ABSTRACT

Calibrating multi-model ensemble predictions from the Jack Rabbit III international model inter-comparison exercise

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Abstract text

Structural uncertainty in models is an often overlooked source of error that can propagate to downstream analysis and decision making. Where predictions from multiple alternative models are available, ensemble methods allow this uncertainty to be quantified, while improving predictive power. The Jack Rabbit III (JRIII) international model inter-comparison exercise, which aims to inform the trial design for large-scale releases of anhydrous ammonia, presents an opportunity to study the structural uncertainty in dispersion modelling.

Structural uncertainty can be addressed through Bayesian model selection/averaging or Bayesian model stacking. However, these approaches can require an inhibitive number of model runs. An alternative approach is to post-process the point predictions from the individual models to form an ensemble prediction. The utility of such low-burden methods has long been recognized in weather forecasting and climate science, and recently has even been successfully applied to combine COVID-19 projections.

Here we use selected trials data to investigate the performance of low-burden methods, such as Ensemble Model Output Statistics (EMOS), for calibration of multi-model ensemble predictions of centerline concentrations. Further, we explore how ensembles might be used to inform the design of chemical release trials.

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