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Bounding the heterogeneous gas uptake on aerosols and ground using resistance model

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Gas uptake on aerosols and ground are potential important atmospheric sinks in a heterogeneous way. Different schemes have been used to characterize the dry deposition and heterogeneous aerosol gas uptake, although they share similar characteristics. In this work, we compared the uptake flux on both ground and aerosols based on a resistance model, to identify the dominate heterogeneous processes within the planetary boundary layer (PBL). The req is introduced to represent the required reactive uptake coefficient on aerosols when these two processes are equally important. It's shown that req is proportional to the dry deposition velocity and inversely proportional to aerosol surface area concentration. Under typical regional background condition, req vary from 1x10-5 to 4x10-4 with gas species, land-use type and season, which indicates that aerosol gas uptake should be included in atmospheric models when uptake coefficient higher than 10-5. We address the importance of heterogeneous gas uptake on aerosols over ground especially for ozone uptake on liquid organic aerosols and for marine PBL atmosphere.