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Formation, chemistry and tropospheric impact of $ClNO_2$

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Heterogeneous uptake of dinitrogen pentoxide, N2O5, to aerosol is one of the most important reactions controlling the global budget of nitrogen oxides, with subsequent impacts on oxidants such as ozone and hydroxyl radical. Most chemistry global models assume that this uptake proceeds through hydrolysis to produce nitric acid, effectively a terminal sink for nitrogen oxides. However, recent field studies have shown that the yield of nitryl chloride, $ClNO_2$, from N2O5 uptake is significant in many locations. Because $ClNO_2$ photolyzes subsequent to its nighttime production to recycle NO_2 and produce atomic chlorine, a potent oxidant, the impact of heterogeneous N2O5 uptake and the role of $ClNO_2$ on the scale distribution of oxidants need to be re-assessed. Here we present global simulations using the chemistry-climate model CAM-Chem, including a state of the art halogen chemistry scheme and different assumptions for the magnitude and spatial distribution of $ClNO_2$ yields from N2O5. The model shows a significant effect of $ClNO_2$ production on tropospheric ozone, hydroxyl radical and peroxyacyl nitrates (PAN) during northern hemisphere late winter and early spring.