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Digital Earths - Rethinking Weather and Climate Prediction

Abstract:

The prediction of weather and climate with computer models and their fusion with observations in data assimilation have been one of the biggest scientific and technological revolutions of the 20th century. Through advances in the computational modelling of the atmosphere, ocean, land and cryosphere, weather forecasts have improved by about a day a decade. We are able to predict major modes of climate variability months ahead and we are able to assess the future of our planet for different scenarios of human behaviour.

Together with these advances, the advent of exa-scale computing is providing an opportunity for a significant leap in weather and climate prediction. It is in our grasp to explicitly resolve thunderstorms, small ocean eddies, rivers and catchments as well as individual large glaciers in global modelling systems, as well as streets and buildings in regional and local systems. In this presentation we summarise the ambition of the World Climate Research Program's Digital Earths Lighthouse Activity to carry out the research that fully integrates weather and climate models with those for human and natural systems to build comprehensive digital information systems. We will focus on the scientific, technological, and community challenges and opportunities that arise from the goal to design and implement digital twins of the Earth at both global and regional scale.