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Plant phenology evaluation of CRESCENDO land surface models

Deborah Hemming¹, **Daniele Peano**², Stefano Materia², Taejin Park^{3,4}, David Warlind⁵, Yuanchao Fan^{6,7}, Hanna Lee⁶, Andy Wiltshire¹, and Chris D Jones¹

¹Met Office, Climate Science, United Kingdom of Great Britain and Northern Ireland (debbie.hemming@metoffice.gov.uk)

²Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici, Bologna, Italy

³NASA Ames Research Centre, CA, USA

⁴Bay Area Environmental Research Institute, CA, USA

⁵Lund University, Lund, Sweden

⁶NORCE Norwegian Research Centre AS, Bergen, Norway

⁷Harvard University, Cambridge, USA

A new generation of land surface models (LSMs) have been developed in the framework of the EU-funded CRESCENDO project aiming to improve understanding of the Earth system as part of the community CMIP6 effort.

These new LSMs explicitly represent key processes in the carbon and nitrogen cycles, enabling more realistic vegetation-climate interactions to be simulated. For instance, vegetation phenology, the seasonality of vegetation, is explicitly represented in all these new LSMs. Intra- and inter-annual variations in vegetation phenology can substantially influence land-atmosphere exchanges of energy, moisture and carbon. Changes in phenological events also provide clear indicators of climate impacts on ecosystems.

Results are presented on the evaluation of phenological variability from offline runs of this new generation of LSMs. In particular, the timing of growing season onset and offset at global scale, and the Leaf Area Index (LAI) peak timing are investigated using monthly mean outputs. Three satellite-derived LAI datasets are used as benchmark observations for this evaluation.

In general, LSMs exhibit high skill in reproducing the observed phenology cycle in the North hemisphere mid- and high-latitudes, while lower skill is obtained in the South hemisphere. All LSMs simulate an offset in the timing of the active vegetative season characterized by later onset and LAI peak. Offset timings are slightly better captured by the LSMs. For these reasons, further development of the representation of phenology is required in LSMs, especially in the South hemisphere, where more complex vegetation and reduced in-situ observations are available.