Global variations in the vertical distribution of water on Mars from a reanalysis of multiple spacecraft observations

Conference or Workshop Item

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Global understanding of the horizontal and vertical transport of water on Mars is required to advance our incomplete understanding of key processes linked to the water cycle such as water escape throughout time and potential habitability. We analyse the global water cycle during the Mars Year 34 dusty season (April 2018-March 2019) from a reanalysis that combines a Mars global circulation model with retrievals of water vapour (column and vertical profiles), temperature profiles and dust column from several instruments on the ExoMars Trace Gas Orbiter and Mars Reconnaissance Orbiter. This reanalysis provides a robust constraint on the evolving 4-D distribution of water, especially when water vapour retrievals are combined with additional atmospheric properties (temperature and dust) that also exert an influence on the evolving global water distribution.

We investigate global transport processes and supersaturation, indicating northern polar latitudes are largely absent of water vapour below 20 km. Variations above this altitude are due to transport from mid-latitudes during a global dust storm, the downwelling branch of circulation during perihelion season and the intense southern summer regional dust storm in Mars Year 34. Evidence is also found of supersaturated water vapour breaking into the northern winter polar vortex.