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WISDOM Antenna Pattern in the presence of Rover and Soil

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The WISDOM ground-penetrating radar aboard the 2022 ESA-Roscosmos Rosalind-Franklin ExoMars Rover will probe the shallow subsurface of Oxia Planum using electromagnetic waves. A dual-polarized broadband antenna assembly transmits the WISDOM signal into the Martian subsurface and receives the return signal. This antenna assembly has been extensively tested and characterized w.r.t. the most significant antenna parameters (gain, pattern, matching). However, during the design phase, these parameters were simulated or measured without the environment, i.e., in the absence of other objects like brackets, rover vehicle, or soil. Some measurements of the rover's influence on the WISDOM data were performed during the instrument's integration.

It was shown that the rover structure and close surroundings in the near-field region of the WISDOM antenna assembly have a significant impact on the WISDOM signal and sounding performance. Hence, it is essential to include the simulations' environment, especially with varying surface and underground.

With this contribution, we outline the influences of rover and ground on the antenna's pattern and particularly on the footprint. We employ a 3D field solver with a complete system model above different soil types, i.e., subsurface materials with various combinations of permittivity and conductivity.