Despite several past and present missions to Mars, very little information is available on its subsurface outside of its polar caps and its very superficial layer. One of the scientific objectives of the European ExoMars mission (ESA) is to characterize the water/geochemical environment as a function of depth and investigate the planet subsurface to better understand the evolution and habitability of the planet. The electromagnetic survey of the Sub Surface will provide a complementary way to probe the subsurface and look for potential deep liquid water reservoirs. The LATMOS is currently developing, a ground penetrating radar (GPR) called EISS (Electromagnetic Investigation of the Sub Surface), developed in the frame of the ESA’s ExoMars mission, initially planned (with 2 stations on Mars).

The main objective of this radar is to perform multi-static soundings of the subsurface: the long loaded dipole antennas will allow to perform successive soundings that can be subsequently analyzed to get a 3D description of the subsurface. The EISS survey is done with a high frequency (HF) antenna: 100kHz-5MHz for relatively high spatial resolution. The antenna is a long loaded dipole, 30meters long to transmit (and also receive in mono-static mode) the signal.

The second step is to develop advanced numerical tools for the retrieval of the subsurface parameters from the received data. Electromagnetic simulations have been performed to optimize the value of this angle based on its impact on the radiation pattern of the two monopoles and the best position is $\text{ant}=225^\circ$. The probability to encounter an attenuation is around 0.2% on one or two of the components are null, while the other angle value ($\theta=90^\circ$) is null while it's around 10% for the configurations whose the angle is less ($\theta=180-195-210^\circ$) and 16% for one monopole configuration. The best configuration would be the $\theta=90^\circ$ configuration, where the angle of the inclined layer in the $x_0z$ plane relative to the horizontal, $\gamma$, is not observed for different subsurface configurations. The direct model used is an analytical one based on ray tracing.

The EISS radar is a ground penetrating radar (GPR) operating at HF frequencies (~2-4MHz) in order to perform deep soundings of the subsurface down to kilometric depth, with a wide bandwidth (100kHz-5MHz) for relatively good spatial resolution. The antenna is a long loaded dipole, 30meters long to transmit (and also receive in mono-static mode) the signal.

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