

## **E-REGION HF EXPERIMENTS AT ARECIBO OBSERVATORY**

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The new Arecibo Observatory – HF facility started operations in 2015. Although the site was hit by hurricane Maria on September 2017, the damages are minimum and it is fully operational. It has a maximum transmitted power of 600kW, with center frequencies at 5.125 MHz and 8.175 MHz. The 8.175 (5.125) MHz band frequency has a gain of 25.5 (22) dB and HPBW of 8.5 (13) degrees. The effects of the HF experiments in the ionosphere are being observed with the Arecibo incoherent scatter radar (ISR). The ISR has height resolution of 300 m. and allows observations from altitudes ~95 km to the topside ionosphere.

This paper shows extraordinary examples of artificial ionization at E-region heights and the role of sporadic E layers when the HF is targeting the F-region. Artificial field-aligned irregularities (AFAIS) at altitudes near 100 km have been possible at high latitudes due to low HF frequencies. For the frequencies available at Arecibo, this kind of observations seemed elusive. However, strong natural ionization had made possible to create artificially enhanced plasma layers at these heights. This paper presents cases of E-region enhanced plasma lines. The data shows exceptional modifications of the ionosphere that range from creating artificial cavities and layers, induced irregularities, substantial variations in temperature profiles to enhanced ion and plasma densities. Also, the paper shows evidence of the interaction between the sporadic E and F-region when performing HF experiments. A theory of a correlation between the two layers due to different conductivities is explored to illustrate how the enhancement of irregularities is produced and maintained over time. A case of strong artificially induced irregularities formed at F-region heights when Sporadic E-layer is present is shown to support the theory.