Geophysical Research Abstracts
Vol. 21, EGU2019-16162, 2019
EGU General Assembly 2019

Process-based improvement of climate prediction in EC-Earth ESM

Franco Catalano (1), Andrea Alessandri (1,2), Matteo De Felice (1,3)

(1) Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Rome, Italy (franco.catalano@enea.it), (2) Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands, (3) Joint Research Centre (JRC), European Commission, Petten, Netherlands

Novel observational global datasets of land-surface variables are expected to significantly enhance understanding and representation of land surface processes representation in Earth System Models (ESMs). To this aim latest available albedo (GLCF-GLASS and COPERNICUS), Leaf Area Index (GLCF-GLASS and COPERNICUS), snow extent (NSIDC), soil moisture (ESA) and ECMWF reanalysis for surface temperature and precipiation (ERA-INTERIM/ERA5) have been analyzed to identify the most relevant processes that contribute to vegetation-climate interactions and feedbacks.
The observational analysis unveiled novel important observational constraints that has driven the development of new process-based parameterizations in HTESSEL (i.e. the land-surface model included in the EC-Earth ESM). The observationally-based formulation of extinction of light below the vegetation canopy has been exploited to derive an interactive computation of the effective cover of vegetation over bare ground. The deterministic and probabilistic performance of the model with improved sensitivity to vegetation variability is evaluated using a retrospective seasonal hindcast experiment with respect to a control experiment where LAI does not vary. Realistic representation of vegetation variability results in a significant improvement of the seasonal forecasts of surface temperature and precipitation, including the skill in predicting the probability of extreme low/high tail events.
To further develop a process-based interactive soil albedo scheme in HTESSEL, the observed relationship between bare soil albedo and moisture content in the soil has been analyzed. Soil albedo parameters have been estimated based on the latest available global COPERNICUS observational dataset. Soil classes discretization is based on global classification of soil textures and colours. For each soil class (combination of different colors and textures), bare soil albedo information has been obtained using COPERNICUS total albedo dataset for each of the four SW bands considered in the IFS radiation code (visible and near infrared for both diffuse and parallel beams) by removing albedo of vegetation fraction. For most of soil classes we found a robust (statistically significant) relationship between albedo and soil moisture for each of the four SW bands. Preliminary evaluation of the effect of the new interactive soil albedo scheme show an improvement in the representation of land-surface variability.