Earth System Model EC-Earth

EC-Earth is developed jointly over 30 European research institutes (Hazeleger et al., 2010). The Coupled Model Intercomparison Project 5 (CMIP5) was the first CMIP for EC-Earth. EC-Earth comprises of atmosphere model IFS, ocean model NEMO and vegetation model LPJ-GUESS, coupled with OASIS coupler. Aerosols and chemistry are included through the global chemistry-transport model TM5.

The Integrated Forecasting Model (IFS) is the atmospheric model developed at European Centre for Medium-Range Weather Forecasts. The proposed research is using IFS with T255 horizontal spectral resolution with 62 vertical levels. The IFS is coupled to the ocean model NEMO, which is run with 1º horizontal resolution and 42 vertical levels. The ice model LIM is coupled directly to the ocean model.

TM5 describes aerosols using a 7-mode size distribution (Vignati et al., 2004), with 4 soluble and 3 insoluble modes. TM5 includes most abundant aerosol species: sulfate, black carbon, organic carbon, sea salt and mineral dust. For the current CMIP6 version of EC-Earth ESM, several relevant modifications are included: 1) TM5 aerosol fields are communicated via OASIS to IFS for aerosol indirect (cloud) effect, 2) interactive dust emissions and 3) secondary organic aerosol scheme are implemented. In default ESM configurations, TM5 uses a grid of 3ºx2º for aerosols and chemistry.

LPJ-GUESS is the terrestrial vegetation components of EC-Earth. It is a dynamic process-based ecosystem model which can predict structural and compositional ecosystem properties. In EC-Earth, the atmospheric model IFS communicates temperature, radiation, precipitation and soil state to LPJ-GUESS. Concurrently, LPJ-GUESS updates simulated low and high vegetation fraction as well as leaf area index to IFS land surface module. In addition to land surface processes, gas-phase transport of CO_2, aerosols and precursors is communicated between TM5 and LPJ-GUESS. The CMIP6-version of EC-Earth includes version 4 of LPJ-GUESS, together with e.g. a new land albedo parameterization and fire module (LPJ-GUESS-BLAZE).

EC-Earth can be used for historical, paleoclimate, present-day and future simulation experiments. Full Earth System Model, including atmospheric composition and carbon cycle, allows investigations of complex interactions and feedback mechanisms. Furthermore, pre-computed EC-Earth data from CMIP6 project will be available online from 2019 onwards.

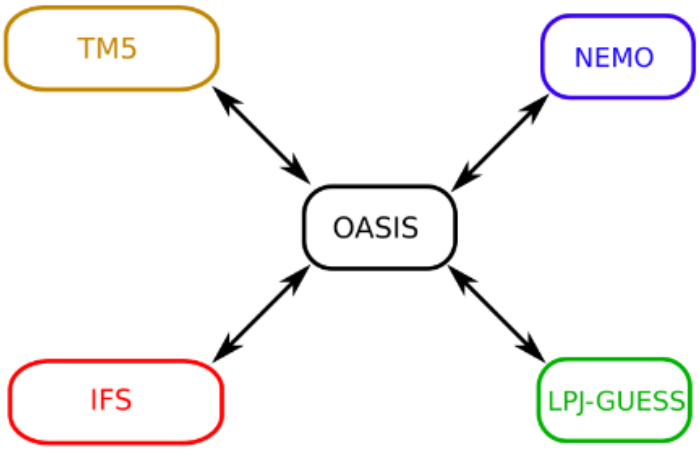

Figure 1: Components of EC-Earth coupled through OASIS coupler.

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