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Volunteer Computing for Large Ensemble Regional Climate Modelling

Suzanne Rosier, Neil Massey, Myles Allen, and the weatherathome Team
Oxford University, UK

climateprediction.net is the world's largest ensemble climate forecasting project. Since its launch in 2003, over 100 million years of climate have been modelled by a distributed network of volunteer computers. Previous models used by the project have concentrated on modelling global long term trends in the climate over centennial timescales. By perturbing the physical parameterisations in these models, the uncertainty of future climate change has been assessed.

A recently launched experiment, weatherathome, explores the effect future climate change will have on patterns and extremes of regional weather. A regional climate model, with a resolution between 25 and 50 km, is embedded in a coarser resolution global model. This finer resolution improves the modelling of local weather features such as precipitation, temperature and wind. Very large ensembles of the model are then calculated using a time slice and automatic continuation approach which enables the effect of the climate on weather to be studied on decadal, and even centennial timescales, all via the volunteer computing network of climateprediction.net.

The weatherathome system allows for different regions and a number of experimental designs to be modelled. Currently three regions have been produced for the system: Europe, Southern Africa and the Western US. The first experiment to be performed using the system is a simulation of the period from 1960 to 2010, for all three regions, using observational datasets to provide forcing to both the global and regional model. Two very large ensembles are created: a perturbed initial condition ensemble and a perturbed physics ensemble. Techniques from forecast verification are then used to compare the statistics of the weather for the model with those from observational datasets. In particular, the initial condition ensemble is used to test the ability of the model to represent extremes of weather. This lends confidence to using the weatherathome system for Detection and Attribution studies as well as decadal-scale prediction of extreme weather under a climate change scenario, as the bias in the model of predicting extreme weather events will be determined. The perturbed physics ensemble is used to assess the uncertainty of the extreme weather statistics and to explore the dependence of these extremes on physical parameterisations.

The results from this initial validation exercise will be presented, along with plans for future experimental setups, including a near future decadal-scale prediction for the years 2010-2030 and a large scale Detection and Attribution study of the climate of the past 50 years.