What fraction of the outer radiation belt electron flux was lost to the atmosphere during the dropout event on the St Patrick's Day storm of 2015?

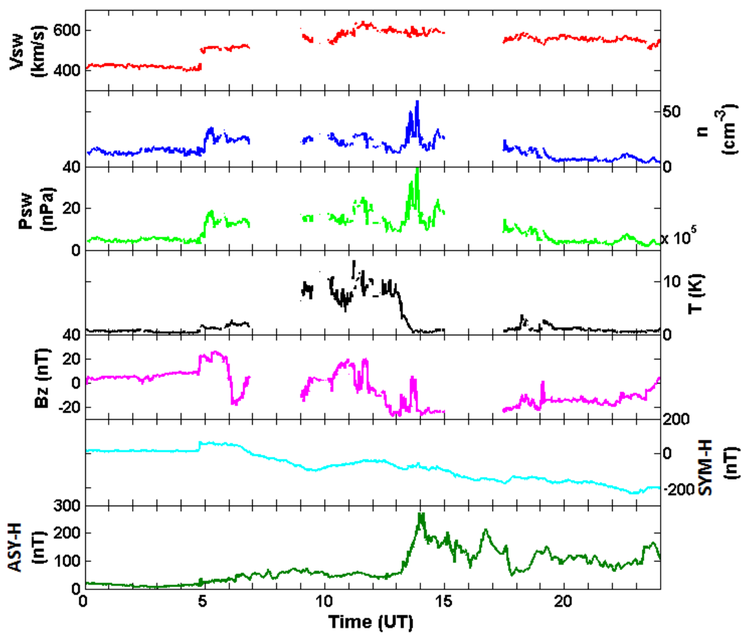
Sneha Gokani[1], Mike Kosch[2,3], Mark Clilverd[4], Craig Rodger[5], Rajesh Singh[6], Ashwini K. Sinha[1], Donald Danskin[7], Steve Marple[3]

[1] Indian Institute of Geomagnetism, New Panvel, Navi Mumbai – 410218, India, [2] South African National Space Agency, Hospital Street, PO Box 32, Hermanus, 7200, South Africa, [3] Department of Physics, Lancaster University, Lancaster, LA1 4YB, UK, [4] British Antarctic Survey, High Cross, Madingley Road, CAMBRIDGE, CB3 0ET, [5] Department of Physics, University of Otago, PO Box 56, Dunedin 9054, New Zealand, [6] Dr. KSK Geomagnetic Research Laboratory, IIG, Jhunsi, Allahabad – 221505, India, [7] Natural Resources Canada, Canada

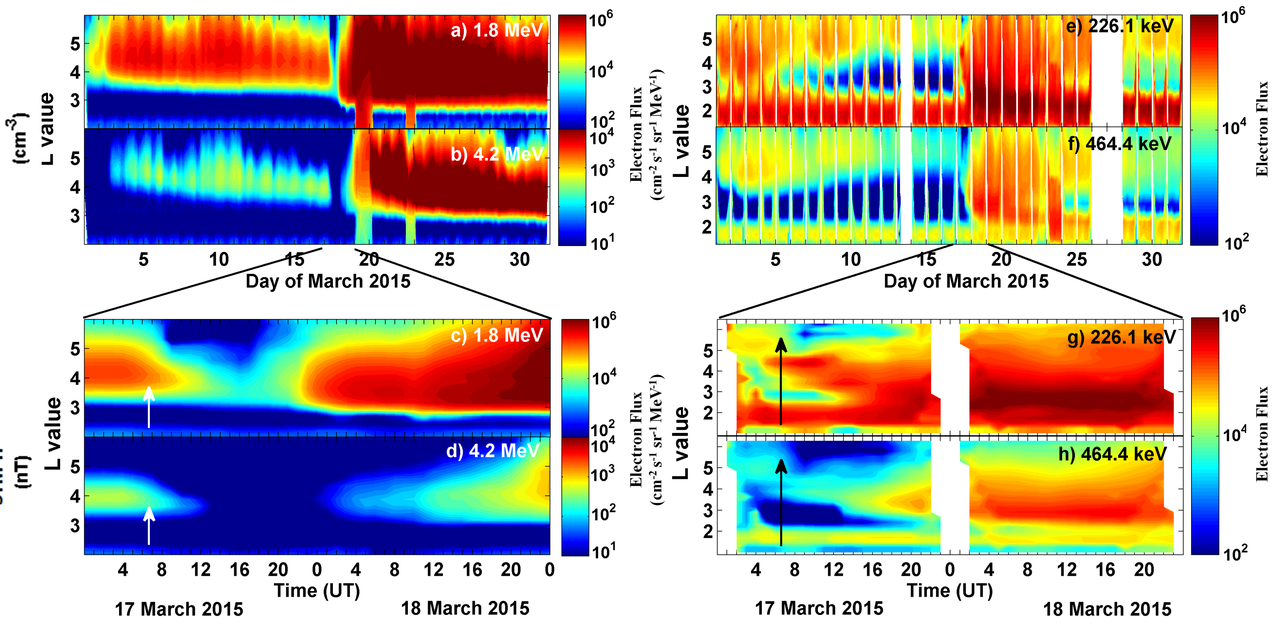
Abstract

During the large geomagnetic storm of 17 March 2015, REPT/RBSP measurements show a deep dropout of >1 MeV electrons at L>4. In this paper we investigate the fraction of the flux lost to the atmosphere. We combine RBSP measurements with ground-based subionospheric VLF from the AARDDVARK network. Strong amplitude and phase perturbations are observed in the NAA signal received at Seattle, and the NDK signal received at St. Johns, Canada. Both propagation paths monitor L≈4 in the MLT night sector. Amplitude decreases of up to ~ 12 dB and phase increases of up to ~180° are observed during the time of the flux dropout event. No VLF perturbations are seen in equivalent paths on the MLT dayside. The night time VLF signal is modelled using LWPC and Wait ionospheric parameters; reflection height (H' in km) and sharpness factor (β in km^{-1}) are calculated to infer the induced changes in D-region ionospheric electron density. The observations will be discussed in detail during the conference.

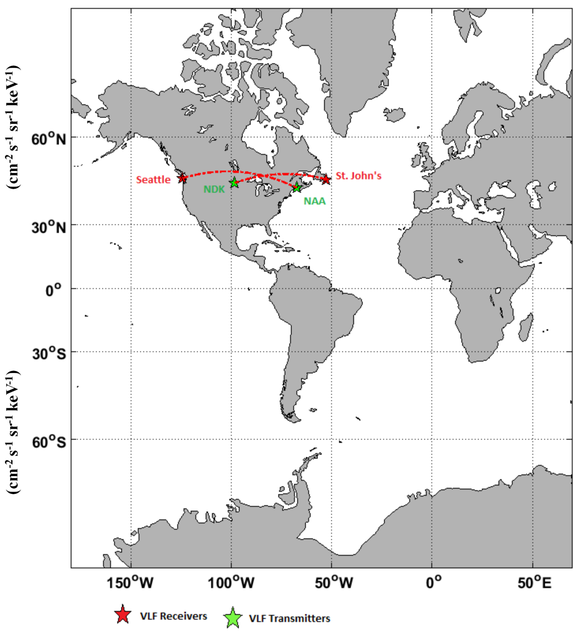
Observations and Results



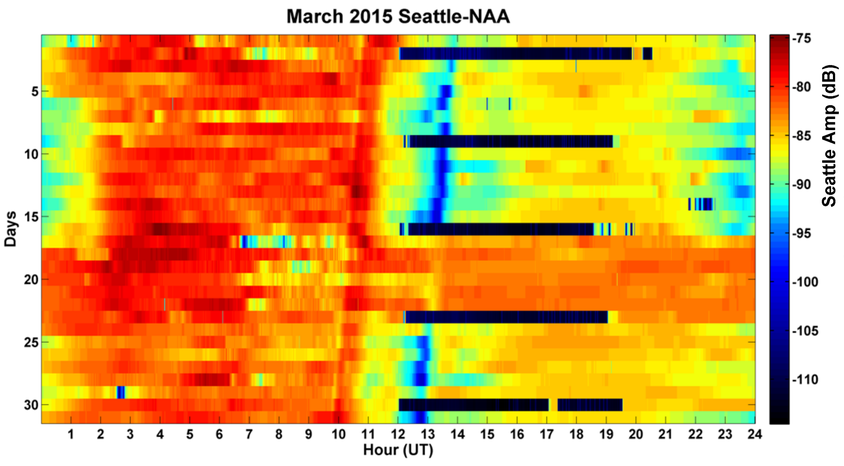
Interplanetary conditions including solar wind speed, density, pressure and temperature, IMF Bz, SYM-H and ASY-H



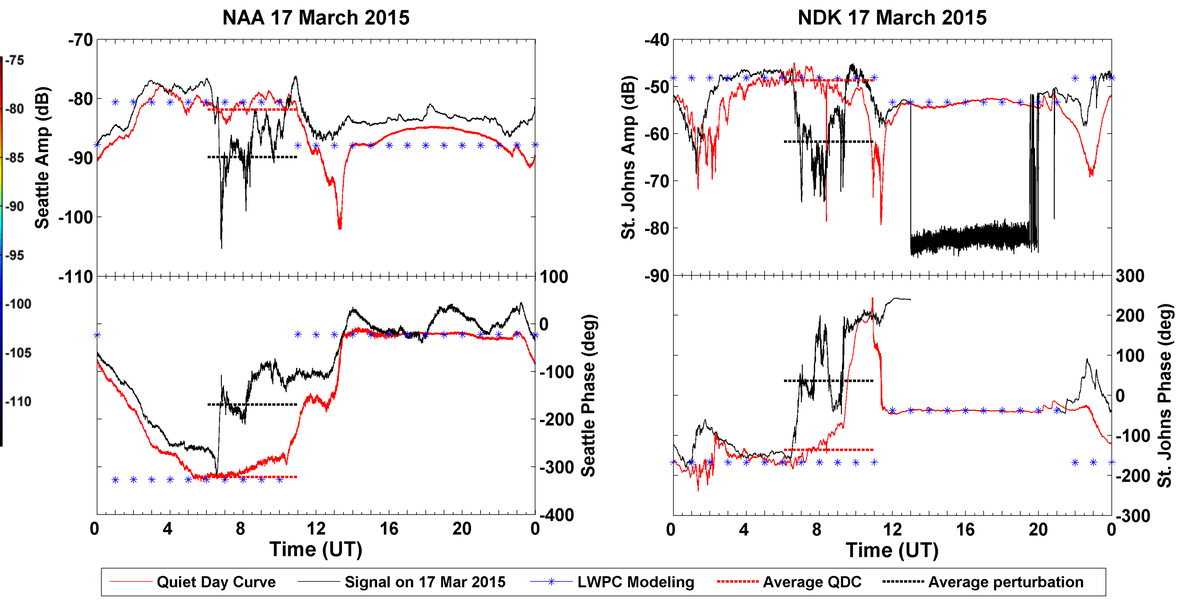
RBSP electron flux from REPT for (a) 1.8 MeV and (b) 4.2 MeV energy channels for whole month of March, 2015; (c) 1.8 MeV and (d) 4.2 MeV energy channels for 17-18 March 2015. RBSP electron flux from MagEIS for (e) 226.1 keV and (f) 464.4 keV energy channels for whole month of March, 2015 and (g) 226.1 keV and (h) 464.4 keV energy channels for 17-18 March 2015

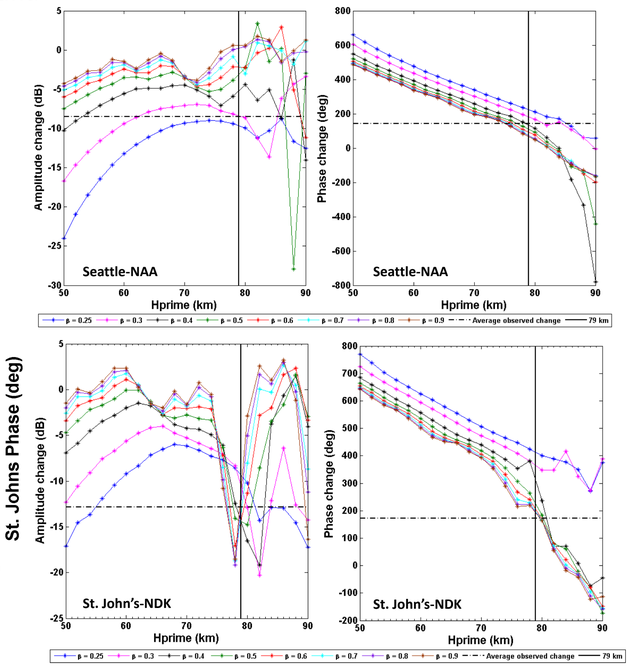


Location of VLF transmitter-receiver pairs with great circle path

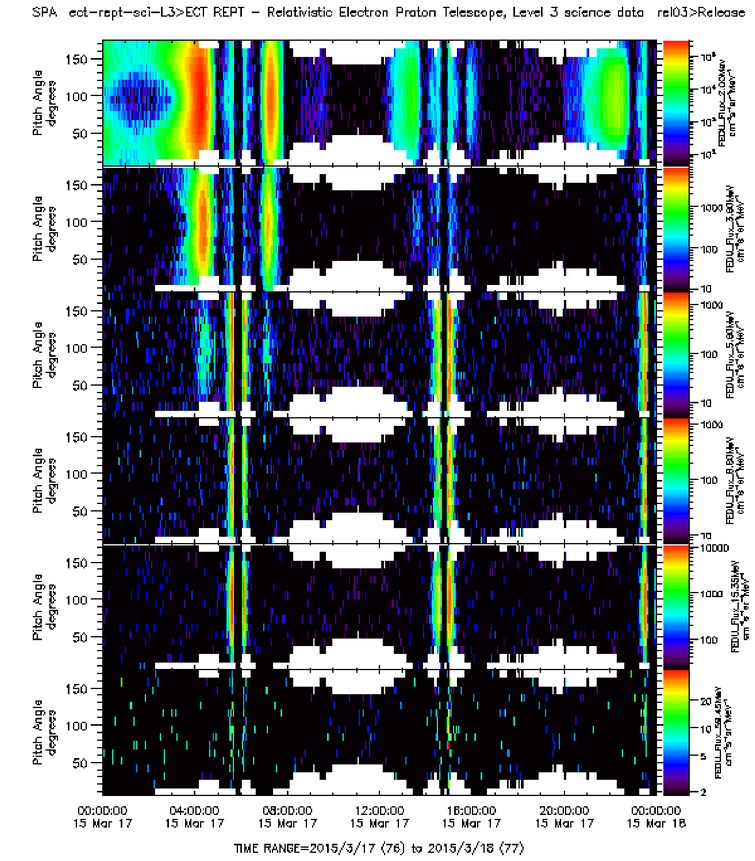


Data quick look plot for the VLF transmitter signal from NAA received at Seattle for month of March, 2015



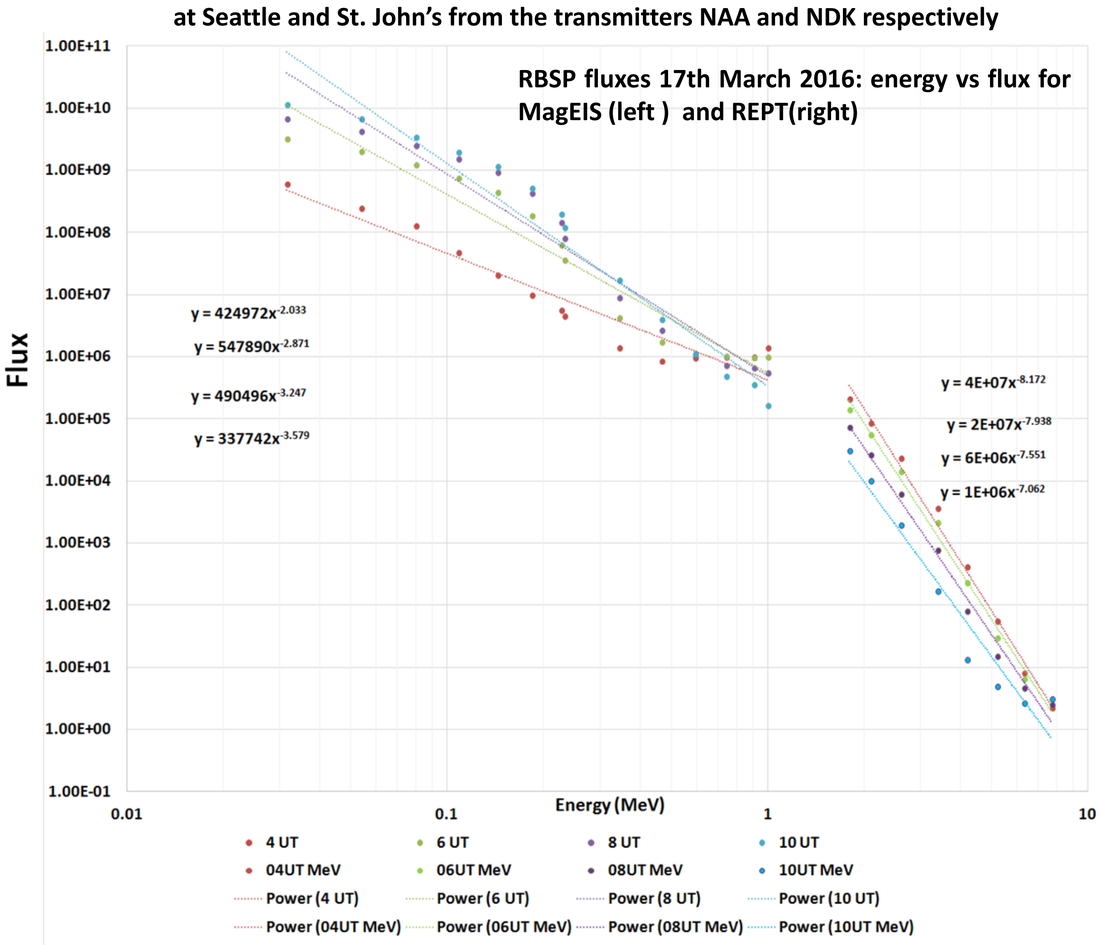


Variation of amplitude with reflection height for varying sharpness factor



Pitch angle distribution for REPT fluxes on 17-18 March 2015

The amplitude and phase perturbations observed for VLF narrowband signal received at Seattle and St. John's from the transmitters NAA and NDK respectively



Summary

- We observed average amplitude decrease upto 12 dB and a phase reversal for VLF transmitter signal over L~4 path falling in MLT night sector during main phase of the storm.
- The LWPC modeled electron density calculations show that very minimal amount of flux was precipitated into the atmosphere during the dropout event

Looking for Postdoc

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