SORS: The Importance of Internal Climate Variability in Climate Impact Projections

Objectives

Abstract: Uncertainty in climate projections is driven by three components: scenario uncertainty, inter-model uncertainty, and internal variability. Although socioeconomic climate impact studies increasingly take into account the first two components, little attention has been paid to the role of internal variability, although underestimating this uncertainty may lead to underestimating the socioeconomic costs of climate change. Using large ensembles from seven coupled general circulation models with a total of 414 model runs, we partition the climate uncertainty in classic dose–response models relating county-level corn yield, mortality, and per-capita gross domestic product to temperature in the continental United States. The partitioning of uncertainty depends on the time frame of projection, the impact model, and the geographic region. Internal variability represents more than 50% of the total climate uncertainty in certain projections, including mortality projections for the early 21st century, although its relative influence decreases over time. We recommend including uncertainty due to internal variability for many projections of temperature-driven impacts, including early-century and mid-century projections, projections in regions with high internal variability such as the Upper Midwest United States, and impacts driven by non-linear relationships.

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Short Bio: Dr. Nathan Lenssen is a postdoctoral scholar at the University of Colorado Boulder and a visiting scientist at the National Center for Atmospheric Research (NCAR). He recieved his PhD in Earth and Environmental Sciences and MA in Statistics from Columbia University. His broad research aims are to better understand the variability, predictability, and change of the climate system, while accounting for uncertainty in observational data and biases in dynamical climate models. His work involves developing statistical and dynamical models as well as the computational

methods needed to apply these models to extremely large datasets. Applications include seasonal-to-decadal climate prediction, quantifying the impacts of ENSO and other sources of climate variability on human systems, and uncertainty quantification of observational temperature data.

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