Superensemble of regional climate model scenarios

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Climateprediction.net is a distributed computing project, a superensemble of tens of thousands of climate simulations performed by thousands of volunteers around the world. The primary motivation of the project is to produce scenarios of Earth's future climate and to quantify the uncertainties. As part of a novel regional modeling project, several experiments have been planned with the regional climate model implemented at 25km resolution over the western US, and embedded in a global model that runs simultaneously. We describe the first two experiments, already nearly complete, which cover 1960-2010 forced with observed sea surface temperatures and 2020-2050 forced with CMIP5 simulations. The superensemble is generated by perturbing the initial conditions and the model physics parameters including cloud microphysics, thresholds for cloud formation and precipitation, albedo of melting ice, and more. We describe the seasonal and interannual variation of climate variables in the western US and compare the historical simulations with observations, permitting an evaluation of the role played by different model parameters in achieving realistic simulations of western US climate. The superensemble approach permits probabilistic descriptions of climate, which, combined with the good resolution, offers an unprecedented ability to quantify future climate. The regional model is configured to output several dozen climate variables relevant to society and the environment, such as heavy rainfall events, extremely high winds, coastal upwelling and snow mass.