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Understanding Subsurface Geoelectrical and Structural Constrains for Low Frequency Radar Sounding of Jovian Satellites

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Thermally stable Ice sheets on earth are known to be among the most favorable geophysical contexts for deep subsurface sounding radars. Penetrations ranging from few to several hundreds of meters have been observed at 10 to 60 MHz when sounding homogenous and pure ice sheets in Antarctica and in Alaskan glaciers. Unlike the terrestrial case, ice sheets on Jovian satellites are older formations with a more complex matrix of mineral inclusions with an even three dimensional distribution on the surface and subsurface that is yet to be understood in order to quantify its effect on the dielectric attenuation at the experiment sounding frequencies. Moreover, ridges, tectonic and shock features, may results in a complex and heterogeneous subsurface structure that can induce scattering attenuation with different amplitudes depending on the subsurface heterogeneity levels. Such attenuation phenomena's has to be accounted in the instrument design and future data analysis in order to optimize the science return, reduce mission risk and define proper operation modes. In order to address those challenges in the current performance studies and instrument design of the proposed radar sounding experiments, we present an attempt to quantify both the dielectric and scattering losses on both icy satellites, Ganymede and Europa, based on experimental dielectric characterization of relevant icy-dust mixtures samples, field work from analog environment and radar propagation simulations in parametric subsurface geophysical models representing potential geological scenarios of the two Jovian satellites. Our preliminary results suggest that the use of a dual band radar enable to overcome several of these constrains and reduces ambiguities associated subsurface interface mapping.

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