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: Diabatic effects in mid-latitude weather systems

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Computer Project Account: Spchbojo….…………………………………………….……

Principal Investigator(s): Hanna Joos and Maxi Boettcher

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Affiliation: ETH Zurich…………………………………………….……

Name of ECMWF scientist(s) collaborating to the project (if applicable) Dr. Richard Forbes

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Start date of the project: 2015 ………..…………………………………………..……

Expected end date: 2017……………………………………………………

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)	160'000	90094.89	90'000	67020.73
Data storage capacity	(Gbytes)	3000		3500	

This template is available at:
http://www.ecmwf.int/en/computing/access-computing-facilities/forms

Summary of project objectives
(10 lines max)

The project focusses on the various microphysical heating rates which have an impact on the dynamics of weather systems. With our special model version of the IFS we are able to relate heating rates and hence PV rates to single microphysical processes. Via a Lagrangian approach, air parcels which experience a diabatic PV modification will be traced in e.g. extratropical cyclones, diabatic Rossby-waves, or blocking situations and so, effects on the dynamics of these systems can be determined. In the 2^{nd} part of the project, the IFS is applied to cases which has been sampled in aircraft measurement campaigns. The aim is to identify microphysical active regions where model and measurements do not coincide.

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

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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

In the framework of this special project we are investigating the effect of microphysical processes in extra-tropical cyclones on meso- and large-scale flow features. Therefore, simulations which only differ in their parametrisations of autoconversion/accretion and evaporation of rain are performed. The changes in the parametrisations are implemented in the model version 40R1.
The case study we are investigating is an extratropical cyclone with a pronounced warm conveyor belt (WCB) in January 2009 over the North Atlantic. Considering the WCB and its general characteristics like the ascent of the trajectories, the net change in PV, or the change in potential temperature, no clear differences can be seen between the two simulations. Noticeable differences occur however in the partitioning between the hydrometeor species along the WCB ascent, where the liquid water content is strongly reduced in the modified forecast. However, the related variations in the diabatic heating rates are rather small.

Already 30hrs after the strongly ascending air masses of the WCB started, slight differences in the upper-level PV structure north and north east of the cyclone can be seen. These disturbances related to the different microphysical parametrisations amplify and propagate eastward in the next hours. It can be shown that the WCB is accountable for a major part of the differences. Our investigations reveal that even the small changes in the microphysics have an effect on the evolution of the upper level PV pattern and also on the associated sea level pressure field downstream of the considered cyclone. Further investigations on this case are in progress.

Another North Atlantic cyclone case from the mid of January 2014 has been simulated, which has been sampled during the NARVAL aircraft campaign. Focus of the measurements was on the post-frontal convection. The simulation will be used to look into the details of the microphysical structures of clouds along the flight path.

List of publications/reports from the project with complete references

Joos H. and Forbes, R., 2015: Impact of different IFS microphysics on a warm conveyor belt and the downstream flow evolution, in preparation for submission to QJRMS

Summary of plans for the continuation of the project

(10 lines max)

The next steps will be to apply our special model version to various weather systems, and to look into the smaller scale features of extratropical cyclones, as for instance fronts or dry intrusions. Convenient cases will be e.g. cyclones, which were sampled during the field campaigns NARVAL in Jan. 2014 and ML-Cirrus in spring 2014. These cases will be further investigated regarding cloud structure and microphysical heating rates, and comparisons with the measurements taken during the campaign will be made.