

# USAGE OF MAGDAS DATA FOR SPACE WEATHER SCIENCE IN INDONESIA: STUDY OF OUTER ELECTRON BELT ACCELERATION

L. Muhammad Musafar K

Space Research Center, National Institute of Aeronautics and Space (LAPAN), Indonesia

A. Yoshikawa and T. Uozumi

International Center for Space Weather Science and Education, Kyushu University, Japan

## ABSTRACT

ICSWSE setup some MAGDAS magnetometers in Indonesian region which are operated by LAPAN. The magnetometers data became more important since LAPAN launched a Space Weather Program. Efforts to support the space weather program such as development of data transfer system were carried out, and recently we develop a system for realtime magnetometer data processing. However, in addition to the realtime data transfer and automatic data processing the study of space weather science is essential to understand the physical processes that is related to space weather itself as well as to improve our space weather monitoring system in future. Some studies that are related to ULF waves have been performed in LAPAN, Indonesia such as the study on the outer electron belt acceleration by ULF waves in the range of Pc5 magnetic pulsations. In this study we analyzed ground-based magnetic data from MAGDAS/CPMN chain to extract the Pc5 magnetic pulsations and 2 MeV electron provided by GOES satellites. A bandpass filter was applied to the H- and D-components of ground-based magnetic field in the range period between 150-600 seconds to localize the Pc5 magnetic pulsations and then, a wavelet transform was performed to each one-hour the filtered Pc5 pulsations. We observed that increasing in the 2MeV fluxes were preceded with long duration and large amplitude of Pc5 magnetic pulsation in both H- and D-components. On the other hand, we also observed an increasing in ratio of power D/H during several days in beginning period of increasing 2MeV electron fluxes. A clearer increasing in D/H powers are observed in low- and mid-latitude rather than high latitude. D-component of Pc5 magnetic pulsations on ground can be used to estimate azimuthal component of electron field in space, and presence of the electric field in space are required for electron acceleration and transport during outer radiation belt formation. From this study we concluded that Pc5 magnetic pulsations could be a role in the acceleration mechanism and transport process of the outer electron belt. In addition, this study was carried out by using MAGDAS data from low to high-latitude which is mean that MAGDAS chain is important for study of space weather especially, for developing country such as Indonesia.

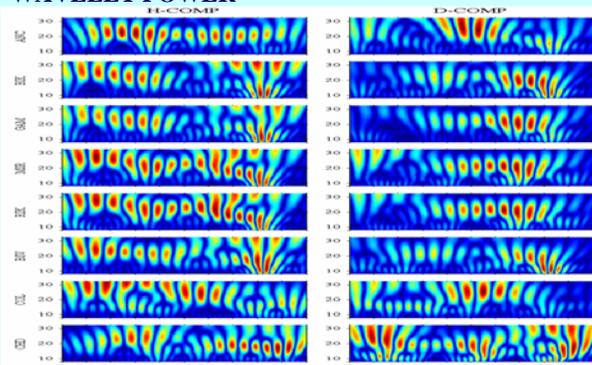
## INTRODUCTION

- ❖ Electron radiation belt in the Earth's magnetosphere are composed by trapped energetic charged particle in the geomagnetic field. From the satellites observation is known there are two regions of electron belts in the magnetosphere. In the region of  $L < 2$  is known as inner electron belt and  $L > 4$  as outer electron belt. One of possible mechanism is a drift-resonant interaction with ULF wave in the magnetosphere since the drift-frequency of the relativistic electron in the range period of Pc5 magnetic pulsations (Elkington, 2006). Pc5 ULF waves play a fundamental role in the dynamics of outer electron belt.
- ❖ Ground-based Pc5 magnetic pulsation during increase period of electron fluxes in the geosynchronous orbit has been analyzed.
- ❖ The study was performed for the ground-based magnetometer data that cover the region from equator-dip to high latitude where H- and D-component of Pc5 pulsation were considered in analyses.

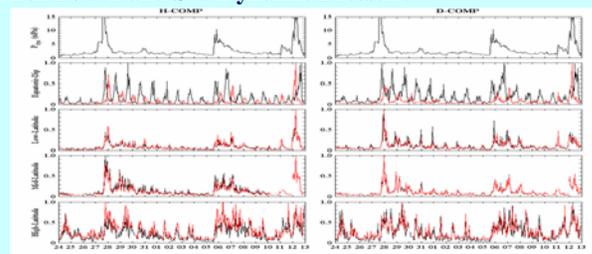
## DATA AND METHOD

- ❖ Ground-based magnetometer data of H- and D-components and electron fluxes data from GOES satellites
- ❖ Data analyses was performed by applying wavelet where Morlet function has been chosen as mother wavelet

## WAVELET POWER



## Pc5 Power and SW Dynamic Pressure



## ACKNOWLEDGMENT

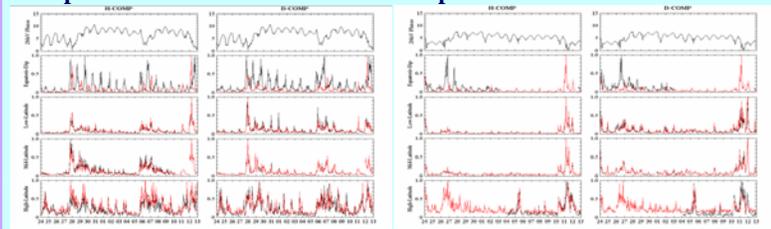
The authors would like to thank to ACE and GOES satellites Team for data sharing.

## LOCATION OF MAGNETOMETERS

No	Stat.	Geomagnetic		Geographic		L
		Lat.	Long.	Lat.	Long.	
1	ANC	-11.77	-77.15	0.77	354.33	1.00
2	DAV	7.00	125.40	-1.02	196.54	1.55
3	BIK	-1.08	136.05	-12.18	207.30	1.05
4	GAM	13.58	144.87	4.57	214.76	1.01
5	MSR	44.37	142.27	37.61	213.23	1.59
6	RIK	43.5	143.8	34.7	210.8	1.48
7	TIK	71.9	128.78	65.67	196.88	5.89
8	CHD	70.62	147.89	64.67	212.12	5.46

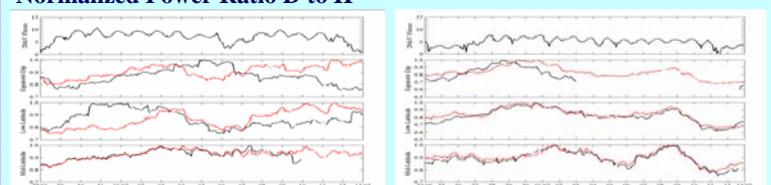
## RESULTS AND DISCUSSION

### Comparison 2-MeV fluxes and H and D power



28 January to 12 February, 2000 in UT. Increasing of 2MeV fluxes associated with long duration increasing of Pc5 power in both H- and D-component. The Pc5 power is needed for energizing the electrons.

### Normalized Power Ratio D to H



28 January to 12 February, 2000 in UT. 24 June to 12 July, 2000 in UT

Monotonically increasing of power ratio D/H for several days during beginning increasing 2 MeV electron fluxes in the dip-, low- and mid-latitudes. This could be interpreted that the Pc5 pulsations responsible for the acceleration processes and transport mechanism for electrons of radiation belt.