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# Generation of an exosphere around an icy moon: the case of Europa

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The exosphere of an icy moon with a tenuous or without atmosphere is the result of different surface release processes and subsequent modification of the released particles. Water ice is directly released, but photolysis and radiolysis due to solar UV and magnetospheric plasma, respectively, can result in OH, H, O and (possibly) $H_2$ production. These molecules can recombine to reform water and/or new chemical species. As a consequence, the neutral environment of Jupiter's icy moon Europa becomes a mixture of different molecules, among which, $H_2O$ dominates in the highest altitudes and $O_2$, formed mainly by radiolysis of ice and subsequent release of the produced molecules, prevails at lower altitudes. In this work we present a Monte Carlo model that simulates the exosphere generation processes at the Europa icy moon and we calculate the escape of $H_2O$, $O_2$ and $H_2$. We show that different configurations between the moon's leading hemisphere and the Sun's position influence the exosphere spatial distribution. We also make an estimation of the sputtered $H_2O$ exosphere of this moon, taking into consideration the trailing-leading asymmetry in the magnetospheric ion bombardment and the energy and temperature dependences of the process yields. We find that a density of about $1.5 \cdot 10^{12}$ $H_2O/m^3$ is expected at altitudes about 0.1 $R_E$ above the surface of the trailing hemisphere. The estimations obtained by this study provide useful information for the preparation of future missions at the Jupiter's moons.