



Initial results from the Arecibo Heating EXperiment (HEX)

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1. Extended Abstract

Modern navigational and communication systems that penetrate or reflect off the ionosphere are highly reliant on the stability of the propagation environment. Terrestrial (e.g. hurricanes and earthquakes) and solar phenomena can generate travelling ionospheric disturbances (TIDs) which can degrade these RF systems. TIDs can also be caused through deliberate modification of the ionosphere.

Artificial Ionospheric Modification (AIM) attempts to disturb a small region of the ionosphere in order to alter the RF propagation environment. It can be achieved through injecting the ionosphere with aerosols, chemicals or radio signals. The effects of any such modification can be detected through the deployment of sensors, including ground based high frequency (HF) sounders and dual-band GPS receivers. The latter, offer a convenient means of obtaining information about the ionosphere, including ionospheric disturbances through changes in the derived Total Electron Content (TEC) information.

The Heating EXperiment (HEX), scheduled to take place in March 2017, was designed to help further our understanding of the effects of heating the ionosphere on both HF and GPS. HEX utilized the Arecibo heating facility in Puerto Rico and deployed a network of HF transmitters and receivers and a small scale TID analysis network.

The TID network comprised three GPS receivers along baselines of approximately 4 km, located 20 km north of the heater. Whilst the HF network had various links spread over a maximum baseline of approximately 3500 km.

Applying a previously tested approach [1] based on ideas from Synthetic Aperture Radar (SAR) the recorded GPS data could be used to detect TIDs and estimate their velocities in order to disentangle the naturally occurring TIDs from those generated by the heater. These detected TIDs could also be correlated to the HF sounder results. This paper will present initial findings from the experiment.

4. References

1. R. W. Penney and N. K. Jackson-Booth "Mitigation of satellite motion in GPS monitoring of traveling ionospheric disturbances," *Radio Science* **50**, 11, 2015, pp1150-1164, doi:10.1002/2015RS005767