

Transport-driven formation of a polar ozone layer on Mars

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Since its discovery by Mariner 7 ultraviolet spectrometer, our knowledge on the seasonal and spatial distribution of ozone on Mars has evolved considerably thanks to parallel efforts in observations and modeling. Martian ozone vertical distribution exhibits two main layers that form the canonical view of ozone profiles on Mars: (1) a near-surface layer, and (2) a detached layer whose altitude is found to vary within the 30 to 60 km altitude range. Here we report evidence from the SPICAM UV spectrometer on Mars Express for the existence of a distinct ozone layer emerging at 40-60 km above the fall / winter poles. This layer is associated with a formation process previously ignored for ozone on Mars, being the consequence of large-scale transport and further recombination of oxygen atoms in the polar night. However, this transport-driven ozone formation is also balanced by loss reactions with HO_x radicals. The seasonal dependence of HO_x concentrations, reflecting the large seasonal variations of water vapor on Mars, creates in turn a dichotomic behavior for the two polar ozone layers, with a significantly richer layer in the southern hemisphere. This newly identified mechanism for ozone formation and seasonal evolution at the Martian poles echoes with the formation conditions of the ozone layer recently discovered on Venus.