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Enhanced chlorine atom activation by hydrolysis of iodine nitrates from marine aerosols at polluted coastal areas

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Coastal regions cover nearly 22% of Earth's continental surface area and give living space for more than 39% of world's population with an urbanization rate of 46% (Kummu et al., 2016). Overall, coastal regions are characterised by strong interactions between the marine and continental environment. Thus, in polluted coastal areas, where clean marine air masses mix with anthropogenic air masses, halogen atoms can have a significant impact on air quality (Muniz-Unamunzaga et al., 2018; von Glasow et al., 2013). The marine atmosphere is highly influenced by halogen chemistry, whereas the continental atmosphere is highly influenced by NO_x chemistry. Hence, the formation of halogen nitrates and their subsequent multiphase chemistry can be a crucial tropospheric chemistry aspect.

In this study, detailed halogen multiphase chemistry simulations are carried out investigating the importance of the interaction of halogen radicals with NO_x forming halogen nitrates on the activation of chlorine atoms. For this purpose, two meteorological scenario simulations are performed, one with cloud occurrence and one without. The simulations imply that especially the hydrolysis of iodine nitrate within aerosols leads to an enhanced chlorine atom activation by ICl photolysis. Whereas $ClNO_2$ photolysis has larger contributions to chlorine activation in the morning, the ICl photolysis dominates chlorine activation at afternoon. Overall, the average contributions to chlorine atom activation in the cloud and cloud-free scenarios by $ClNO_2$photolysis are 42 % and 62 % and by ICl photolysis 35 % and 28 %, respectively. Therefore, the simulations imply the hydrolysis of iodine nitrates affects the atmospheric oxidation capacity, VOC oxidation, and ozone formation potential and has to be considered in chemical transport models.

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