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FOCUS ON THE ITALIAN P-BAND AIRBORNE RADAR: CURRENT PERFORMANCE AND
FUTURE PERSPECTIVES

Abstract

The use of penetrating radar (in the VHF e UHF bands, at frequencies below 1 GHz usually known as P-Band) from a planetary orbit it is nowadays a well proven technique: in 2005 the Italian experiment MARSIS, embarked on Mars Express mission, has shown the potential of a radar Sounder. On a planet like Mars, where the soil contains a low amount of moisture, the penetration is generally higher than those achievable on Earth at the same frequencies. On Earth, Ground Penetrating Radars are used for applications such as locating buried pipes and archaeological surveys but the results are very limited for subsurface mapping of large areas, or non-accessible regions. The use of airborne platforms appears to be very promising for Earth applications: helicopters, as example, may fly at different altitudes and allow multiple crossed passages over selected areas, increasing the capacity of identifying features in the underground. Selection of the radar central frequency, bandwidth and pulse duration is the most critical aspect in the design of Sounding and SAR radars with respect to their scientific, civilian and military application goals. In this context, the Italian Space Agency recently promoted and supported the development of a new multi-mode and multi-band airborne radar penetrating system in P-band. The developed hardware is composed by a Sounder module at 163MHz and a Synthetic Aperture Radar module at 450MHz (Low frequency) and 900MHz (High frequency). The combined use of low frequency, high bandwidth and different polarization can guarantee various applications, ranging from biomass evaluation, archaeological and geological exploration, deforestation and agriculture monitoring and detection of buried targets. The system is compact and lightweight and allows a real-time switching between Sounder and SAR mode; several tests have been carried out installing the radar on helicopters and new processing algorithms permit to obtain high-resolution images. The data analysis performed during the test campaigns shows the potentiality of the system and suggests several improvements on the system to enhance results. An upgrade of the system, including among others the full polarization and the increasing of the Tx band, is on-going. The SAR is considered as a proof-of-concept for future dedicated spaceborne missions. In this paper we report the results achieved so far, showing the best performance reached by this system. A focus on the best areas of application in which this system can operate is shown and the new performance reached by the upgraded system is included.