Near real-time input to an HF propagation model for nowcasting of HF communications with aircraft on polar routes

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The authors have previously reported on the development of an HF propagation model for signals reflected from the northerly regions of the ionosphere, and its validation by comparison with measurements made over a number of paths within the polar cap, crossing the auroral oval, and along the mid-latitude trough. The model incorporates various features (e.g. convecting patches of enhanced plasma density) of the polar ionosphere that are, in particular, responsible for off-great circle propagation and can lead to propagation at times and frequencies not expected from on-great circle propagation alone. Currently, the model drivers include ionosonde measurements and geomagnetic data from a period of several days spanning the time of interest. We have previously only examined the propagation effects on a historical basis, and have achieved good agreement between measurements and simulations.

There is a need for improved techniques for nowcasting and forecasting (over several hours) HF propagation at northerly latitudes to support airlines operating over the increasingly popular trans-polar routes. This is an area currently being addressed by the assimilation of real-time measurements into the propagation model, including ionosonde measurements to define the background ionosphere and Total Electron Content (TEC) measurements as indicators of the presence and magnitude of polar patches. The effects of D-region absorption in the polar cap and auroral regions is integrated in the model through satellite and ground-based measurements. The model development is supported by the collection of HF propagation measurements over several paths within the polar cap, crossing the auroral oval, and along the mid-latitude trough. The presentation will focus on the recent developments in this area.