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Global Distribution of The Unintended Sources of Radio Frequency Interference

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Ionospheric irregularities/bubbles are one of the earliest known effects of space weather that can change and vary rapidly the phase and amplitude of a radio signal, respectively. The global navigation satellite system (GNSS) signals scintillate with amplitude variations due to ionospheric irregularities. This can interrupt GNSS operations, affecting a wide range of its applications. Recently, using the GNSS receiver onboard COSMIC-2 low-earth-orbit (LEO) satellite constellation, we have identified additional impact from other unintended sources of radio frequency interference (RFI). Since the use of GNSS in civilian applications has added exponentially, understanding the global distribution of the RFI and the nature of the signals emitted from the sources as well as mitigating its effect on GNSS is critically important, particularly to those new applications that are life-critical such as GNSS-aided aviation. In this paper, we have developed a highly sensitive RFI detection algorithm that utilizes variations in the signal to noise ratio (SNR) detected by GNSS receivers onboard COSMIC satellites and identify the time and location of the unintended sources of RFI. Our preliminary study shows that the global distributions of the RFI occurrence is well correlated with regional conflicts and other geopolitical activity.