Geophysical Research Abstracts,
Vol. 11, EGU2009-6649-4, 2009
EGU General Assembly 2009

Preliminary Results of Simulations and Field Investigations of the Performance of the WISDOM GPR of the ExoMars Rover

V. Ciarletti (1), C Corbel (1), P Cais (2), D Pltettemeier (3), S.E. Hamran (4), M Oyan (4), S Clifford (5), and A Reineix (6)

(1) CETP/IPSL, Velizy, France (ciarletti@cetp.ipsl.fr), (2) Laboratoire d'Astrophysique de Bordeaux, France, (3) Technische Universität Dresden, Germanyn, (4) Forsvaret forskningsinstitutt, Kjeller, Norway , (5) Lunar and Planetary Institute, Houston,USA, (6) XLIM Limoges, France

WISDOM (Water Ice and Subsurface Deposit Observations on Mars) is a ground penetrat-ing radar (GPR) that was selected as one of three survey instruments on the ExoMars Rover Pasteur Payload. Its purpose is to characterize the nature of the shallow subsurface (including geological structure, electromagnetic properties, and potential hydrological state) and identify the most promising locations for investigation and sampling by the Rover's on-board drill - providing information down to a depth of 2 or 3 meters with a vertical resolution of a few centimeters (performance characteristics that will vary, depending on the local permittivity and conductivity of the subsurface).

WISDOM is a polarimetric, step-frequency GPR operating over the frequency range of 0.5 - 3 GHz. The polarimetric capability of WISDOM is particularly useful for identifying and characterizing oriented structures like faults, fractures and stratigraphic interface roughness. To achieve this objective, special care has been dedicated to the design of the antenna system, which consists of a pair of Vivaldi antenna to conduct both co- and cross-polar measurements.

WISDOM will perform its scientific investigations at each of the sites visited by the Rover and during the intervening traverses. During a traverse between two successive experiment cycles of the mission (drilling and sample analysis), WISDOM soundings will be performed to provide a coarse survey of the structure and nature of the underground and its large-scale variations. This information is required to understand the overall geological context and the properties of the subsurface. When a particular location has been selected for potential investigation by the drill, WISDOM will obtain subsurface profiles on a 2D grid, in order to synthesize a 3D map of subsurface soil characteristics and spatial variabil-ity. Full polarimetric soundings will be performed at 10 cm intervals along each parallel grid line, which will have a line-to-line spacing of 100cm. The typical grid-size for this 3D characterization is 5 m x 5 m.

FDTD electromagntic simulations have been run on realistic Martian subsurface models to investigate the likely performances of the instrument once on Mars. In additiona, experi-mental field data was acquired during a 2008 mission to Svalabard, where the performance of the instrument in a permafrost environment was demon-strated. The results of that inves-tigation showed that WISDOM is capable of obtaining accurate data to depths in excess of 2-3 meters in ice-rich environments – successfully soundings through sediment layers, ice, and even into the underlying moraine, with sufficient spatial resolution to identify fine-scale layering within the intervening ice. Further results of these investigations will be presented at the meeting.