Calibrating a Global Chemistry Transport Model for Tropospheric Ozone and OH

Oliver Wild

Lancaster University, United Kingdom

Author list (excluding presenting author)

Ed Ryan

Abstract

While the major physical, chemical and dynamical processes governing the abundance of atmospheric oxidants such as ozone and OH are largely understood, obtaining a quantitative understanding of the importance of these processes and the interactions between them remains challenging. Weaknesses in representing these processes in atmospheric chemistry transport models introduces substantial uncertainty, and model intercomparisons show considerable diversity even when representing current conditions. In this study we perform a global uncertainty analysis on a chemistry transport model to identify the processes contributing most to uncertainty in tropospheric ozone and OH. We then use atmospheric observations to calibrate the model and identify weaknesses in process representation and understanding. We find that the largest uncertainties are associated with chemical kinetic data for key reactions, with factors influencing photolysis rates, and with deposition processes, and that addressing these would provide the largest benefits to simulation of tropospheric ozone and methane lifetime. We demonstrate that calibration is valuable to identify structural errors in models, and that it allows constraint of uncertainty in key processes. Calibration with surface ozone measurements alone is shown to be insufficient to constrain the model, and we highlight the importance of applying a broad range of different observational metrics through the troposphere. While this study is exploratory in nature, focussing on a limited number of parameters and metrics, we clearly demonstrate the value of rigorous calibration for providing important new constraints on key processes and their representation in atmospheric models.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

TOAR: Tropospheric Ozone Assessment Report