

# COSMIC-2 CAPABILITIES FOR MONITORING IONOSPHERIC SCINTILLATION

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The COSMIC-2 program has demonstrated new methods for monitoring ionospheric scintillation using the radio occultation (RO) technique that provide substantial improvements relative to past ground-based systems that can only provide localized knowledge. COSMIC-2 is able to provide maps of the presence or absence of the ionospheric irregularities that cause scintillation throughout the equatorial region at all longitudes and refresh these maps on time scales that approach the growth rates of the underlying instabilities. The All Clear product, based on 1 Hz Signal-to-Noise Ratio (SNR) occultation observations, indicates which longitude sectors can be confidently stated to be scintillation-free, whereas the Bubble Map product, derived from a combination of 50-100 Hz carrier phase and SNR observations, specifies regions in which irregularities have been detected. Two different irregularity geolocation algorithms underly the Bubble Maps. These algorithms utilize back-propagation techniques to localize irregularities to an accuracy of  $\sim 1^\circ$  in longitude. All of these products and algorithms have been validated by the COSMIC-2 space weather Cal/Val team. In addition, the team has also investigated the possibility of augmenting the Bubble Maps using data from the Ion Velocity Meter (IVM) sensors on the COSMIC-2 spacecraft. IVM measures the in-situ density along the satellite tracks and can be used to localized irregularity regions as long as they extend up to the COSMIC-2 altitude. Important factor enabling the successful COSMIC-2 scintillation capabilities are COSMIC-2's equatorial, low inclination orbits and the program's low data latency. These factors must be considered by future RO sensing programs seeking to replicate or improve upon the COSMIC-2 baseline capability.