

# 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** 2015

**Project Title:** Investigation of large scale precursor conditions for extreme cyclone development in the extra-tropics

**Computer Project Account:** SPGBLECK

**Principal Investigator(s):** Dr. Gregor C. Leckebusch

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

**Start date of the project:** January 2015

**Expected end date:** December 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
<b>High Performance Computing Facility</b>	(units)	--	--	5,000	0
<b>Data storage capacity</b>	(Gbytes)	--	--	2,000	0

## **Summary of project objectives**

(10 lines max)

This project aims at the investigation and diagnosis of severe storm events in different geographical regions of the earth. Several kinds of dynamical systems are highly affecting social and technical infrastructures and for a proper risk assessment analysis the estimation of wind storm related risks for e.g. Europe or other wind storm affected regions is of crucial interest. Thus, this project addresses mainly extreme, severe mid-latitude winter storms. Basically, studies on (historical) wind storms suffer from a lag of comparable knowledge about meteorological conditions responsible also for the storm developments and thus for related impacts. In the project key circulation patterns will be identified and related to their physical origins with respect to different characteristics of extra-tropical storm events.

## **Summary of problems encountered (if any)**

(20 lines max)

No principle problems encountered.

## Summary of results of the current year (January to June 2015)

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

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In the first 6 months of the special project, **no allocated computer resources have been used**. Nevertheless, an overview of activities so far making use of **general** ECMWF facilities in the context of this project is given here. In the course of special project, we intend to make use of the allocated storage and compute server resources.

In the SPGBLECK project multiple datasets are used, especially for the investigation of extra-tropical cyclones and wind storm events and to a smaller extent to analyse the variability of indoor growing conditions due to light availability. These datasets include: 1) ERA-Interim, 2) ECMWF Seasonal Forecasts (system3 & 4) and 3) ERA-20C. All datasets have been obtained via the MARS archive.

Our project mainly focuses on the investigation of extra-tropical cyclones in the European / North Atlantic region. Two algorithms to detect cyclones as well as wind-storm events are used for the identification in the above data sets. In order to analyse the potential and real predictability of extreme storms in actual state-of-the-art seasonal forecast suites, the ECMWF (system3&4) forecasts together with the HADGEM-GA3 forecasts (provided by the Met Office) are currently under investigation. The MARS archive has been used to obtain the ECMWF system3 & system4 forecasts. Northern hemispheric cyclones are identified by using 6-hourly MSLP data, whereas near-surface wind speeds are used to detect wind storm events. Additionally, ERA-Interim reanalysis data has been used for tracking cyclones and wind storm events, which is further used to assess the skill of all seasonal forecast suites.

First results show positive skills (using the ranked probability skill score, RPSS) over most parts of the northern hemisphere. It is planned to extend these analyses using deterministic and probabilistic skill scores, e.g., Brier Skill Score, root mean square deviation. Work undertaken in this project will eventually lead to a publication focusing on the ability of current seasonal forecasts in simulating these events (Befort et al., 2015a). Next, potential mechanisms affecting the inter-annual variability (and thus the potential predictability) of wind storm events and extra-tropical cyclones will be analysed. This will include oceanic conditions (e.g., SST) and the state of the cryosphere (e.g., sea ice distributions).

ECMWF facilities have also been used for a study analysing the newly released ERA-20C dataset. Extra-tropical cyclones and wind storms over both hemispheres have been identified for the period from 1901 until 2008. The aim of this study is to investigate differences of longer- and shorter-term variability in ERA-20C and the NOAA-20CR dataset regarding these events. First results indicate partly different long-term trends in both sign and magnitude for cyclones and wind storm events in the respective re-analyses. A publication summarizing this work is thought to be submitted by the end of July 2015 (Befort et al., 2015b).

In another more applied study dealing with the potential of greenhouses for a more efficient growth of vegetables we also used the ERA Interim Reanalysis. In this analysis we used - among others - the variable PAR (**Photosynthetically Active Radiation**). Because of our study, an inaccuracy in the ERA Interim calculation method for PAR could be identified. According to the ECMWF Data Services (USCS) the identification of this error has been very useful and could thus be corrected in any upcoming new version of the re-analysis data set.

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## List of publications/reports from the project with complete references

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### Peer-reviewed Publications:

- Befort, D.J., G.C. Leckebusch, A. Weisheimer, J. Knight, H. Thornton, and J. Roberts, 2015: Verification of state-of-the-art ECMWF and Met Office Seasonal Forecast Suites in Simulating Wintertime Cyclone and Wind Storm Events over the Northern Hemisphere. in preparation
- Befort, D.J., S. Wild, T. Kruschke, U. Ulbrich and G.C. Leckebusch, 2015, Long-term Trends of Extra-tropical Cyclones and Wind Storms in ERA-20C and NOAA-20CR, Atmospheric Science Letters, to be submitted July/August 2015.

### Conference contributions:

- G.C. Leckebusch, Befort, D.J., A. Weisheimer, J. Knight, H. Thornton, J. Roberts and L.Hermanson, 2015: Extra-tropical cyclones and Windstorms in Seasonal Forecasts. EGU2015-11120. EGU General Assembly. Vienna, Austria.

## Summary of plans for the continuation of the project

(10 lines max)

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The project will continue as planned and described in the original project description. Due to the late appointment of staff we apply for a two year continuation of the project. Thus, we included a request for continuation of the project.