

# 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:** Development of a 3-layer thermodynamic model of the upper ocean for studies on teleconnections from the tropical oceans  
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**Computer Project Account:** ...SPITKUCH.....  
 .....  
**Principal Investigator(s):** Fred Kucharski.....  
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**Affiliation:** ...The Abdus Salam ICTP, Strada Costiera 11, 34151 Trieste, Italy.....  
**Name of ECMWF scientist(s) collaborating to the project (if applicable)** ...Franco Molteni.....  
**Start date of the project:** ...1st January, 2020.....  
**Expected end date:** ...31st Dec 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
<b>High Performance Computing Facility</b>	(units)	950000	N/A	950000	N/A
<b>Data storage capacity</b>	(Gbytes)	900	N/A	900	N/A



**Summary of project objectives** (10 lines max)

The proposed Special Project is planned in two phases. The first phase, which is expected to last one year and is covered by the 2020 proposal, will include:

- a) re-tuning and testing the model in forced model with energy fluxes and PBL variables from ERA5;
- b) testing the model in coupled mode with the SPEEDY AGCM and perform multi-decadal historical runs in both free and pacemaker mode;
- c) coupling TOM3 to OpenIFS and test the coupled system on seasonal to multi-year (~5yr) scale.

At the end of this first phase, it is expected to have an ‘optimal’ set of model parameters which provide a suitably realistic representation of thermodynamically driven ocean variability.....  
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**Summary of problems encountered** (10 lines max)

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 ...As in 2020, due to the COVID 19 outbreak, some visits planned between the researchers involved had to be cancelled, and thus progress has been somewhat slower than expected.....  
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**Summary of plans for the continuation of the project** (10 lines max)

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 ...Point a) of the objectives summary is completed now, and we are currently working on the coupling of TOM3 with SPEEDY, and for the second half of 2021 it is planned to continue to couple the slab ocean model to the SPEEDY AGCM, addressing point b).  
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**List of publications/reports from the project with complete references**

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 ...Not yet, but we are already working on them.  
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**Summary of results**

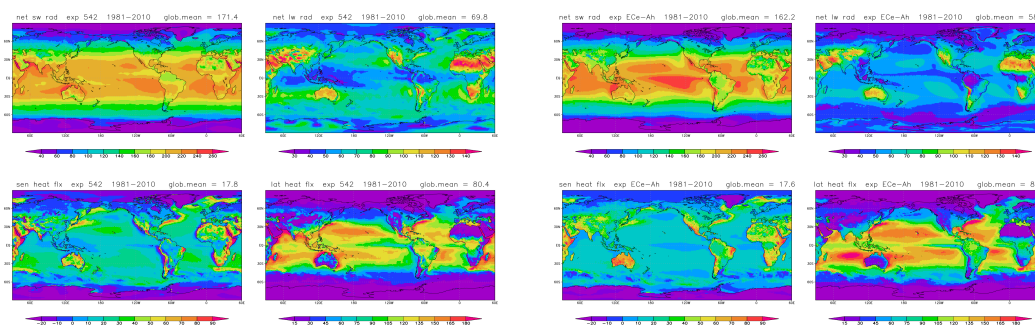
If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a

short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

The 3-layer model has been further developed and tested in the beginning of 2021, driven by ERA5 reanalysis data. Also, for the purpose of the coupling in the coming months, in the first half of 2021, the SPEEDY physical parametrization scheme has been updated in order to reduce biases in mean climate. Changes are in the horizontal and vertical diffusion of moisture, in the longwave radiation scheme used in clouds, land and ozone climatologies, stratospheric longwave radiation scheme, as well in the zenith-angle effect in shortwave transmissivity. Also the horizontal resolution has been increased (120x60 cubig grid instead of 96x48 quadratic grid). Fig. 1 shows components of the surface energy balance compared to the ECMWF IFS 43r1 AMIP run, whereas Fig. 2 compares the global mean land surface temperatures from the same runs. The new version of the SPEEDY model performs reasonably well compare to the ECMWF model.

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Surface heat fluxes, SPEEDY vs. IFS 43r1 (AMIP 1981-2010)



SPEEDY v.42

IFS 43r1

ann./glob.mean anom(Tas, land) clim: 1981-2010  
exp: 541 (red), ECMWF-Ah (gr)

