Improving Signal-to-Noise Ratio in Oblique Ionosonde Soundings Using New Hardware Capability of the DPS4D Ionosonde

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1 Extended Abstract

Travelling Ionospheric Disturbances (TIDs) are ionospheric signatures of atmospheric gravity waves. They can result from a variety of natural or artificial sources. Their identification and tracking is important because the TIDs affect all services that rely on predictable ionospheric radio wave propagation. An operational system for detecting TIDs using the exploitation of the European network of high precision DPS4D ionosondes has recently been developed and implemented [1], see Figure 1 (left). This system is based on the Frequency-Angular Sounding method [2], which uses data obtained from Digisonde-to-Digisonde oblique, single frequency soundings to derive various characteristics of TIDs, see Figure 1 (middle).

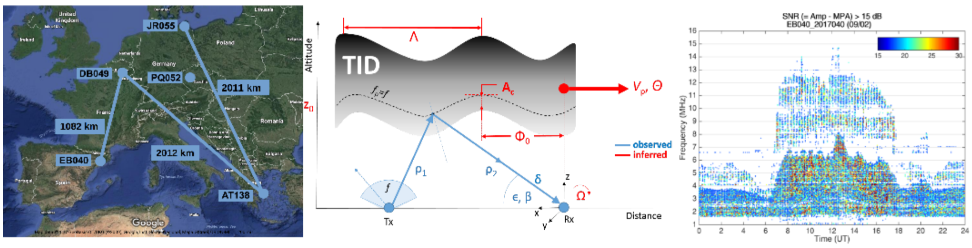

Figure 1. The Net-TIDE network for TID detection using European Digisondes (left); illustration of the FAS technique (middle); and the typical daily pattern of SNR variations for different frequencies measured in Ebre (right).

Improving the signal-to-noise ratio (SNR) of the data obtained from oblique ionosonde soundings is a key factor in the further development of operational systems using such data. This is especially of concern for oblique soundings on long distances [3]. We use here the example of soundings between Dourbes and Ebre (ground distance 1082 km). The right panel of Figure 1 shows the diurnal SNR variations measured in Ebre, with tboth vertical echoes and oblique signals from Dourbes visible. New transmitter cards have been developed for the DPS4D digital ionosonde and have been installed at different European observatories. This new hardware provides a new capability of using longer pulse soundings in order to improve the SNR in long-distance oblique operations. We present the results of a study comparing the results of long-pulse soundings to those obtained with the traditional settings, so ass to validate the new capacity and quantify the improvements.

References

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[3] T.G.W. Verhulst, D. Altadill, J. Mielich, et al., "Vertical and oblique HF sounding with a network of synchronized ionosondes," *Advances in Space Research* **60**, 8, October 2017, pp. 1797–1806, doi:10.1016/j.asr.2017.06.033.