



Multiparametric study of polar ionosphere on both hemispheres

Giulia D'Angelo¹, Lucilla Alfonsi², Luca Spogli², Claudio Cesaroni², and Vittorio Sgrigna¹

¹Università degli studi "Roma Tre" (Italy), Via della Vasca Navale, 84, 00146 Rome, Italy. ²Istituto Nazionale di Geofisica e Vulcanologia (Italy), Via di Vigna Murata, 605, 00143 Rome, Italy.



What we mean with multiparametric study

The adopted approach maximizes the spectrum of information to characterize irregularities



Sunspot, Sun emission at 10.7 cm, intensity of IMF and its B_z and B_y components, solar wind speed

```
K<sub>p</sub>, D<sub>st</sub>, AL, AU, AE, AO, PCN, PCS
```

Convection velocity, potential maps

 σ_{Φ} , TEC

GPS receivers

GISTM (GPS Ionospheric Scintillation and TEC Monitor) receivers which consist of NovAtel GSV4004 dual frequency (L1 1575.42 MHz; L2 1227.6 MHz) receivers.



GISTM generates phase and amplitude at 50 Hz and code/carrier divergence at 1 Hz for each satellite being tracked on L1 frequency. The receiver provides:

- Phase scintillation index $\sigma_{\Phi} = \sqrt{\langle \Phi^2 \rangle \langle \Phi \rangle^2}$ standard deviation of the phase on the carrier frequency, calculated on the L1 over time intervals of 1, 3, 10, 30 and 60 s;
- Amplitude scintillation index $S_4 = \sqrt{\frac{(\overline{l^2} \overline{l^2})}{\overline{l^2}}}$ standard deviation of the received power normalized by its mean value, calculated on the L1 over time intervals of 1, 3, 10, 30 and 60 s;
- TEC (Total Electron Content) and relative TEC values every 15 s from L1 and L2;

vulcani ambiente 9



http://chain.physics.unb.ca/

electronic Space Weather upper atmosphere

http://www.eswua.ingv.it/ 🔮



Period under investigation: March 2015

• St. Patrick storm 17-26 March







17/03/2015

Concluding Remarks

- The multiparametric approach allows to make inferences on the role of the sudden changes of the terrestrial and interplanetary magnetic field in the scintillations production.
- Moreover the multiparametric approach allows to make inferences on the changes of the plasma motion that produce scintillations.
- Reconstruction of the plasma convection cells helps in characterizing the response of ionospheric conjugate points to the same magnetic disturbance.

Acknowledgments

Data used in this work were kindly given by: CHAIN, Canadian High Arctic Ionospheric; Network SuperDARN, by Virginia Tech data base; EISCAT, European Incoherent Scatter Scientific Association; Data Analysis Center for Geomagnetism and Space Magnetism, Kyoto University; NASA for the ACE data; PNRA, Programma Nazionale Ricerche in Antartide. Authors thank in particular Dr Richard Chadwick, researcher at the University of Brunswick (Canada) and Dr Angeline G. Burrell researcher at the University of Leicester (UK).