Overview of first atmospheric results from InSight

Conference or Workshop Item

Geophysical Research Abstracts
Vol. 21, EGU2019-11612-2, 2019
EGU General Assembly 2019

Overview of First Atmospheric Results from InSight

Aymeric Spiga (1), Don Banfield (2), Claire Newman (3), Ralph Lorenz (4), François Forget (1), Daniel Viudez-Moreira (5), Jorge Pla-Garcia (5), Mark Lemmon (6), Nick Teanby (7), Naomi Murdoch (8), Raphaël Garcia (8), Philippe Lognonné (9), Balthasar Kenda (9), David Mimoun (8), Ozgur Karatekin (10), Stephen Lewis (11), William T. Pike (12), Nils Mueller (13), Ehouarn Millour (1), Bruce Banerdt (14), and the TWINS and InSight teams

(1) Laboratoire de Météorologie Dynamique (LMD), Sorbonne Université, Centre National de la Recherche Scientifique, Paris, France (spiga@lmd.jussieu.fr), (2) Cornell Center for Astrophysics and Planetary Science, Cornell University, Ithaca, NY, USA, (3) Aeolis Research, Pasadena, CA, USA, (4) Johns Hopkins University Applied Physics Lab, Laurel, MD, USA, (5) Centro de Astrobiologia (CAB), Madrid, Spain, (6) Space Science Institute, USA, (7) University of Bristol, United Kingdom, (8) Institut Superieur de l'Aeronautique et de l'Espace (ISAE), Toulouse, France, (9) Institut de Physique du Globe de Paris (IPGP), France, (10) Royal Observatory of Belgium, Brussels, Belgium, (11) Open University, Milton Keynes, United Kingdom, (12) Imperial College, London, United Kingdom, (13) DLR Institute of Planetary Research, Berlin, Germany, (14) Jet Propulsion Laboratory, Pasadena, CA, USA

The InSight spacecraft landed in the flat regions of Elysium Planitia on November 26th 2018. The instruments on board InSight make it capable of acting as a meteorological station at the surface of Mars. A pressure sensor (PS), two temperature and wind sensor booms (TWINS), along with the InSight FluxGate (IFG) magnetometer, form the Auxiliary Sensor Payload Suite (APSS). This is complemented by capabilities to measure surface brightness temperature by the radiometer in the Heat-Flow and Physical Properties Package (HP3) suite, to explore the impact of atmospheric processes on seismic measurements by SEIS, and to use InSight cameras to estimate atmospheric opacity (notably caused by suspended dust particles) and other atmospheric phenomena such as clouds and dust devils. We will discuss results drawn from atmospheric measurements on board InSight over the first two months of operation, highlighting new perspectives permitted by the high-frequency, continuous nature of the InSight acquisitions. Surface pressure measurements record global-to-local atmospheric phenomena: CO_2 condensation (annual), dust cycle and storms (seasonal), baroclinic waves (weekly), thermal tides (daily), gravity waves (thousands of seconds), convective cells (hundreds of seconds), convective vortices (tens of seconds, leading to dust devils if dust particles are transported in the vortex). Two main large-scale wind regimes were expected from Global Climate Modeling at the InSight landing site during a typical year: towards the northwest in northern spring and summer, then in the opposite direction in southern summer. Existing in-situ measurements on Mars and Large-Eddy Simulations indicate that daytime convective vortices and cells not only impact pressure, but also temperature and winds; the nighttime atmosphere on Mars is comparatively much less turbulent and dominated by shear-driven turbulence, in contrast to the buoyancy-driven turbulence active in daytime. All such existing measurements and model predictions will be compared and challenged with InSight measurements. Seismic signatures associated with atmospheric phenomena will also be discussed, with a particular emphasis on the knowledge gained by the unprecedented measurements performed by InSight's seismometers.