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 ………2019………………………………………..……

Project Title: Decadal climate predictions: exploit vegetation dynamics and improve fire risk assessment ……………………………………….……

Computer Project Account: ………………… spnlales ………………………………..……

Principal Investigator(s): ……………… Alessandri Andrea ………………………..…… ………………………………………………………………..……

Affiliation: …… KNMI…........(other affiliation: ENEA, Italy)……

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

Start date of the project: ……………1 January 2018…………………………..……

Expected end date: …………31 December 2019…………………………..……

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)	4,6 Millions	5015404.72	5 Millions	4323472.26
Data storage capacity	(Gbytes)	13900	0	29000	10000

Summary of project objectives (10 lines max)

The objectives of this special project is (i) to verify the actual improvement of the decadal climate predictions due to improved land surface/vegetation and (ii) assess the related benefit for the prediction of fire risk. To this aim a set of sensitivity experiments will be performed with a modified version of EC-Earth that improves vegetation representation and variability by either prescribing or modeling the vegetation state and variability.

Summary of problems encountered (10 lines max)

The experiment planned in SPNLALES is based on the availability of the control DCPP hindcasts (DCPP-ctrl) that were originally scheduled to be completed by early 2018 as part of BSC's contribution to DCPP (Component A1). However, simulation of DCPP-ctrl hindcasts was delayed by more than one year requiring amendment to SPNLALES last year. The simulation of DCPP-ctrl hindcasts has been commenced only recently (May 2019), i.e. after release of the 3.3.1 version of EC-Earth, which is required for the DCPP runs. Even though delays of EC-Earth3 finalization affected significantly the realization of SPNLALES, we are now ready to perform the sensitivity hindcasts (DCPP-vege).

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

We are now ready to perform the sensitivity hindcasts (DCPP-vege) with an improved representation of the land cover/vegetation state and using the Autosubmit procedure as modified and ported to the ECMWF HPC.

Given the limited HPC resources available in the SPNLALES project, only a limited number of start dates will be possible. To allow enlarged sampling (i.e. simulation of additional start dates, and/or ensemble members) attempts will be performed to obtain additional resources at ECMWF from member state accounts and/or from request of additional resources in SPNLALES.

List of publications/reports from the project with complete references

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Summary of results

Workflow manager configuration and setup

In collaboration with the colleagues at Barcelona Supercomputing Centre (BSC), the Autosubmit workflow manager has been employed in order to set-up a semi-automated procedure for the production of the improved set of decadal hindcasts (DCPP-vege).

The Autosubmit procedure was originally setup to run on Marenostrum HPC based in Barcellona, and so it was modified and ported in order to be usable for ECMWF HPC.

Accordingly, the EC-Earth runtime scripts have been modified in order to perform parallel scheduling of the decadal predictions and post-processing and by setting up the required running environment including preparation and transfer in the working directory of the initial and boundary conditions required by the model.

System set-up and implementation of the initialization strategy

In collaboration with the colleagues at BSC the initialization strategy has been implemented following the DCPP protocol. The initialization of DCPP-vege shares with DPCC-ctrl the same initialization of all components but with an improved representation of the land cover/vegetation state.
Transient land cover/vegetation conditions for the DCPP-ctrl will be the same ones prepared for the DECK simulations. These have been produced from one of the historical simulations performed with the EC-Earth-Veg version of the EC-Earth model, which includes the LPJ-GUESS dynamic vegetation model (Smith et al., 2014).
To evaluate the actual improvement of the decadal climate predictions due to improved land surface/vegetation, the DCPP-vege experiment will be provided with more realistic land cover/vegetation states: for each grid point the fraction of high and low vegetation as well as the dominant types for each tile will be derived from simulations with the offline dynamic vegetation model (LPJ-Guess; Smith et al., 2014) and the Offline Surface Model (OSM, the off-line version of H-TESSEL which is part of IFS; Hurk et al., 2003; Balsamo et al., 2009), forced by ERA20C and/or ERA-5 Reanalysis and the Land-Use Harmonization (LUH2) dataset (Hurtt et al. 2011). The developments of these off-line model components have been done recently through a collaboration between a number of EC-Earth partners and with significant contribution coming from SPNLALES project. Furthermore, the Leaf Area Index (LAI) of low and high vegetation for DCPP-vege has been obtained from available satellite derived LAI data from the third generation GIMMS and MODIS satellite observations (Zhu et al. 2013). The LAI dataset has been pre-processed (monthly averaged, interpolated, gap-filled) in order to be used in HTESSEL.

Fire models and enhanced fire danger forecasting

As part of this Special Project, it is expected that better Earth system predictions coming from improved land surface-vegetation representation will allow for better fire prediction. The strategy is to use the offline version of the LPJ-Guess model used in EC-Earth, forced by the output of the DCPP runs (that are accomplished with LPJ-Guess turned off, i.e. without simulation of an interactive dynamic vegetation). The LPJ-Guess dynamic vegetation model has been configured to be used off-line from EC-Earth to conduct seasonal-to-decadal predictions of fire danger. This setup will allow to calibrate, test and refine the fire model that is included in LPJ-Guess. Currently the fire model within LPJ-Guess is the GlobFIRM model. Preliminary results of the offline LPJ-GUESS model, forced by the first results of BSC's DCPP hindcasts are illustrated in Figure 1, display a bias of around 1 PgC. Work is underway, in collaboration with Lund University, to add the SIMFIRE/BLAZE and SPITFIRE models as additional options in LPJ-Guess, by the end of the summer 2019. Therefore, it will be possible to test and refine three different fire models and select the one that can provide the better performance.

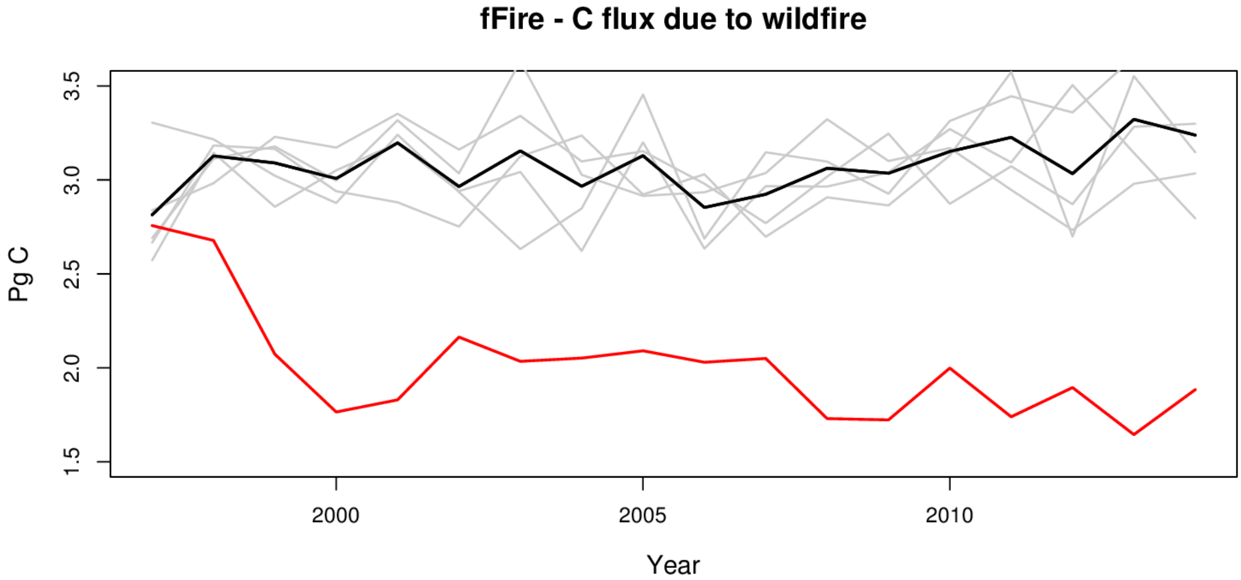

Figure 1: *Carbon flux due to wildfire: estimations from GFED4s, compared to first year forecasts from the offline version of LPJG (with th GlobFIRM model) forced by 5 members of the DCPP forecasts done by BSC.*

References

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