Water in the Martian Atmosphere During Global Dust Storms

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Description:
The student will use the Open University Mars global circulation model to investigate the links between water vapour, water ice clouds and dust in the atmosphere of Mars [1]. In 2018, Mars experienced a global dust storm, when most of the planet was enshrouded in a layer of dust resulting from global-scale dust activity. During such extreme events, the distribution of water vapour and ice (in the form of clouds) is modified significantly, resulting in the transport of water to much higher altitudes in the atmosphere than is normally possible. This ‘uplift’ of water is believed to be linked to the overall loss of water from the top of the atmosphere of Mars. Understanding the behaviour of water under such extreme dust activity conditions could help understand how Mars has lost its atmosphere over time.

Dust, water vapour and ice are transported by winds in the martian atmosphere. They interact through absorbing and emitting radiation, affecting atmospheric temperatures and wind patterns in turn [2]. Temperatures determine where water vapour freezes into ice or ice sublimates, and dust may play a further role as a condensation nucleus for ice particles. Modelling work in this project will be closely linked to the latest observations from the NOMAD (Nadir and Occultation for MArs Discovery) instrument aboard ESA ExoMars Trace Gas Orbiter [3]. NOMAD gives uniquely detailed vertical profiles of these constituents and aerosols and the project will include simulation of actual weather events on Mars, including the 2018 Global Dust Storm, extending into the future as the project progresses.

References:


Qualifications required: Suitable for graduates with a physics, mathematics or related numerate undergraduate degree.