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Role of aerosol uptake in controlling the oxidation of isoprene through reaction with NO_3: model analyses of aircraft observations during RONOCO campaign

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Isoprene is the most emitted non-methane biogenic volatile organic compound. Despite its high reactivity, late-day emission remain in atmosphere after the sunset affecting the nighttime chemistry of NO_y (NO, NO_2, HNO_3, total peroxy nitrates (ΣRO_2NO_2), total alkyl nitrates ($\Sigma RONO_2$), N2O5, NO_3).
Nocturnal observations of total peroxy nitrates and total alkyl nitrates carried out during summer 2010 above the United Kingdom (RONOCO campaign, on-board the Bae-146 aircraft) are analyzed using a tropospheric chemistry box-model (DSMACC). The model includes a detailed description of gas-phase atmospheric chemistry, the Master Chemical Mechanism (MCM) v3.2. In this work aerosol uptake of peroxy nitrates and alkyl nitrates has been added to the normal mechanism.
In order to investigate the role of aerosol uptake on the peroxy nitrates and alkyl nitrates, sensitivity tests involving the aerosol surface and the uptake coefficient are carried out. Results show different responses of the model performances in simulating the concentrations of alkyl nitrates and peroxy nitrates to changes of the aerosol surface and the uptake coefficient: the decrease of the first impacts both the modeled alkyl nitrates and peroxy nitrates with an increase of its concentrations, resulting in an overestimations of peroxy nitrates whereas alkyl nitrates tend to be in better agreement with the measured data. Also decreasing the uptake coefficient has similar effects of the decrease of aerosol surface. The increase of the aerosol uptake causes a decrease of modeled alkyl nitrates and peroxy nitrates concentrations, resulting in a better agreement between measured and modeled peroxy nitrates. The impact of aerosol uptake on the NO_y nighttime chemistry and on the isoprene degradation is discussed, as well.