Towards an empirical model of HF propagation at high latitudes

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The dependence of HF propagation conditions at low- and mid-latitudes on solar ionisation and geomagnetic activity is reasonably well understood, which has allowed developing robust and reliable phenomenological models used for forecasting purposes. However, the high-latitude ionosphere is much more variable due to the presence of energetic precipitating particles, strong electric fields and irregular patches of enhanced ionisation. As the result, propagation conditions at these latitudes are much more dynamic and complex so that an acceptably accurate forecast is practically unachievable. In order to address this issue, we analysed statistics of HF propagation at auroral and polar latitudes based on data the Super Dual Auroral Radar Network (SuperDARN). While the conventional HF forecasting relies on characteristics derived from certain model representations of both the ionosphere and radiowave propagation mode, the novelty of the present approach is that it is based on the direct observation of the HF propagation characteristics utilising the angle of arrival and other characteristics of the radar echoes so that it bypasses these two additional sources of uncertainty. This approach would also allow using SuperDARN for a near-real-time monitoring ("nowcasting") of the propagation conditions which is vital for a broad range of space weather applications at high latitudes.