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Quantification of wind flow in the European Mars Simulation Wind Tunnel Facility

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We present the European Mars Simulation Wind Tunnel facility, a unique prototype facility capable of simulating a wide range of environmental conditions, such as those which can be found at the surface of Earth or Mars. The chamber complements several other large-scale simulation facilities at Aarhus University, Denmark.

The facility consists of a 50 m^3 environmental chamber capable of operating at low pressure (0.02 - 1000 mbar) and cryogenic temperatures (-130 °C up to +60 °C). This chamber houses a re-circulating wind tunnel capable of generating wind speeds up to 25 m/s and has a dust injection system that can produce suspended particulates (aerosols). It employs a unique LED based optical illumination system (solar simulator) and an advanced network based control system.
Laser based optoelectronic instrumentation is used to quantify and monitor wind flow, dust suspension and deposition. This involves a commercial Laser Doppler Anemometer (LDA) and a Particle Dynamics Analysis receiver (PDA), which are small laser based instruments specifically designed for measuring wind speed and sizes of particles situated in a wind flow. Wind flow calibrations will be performed with the LDA system and presented. Pressure and temperature calibrations will follow in order to enable the facility to be used for the testing, development, calibration and comparison of e.g. meteorological sensors under a wide range of environmental conditions as well as multi-disciplinary scientific studies.

The wind tunnel is accessible to international collaborators and space agencies for instrument testing, calibration and qualification. It has been financed by the European Space Agency (ESA) as well as the Aarhus University Science Faculty and the Villum Kann Rasmussen Foundation.