies from model simulations and ECMWF's reanalyses is shown in Fig. 1 (left). The same issues as already mentioned with respect to cyclone frequencies are visible here. A comparison of linear long-term trends over the period covered by the reanalyses (Fig. 1 right) reveals that the overall trend pattern is similar, while modeled trends are substantially less pronounced. Verification of the hindcasts yields significant prediction skill over the Northwest Atlantic and Northwest Pacific as well as the Eastern Mediterranean for lead times of 2-5y and 2-9y (not shown here).

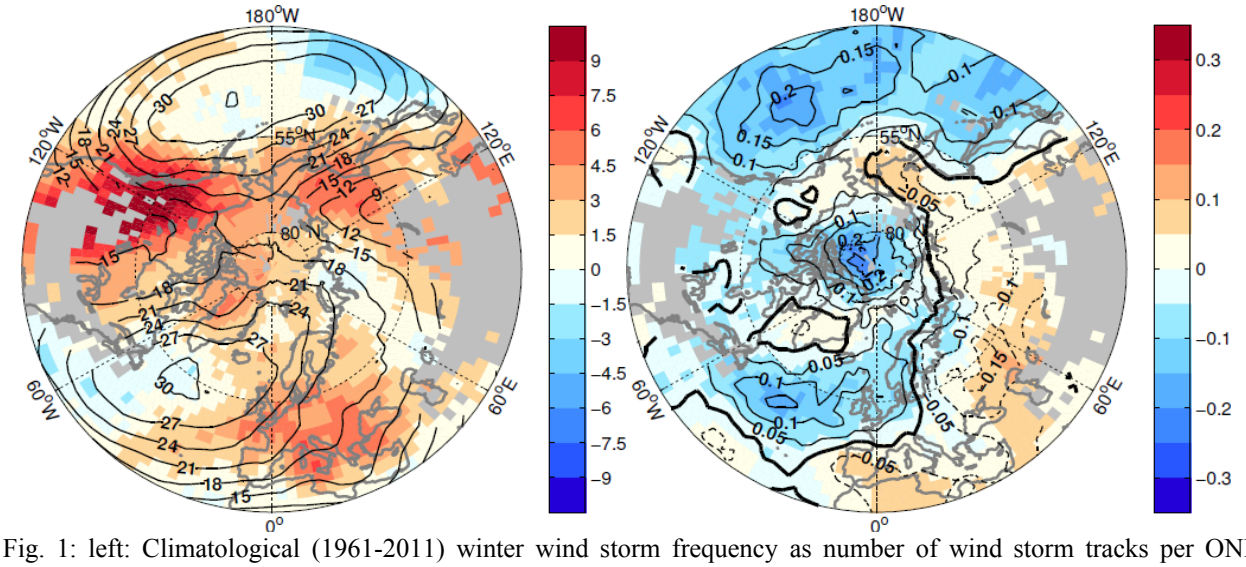

Fig. 1: left: Climatological (1961-2011) winter wind storm frequency as number of wind storm tracks per ONDJFM within 1000km radius; right: linear long-term trend over respective period; results according to ERA40 and ERA-Interim as black contours and colored bias of MPI-ESM-LR

List of publications/reports from the project with complete references

Dobler, C., G. Bürger, and J. Stätter (2013), Simulating future precipitation extremes in a complex Alpine catchment, Natural Hazards and Earth System Sciences, 13, 263-277.

Bürger, G., D. Reusser, and D. Kneis (2009), Early flood warnings from empirical (expanded) downscaling of the full ECMWF Ensemble Prediction System, Water Resources Research, 45(10), W10443.

Kruschke, T., H.W. Rust, C. Kadow, G.C. Leckebusch, U. Ulbrich, 2014a: Evaluating decadal predictions of northern hemispheric cyclone frequencies, *Tellus A,* 66, 22830, http://dx.doi.org/10.3402/tellusa.v66.22830

Kruschke, T., H.W. Rust, C. Kadow, W.A. Müller, H. Pohlmann, G.C. Leckebusch, U. Ulbrich, 2014b: Probabilistic evaluation of Northern Hemisphere winter storm frequencies in the MiKlip decadal prediction system. To be submitted to *Meteorologische Zeitschrift* until 31/07/2014

Other References:

Leckebusch, G.C., D. Renggli, U. Ulbrich, 2008: Development and application of an objective storm severity measure for the Northeast Atlantic region. *Meteorologische Zeitschrift*, 17(5), 575-587(13), http://dx.doi.org/10.1127/0941-2948/2008/0323

Summary of plans for the continuation of the project

(10 lines max)

no further plans