Assimilation Canadian High Arctic Ionospheric Model (A-CHAİM): One year of near real time ionospheric specification

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The Assimilation Canadian High Arctic Ionospheric Model (A-CHAİM) is an operational data assimilation system that provides 3D ionospheric electron density in near real-time [1]. A-CHAİM is hosted at the University of New Brunswick and assimilates all ground and space-borne Global Navigation Satellite System (GNSS), ionosonde, Incoherent Scatter Radar, and altimeter data that is available within 3 hours of real time. The system uses a flavour of auxiliary particle filter to update the nonlinear basis functions of Empirical CHAIM (E-CHAİM) [2,3,4], which is used as the system’s background model, and provides output for all regions above 45°N geomagnetic latitude. The latest version of the system has been operational since March 2021, with prior versions dating back to December 2019.

This study will examine the performance of A-CHAİM over the operating period of its latest release using datasets that are not available in near-real-time (and thereby are not assimilated), including a selection of ionosondes and in situ measurements. We will further examine the performance of the system’s different latency products to assess the effect of progressive data loss and short-term forecast on system performance. Particular focus will be placed on the capacity of the system to represent shorter temporal and spatial scales than the E-CHAİM background model.

An example comparison of the model and observed foF2 amplitude spectra for intermediate time scales is presented in Figure 1. As noted in [5], E-CHAİM has limited capacity to capture ionospheric variability of these intermediate time scales; however, A-CHAİM is capable of substantially recovering the representation of these variations.


Figure 1. Average amplitude of foF2 from ionosondes measurements (black), E-CHAİM (blue) and A-CHAİM (red) at Blissville (45.60N, 66.56E) between March and September, 2021.