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Reconstructing the propagation of Whistlers observed in ELF during ASM burst sessions from the lightning strikes to their detection and validation of IRI model

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New sessions of burst-mode acquisition of the Absolute Scalar Magnetometers (ASM) onboard Swarm satellites have been conducted during 2019 , with the aim of acquiring events covering various geophysical conditions, in terms of geomagnetic latitude, spacecraft Local Time and season, to better understand the conditions under which the ELF component of whistlers is excited and can be detected at satellite altitude and to provide an additional ionospheric monitoring.

Among all candidate events detected using an automatic algorithm specifically designed for that purpose, a selection of remarkable whistler events have been further studied. Firstly, from the estimation of the whistler dispersions, the origin times of the lightning discharge have been estimated and validated with ground data from the World ELF Radiolocation Array (WERA), providing the locations of the lightning strikes and their intensity in the ELF spectral band. These locations have also been validated using data from the World Wide Lightning Location Network (WWLLN) providing measurements.

Subsequently, to reconstruct the propagation path inside the ionosphere of the ELF component of the whistler, a dedicated ray-tracing algorithm has been designed. It uses a background ionosphere model of electron and ions based on the International Reference Ionosphere. For the purposes of producing a ionospheric representation as close as possible to the experimental conditions, the update of the main ionospheric parameters based on worldwide ionosonde data IRTAM has been applied, validating it by using ionosonde data available in the vicinity of specific whistler events. The in-situ electron density measurements of the Electric Field Instrument (EFI) of Swarm satellite have also been used to constrain the model in the topside ionosphere.

We present the recent results obtained during some of these burst sessions, and discuss the possibility offered by this new dataset to validate global ionospheric models and provide a new avenue in ionospheric research, that could be also pursued by the NanoMagSat mission.

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