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The H_2O and O_2 exospheres of Jupiter's moon Ganymede

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Abstract.

A simulation of the H_2O and O_2 exospheres of Jupiter' moon Ganymede, through the application of a 3D Monte Carlo modeling technique, is presented. Our model takes into consideration the combined effect on the exosphere generation of the main surface release processes (i.e. sputtering, sublimation and radiolysis) and the surface precipitation of the energetic ions of Jupiter's magnetosphere constrained strongly by Ganymede's intrinsic magnetic field. In order to model the magnetospheric ion precipitation to Ganymede's surface, we used as an input the electric and magnetic fields from the global MHD model of Ganymede's magnetosphere (Jia et al., 2009). The exospheric model described in this paper is based on EGEON, a single-particle Monte Carlo model already applied for a Galilean satellite (Plainaki et al. 2010, 2012, 2013). We find that at small altitudes above the moon.s subsolar point the main contribution to the neutral environment comes from sublimated H_2O whereas the spatial distribution of the directly sputtered-H_2O molecules exhibits a close correspondence with the plasma precipitation region and extends at high altitudes, being, therefore, well differentiated from the sublimated water. Moreover, we find that the O_2 exosphere comprises two different regions: the first one is an homogeneous, relatively dense, thermal-O_2 region extending to some 100s of km above the surface, whereas the second one is less homogeneous and consists of more energetic O_2 molecules sputtered directly from the surface after water-dissociation by ions has taken place; the spatial distribution of the energetic surface-released O_2 molecules depends both on the impacting plasma properties and the moon's surface temperature distribution.

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