4th URSI AT-RASC, Gran Canaria, 19-24 May 2024

Space Weather Ionospheric Network Canada

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Space Weather Ionospheric Network Canada (SWINCan) is a pan-Canadian, ground-based remote sensing network that will provide continuous, real-time monitoring of the ionosphere spanning polar, auroral, and sub-auroral regions. SWINCan capitalizes on Canada's geographic expanse and proximity to the northern magnetic pole, which provides a unique natural laboratory for the fundamental study of solar-terrestrial interactions. This network will observe the multi-scale structuring and dynamics of the high-latitude ionosphere with unprecedented detail, providing essential measurements to resolve the internal and geospace coupling processes that drive this complex behaviour. SWINCan will also provide essential input for enhancing three-dimensional empirical modeling capabilities of ionospheric plasma density, and for mitigating the effects of space weather on modern technological systems such as position, navigation, and timing (PNT), radio communication, and over-the-horizon-radar, services critical to social, military, science, and major economic sectors. SWINCan is an expansion and modernization of the Canadian High Arctic Ionospheric Network (CHAIN), operated by the Radio and Space Physics Laboratory (RSPL) at the University of New Brunswick (UNB) and currently one of the world's largest ionospheric observation networks.

SWINCan will deploy 104 state-of-the-art global navigation satellite system (GNSS) receivers and 10 specialized modular ionospheric sounder (MODIS) systems across Canada (Figure 1), adding to the 39 GNSS and 10 ionosonde systems currently installed as part of CHAIN. New SWINCan GNSS receivers include 100 high-rate (100 Hz) ionospheric scintillation and total electron content monitors (GISTMs) that will provide real-time, multi-scale observation of the ionospheric structure and dynamics. Low-cost GNSS systems are also being deployed at a number of high schools in Eastern Canada as part of EclipseNB, an RSPL education outreach and science initiative to foster student interest in STEM disciplines and observe the ionospheric response to the April 8, 2024, solar eclipse. MODIS systems developed by RSPL are next generation, high-frequency (HF) ionospheric sounders, which take advantage of the latest developments in software defined radio and signal processing technology. While providing ionograms and 3D ionospheric drift velocity at a fraction of the cost of current CHAIN ionosondes, MODIS also features scalable coherent timing with nanosecond subsample precision and multi-channel, remote controlled operation. The ionosonde application includes stand-alone and oblique sounding, and permits interdependent experiments with other ground and spaceborne radio systems. The system hardware is designed for operation and maintenance in harsh, remote environments such as the Canadian Arctic.

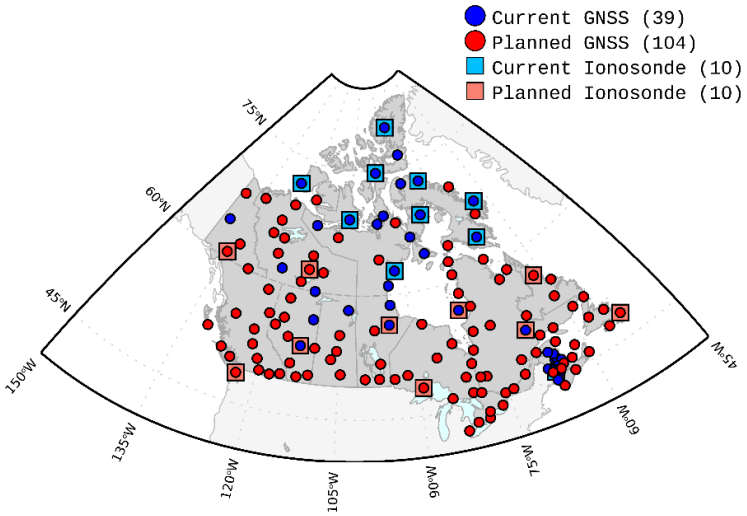

Figure 1. Map of current and planned SWINCan locations