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Nighttime chemistry: observations and modelling from RONOCO

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During the day, the hydroxyl radical (OH) is abundant and the nitrate radical (NO_3) is rapidly photolysed, so NO_3 is not an important daytime oxidant. At night, however, OH concentrations are low, and so NO_3 takes its place as the primary oxidant driving nighttime chemistry. The aims of the RONOCO project (ROle of Nighttime chemistry in controlling the Oxidising Capacity of the atmosphere) are to quantify the processes influencing nighttime chemistry, using UK-based aircraft observations in combination with atmospheric chemistry models covering different scales (including a box model, a high resolution regional model and a global model).
Here, results from the global chemistry transport model pTOMCAT will be presented. Model results are compared to observed chemical composition. Observations including O_3, CO, NO_x, NO_3, N2O5, HNO_3, PAN, aerosol and VOCs were taken on board the FAAM (Facility for Airborne Atmospheric Measurement) BAe146 research aircraft during July-August 2010 and January 2011, around the UK.
The model is used to quantify different loss processes for NO_3 and N2O5 (including reaction with different VOCs, N2O5 hydrolysis on aerosol, dry deposition). Sensitivity tests to vary the chemical scheme and N2O5 hydrolysis on aerosol are performed to establish the impact these processes have on the model. The effect of model resolution is also tested, and the effect of nighttime chemistry is evaluated at the global scale.