# Martian dust devils: Paving the way for analysis of pressure and wind data from MEDA on Mars 2020

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**Introduction:** Atmospheric dust plays a major role in the thermal conditions of the Martian atmosphere and in the modulation of its daily pressure cycle. Dust is lifted in the martian atmosphere by many processes, being one of them the development of dust devils. The so-called dust devils are warm convective vortices at the Planetary Boundary Layer with surface winds strong enough to lift dust particles rendering these vortices visible. Many observations of them are available in the literature, either from images from orbit [1], from the observations of their dust trails [2] or from images from instruments on landed missions [3]. Dust devils have also been extensively studied by surface meteorological instruments including pressure sensors wich detect the sharp decrease in atmospheric pressure characteristic of the close passing of a surface convective vortex [4, 5]. Unfortunately these pressure "only" measurements can not determine the main parameters that define the vortices such as their size, absolute intensity (or maximum pressure drop at its outer radius) and distance to the pressure sensor. A small signal can be detected by an intense vortex at a large distance or by a small vortex passing close to the pressure sensor. A recent heuristic model of dust-devil trajectories able to simulate pressure and winds for different models of vortices has been recently developed [6]. That work shows that the degeneracy between pressure intensity, size and distance is broken when simultaneous wind data with enough quality is available. Previous meterological instruments on the surface of Mars have not been able to measure these parameters together with enough precision and temporal sampling. However, the new Mars Environmental Dynamics Analyzer MEDA instrument on the Mars 2020 mission will be able to obtain such data.

**Dust devil toy model:** We have developed a similar model to the one developed in [6]. This heuristic model takes into account the trajectory of the dust devil, its defining parameters such as its size and intensity and can be considered as a toy model simple enough to launch tens of thousands of simulations covering a large space of parameters for possible dust devils. Different analytical models of convective vortices can be tested too from Lorentzian profiles of the pressure drops to other relations between the pressure drop radial profile and the vortex circulation.

**REMS data:** In a previous work [5] we examined pressure data obtained by the REMS instrument on the Mars Science Laboratory and characterized more than 1000 pressure drops of 0.5 to 4.3 Pa in the surface of Mars. This data provides a sample large enough to compute statistics. Although no wind data is available for these vortices they can be compared with our database of synthetic dust devils based on [6]. A systematic exploration of the space of parameters that best fit the REMS observations will be presented. We also develop the techniques to make similar comparisons with future MEDA data that will also include wind intensity and direction and we explore the accuracy and temporal sampling required to determine dust devil properties from MEDA measurements.

**Conclusion:** We hope that this preparatory work will allow a quick analysis of dust devils to be found in the context of the Mars 2020 mission.

**References:**

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