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Long and short time variations of the Na/K ratio in the exosphere of Mercury.

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Here we present the results of our model for the short-time and yearly variations of the Sodium and Potassium exosphere of Mercury. Such surface-bounded exosphere is produced by release processes occurring at the planetary surface, such as ion sputtering, thermal- or photon-stimulated desorption. The amount of surface Sodium or Potassium that is available for release, however, is limited. Those release processes deplete the surface in Na and K, which is continuously refilled by diffusion from the interior of regolith grains or by chemical sputtering. Ejected particles may either escape the gravity field, assisted by the radiation pressure acceleration, or be photoionized, or fall back onto the surface. Falling particles will stick to the surface.
A Montecarlo model, simulating all these processes, is used to obtain the exosphere densities and the Na/K ratio, taking into account the planet's orbit and rotation speed. The influence of variations of the solar wind precipitation (i.e. CMEs) is also included. We compare this model with either ground- and space-based observations of the exosphere and tail to evaluate the effectiveness of each source process. We find that including a source process which effectiveness is proportional to the precipitation of solar wind protons, is necessary to explain most of the available observations in both qualitative and quantitative way. We find that, to reproduce dawn-dusk asymmetries, we need to include the rotation of Mercury's surface in the model. After finding the correct model parameter by calibrating the model with observation, we simulate the short-term and yearly variations of Na/K.