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Modelling the boundary layer and the impact of snowpack emissions at south pole and halley, antarctica

P. D. Hamer (1), D. E. Shallcross (1), D. Lary (2)

(1) Atmospheric Chemistry Reasearch Group, School of Chemistry, University of Bristol, Cantock's Close, Bristol, BS8 1TS, (2) NASA Goddard Space Flight Centre, Greenbelt Rd., Greenbelt, Md., 20771-0001

Contrary to previous assumptions, recent studies in Antarctica have shown that there is a wide variety of chemistry occurring within the boundary layer. This study has taken an existing urban chemistry two-box model and heavily modified it to adapt it to Antarctic conditions. At South Pole it is believed that the main drivers behind this chemistry are emissions of NO_x, HONO and carbonyl species from the snowpack coupled with high actinic fluxes during the polar spring/summertime. These emissions influence the overlying atmosphere and force ozone concentrations to rise. Including these emissions and enhancing the albedo in our model has lead towards success in reproducing some of the unusual chemistry that leads to high ozone episodes (40 ppbv). By including deposition to snow and subsequent photolysis of organic hydroperoxides we have been able to reproduce observed concentrations of formaldehyde from South Pole. At Halley the atmosphere is influenced by NO_x emissions and chemical species advected from the marine environment. Halogen species are responsible for ozone depletions and affect the HO_x budget, and sulphur compounds are of interest with respect to aerosol formation. Using 4-D variational data assimilation it has been possible to link our unconstrained box model with the data collected during the CHABLIS campaign to further our understanding of the processes occurring there.