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Exploit observational constraints to improve understanding and modeling of vegetation-climate interactions and feedbacks

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A combination of emerging global data products and techniques are employed to monitor, quantify and understand land variability and improve understanding of the relationship and couplings between land-vegetation and climate and of the processes and mechanisms involved. Latest available gridded datasets from the Global Land Cover Facility (GLCF; http://glcf.umd.edu), National Snow and Ice Data Center (NSIDC; https://nsidc.org/), European Space Agency (ESA) and Copernicus land monitoring service (http://www.copernicus.eu/) are acquired to provide global description of the biophysical state of vegetation (e.g. leaf area index, fraction of green vegetation cover) and the coupling with the atmosphere and the energy/water budget (e.g. albedo, soil moisture, land surface temperature, precipitation, circulation).

Several processes are identified that can contribute to the mediation role exerted by vegetation in the snow-albedo feedback and in the soil moisture-rainfall feedback. In particular, a strong coupling between vegetation and climate is found over middle to high latitudes deciduous forests with a modulation of snow-albedo feedback by vegetation. Analysis of trends in vegetation extent and phenology revealed the potential for positive feedbacks between climate warming and vegetation. For the vegetation phenology, it is shown that anticipated/delayed onset of the vegetation growing season coupled with climate change/variability further feedbacks with a decrease/increase in albedo, which results in increase/decrease of the climate change/variability signal.

By exploiting this unprecedented collection of observational land data, the innovative two-way seamless strategy proposed in the frame of the H2020 PROCEED project (http://projects.knmi.nl/proceed/) is applied in order to better constrain land-vegetation parameterizations and to improve land surface processes representation in the EC-Earth Earth System Model (ESM). The methodology is applied in order to obtain a more realistic sensitivity of EC-Earth to vegetation variability, which leads to significant improvements of climate simulation and prediction at multiple time-scales. Preliminary results of a new interactive surface albedo scheme that includes dependence on vegetation effective cover and on soil moisture content will be as well reported.