



Mars Ionosphere preliminary impact analysis on SHARAD radar signal

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SHARAD is the sub-surface sounding radar provided by the Italian Space Agency (ASI) as a facility instrument to NASA's 2005 Mars Reconnaissance Orbiter (MRO). SHARAD is a wideband low-frequency nadir-looking pulse limited radar sounder transmitting at a centre frequency of 20 MHz within 15-25 MHz spectral range. The transmitted waveform is a 10 MHz bandwidth chirp linearly modulated in frequency. The transmitted pulse bandwidth provides a theoretical range resolution of 15 m in free space propagation. Horizontal resolution is 300-1000 m along-track, and is achieved by means of a focused synthetic aperture processing. Horizontal resolution across-track is 1500-8000 m, depending on spacecraft altitude and terrain roughness.

SHARAD has been launched on August '05 and has started its nominal observation phase since November '06.

The primary objective of the SHARAD investigation is to map, in selected locales, dielectric interfaces to depths of up to one kilometer in the Martian subsurface and to interpret these interfaces in terms of the occurrence and distribution of expected materials, including rock, regolith, water, and ice.

The need to penetrate martian surface requires radar operation at a MHz frequency regime which make ionospheric distortions unavoidable. This will result in a signal phase distortion across the spectrum of the received radar pulses which may cause severe degradation of the instrument performances in term of SNR and pulse spreading

and therefore in sub-surface interface resolving capabilities.

This paper will quantify the impact of Mars ionosphere on the radar signal making use of Phase Gradient Autofocusing algorithms to estimate range-independent phase error functions (PEFs) which are due to the unknown components. Preliminary results will be presented using SHARAD first data.