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# Including observational uncertainty in multi-model ensemble weighting methods

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Multi-model ensembles (MME) of climate models are used to investigate and understand structural uncertainty. Also, observational datasets are subject to uncertainty in how they represent the state of our environment. Increasingly, ensembles of observational datasets are generated in order to incorporate, mostly parametric, uncertainty (e.g., Cornes et al. 2018). However, dataset uncertainty is not systematically included when evaluating or weighting climate models, as there are no conceptual frameworks and quantitative methods for comparing ensembles of models to ensembles of datasets.

Using a single dataset as ground truth is a reasonable strategy when climate model uncertainty dominates dataset uncertainty (Knutti et al. 2017). However, as model skill improves, dataset uncertainty will more likely become a reason for disagreement between model outputs and observations. Hence, the importance to include dataset uncertainty in climate model aggregation is increasing. We investigate possibilities to include dataset ensembles for climate model aggregation. Here, we are focusing on Europe using the CMIP5 MME, the dataset ensemble E-OBS (Cornes et al. 2018) and the model weighting approach developed by Knutti et al. (2017). First, dependent on variable, geographical region and season, we investigate the patterns of the combined dataset and climate model uncertainty. Second, we explore how including dataset uncertainty affects the robustness of model weighting results. Third, we propose an approach to combine observational ensembles with model ensembles. Fourth, we discuss the epistemological implications of accepting that datasets are a plausible but imperfect approximation to the actual state of the system.

Cornes, Richard C., Gerard Schrier, Else J. M. Besselaar, and Philip D. Jones. 2018. “An Ensemble Version of the E-OBS Temperature and Precipitation Data Sets.” Journal of Geophysical Research: Atmospheres 123 (17): 9391–9409. https://doi.org/10.1029/2017JD028200.

Knutti, Reto, Jan Sedláček, Benjamin M. Sanderson, Ruth Lorenz, Erich M. Fischer, and Veronika Eyring. 2017. “A Climate Model Projection Weighting Scheme Accounting for Performance and Interdependence.” Geophysical Research Letters 44 (4): 1909–1918.