Proposal for an international project aimed at quantifying the impact of land Earth system processes and feedbacks on seasonal climate forecasts (GLACE-ESM)

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Several works have been showing the importance of the land biosphere (i.e. vegetation/land cover including anthropogenic effects and land-use changes) in forcing interannual climate anomalies and in modulating the forcing from soil moisture or snow. Recent work have further demonstrated significant effects of the representation of realistic vegetation-cover anomalies in the prediction of temperature and precipitation at multiple time-scales.

Earth System Models (ESMs) development has seen in the last decade an accelerated effort for the land biosphere (including anthropogenic forcing). However, the lack of enough observations to constrain the model complexity has led to the development of often diverging representation of surface processes between different land surface models. Therefore, the use of multi-model is also fundamental because of the uncertainty in the representation of land surface processes and related poorly constrained parameterizations.

The aim of this initiative is to evaluate the impact of including Earth System processes over land (from the latest Earth System Model developments in the frame of CMIP6 and beyond) on the performance of seasonal forecasts by state-of-the-art dynamical prediction systems. As a result, this effort is also expected to be a contribution towards new frontiers in the development of Earth system predictions and towards uncertainty reduction by better understanding/constraining the land surface processes.

Building from already established efforts (e.g. SNOWGLACE, LS3MIP) a set of soil-moisture and snow initialized hindcasts (covering some portion of the satellite-era) will be taken as the reference to further quantify the impact of land Earth System processes on seasonal forecasts. Long memory biophysical states or processes will be either persisted (from available satellite observations prior of the onset of the hindcast) or (optionally) initialized and dynamically simulated by the land models. It is expected that a good representation of the groups previously involved in GLACE-2 will participate in this coordinated efforts. Preliminary contact and indication of possible interest has already been expressed by several modelling groups.

In connection with the ongoing experiences in CMIP6, LS3MIP, LUMIP, GSWP-3, GLACEWSNOW and PROCEED, the details of experimental protocol will be implemented during 2018. Optionally, decadal (5-years or more) hindcasts may be as well considered. See GLACE-ESM Concept Note at following google doc link: https://tinyurl.com/GLACE-ESM