FORECASTING THE ELECTRON FLUXES AT GEOSYNCHRONOUS ORBITS VIA LATITUDINAL GLOBAL-MODE PC 5 PULSATIONS: A STATISTICAL ANALYSES COMPARISON STUDY

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私は再び日本に来られると
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UN/Japan Workshop on Space Weather: Science and data products from ISWI instruments 2-6 March 2015, Fukuoka, Japan

OUTLINE

- INTRODUCTION.
- DATA.
- OBSERVATIONS.
- PREVIEW OF STATISTICAL ANALYSESE
- ACKNOWLEDGEMENT.

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1. INTRODUCTION

What are Pc 5 geomagnetic pulsations?

- Geomagnetic pulsations: Ground signatures of ultra low frequency (ULF) hydro-magnetic waves originate and propagate in the space or within the magnetosphere.

- A ULF frequency range (frequency: 2-7 mHz , period: 150-600 s) of geomagnetic pulsations is termed as Pc 5.

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Introduction…continue

Magnetospheric Pc 5 pulsations

External Pc 5 mechanisms including wave-plasma variations coupled to the solar wind (1) (2)
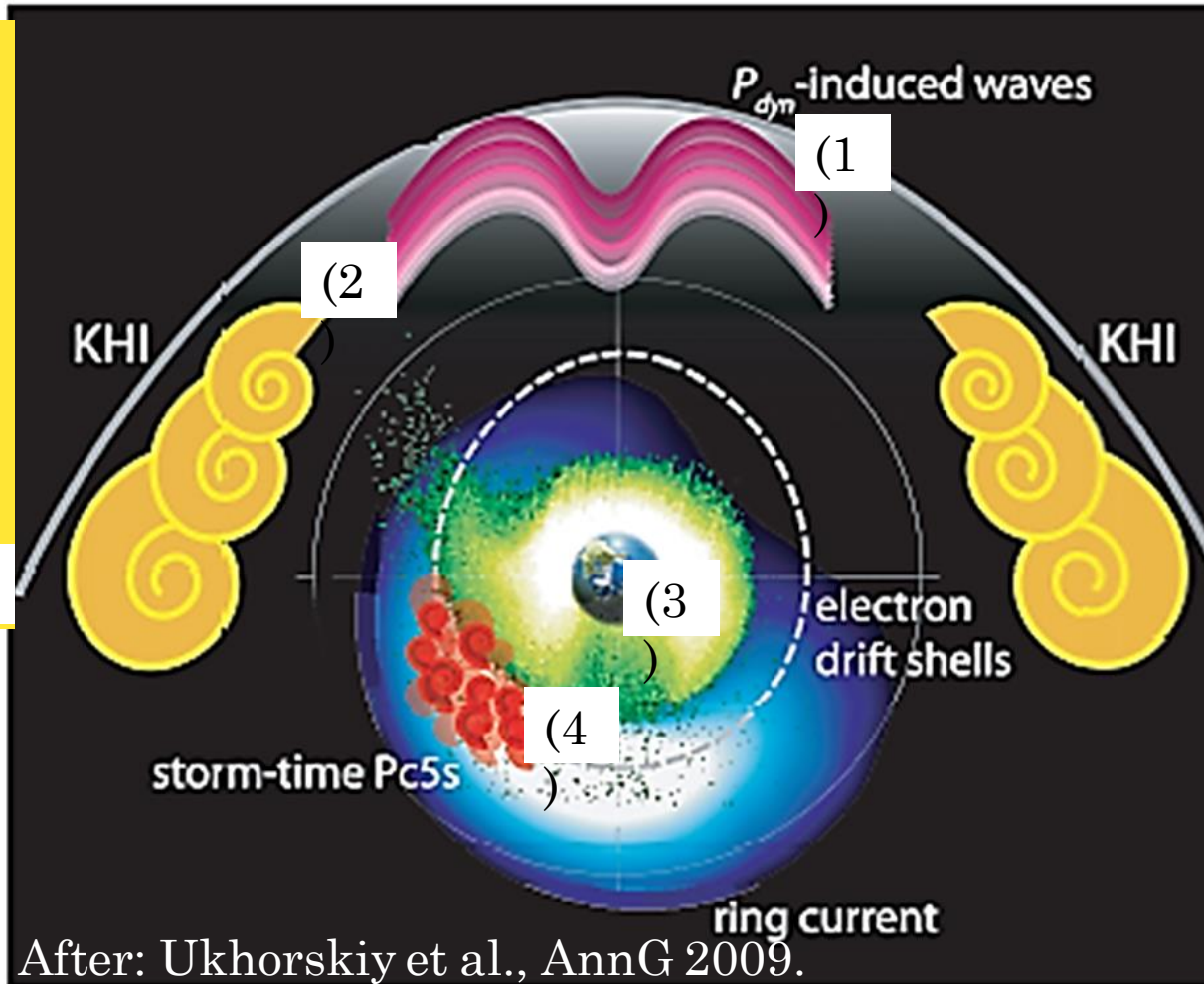
Internal Pc 5 mechanisms including low frequency instabilities of ring current plasma such as storm time Pc 5. (3) (4)

After: Ukhorskiy et al., AnnG 2009.

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Introduction…continue

# ENHANCEMENT OF GEOSYNCHRONOUS ELECTRON FLUXES DURING STORM TIMES

- Storm time enhanced amplitudes (increased power) of ULF pulsations, preferable in the range of Pc 5 pulsations, have been recommended as strong candidate mechanism which drives enhancements on electron fluxes at geosynchronous orbits.

- Also, an alternatively candidate mechanisms is the global Pc 5 pulsations

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Introduction…continue

After: (After: O'Brien et al., 2001, modified).
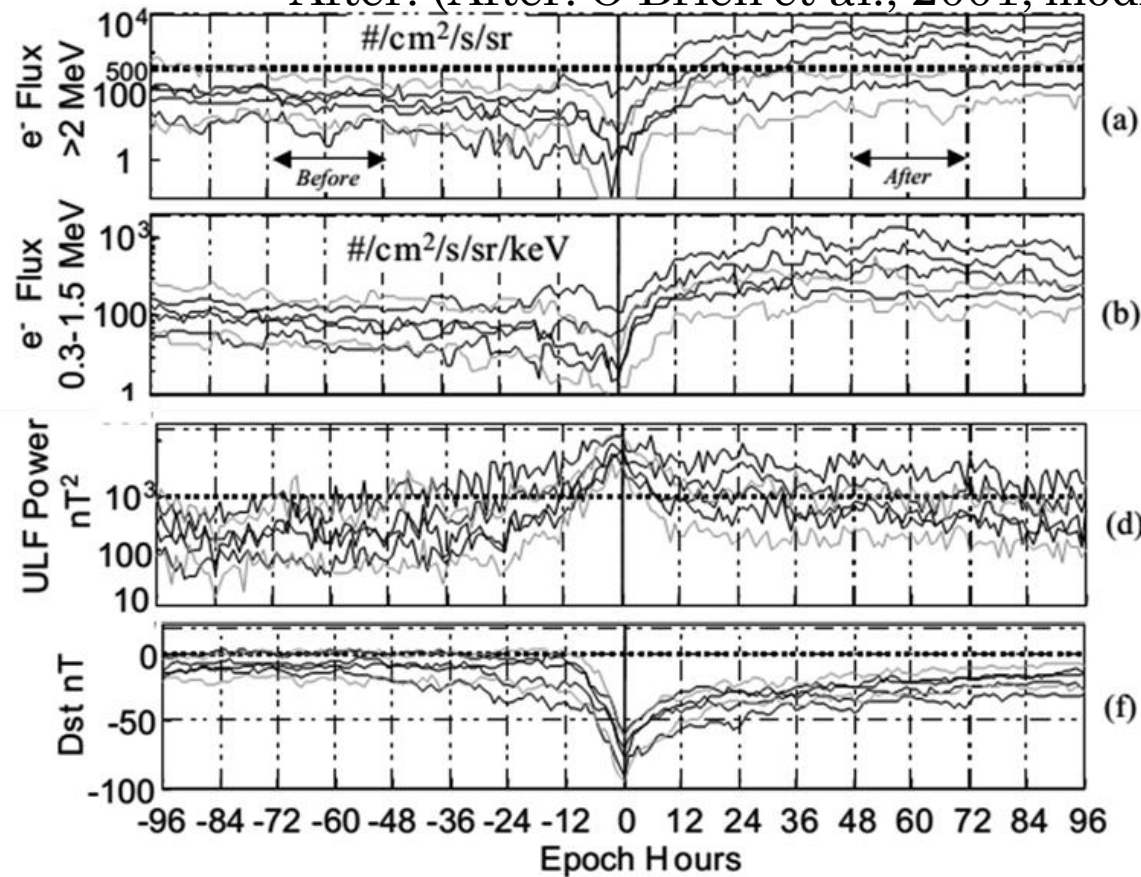
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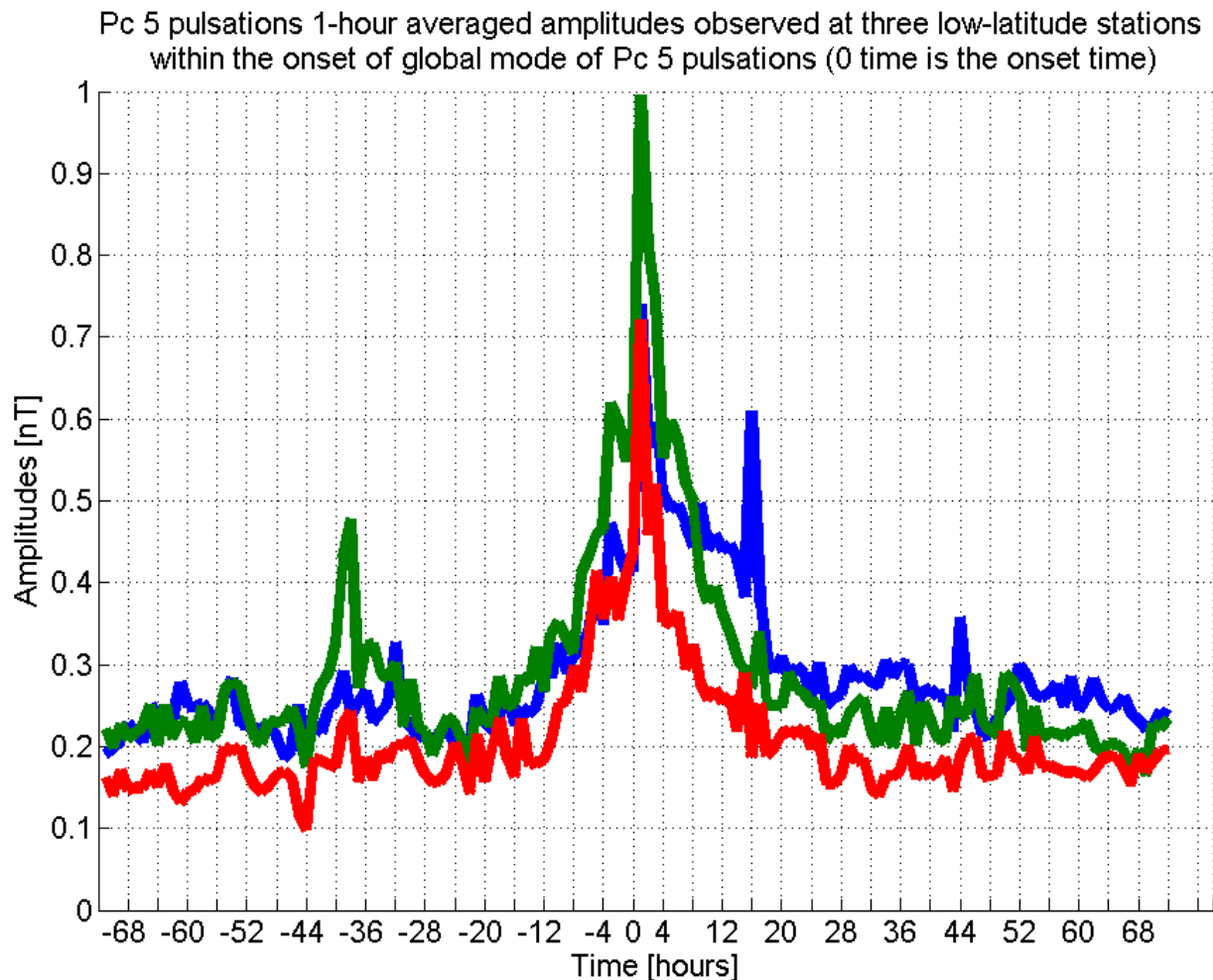## ULF AS A PREDICTOR VARIABLE FOR GEOSYNCHRONOUS ELECTRON FLUXES

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- Many studies were carried out to predict enhancement on geosynchronous energetic electron fluxes.

- Engebretson et al., (2014) have recently investigated on a statistical analyses to predict relativistic electron fluxes at geostationary orbits following storms taking into account different variables, and they found that the ULF pulsation is the most influencing variable on the prediction models they have obtained.

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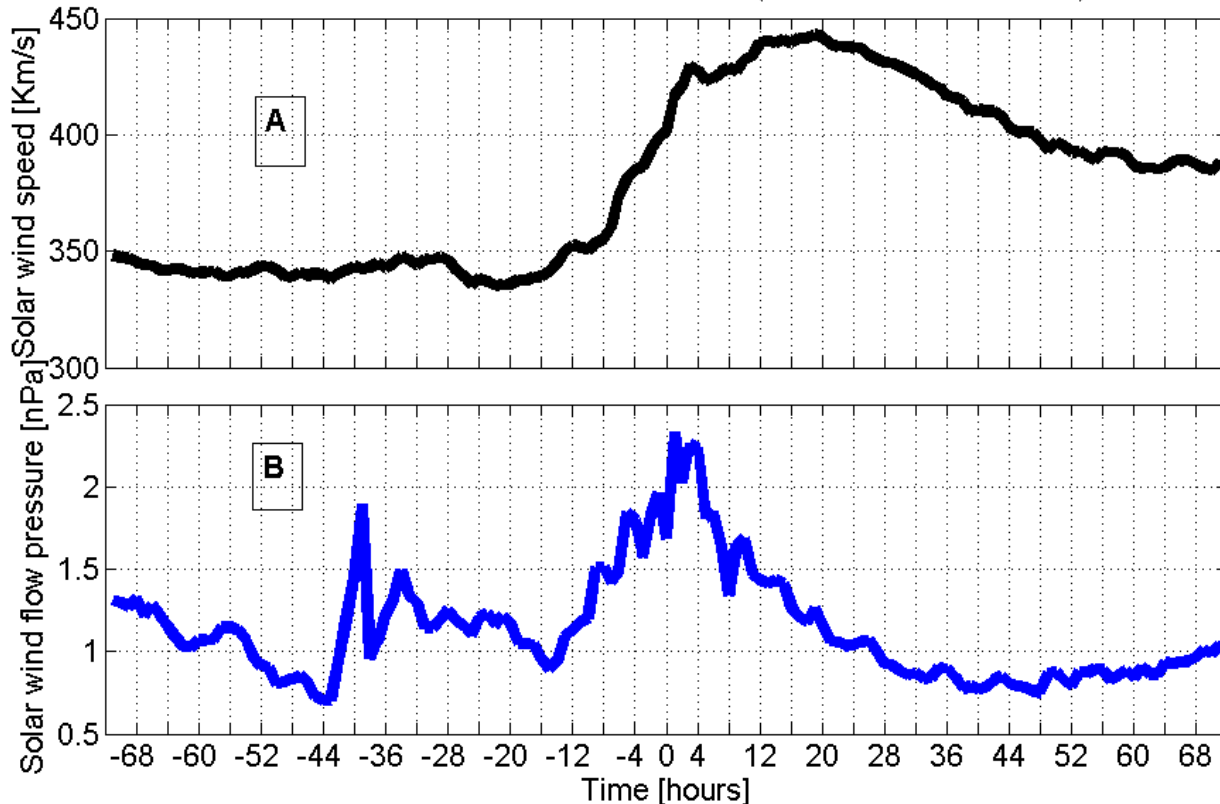
LATITUDINAL GLOBAL MODE PC 5 PULSATIONS

- In a recently published work we had Introduced latitudinal global-mode Pc 5 (G-M Pc 5) pulsations which are not specified to storm time and we found their good relation with the solar wind parameters and as well with the geosynchronous electron fluxes. We termed the opposite mode as the local-mode Pc 5 (L-M Pc 5) pulsations.

- However, it could be plausible if we checked the prediction of geosynchronous electron fluxes via these global mode-Pc 5's and also if we compared it to the prediction via the local-mode.

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Introduction…continue

GLOBAL-MODE PC 5 PULSATIONS

Pc 5 pulsations 1-hour averaged amplitudes observed at three low-latitude stations within the onset of global mode of Pc 5 pulsations (0 time is the onset time)

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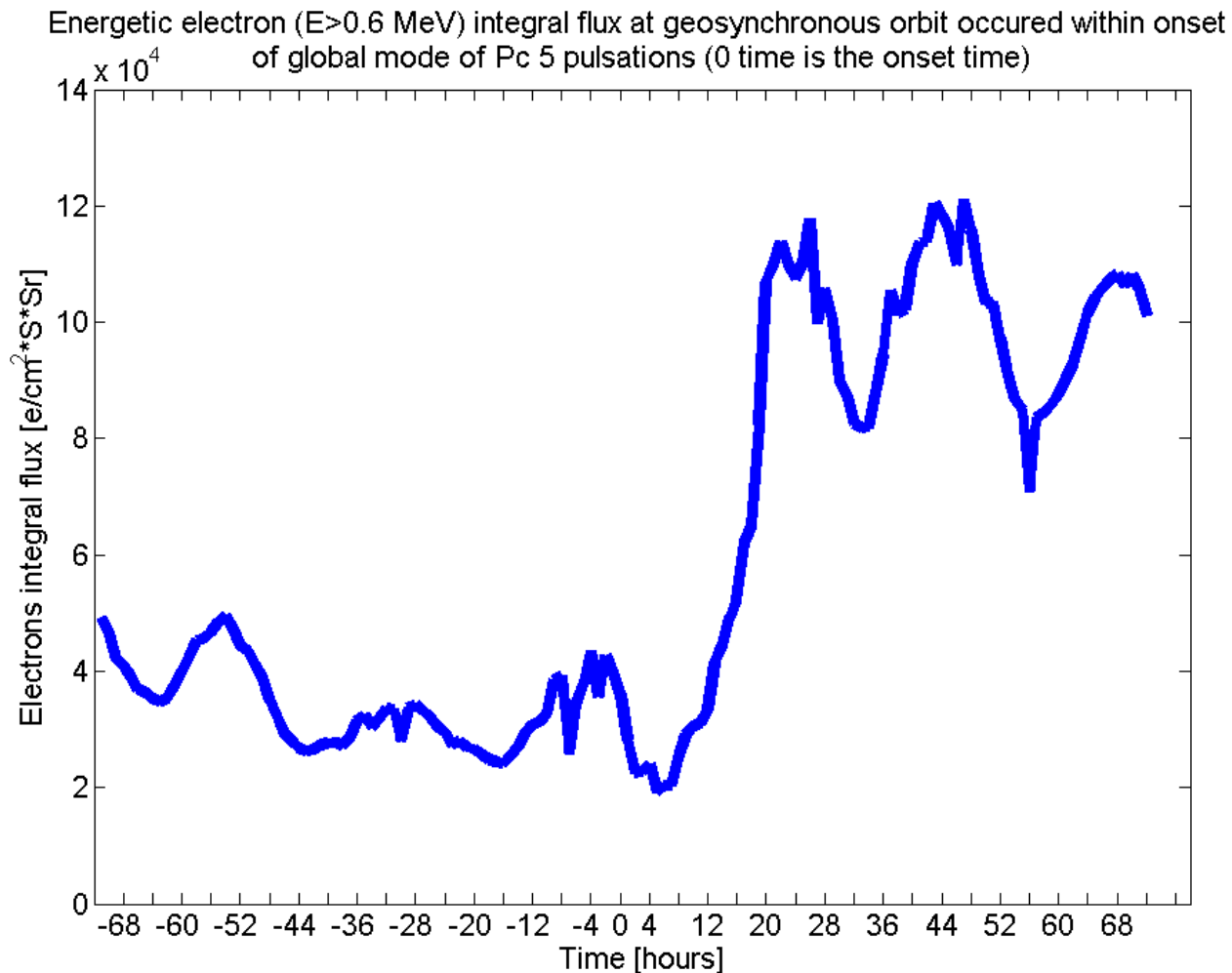
SOLAR WIND CONDITIONS DURING ONSET OF G-M PC 5'S PULSATIONS

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Solar wind flow (A) speed, and (B) pressure within a period of onset of global mode of Pc 5 pulsations observed at three low-latitude stations (0 time is the onset time)

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ENHANCEMENT OF ELECTRON FLUXES AHEAD OF G-M PC 5'S ONSET

Energetic electron (E>0.6 MeV) integral flux at geosynchronous orbit occured within onset of global mode of Pc 5 pulsations (0 time is the onset time)

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2. DATA

- H-component magnetic data obtained from MAGnetic Data Acquisition System (MAGDAS) project which is of the International Center for Space Weather Science and Education (ICSWSE) of Kyushu University, Fukuoka, Japan: http://www.serc.kyushu-u.ac.jp/index_e.html.

- Electron fluxes obtain from the Geostationary Operational Environmental Satellite (GEOS); the OMNI database at the Coordinated Data Analysis Web (CDAWeb): http://cdaweb.gsfc.nasa.gov/.

- Dst from the data retrieval and visualization system which is called OMNIWeb Plus interface: http://omniweb.gsfc.nasa.gov/form/dx1.html.

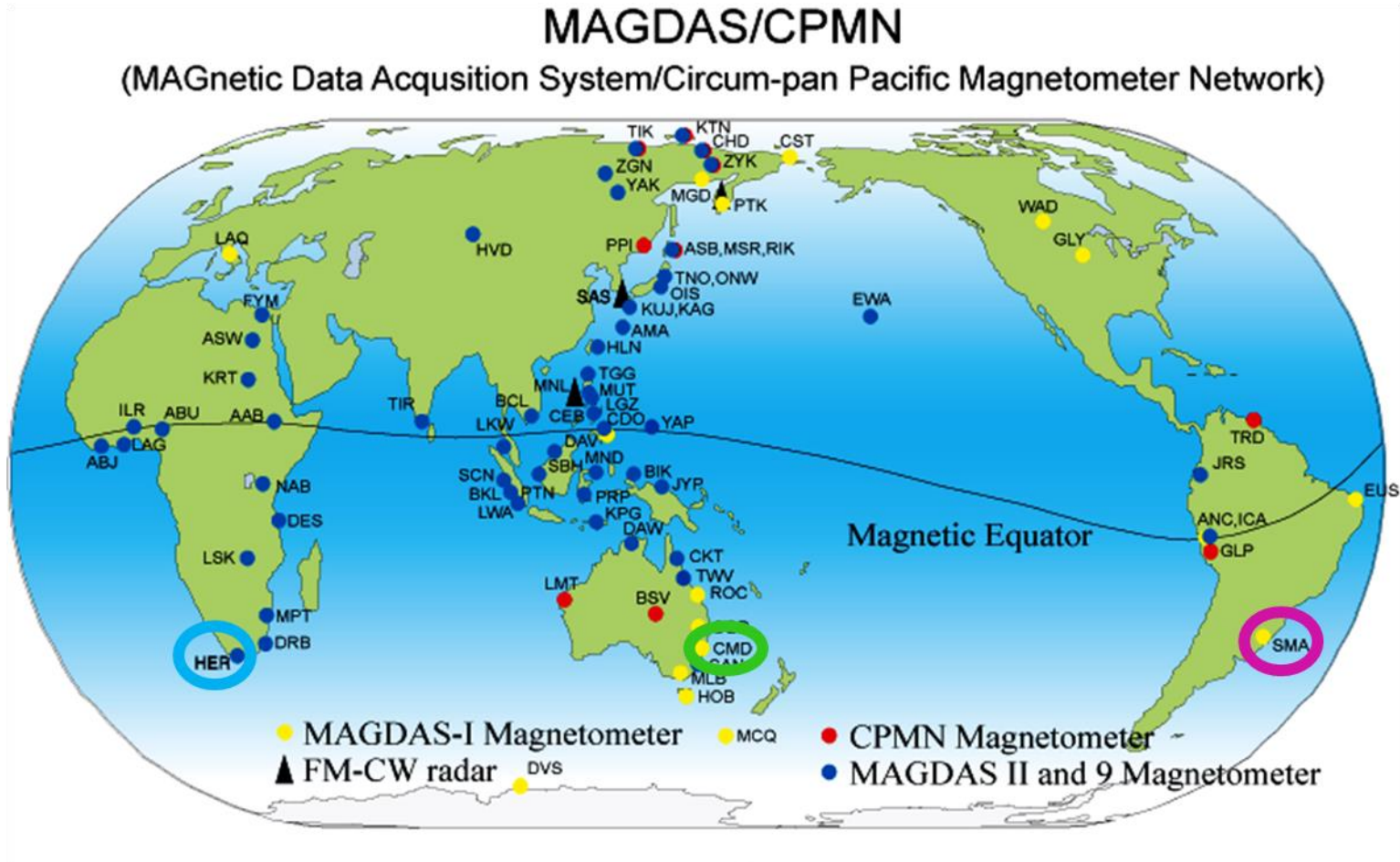UN/Japan Workshop on Space Weather: Science and data products from ISWI instruments 2-6 March 2015, Fukuoka, Japan

3. OBSERVATIONS

- In this work the G-Mode Pc 5's are defined as those latitudinal Pc 5 oscillations simultaneously observed in the ground, which appear in three stations being selected longitudinally apart as to cover America, Africa and Australia sectors in the globe.

- Those oscillations should be restricted to the conditions:

1. be quasi-sinusoidal in a duration of at least for 2 hour.
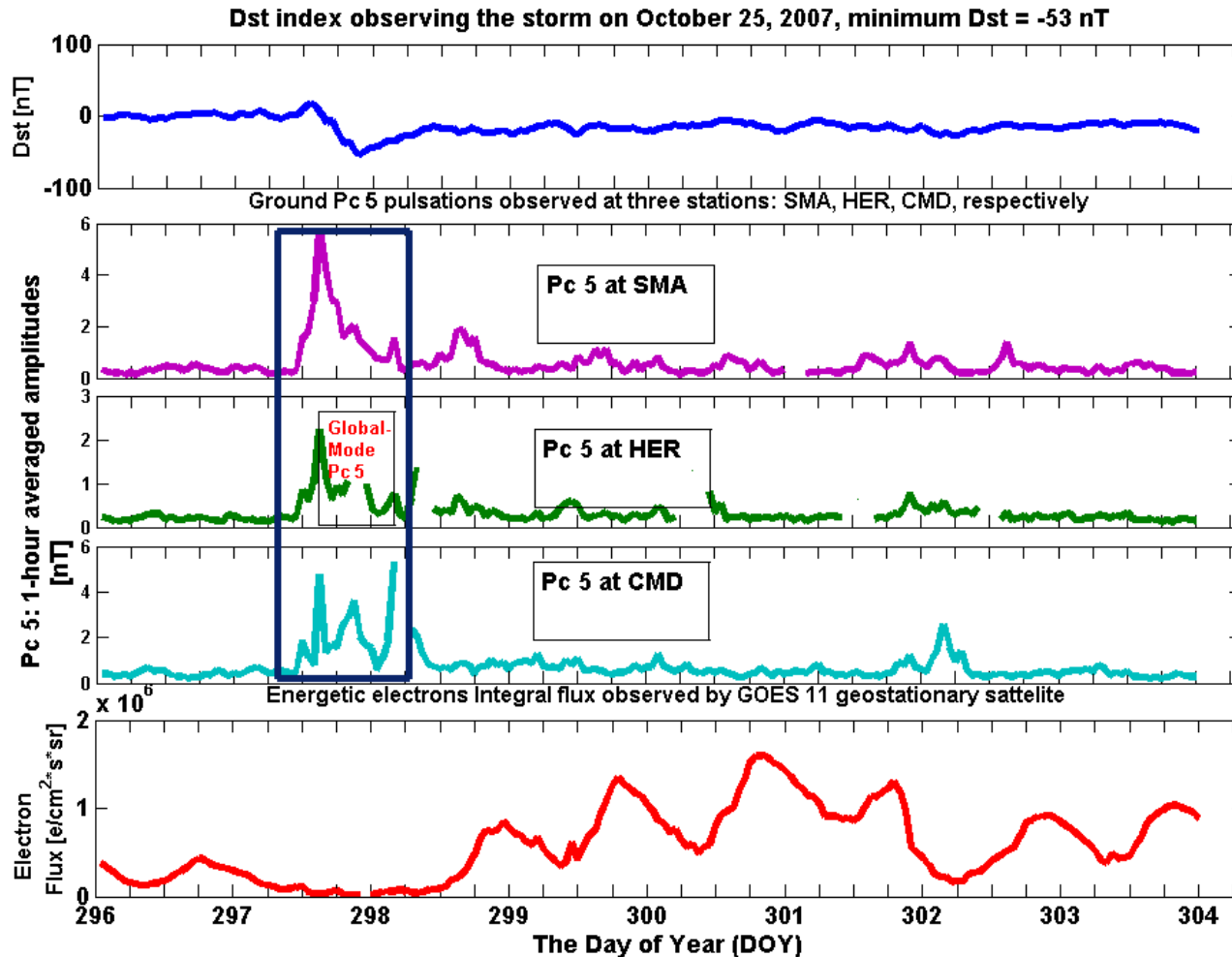
2. Their averaged amplitudes ≥ 0.4 nT

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THREE MAGDAS STATIONS USED TO EXTRACT G-M PC 5'S

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# Observation…continue

STORM TIME GLOBAL-MODE PC 5 PULSATIONS

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Observations…continue

STORM TIME LOCAL-MODE PC 5 PULSATIONS

Dst index observing the storm on November 20, 2007, minimum Dst = -59 nT

Ground Pc 5 pulsations observed at three stations: SMA, HER, CMD, respectively

Energetic electrons Integral flux observed by GOES 11 geostationary sattelite

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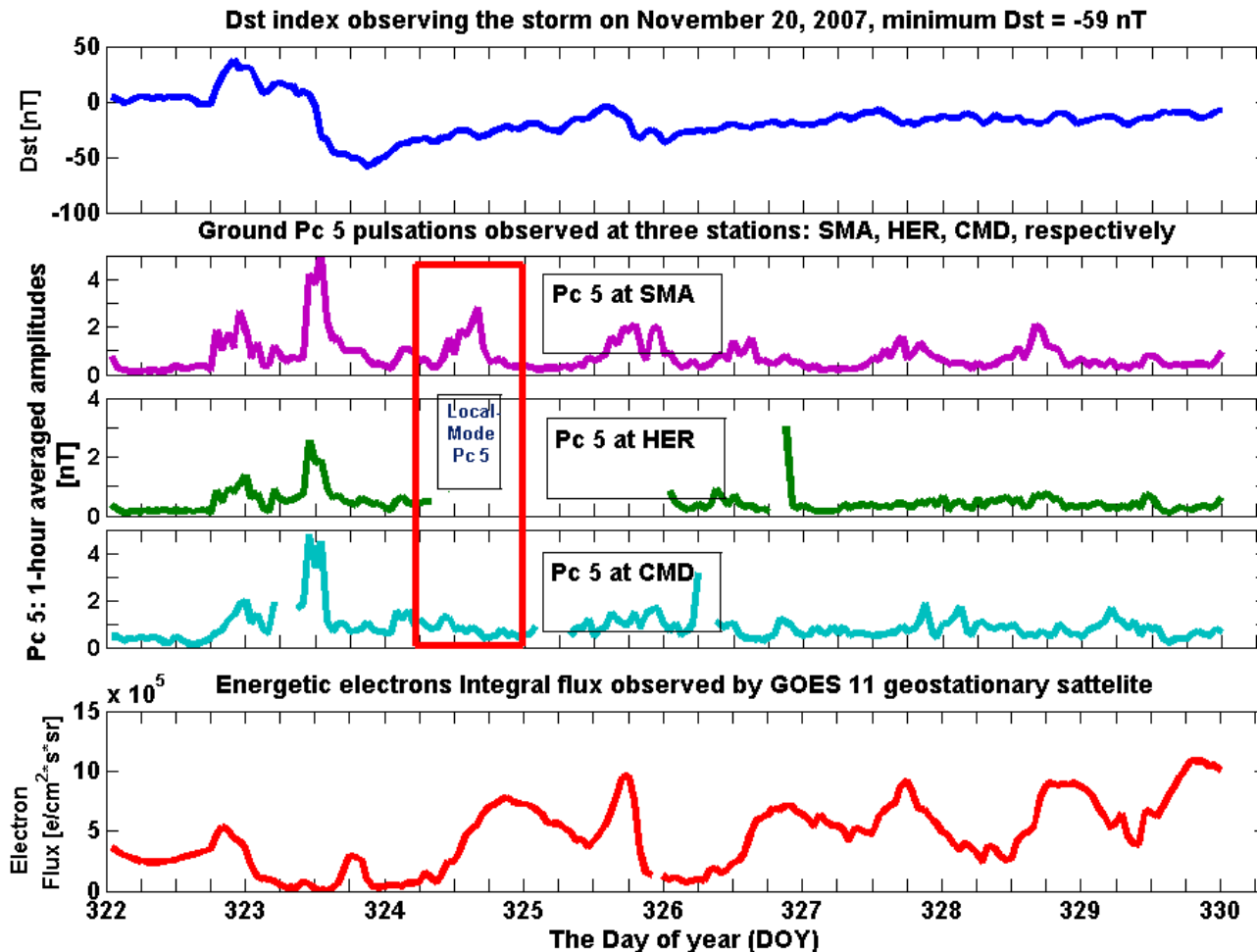
4. PREVIEW OF THE STATISTICAL ANALYSES

- We shall carry out a linear regression analyses using storm time G-M Pc 5's amplitudes as predictor variable to predict the electron fluxes after the minimum Dst index; same analysis would be done for the L-M Pc 5's amplitudes.

- On these analyses each of the G-M and L-M Pc 5's amplitudes will be averaged and the increase of fluxes will be averaged over 48 hours just after the minimum Dst and between: 48-120 hours following the storm.

- Results of individual analysis on each mode of the Pc 5 pulsations would be compared.

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5. ACKNOWLEDGEMENT

- We acknowledge the team who facilitated the provision of the satellite data, the PI is: J.H. King, N. Papatashvilliand of AdnetSystems, NASA GSFC.

- We acknowledge the PI of the MAGDAS and the MAGDAS group for providing the ground magnetic data.

- We appreciate the support and the fund from Deanship of Scientific Research, Sudan University of Science and Technology (SUST), Khartoum, Sudan, great thanks to the Dean: Prof. Amel and her supporter the Deputy Dean: Dr. Rashid Saeed.

- finally I thank Uz. Mohamd Alamin for his great help and providing statistical packages.

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