Coordinated global high resolution coupled climate modelling - PRIMAVERA

Malcolm Roberts (1), Helene Hewitt (1), Dorotea Iovino (2), Adrian New (3), Bablu Sinha (3), George Nurser (3), Rein Haarsma (4), Torben Koenigk (5), Virginie Guemas (6), Jin-Song von Storch (7), Chris Roberts (8), and Tido Semmler (9)

(1) Met Office Hadley Centre, Met Office, Exeter, UK (malcolm.roberts@metoffice.gov.uk), (2) Centro Euro-Mediterraneo sui Cambiamenti Climatici S.c.a.r.l (CMCC), Italy, (3) National Oceanography Centre, Southampton, UK, (4) Koninklijk Nederlands Meteorologisch Instituut (KNMI), De Bilt, Netherlands, (5) Sveriges Meteorologiska och Hydrologiska Institut (SMHI), Norrköping, Sweden, (6) Barcelona Supercomputing Center (BSC), Barcelona, Spain, (7) Max Planck Gesellschaft zur Foerderung der Wissenschaften E.V., Hamburg, Germany, (8) European Centre for Medium-Range Weather Forecasts (ECMWF), Reading, UK, (9) Alfred-Wegener-Institut, Helmholtz-Zentrum für Polarund Meeresforschung, Bremerhaven, Germany

One of the uncertainties in the role that model resolution plays in global coupled climate simulation has been the lack of a coordinated experimental design and a large ensemble of multi-model, multi-resolution simulations to enable detailed analysis of the relevant processes. The European H2020 project PRIMAVERA has 7 different coupled models following the CMIP6 HighResMIP protocol for 1950-2050, at resolutions ranging from 130km-1˚ to 25km-1/12˚, and as such is providing a rich data source for analysis.

With a focus on the Atlantic and European climate variability and change, initial analysis has examined mean state biases such as SST, mixed layer depths, heat content and Gulf Stream position and variability, as well as fluxes of heat and moisture between the Atlantic and Arctic systems. Aspects of variability such as the Atlantic Meridional Overturning Circulation (AMOC) and links to the Atlantic Multidecadal Oscillation have also been examined, as well as air-sea interactions and coupling strength. Aspects of sea-ice processes and links to the ocean circulation are also being investigated.

One of the main challenges in analysing datasets such as these are the data volumes – the project expects to locally store at least 3 PB of data. All the data from the models will, for the next 2 years, be available on one platform (CEDA-JASMIN), on which our joint analysis is ongoing. We are also planning coordinated analysis with a variety of other partners (e.g. CLIVAR, tropical cyclone community), for which the application of standardised methods and algorithms will enable us to share results more easily - this approach emphasises moving the algorithm to the data rather than vice versa.

In addition to the model analysis, the project is developing new parameterisation schemes targeted at higher resolution models. These include upper ocean mixing schemes based on Langmuir turbulence and internal mixing processes, as well as the representation of sea-ice dynamics and thermodynamics such as rheology and multi-layer sea-ice.