An Extended View of Ozone and Chemistry in the Atmosphere of Mars

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We present an ongoing effort to characterize chemistry in Mars' atmosphere in multiple seasons on timescales longer than spaceflight missions through coordinated efforts by GSFC's HIPWAC spectrometer and Mars Express SPICAM, archival measurements, and tests/application of photochemical models. The trace species ozone (O$_{3}$) is an effective probe of Mars' atmospheric chemistry because it is destroyed by odd-hydrogen species (HO$_{x}$, from water vapor photolysis). Observed ozone is a critical test for specific predictions by 3-D photochemical models (spatial, diurnal, seasonal). Coordinated measurements by HIPWAC and SPICAM quantitatively linked mission data to the 23-year GSFC ozone data record and also revealed unanticipated inter-decadal variability of same-season ozone abundances, a possible indicator of changing cloud activity (heterogeneous sink for HO$_{x}$). A detailed study of long-term conditions is critical to characterizing the predictability of Mars' seasonal chemical behavior, particularly in light of the implications of and the lack of explanation for reported methane behavior.