

Effects on GNSS from heating using the Arecibo HF facility

Poppy L. Martin, Natasha K. Jackson-Booth, Tom A. Leonard and John A. McGraghan
QinetiQ, Malvern, Worcs, WR14 3PS, UK, plmartin@qinetiq.com

The spatial and temporal variation of the Earth's ionosphere is affected by many solar and terrestrial influences, causing disturbances which impact the operation of radio systems for modern communication and navigation. Whilst a number of these disturbances are caused by natural phenomena such as hurricanes, earthquakes and solar storms, small regions of the ionosphere can also be temporarily altered by Artificial Ionospheric Modification (AIM). AIM can be achieved through injecting the ionosphere with aerosols, chemicals or radio signals and the effects of the modification can be detected through the deployment of sensors. These sensors include ground-based High-Frequency (HF) sounders, providing measurements of the bottom-side of the ionosphere, and dual-band Global Navigation Satellite System (GNSS) receivers. GNSS receivers can be used to provide a range of information about the ionosphere, including the occurrence of scintillation and Travelling Ionospheric Disturbances (TIDs).

The Heating EXperiment (HEX), which took place at the Arecibo facility in Puerto Rico in March and May 2017, was designed to further our understanding of the phenomena caused by artificially heating a small region of the ionosphere. A HF measurement experiment spread between Texas and Trinidad was deployed, and a small-scale TID detection network was set up near the heater. The TID network comprised three GNSS receivers along baselines of approximately 4 km, located 20 km north of the heater. This paper concentrates on the results from the GNSS receivers during the campaign. Observations of scintillation and TIDs will be discussed.