EPSC Abstracts
Vol. 13, EPSC-DPS2019-1141-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Probing Active Dust Devils with an Instrumented Drone

Brian Jackson (1), Ralph Lorenz (2) and Michelle Szurgot (3)
(1) Boise State University, Department of Physics, Boise, United States (bjackson@boisestate.edu)

(2) Applied Physics Lab, Johns Hopkins University, Columbia, United States (Ralph.Lorenz@jhuapl.edu)

(3) Boise State University, Department of Physics, Boise, United States (michelleszurgot@u.boisestate.edu)

Abstract

Dust devils are low-pressure, dry convective vortices powered by surface heating and rendered visible by dust. They occur in arid climates on Earth but ubiquitously on Mars, where they may dominate the supply of background haze. The radiative effects of dust contributes tens of Kelvin of heating to the martian atmosphere, and so dust devils probably play an important role in Mars' climate. The dust-lifting capacity of a devil depends sensitively on its structure, particularly the wind and pressure profiles, but the exact dependencies are poorly constrained. Thus, the exact contribution to Mars' atmosphere remains unresolved. Moreover, most previous studies of martian dust devils have relied on passive sampling of the profiles via meteorology packages on landed spacecraft. Analog studies of terrestrial devils have employed more active sampling (instrumented vehicles or manned aircraft) but have been limited to near-surface (few meters) or relatively high altitude (hundreds of meters) sampling.

Unmanned aerial vehicles (UAVs) or drones, combined with miniature, digital instrumentation, promise a novel and uniquely powerful platform from which to sample dust devils at a variety of altitudes. Measurements made aloft are more directly relevant for evaluating the dust that is injected into the atmosphere since surface observations may also have a transient contribution from the sand skirt. Further, the near-surface windfield has a complex corner flow with a radial inflow component being directed upwards. Such measurements complement surface results by exploring the two-dimensional vortex structure away from the ground.

In this presentation, we will describe our ongoing work to probe active dust devils on a playa in southeastern Oregon on the Alvord Desert using an instrumented quadcopter. We will also discuss our work characterizing the micro-meteorological environment to explore the relationships between, for example, the near-surface atmospheric lapse rate, which influences boundary convective instability, and dust devil occurrence rates. We will present results from encounters with active dust devils, including footage collected onboard the drone from inside the dusty vortices.

1. Figures

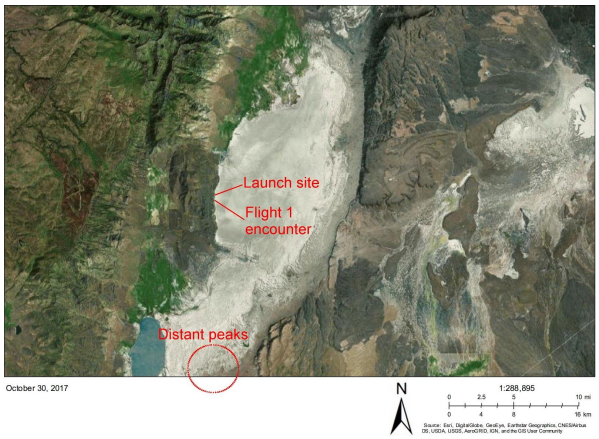

Figure 1: Landsat image of Alvord Desert, courtesy of NASA Goddard Space Flight Center and the U.S. Geological Survey. From [1].

Acknowledgements

The authors gratefully acknowledge from the Office of Idaho Water Resources for supporting our field work. This research is funded by a grant from NASA's Solar System Workings program.

References

[1] Jackson, B. et al. (2018) *Remote Sensing*, 10, 65.