



Real-time HF Radio Absorption Maps Incorporating Riometer and Satellite Measurements

Neil Rogers (1), Farideh Honary (1), Mike Warrington (2), Alan Stocker (2), and Donald Danskin (3)

(1) Department of Physics, Lancaster University, Lancaster, United Kingdom. (n.rogers1@lancaster.ac.uk), (2) Department of Engineering, University of Leicester, Leicester, United Kingdom., (3) Geomagnetic Laboratory, Natural Resources Canada, Ottawa, Ontario, Canada.

A real-time model of HF radio propagation conditions is being developed as a service for aircraft communications at high latitudes. An essential component of this is a real-time map of the absorption of HF (3-30 MHz) radio signals in the D-region ionosphere. Empirical, climatological Polar Cap Absorption (PCA) models in common usage cannot account for day-to-day variations in ionospheric composition and are inaccurate during the large changes in recombination rate at twilight. However, parameters of such models may be optimised using an age-weighted regression to absorption measurements from riometers in Canada and Scandinavia. Such parameters include the day- and night-time sensitivity to proton flux as measured on a geostationary satellite (GOES). Modelling the twilight transition as a linear or Gauss error function over a range of solar-zenith angles ($\chi_l < \chi < \chi_u$) is found to provide greater accuracy than 'Earth shadow' methods (as applied in the Sodankylä Ionospheric Chemistry (SIC) model, for example) due to a more gradual ionospheric response for $\chi < 90^\circ$. The fitted χ_l parameter is found to be most variable, with smaller values (as low as 60°) post-sunrise compared with pre-sunset. Correlation coefficients of model parameters between riometers are presented and these provide a means of appropriately weighting individual riometer contributions in an assimilative PCA model.

At times outside of PCA events, the probability of absorption in the auroral zones is related to the energetic electron flux inside the precipitation loss cone, as measured on the polar-orbiting POES satellites. This varies with magnetic local time, magnetic latitude and geomagnetic activity, and its relation to the real-time solar wind – magnetospheric coupling function [Newell *et al.*, 2007] will be presented.

Reference: Newell, P. T., T. Sotirelis, K. Liou, C.-I. Meng, and F. J. Rich (2007), A nearly universal solar wind-magnetosphere coupling function inferred from 10 magnetospheric state variables, *J. Geophys. Res.*, 112, A01206, doi:10.1029/2006JA012015.