SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2021…….……
Project Title:	Disentangling the local and remote effect of SPPT on seasonal timescales…
Computer Project Account:	SPGBDJB……..……
Principal Investigator(s):	Daniel J Befort Antje Weisheimer, Christopher H. O'Reilly, Tim Palmer, Tim Stockdale
Affiliation:	University of Oxford
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Antje Weisheimer, Tim Stockdale
Start date of the project:	1.1.2020
Expected end date:	1.1.2022

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)	13 000 000	13 000 000	10 000 000	7 771 488
Data storage capacity	(Gbytes)	20 000		30 000	

Summary of project objectives (10 lines max)

Stochastic physics (SPPT) has shown to improve seasonal forecasts over the tropics as well as over the extratropics. In general, there are two sources for increased skill in the extratropics, being the local SPPT effect due to adding noise related to sub-grid scale processes over the extratropics itself and the remote SPPT effect, which positively impacts tropical-extratropical teleconnections. This project aims to disentangle the remote and local effect of SPPT by conduct a set of two hindcasts, for which the 1st hindcast uses stochastic physics over the tropics only, whereas SPPT in the 2nd hindcast experiment is only activated over the extratropics. These simulations will be carried out using ECMWF's coupled model CY46R1. This is motivated as control experiments w/ and w/o global SPPT have already been conducted using the same model version in the special project "*Assessing the impact of stochastic physics (SPPT) on sub-decadal time-scales"* (PI: Daniel J. Befort, 2019).

Summary of problems encountered (10 lines max)

The progress of the project is slightly delayed to the outbreak of the corona pandemic. However, all planned simulations are finished and preliminary analyses have been carried out. It is planned to thoroughly investigate the impact of local SPPT in the 2nd half of 2021.

Summary of plans for the continuation of the project (10 lines max)

After thoroughly analysing the existing control simulations w/ and w/o global SPPT from the last special project ("*Assessing the impact of stochastic physics (SPPT) on sub-decadal time-scales"; PI: Daniel J. Befort, 2019)*, the code to enable regional stochastic physics has been implemented into CY46R1. As all simulations planned to be conducted are finished by now, special focus will be put on detailed analyses of the impact of local SPPT.

List of publications/reports from the project with complete references

A publication using the global w/ and w/o SPPT simulations from the previous special project, which serve as control simulations for this project, has been published early 2021.

Befort, D. J., O'Reilly, C. H., & Weisheimer, A. (2021). Representing model uncertainty in multiannual predictions. *Geophysical Research Letters*, 48, e2020GL090059. https://doi.org/10.1029/2020GL090059

Summary of results

The impact of globally applying SPPT has been analysed using 2 hindcast simulations initialized each November from 1981 until 2014. In agreement with previous studies largest benefits using SPPT are found over the tropical Pacific Ocean, for which SSTs in the w/o SPPT hindcast are heavily overconfident due to too little ensemble spread. In contrast, reliability is enhanced (mainly due to increased spread) in the w/ SPPT hindcast experiment. Besides improvements on seasonal time-scales, we find that SPPT positively benefits tropical SSTs and the large-scale atmospheric circulation over the extratropical North Pacific in the 2nd winter of the forecasts (14-16 months). Simulations with SPPT restricted to the tropics and extratropics planned in this special project are planned to be limited to 7 forecast months, but due to the PI's code developments restart files will be saved at the end of the integration. Thus, these simulations can be extended at a later stage and it is currently discussed in how far this will be pursued in an upcoming special project.