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	2018
Project Title:	Using Earth Observations to constrain land-atmosphere interactions
Computer Project Account:	SPPTDUTR
Principal Investigator(s):	Emanuel Dutra
Affiliation:	IDL, University of Lisbon
Name of ECMWF scientist(s) collaborating to the project (if applicable)	…… ……
Start date of the project:	01/01/2018
Expected end date:	31/12/2020

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)	-	-	2500000	19159 (0.8%)
Data storage capacity	(Gbytes)	-	-	4000	4187*

*Storage has been accounted under project ptearth by default and not spptdutr

Summary of project objectives

Processes occurring at the land surface impact weather and climate variability. We propose that constraining land-atmosphere exchanges using Earth Observations (EO) will enhance current weather forecasts skill of near-surface fields, such as temperature, and improve the realism of present day climate models leading the way to increase climate change projections reliability. The project focus on three main components: (i) development of key processes in the land surface model HTESSEL (ii) use of EO data to constrain model parameters, and (iii) weather forecasts and climate simulations. The computational component includes on a first stage offline simulation of HTESSEL and on a second stage IFS short-range forecasts and EC-EARTH climate simulations.

Summary of problems encountered

No major problems were encountered. Only a few fixes were necessary to allow submitting "surface" experiments as user ptb (class=pt). Contact with user support was necessary to solve some archival issues in mars as class=pt, but these were quickly addressed by user support, and we are thankful for their availability and support.

Summary of results of the current year

Overview

In these first 6 months of the project (Jan 2018-Jun 2018) the work has been mainly focused on data processing of ERA5 meteorology and GSWP3 (explaining the data storage usage), while the computational component has been reduced. Work was necessary to implement the EC-EARTH surface model into an up-to-date driver to allow performing surface experiment. In addition, land-surface sensitivity to model parameters was initiated. The climate simulations with EC-EARTH did not started yet, and this mainly explains the reduced usage of computational resources since surface only experiments require reasonably small resources.
Considering the delays in EC-EARTH as well as delay in hiring a post-doc it is likely that the computational resources allocated to 2018 will not be used in full, and currently we estimate to use only about 10% of the allocated resources. Therefore, a reduction of the allocated resources to the project is acceptable.

EC-EARTH surface only

The initial work included the integration of the surface code of EC-EARTH with an up-to-date HTESSEL driver to allow surface experiments. This has been achieved, and simulations from 1901 to 2010 were carried out using either ERA20C or GSWP3 forcing. This work will be latter integrated into LS3MIP. Initial tests allowed to identify an excessive melting of some Glaciers (mainly in Greenland) due changes in the snow albedo formulation in EC-EARTH. Although this change was based on observations, the model was melting significant areas of Greenland after a few decades of integration. This resulted in a revision of EC-EARTH reverting the changes to the original constant snow albedo formulation over glacier. The long integrations using GSWP3 meteorological forcing has identified some issues in the forcing resulting in excessive dew deposition in northern areas. This has been associated with relative humidity in the forcing above 100% when using the model's formulation (different treatment of water/ice). This has been partially fixed by limiting relative humidity to 100%, but we're in contact with the data providers to further understand this issue.

Surface sensitivity
Work on this topic started with using a sub-set of FLUXNET stations to evaluate in detail CHTESSEL and CTESSL model performance. This work is done mainly developed by the PhD student David Steven (Faculty of Sciences, supervised by E. Dutra). The initial results were presented at EGU. Changes to the input data of Albedo and LAI using the most recent MODIS collection 6 have been tested with encouraging improvements on the side of the random errors, while sensitivity of key parameters such as the minimum stomatal resistance has been carried out.

Despite not being initial part of the project proposal, sensitivity simulations to the snow cover fraction parameterization were tested under the ISSI-BJ-HTP project[1]. This was motivated by the systematic over-estimation of snow depth and cover over the Tibetan Plateau region. This is ongoing work, but the initial results show a small sensitivity to the snow cover parameterization.

List of publications/reports from the project with complete references

David Stevens**,** Emanuel Dutra, and Pedro MA Miranda, Land - atmosphere exchanges and the role of model formulation and high resolution earth observations. EGU 2018, Vienna. Abstract online: https://meetingorganizer.copernicus.org/EGU2018/EGU2018-18153-1.pdf

Summary of plans for the continuation of the project

Work will continue in exploring model parameters sensitivity as well as evaluation of LST. A recently funded project by the Portuguese national science foundation (FTC) focusing on this subject will allow the hiring of a post-doc (expected by the end of 2018). In parallel, testing of the EC-EARTH climate model is expected to start still in 2018. Due to these delays, we expect to use only a fraction of the allocated computational resources in 2018 (about 10%), as most of the computationally demanding simulations will mainly start in 2019.

[1] https://software.ecmwf.int/wiki/display/~pad/ISSI-BJ-HTP+Material