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MCM Box Modelling of the OP3 Aircraft Campaign

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Recent evidence suggests a significant failing in our understanding of the atmospheric chemistry of isoprene under low NOx conditions, with important consequences for modelling of OH and the climate gases methane and ozone. Several recent experimental and theoretical studies have also challenged our understanding of isoprene oxidation in the atmosphere, and there is a growing body of evidence from field observations, laboratory experiments and theoretical work suggesting that the current understanding of the OH-initiated oxidation of isoprene is incomplete.

In this work we use the Master Chemical Mechanism (MCM) in the Dynamically Simple Model of Atmospheric Chemical Complexity (DSMACC) to investigate recently proposed changes to the mechanism for isoprene oxidation currently adopted in atmospheric models. The model is constrained to observations made onboard the BAe146 FAAM research aircraft during the Oxidant and Particle Photochemical Processes (OP3) field campaign over Borneo in July and August 2008, and comparisons between the OH and HO2 concentrations obtained from the model and those observed during the field campaign provide a test for the understanding of isoprene oxidation in this region. Results indicate a requirement for additional OH sources related to isoprene, with the model vastly underestimating the observed OH concentrations.

Implementation of recent findings from experimental and theoretical investigations of isoprene chemistry result in significant improvements in model success, and provide important insights to previously unknown sources of OH in the atmosphere.