# Space Based Synthetic Aperture Radar Measurements of a Corner Reflector on Ascension Island – First Results from PALSAR-2

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Trans-ionospheric signals can be degraded by electron density irregularities in the ionosphere causing signal scintillation, i.e. variations in the signal phase and amplitude. Worldwide measurements of scintillation are typically accomplished using Global Navigation Satellite Systems (GNSS) receivers, but data is sparse both over oceans and deserts where receivers are difficult to deploy and also in the polar regions. These restrictions limit the development of our understanding and our ability to model the ionospheric environment. In contrast, polar orbiting space-based synthetic aperture radar SARs are typically able to provide nearly complete imagery of the Earth's surface including oceans, deserts and polar regions. Given that the SAR images (from L-band and lower frequency systems) are degraded by these same ionospheric irregularities it is reasonable to suppose that ionospheric irregularity and scintillation information can be derived from SAR images.

Variations of signal phase, due to the ionosphere, degrade the along-track point spread function (PSF) of the SAR system, causing the sidelobes to increase and if severe enough can cause complete defocusing of the image. (The PSF of an imaging system characterizes the response of that system to a point target, providing insight into the characteristics of images produced by the imaging system.)

The inverse problem - characterising the ionospheric strength of turbulence, $CkL$ and the spectral slope, $p$, from an image – should be possible if a bright point target can be identified, for example a corner reflector. In order to investigate this, two corner reflectors, which appear as point targets in SAR images, were placed on Ascension Island and one scintillation season (2014-15) of data has been collected.

In this paper we present initial results from images and PSFs produced by the Phased Array L-Band Satellite 2 (PALSAR2), which was launched in 2014, under a variety of ionospheric conditions.