

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 2016

Project Title: Impact of land surface and ocean initial conditions on sub-seasonal to seasonal forecasts

Computer Project Account: SPFRBATT

Principal Investigator(s): Lauriane Batté

Affiliation: CNRM (Météo-France)

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

Start date of the project: 01/01/2016

Expected end date: 31/12/2018

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)	N/A	N/A	10,000,000	163,880
Data storage capacity	(Gbytes)	N/A	N/A	20,000	0

Summary of project objectives

(10 lines max)

The main objectives of this special project are to assess beyond conclusions from the FP7-SPECS project the impact of the initialization of land-surface and sea-ice components of the CNRM-CM model on sub-seasonal and seasonal predictability. Two main questions are addressed:

- What is the extent of initial condition information needed to properly initialize the sea ice and land-surface components of the model?
- Can improvement in model initialization impact the predictability of specific events?

The objective is to study these questions using land surface and sea ice initial conditions and climatologies built with the corresponding CNRM-CM components run in forced mode, and studying specific test cases with initial conditions representing extremes of the climatologies.

Summary of problems encountered (if any)

(20 lines max)

This project has started in January of this year.

The problems encountered so far are related to delays in the availability of the most recent versions of the components of the coupled system CNRM-CM.

We originally intended to work with a more recent version of NEMO-GELATO but due to delays had to switch back to NEMO 3.2. Compiling NEMO 3.2 on the new Broadwell nodes is work in progress.

Similarly, the new ARPEGEv6.2 is still under development, and the most recent version of the SURFEX interface enabling nudging of land surface towards reference data is not yet ported on the Cray. We therefore chose to start some analysis of land surface initial condition sensitivity using the ERA-Land reanalysis, and prepare the upcoming experiments using an offline SURFEX run later on this year.

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

Due to the delays mentioned above, and taking into account the fact that the project started this January, results for this project are limited and have consisted mainly in consolidation of results from other research projects, and preliminary work for the assessment of the impact of soil moisture and sea ice on predictability.

Preliminary work for this project focused on the impact of soil moisture initialization on seasonal predictability, based on conclusions from Ardilouze et al. (2016). This paper showed in a multi-model framework that seasonal prediction re-forecast skill of near-surface temperature can be improved by including a more realistic inter-annual variability of soil conditions (with respect to climatology). One region of focus of the study is the Balkans region, where models manage to capture the warmer summers following pronounced dry initial soil moisture conditions.

We ran (on the Meteo-France supercomputer) an offline SURFEX run with the ISBA-DIF explicit multilayer soil scheme (Masson et al. 2013) forced with ERA-Interim, correcting total precipitation using GPCP data. Figure 1 shows the soil wetness index for the root layer in this offline run, computed over the Balkans region for May 1st 1979-2013. Over the Balkans, 2007 and 2012 stand out as remarkably dry conditions in early May, whereas 2006 is the wettest year in the period. These results are consistent with ERA-Land reanalysis data.

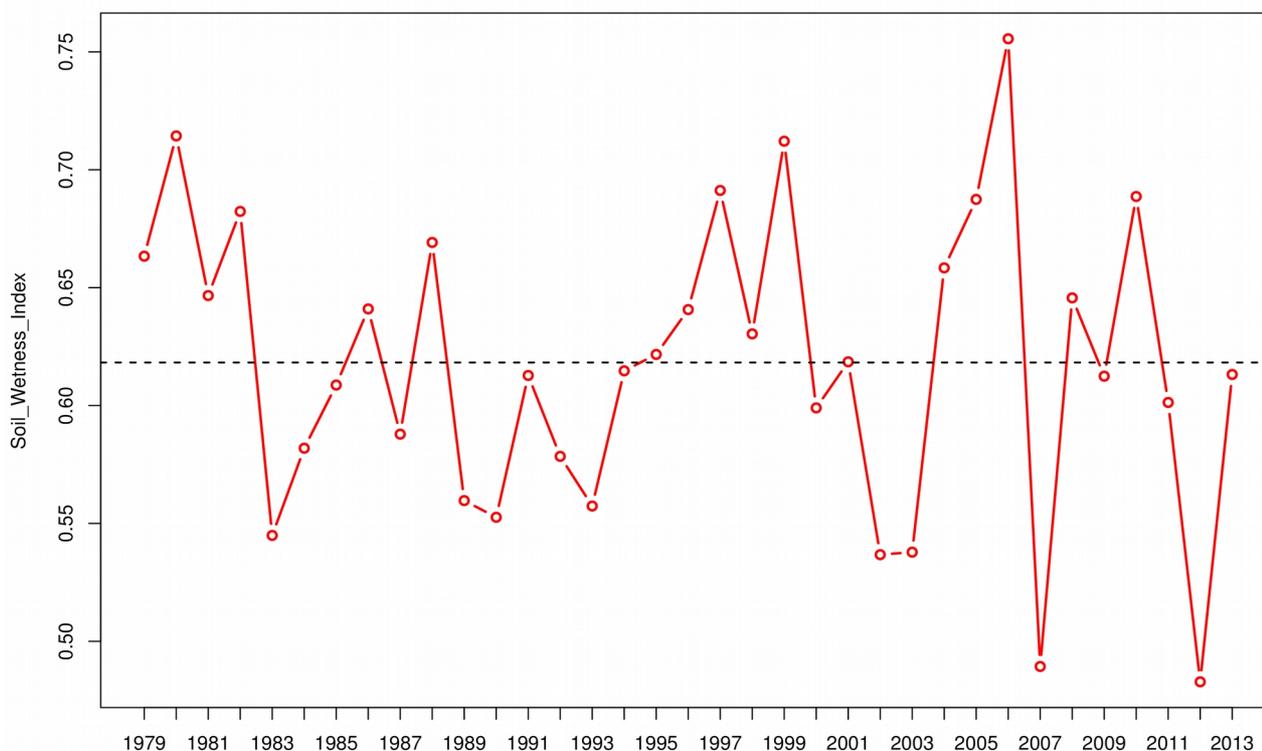


Fig. 1: May 1st root layer soil wetness index averaged over the Balkans region (15E-25E, 40N-50N) in the offline SURFEX integration using ERA-Interim forcing

As a preliminary assessment of the CNRM-CM coupled models' sensitivity to soil moisture initial conditions over the region, a target experiment has been run. The summer of 2012 was unusually

warm over South-Eastern Europe, and as shown above, the soil was particularly dry at the beginning of May of the same year. We performed 3 sets of 15-member ensemble reforecasts of that summer, differing only by the land surface initial conditions. These 4-month simulations are initialized on May 1st. The reference experiment is initialised with the actual land-surface of the 1st of May 2012, with a very low soil moisture. The perturbed experiment number 1 is initialised with the 1st of May 2009 land-surface conditions (average soil moisture) and the perturbed experiment number 2 is initialised with the 1st of May 2006 land surface-conditions (very high soil moisture). Results of these runs still need to be processed (first by looking at the difference in temperature forecasts in these runs).

For sea ice initial conditions, changes in NEMO 3.2 code to run a forced run with bulk core ERA-Interim forcing have been implemented and compilation on the new Broadwell nodes is under way.

References:

Masson V., Moigne P.L., Martin E. et al (2013): The SURFEXv7.2 land and ocean surface platform for coupled or offline simulation of earth surface variables and fluxes. *Geosci Model Dev* 6:929–960. doi: 10.5194/gmd-6-929-2013

List of publications/reports from the project with complete references

Ardilouze, C., Batté, L., Bunzel, F., Decremet, D., Déqué, M., Doblas-Reyes, F. J., Douville, H., Fereday, D., Guemas, V., MacLachlan, C., Müller, W., and Prodhomme, C. (2016): Multi-model assessment of the impact of soil moisture initialization on mid-latitude summer predictability, *submitted to Climate Dynamics*

Summary of plans for the continuation of the project

(10 lines max)

As stated above this project is just starting due to code versions availability.

By the end of this year we intend to have completed the climatologies and forced runs for both SURFEX and GELATO, as well as the first set of case studies. Preliminary analysis and current research interests with a focus on Balkans imply that for the land surface soil moisture initial condition “extremes” (please refer to the original submission for specifics), we will probably select 2006 as HumExt+ for summer case studies, and 2007 as HumExt-, and evaluate as planned the impact of these initial conditions on the 2003 summer, which incidentally was also the hottest summer in the period over the Balkans region.