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Simulating Mars D/H and atmospheric chemistry during the 2018 Global Dust Storm and comparing with NOMAD observations

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The NOMAD instrument suite on the ESA-Roskosmos ExoMars Trace Gas Orbiter (TGO) observes the physical and chemical composition of the Martian atmosphere with highly resolved vertical profiles and nadir sounding in the IR and UV-vis domains. Vertically resolved profiles of, amongst other species, water vapor, HDO, ozone, CO, CO_2, oxygen airglow, dust and clouds were obtained for more than one Martian year [1-5]. During its first year of operations, NOMAD witnessed the 2018 Global Dust Storm (GDS) during its onset, peak and decline. The redistribution of water vapor to high altitudes and latitudes observed during the GDS was explained using the GEM-Mars General Circulation Model (GCM) [6-8]. The GCM was driven by the dust optical depths for Mars Year 34 provided by [9]. The photolysis products of water vapor are a major driver for the atmospheric chemistry on Mars. As water vapor is redistributed over the atmosphere, it is expected to have considerable impact on many other species. GEM-Mars contains routines for atmospheric chemistry and here we present some results of the simulated impact of the GDS on atmospheric chemistry and on several of the observed species. GEM-Mars now also includes the simulation of HDO and the fractionation of water vapor upon cloud formation. The simulations will be compared with the vertical profiles of the D/H ratio obtained from NOMAD observations. The impact of the GDS on D/H can be estimated from these simulations.

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