

Nicholas G. Heavens (Space Science Institute, London, United Kingdom)

Employment History

Research Scientist, Space Science Institute, 2019–present
Research Assistant Professor of Planetary Science, Department of Atmospheric and Planetary Science, Hampton University, 2012–2019
Postdoctoral Research Associate (Dr. Natalie M. Mahowald), Department of Earth and Atmospheric Sciences, Cornell University, 2010–2012
Graduate Research/Teaching Assistant (Drs. Mark I. Richardson and Yuk L. Yung), Division of Geological and Planetary Sciences, California Institute of Technology, 2005–2010

Academic Degrees

Ph.D., Planetary Science, California Institute of Technology Thesis: <i>The Impact of Mesoscale Processes on the Atmospheric Circulation of Mars</i>	2010
M.S., Planetary Science, California Institute of Technology	2007
S.B., Geophysical Sciences (Honors), The University of Chicago Thesis: <i>Climatology of Heat and Moisture Transport in the Lower Troposphere of the Red Sea</i>	2005

Narrative of Research Experience

My research focuses on modern Martian meteorology and late Paleozoic climate. My work and the work of my collaborators has transformed our understanding of the Mars system: from a desert with random disorganized dust storms slowly and steadily leaking water into space, to a dynamic planet where dust storms are convectively organized weather systems that couple the lower and middle atmosphere to the escape of constituents from the upper atmosphere. In addition, my Earth work has yielded the first global reconstructions of the Earth's dust cycle in deep time, the strongest evidence for the iron fertilization hypothesis in deep time, and the standard aerosol parameterization approach currently used by deep time model intercomparison projects.

Key Publications

Heavens, N.G., A. Pankine, J.M. Battalio, C. Wright, D.M. Kass, A. Kleinböhl, S. Piqueux, J.T. Schofield, 2022, Mars Climate Sounder Observations of Gravity-Wave Activity throughout Mars' Lower Atmosphere, *Planetary Science Journal*, **3**, 57, doi: 10.3847/PSJ/ac51ce.

Heavens, N.G., D.M. Kass, A. Kleinböhl, and J.T. Schofield, 2020, A Multiannual Record of Gravity Wave Activity in Mars's Lower Atmosphere from On-Planet Observations by the Mars Climate Sounder, *Icarus*, **341**, 113630, doi: 10.1016/j.icarus.2020.113630.

Sardar Abadi, M., J. Owens, X. Liu, T. Them II, X. Cui, **N.G. Heavens**, and G. Soreghan, 2020, Atmospheric Dust Stimulated Marine Primary Productivity During Earth's Penultimate Icehouse, *Geology*, **48**, 247-251, doi:10.1130/G46977.1

Heavens, N.G., D.M. Kass, J.H. Shirley, S. Piqueux, and B.A. Cantor, 2019, An Observational Overview of Dusty Deep Convection in Martian Dust Storms, *J. Atmos. Sci.*, **76** (11), 3299-3326, doi: 10.1175/JAS-D-19-0042.1

Heavens, N.G., A. Kleinböhl, M.S. Chaffin, J.S. Halekas, D.M. Kass, P.O. Hayne, D.J. McCleese, S. Piqueux, J.H. Shirley, and J.T. Schofield, 2018, Hydrogen escape from Mars enhanced by deep convection in dust storms, *Nature Astron.*, **2**, 126–132, doi: 10.1038/s41550-017-0353-4.

Heavens, N.G., 2017, Textured Dust Storm Activity in Northeast Amazonis–Southwest Arcadia, Mars: Phenomenology and Dynamical Interpretation, *J. Atmos. Sci.*, **74** (4), 1011–1037, doi:10.1175/JAS-D-16-0.211.1.

Marshall, C., D.J. Large, and **N.G. Heavens**, 2016, Coal derived rates of atmospheric dust deposition during the Permian, *Gondwana Research*, **31**, 20–29, doi:10.1016/j.gr.2015.10.002.

Heavens, N.G., C.A. Shields, and N.M. Mahowald, 2012, A paleogeographic approach to aerosol prescription in simulations of deep time climate, *J. Adv. Model. Earth Syst.*, **4**, M11002, doi:10.1029/2012MS000166.

Honors

2021: Outstanding Public Outreach Award, Space Science Institute

2021: 2020 Editors' Citation for Excellence in Refereeing for *JGR-Planets*

2020: NASA PMCS, *MOSAIC: Mars Orbiters for Surface-Atmosphere-Ionosphere Connections*, *NASA Planetary Mission Concept Studies*, \$150k, Co-I

2019: NASA MDAP, *Improved Climatology of Lower and Middle Atmospheric Gravity Wave Activity at Mars*, \$552k, PI

2019: NSF Sedimentary Geology and Paleobiology- *Equatorial Glaciation and Landscape Burial in the Late Paleozoic: Implications for Pangaeon Climate and Tectonics*, \$156k, Non-Lead PI

2015: NASA NEXSS, *The Living, Breathing Planet*, \$3.8M, Co-I

2015: NASA SSW, *Modeling Dust Injection and Vertical Mixing for the Next Generation of Martian Exploration*, \$431k, PI

2014: NSF HBCU RISE, *Hampton University: Advanced Physical Modeling and Simulation for 21st Century Scientists*, \$999k, Co-PI

2014: NASA MDAP, *The Structural and Dynamical Role of Deep Convection in Martian Dust Storms*, \$500k, PI

2013: NSF Sedimentary Geology and Paleobiology- *Investigating the Biotic and Paleoclimatic Consequences of Dust in the Late Paleozoic*, \$174k, Non-Lead PI

2010, 2011: NASA Group Achievement Award for the Mars Climate Sounder Team

2010: First Prize, American Meteorological Society Applied Meteorology and Climatology Student Presentation Competition

Professional Society Memberships

American Geophysical Union (Member); Division for Planetary Sciences, American Astronomical Society (Affiliate Member); Royal Astronomical Society (Fellow); Geological Society of London (Fellow); Royal Meteorological Society (Fellow); European Astronomical Society (Member); Burgon Society (Fellow)