



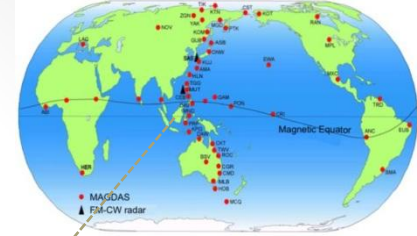
CURRENT STATUS OF MAGDAS NETWORK IN INDONESIA AND ITS APPLICATIONS

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^aL.M Musafar K, ^aSetyanto C.P

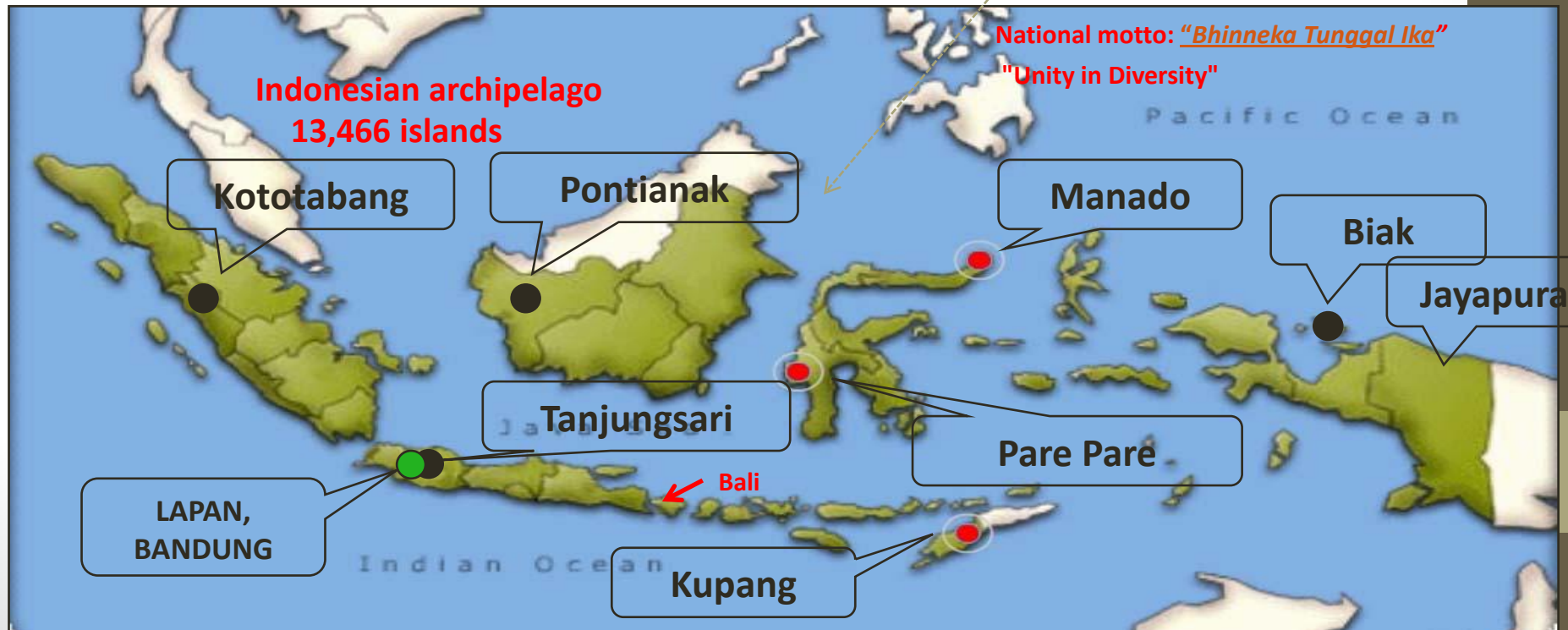
^aSpace Science Center – LAPAN, Bandung 40173, Indonesia

MAGDAS NETWORK IN INDONESIA



International Collaboration Research of LAPAN (National Institute of Aeronautics and Space), Indonesia and SERC (Space Environment Research Center), Kyushu University.

MAGDAS has been installed since 2005 at three sites in Indonesia: PRP (Pare-Pare, South Sulawesi), MND (Manado, North Sulawesi) and KPG (Kupang, East Nusa Tenggara).



Manado Station

- Magdas was installed in Manado since July 26th, 2005.
- It is replaced with Magdas II on January, 2010.

GMB Magnetometer records 3 component i.e H-component, D-component, Z-component. *and 1 Hz sampling.*

GLat	GLon	MLat	MLon
1.44	124.84	-6.91	196.06



MAGDAS Sensor



Old data transfer system

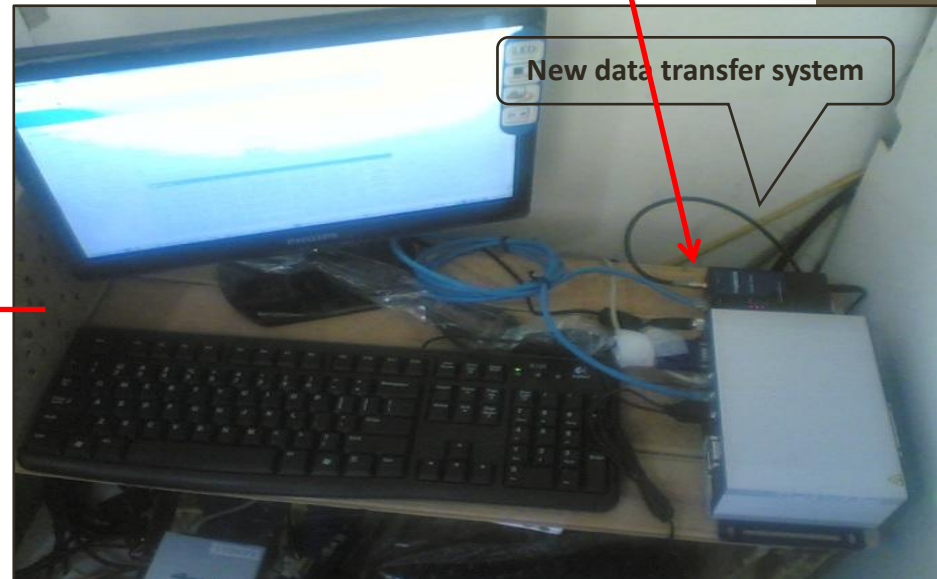


GPRS - GSM Modem



3G GSM Router

New data transfer system



Pare Pare Station

- Magdas was installed in Pare-Pare since July 24th, 2005
- It is replaced with Magdas II on January, 2010

GMB Magnetometer records 3 component i.e H-component, D-component, Z-component. *and 1 Hz sampling.*

MAGDAS Sensor



GLat	GLon	MLat	MLon
-3.60	119.40	-12.38	190.75



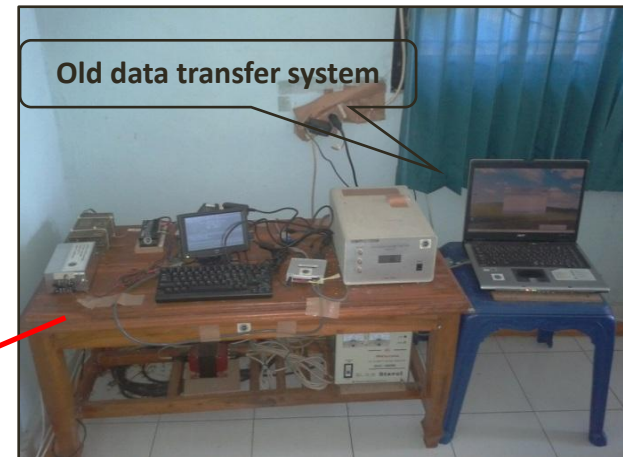
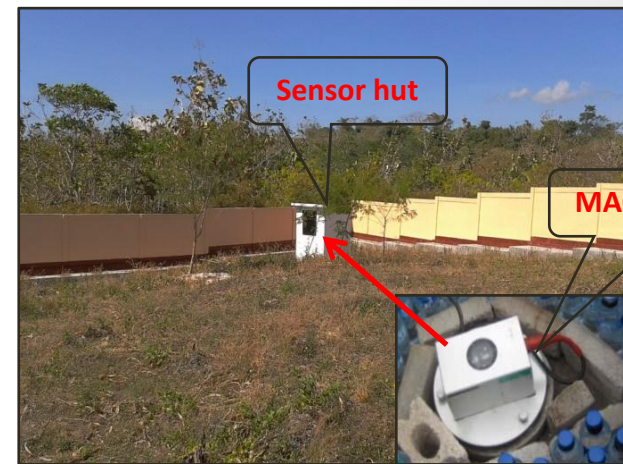
Old data transfer system

New data transfer system

Kupang Station

- Magdas was installed in Kupang since July 21th, 2006
 - replaced with *Magdas II* on January, 2010.
- FRG-601 Magnetometer records 3 component i.e H-component, D-component, Z-component. and 1 Hz sampling.

GLat	GLon	MLat	MLon
-10.20	123.40	-19.58	194.95



Jayapura Station -new



Magdas-9 tipe FRG 604RC

- Sensor (FRG604RC)
- Armadillo
- Modem GPRS
- Data: H-component, D-component, Z-component, F, dan T
- Software: ProArmadillo-091

MAGDAS DATA

Sampling data is 1 second and a file is created every 10 minutes.

File size : PRP and MND = 14.400 byte (86400 x 6) a file.

144 files (2.073.600 byte) a day.

: KPG = 7.200 byte (86400 x 3) a file.

144 files (1.036.800 byte) a day.

File name format : MYYMMDDHHmm.sno

where : M/W → M for PRP and MND, W for KPG

YY → Year

MM → Month

DD → Day

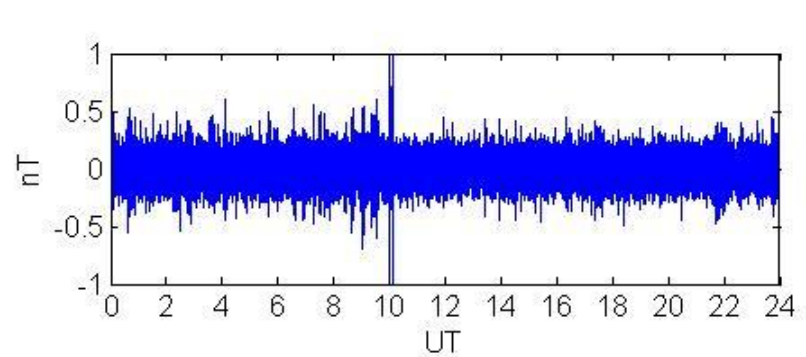
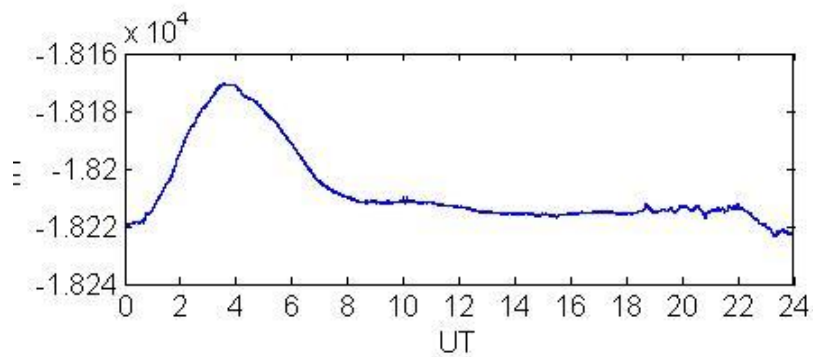
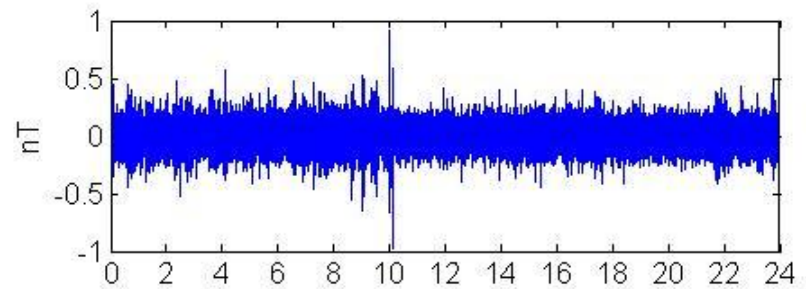
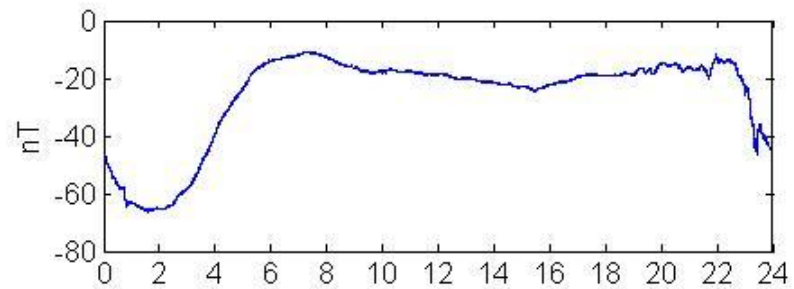
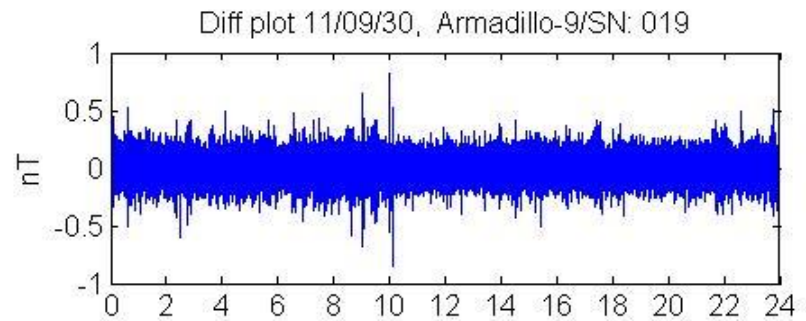
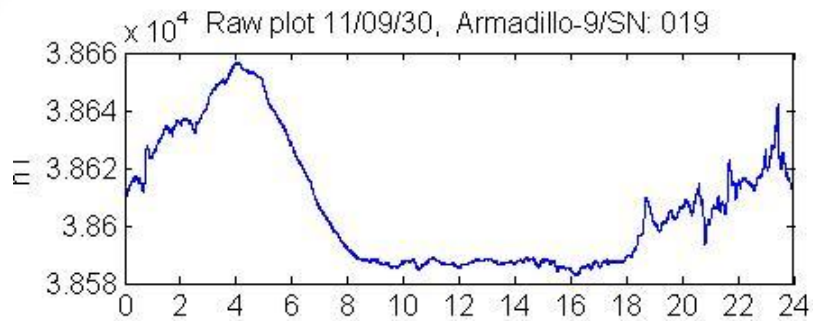
HH → Hour

mm → Minute

sno → Serial no of Armadillo-9

(MND=011,PRP=019,KPG=024)

Examples: M1109302350.011, M1109292340.019, W1104280640.024



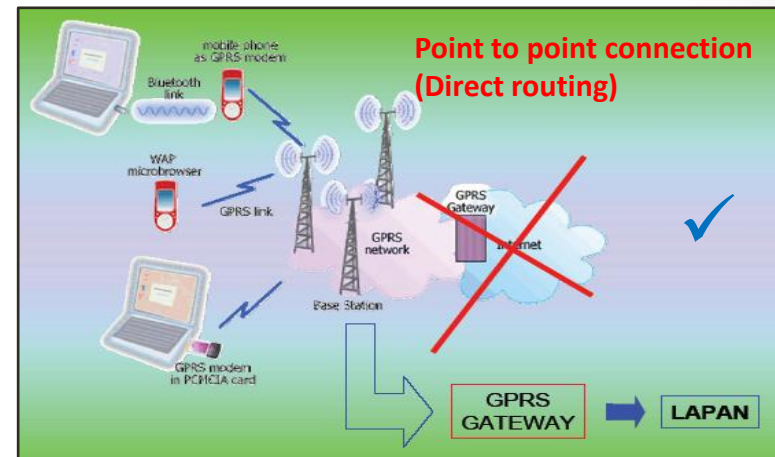
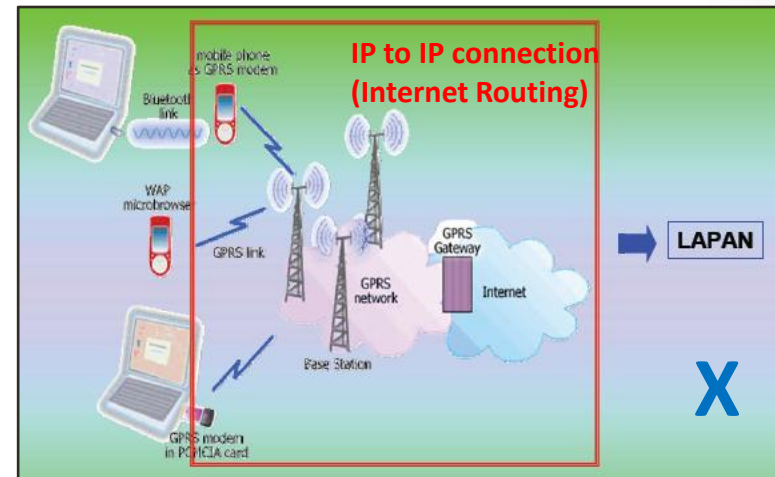
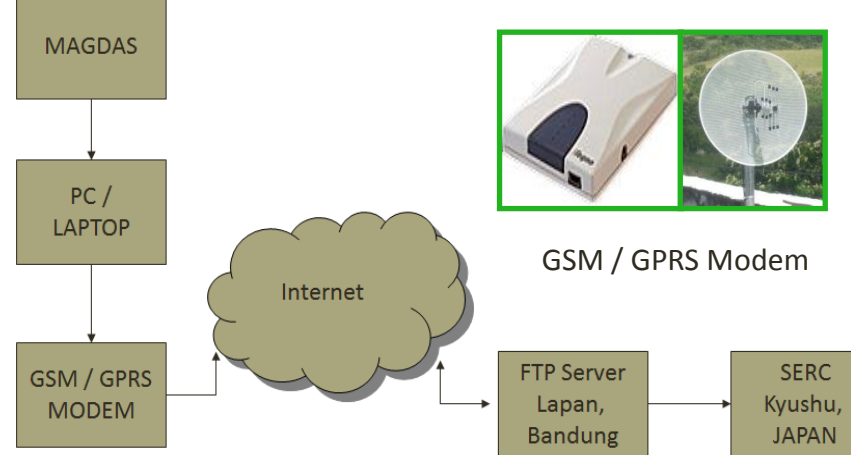
Pare-Pare Station on September 30, 2011

DATA TRANSFER

Common problems in Indonesia for remote data acquisition:

1. ISP (Internet Service Provider) available only in cities.
2. Dial-up connection over land-line telephone is unreliable and expensive.
3. Satellite service provider is very expensive.

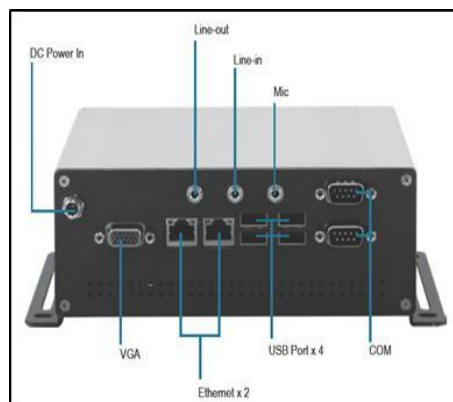
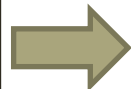
→ the cell phones grew rapidly and is getting to cover to most villages.



New Data Transfer System

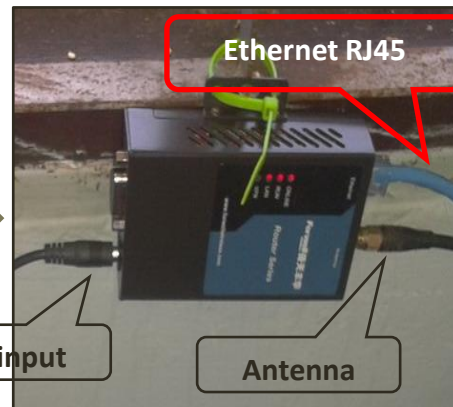
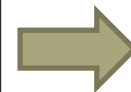
To support near real time data transfer and magnetic observation:

- a new data transfer system is developed to increase reliability of our data transfer system.
- using an embedded controller and a mobile router for cellular network to replace PC/Laptop and GSM modem in our old system.



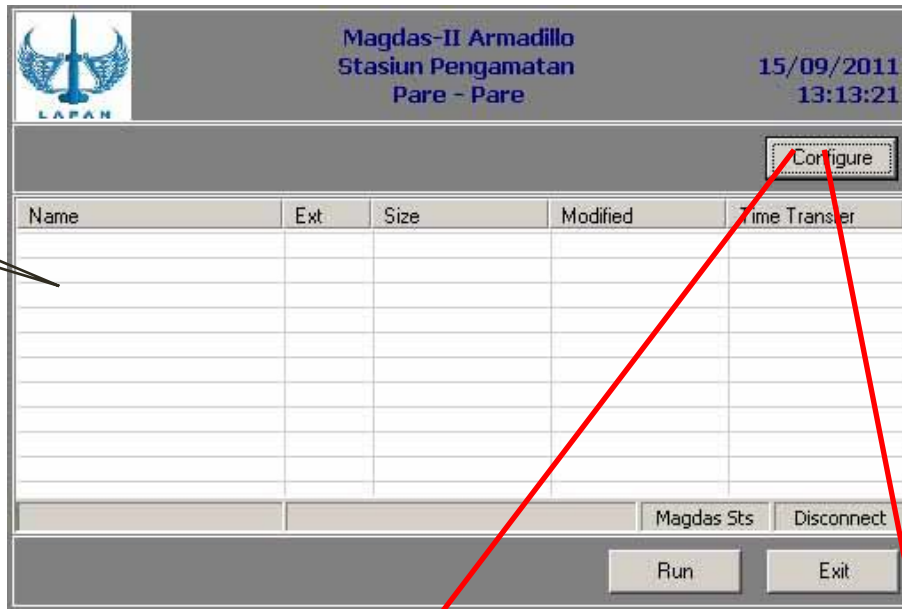
Benefit:

- DC Input 8.5~19V
- Intel Atom N270, 1.05A @DC 19V
- Passive Cooling (low maintenance)
- Windows XP, Linux 2.4 Support (GUI)
- CompactFlash or SSD
- USB: Host USB2.0 x 4
- LAN: RJ-45 x 2
- Serial Port: RS-232 x 2

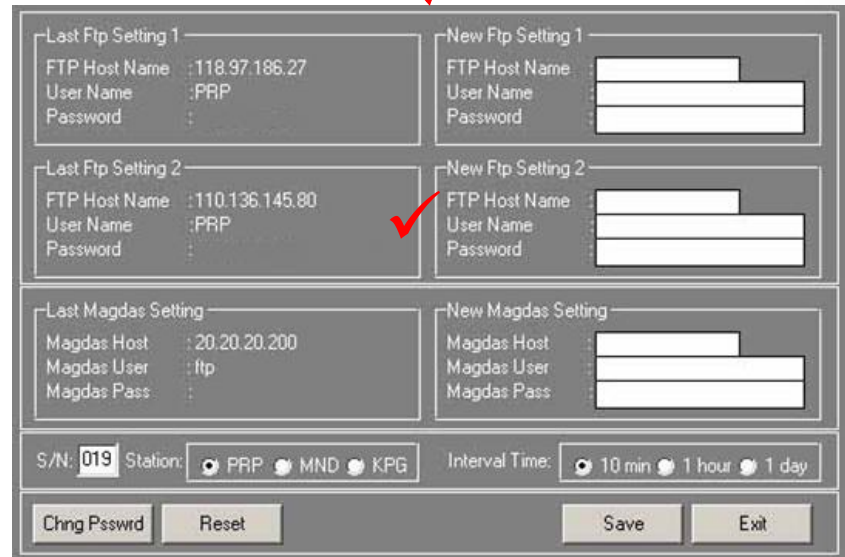
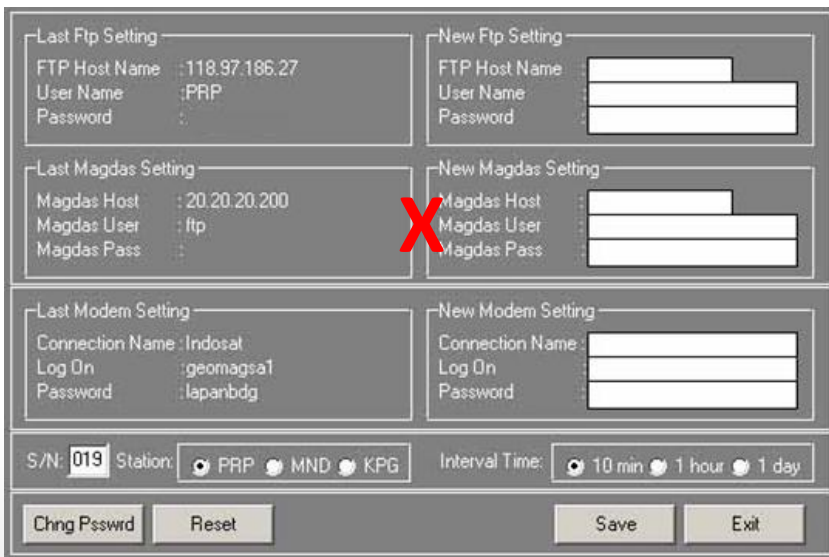


Benefit:

- DC Input 7~25V
- Support multi-band HSDPA network
- UL/DL: 384kbps/7.2Mbps Ethernet RJ45 interface
- WEB/Telnet/console management interface (needed at 1st time only).
- Always keep On-Line (internet)
- Built-in DHCP server



List of data sent



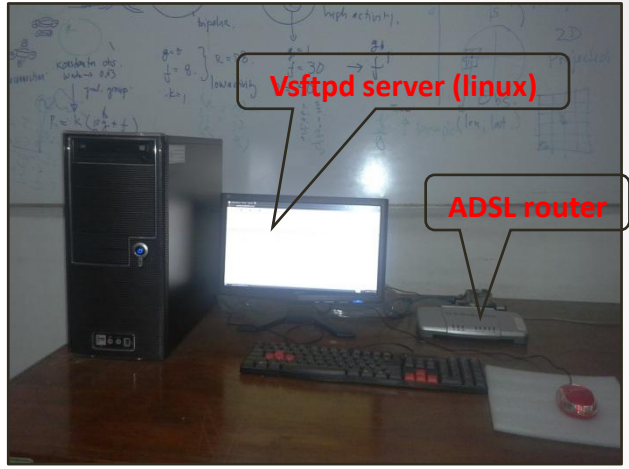
Data transfer program < main view > (top)

Old software setting has one ftp host (left). New software has two ftp host (right)

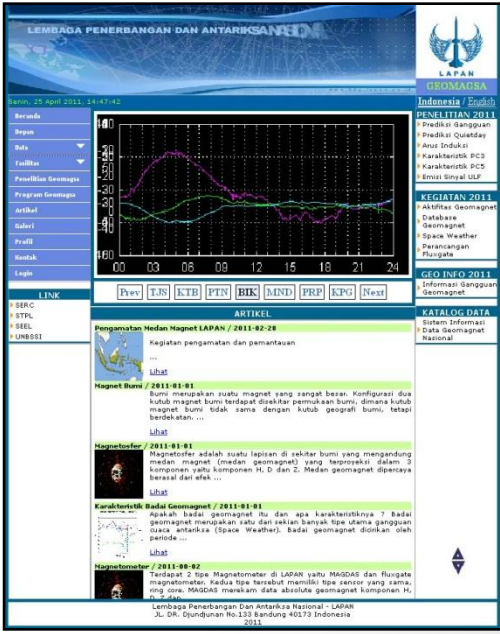
The data is transferred continuously to our server (Bandung). We also setup another server as backup when our main server down.



Data is transferred to primary server <host: 118.97.186.27> (left), or to secondary server <host: 110.136.145.80> (right)



To monitor performance of the data transfer of the system we developed a near real-time data quick look at Space Science Center (LAPAN).



Central Monitoring Room

<http://www.bdg.lapan.go.id/>

Problem of Data Quality

A common problem that occurs on the geomagnetic observation in Indonesia is about the noise due to human activity, or devices that emitting electromagnetic waves, near the observatory.

It is possible to put Magnetometer away from noise sources. When there is no availability of electricity, the solar cells is used to powers the Magnetometer and 3G routers.

→ the location must be in the cellular networks coverage .



Cell phone covering the village

2x100WattPeak
(mono crystalline)

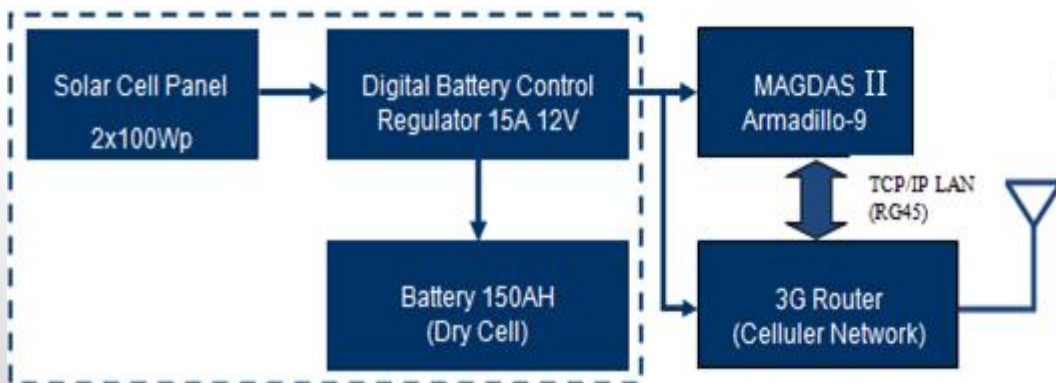
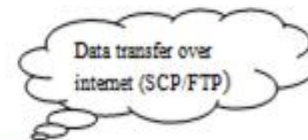


Battery



Fuses

Battery control regulator
(digital)

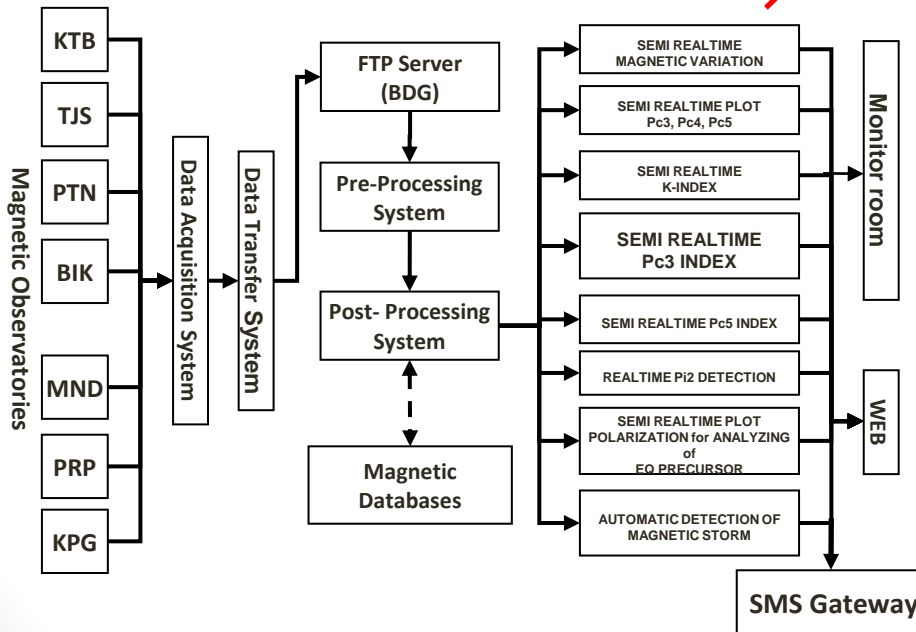
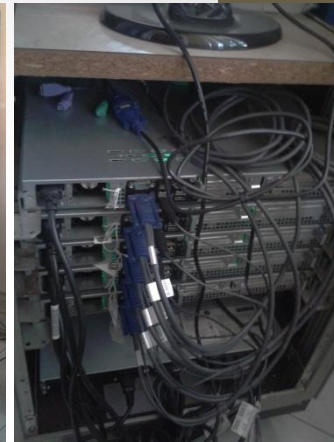


DATA PROCESSING

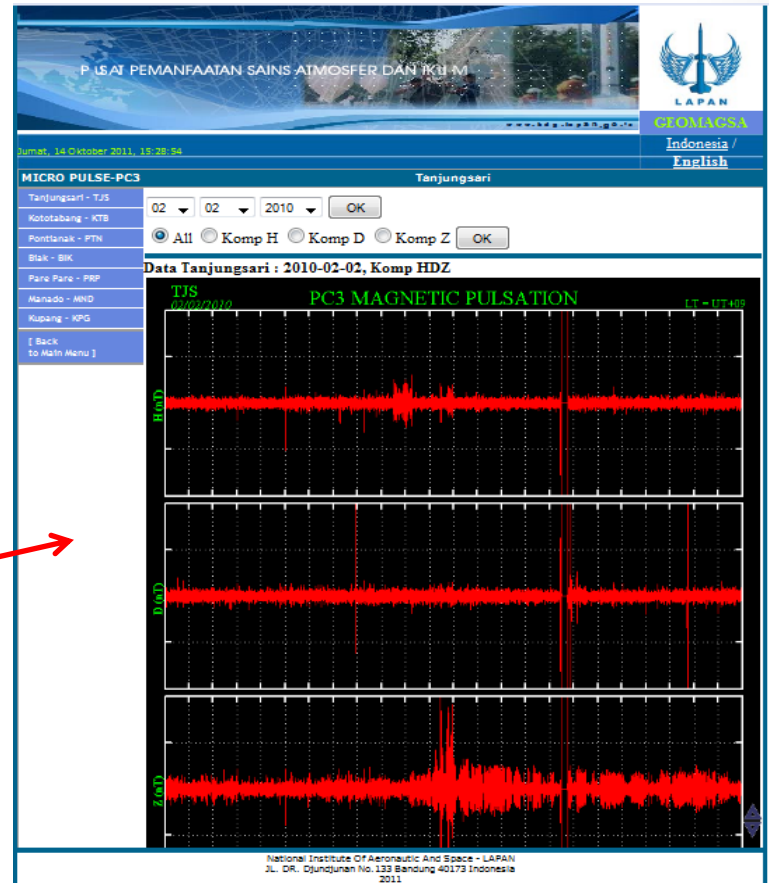
To support LAPAN's Space Weather Monitoring Program

<http://demoswm.dirgantara-lapan.or.id/geomagnet.php>

- Develop data processing based-on parallel computation
- The output of data processing is displayed in our website.

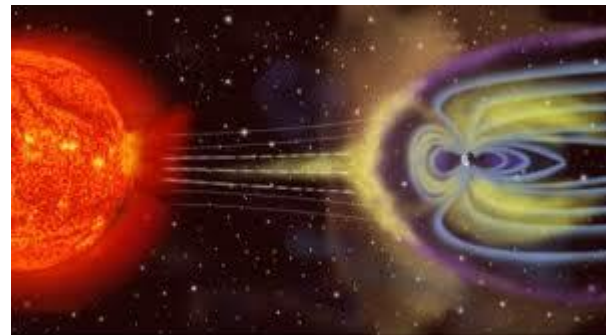
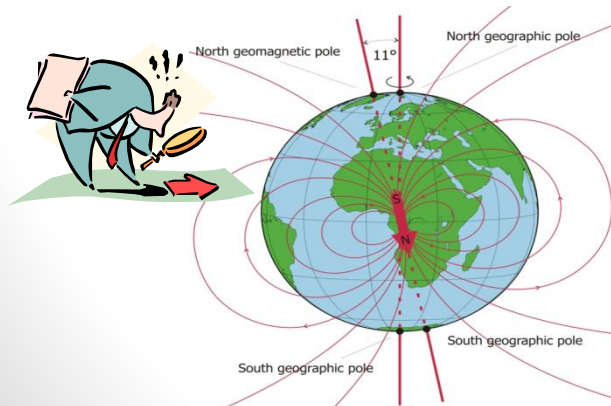


Early warning system



MAGDAS APPLICATIONS

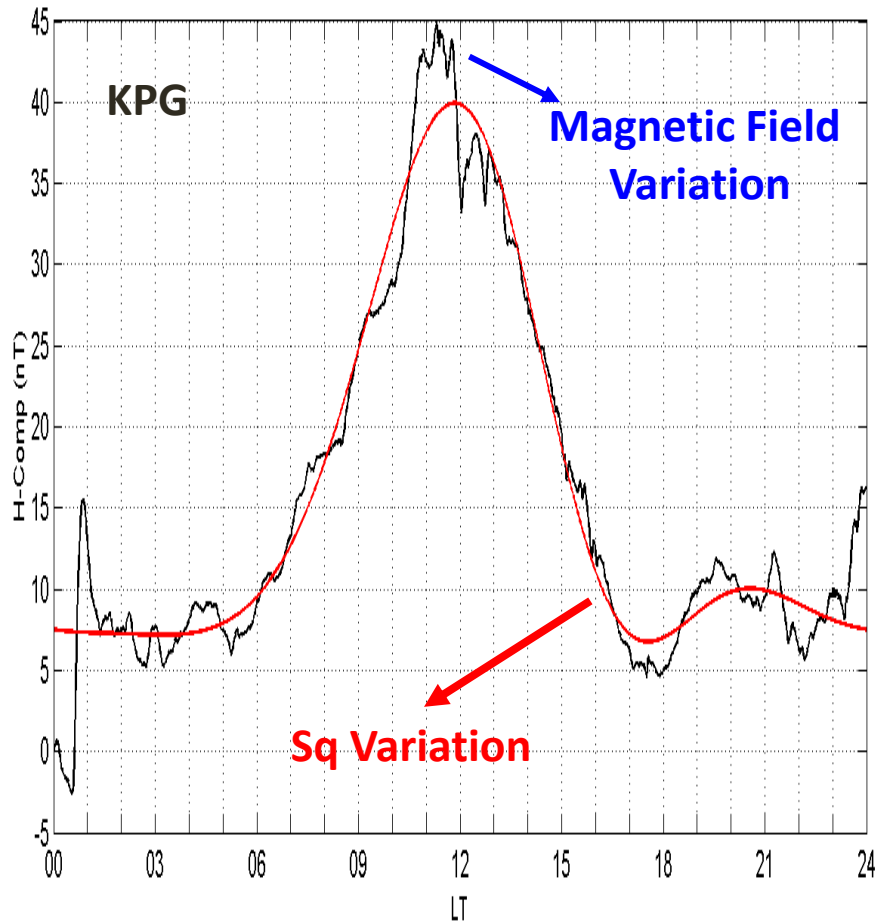
- MAGDAS in Indonesia have a great contribution on the study of coupling of solar wind – magnetosphere – ionosphere.
- we study about local geomagnetic disturbances, continuous (Pc3 and Pc5) and irregular (Pi2) magnetic pulsations.
- We will show some of our results on the study: characteristics of Pi2 magnetic pulsation, relationship between Pc3 and velocity of solar wind and relationship of Pc5 with solar wind pressure, magnetic storm and magnetospheric substorm. Study on ULF anomalies that related to earthquake also performed.



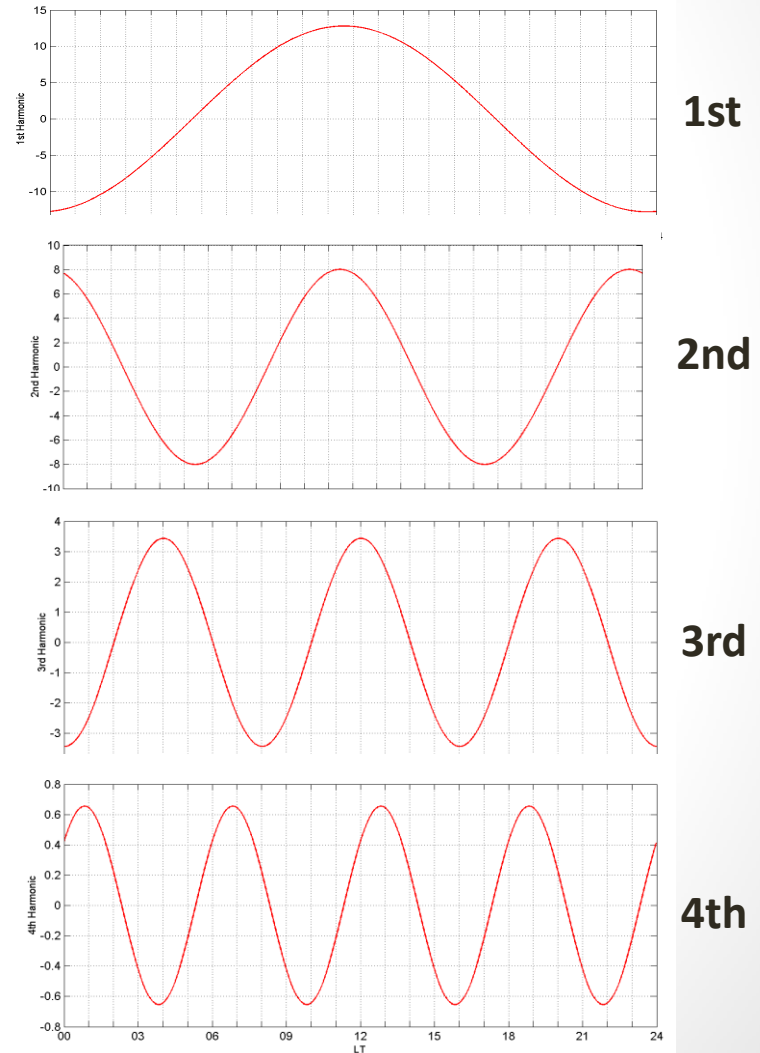
Study of Sq Variations and Geomagnetic Disturbance

Local Time Variation and Its Fourier Decomposition

Magnetic Variation, 5 May, 2011



Fourier Harmonics

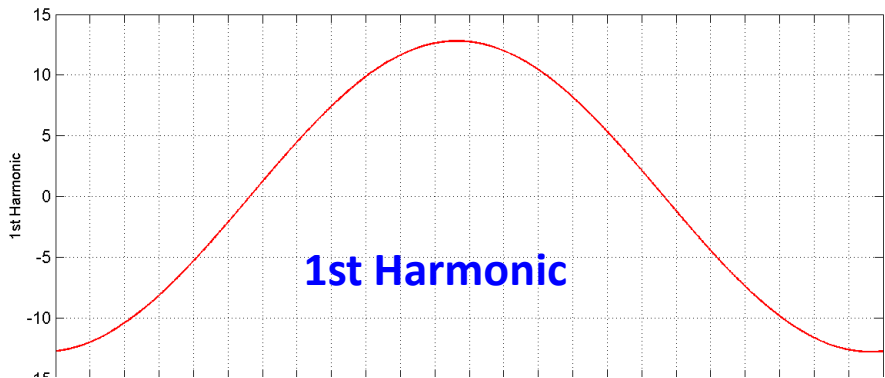


Study of Sq Variations and Geomagnetic Disturbance

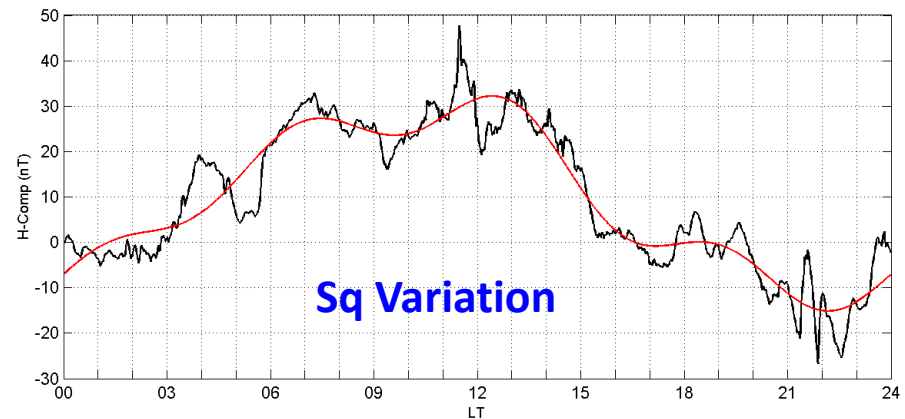
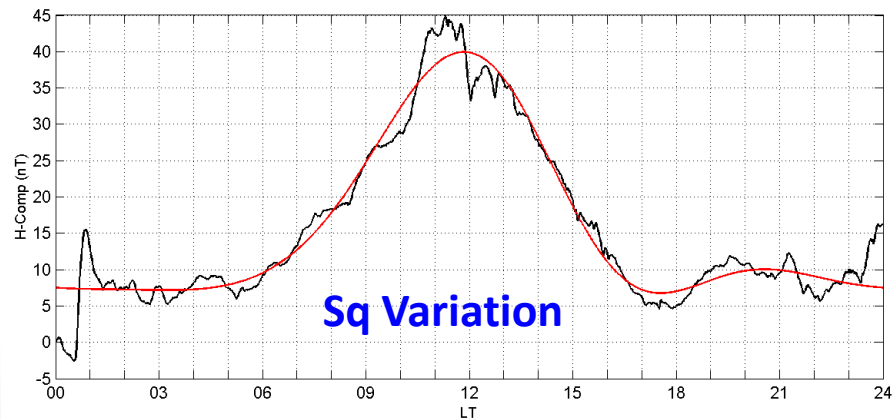
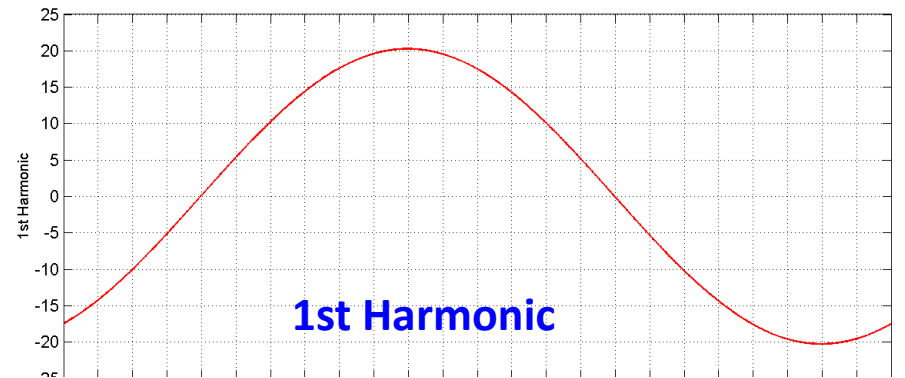
Selection of 5-Most Quiet Days

- Selection of 5-Quietest Days are base-on symmetry of Fourier Harmonics

KPG (5 May, 2011)



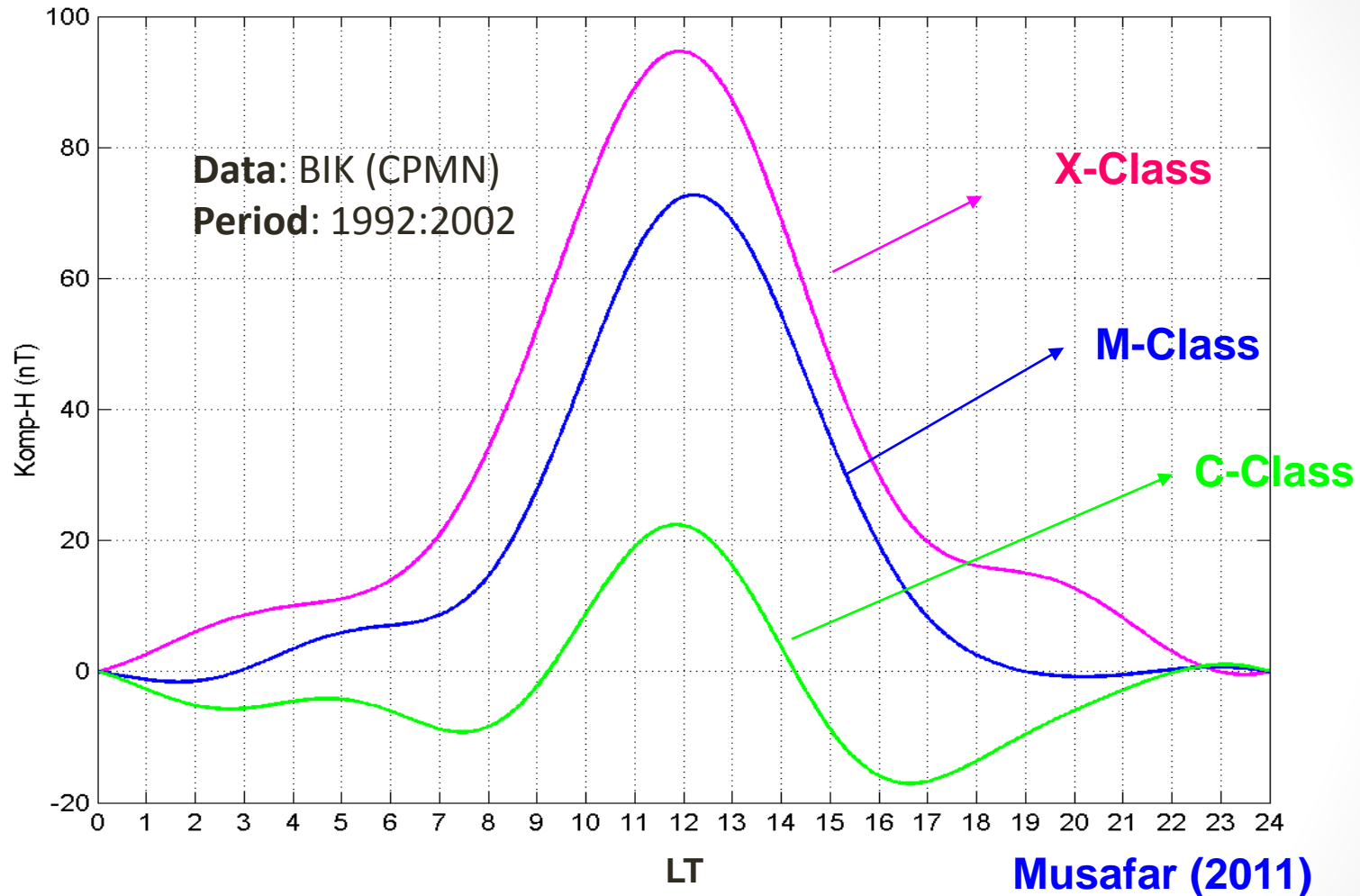
KPG (1 May, 2011)



- 1st-harmonic of Sq on 5 May more symmetry than 1-May, we concluded that Sq variation during 5 May is more quiet than during 1 May, 2011

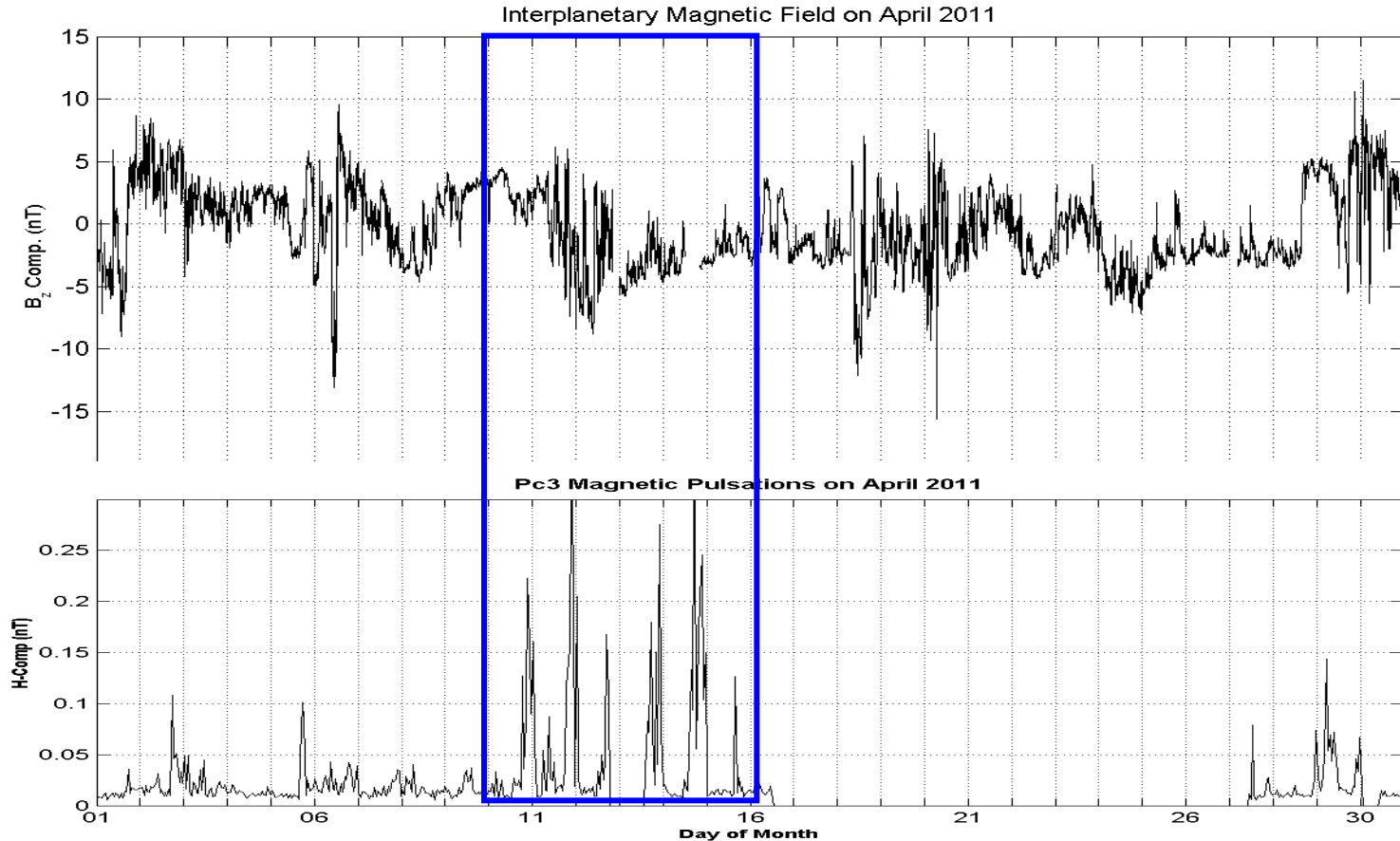
Another Results on Study of Sq Variation

Solar Flare Dependence of Sq Variation



- The Sq (solar quiet) variation calculated by using Fourier decomposition

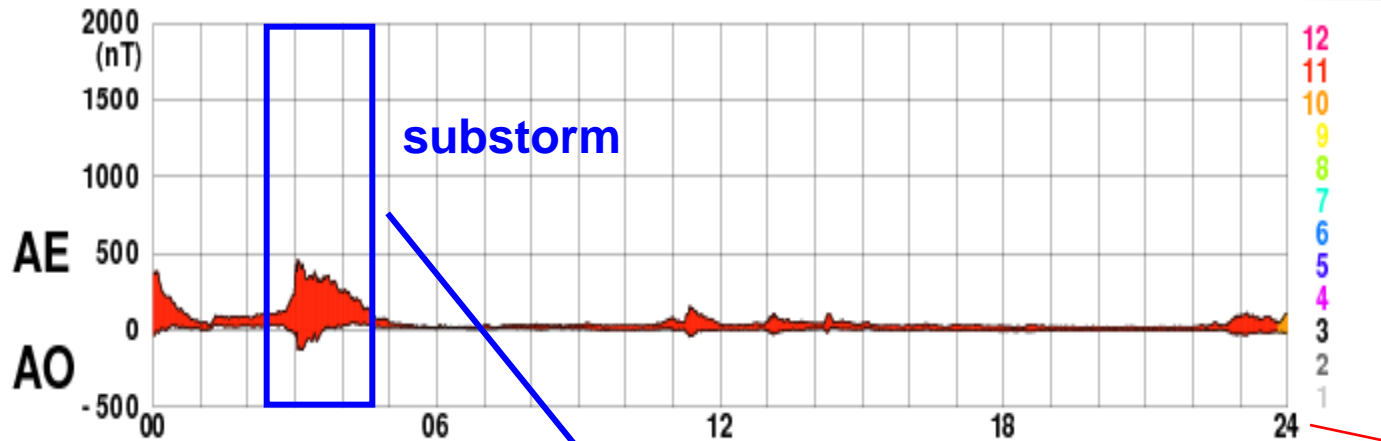
Study of Relationship Pc3 Pulsation and Bz-Comp. of IMF



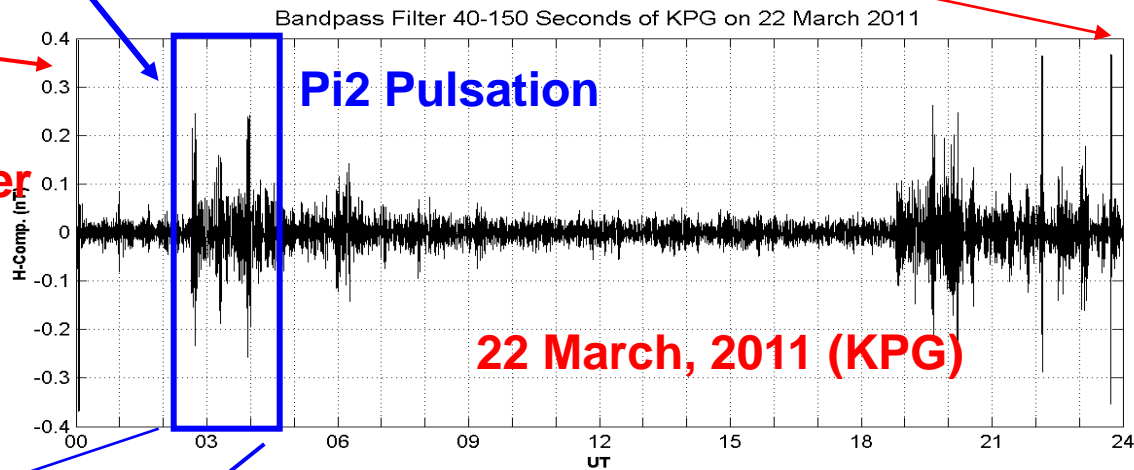
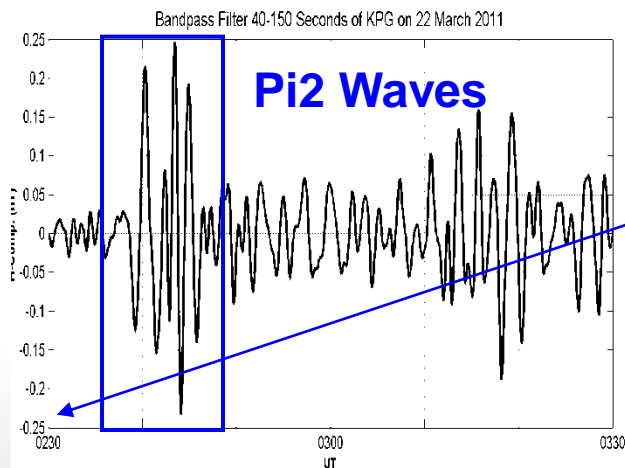
- Large enhancement of magnitude of Pc3 pulsation observed during long duration of southward interplanetary magnetic field.
- The study is aimed to understand effects of changes in solar wind to the Pc3 magnetic pulsation observed from ground stations. And to understand physical processes of Pc3 pulsation generation mechanism.

Study of Low-Latitude Pi2 Magnetic Pulsations

Data (KPG) 22 March, 2011



Filtering using Butterworth Filter

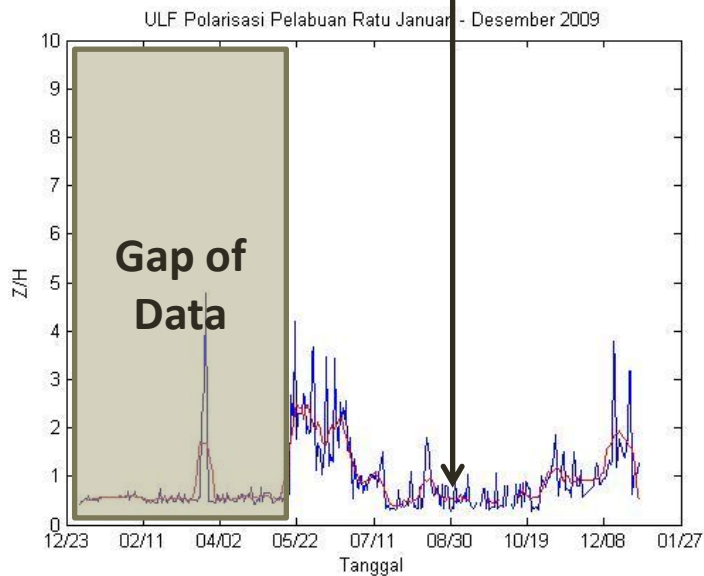
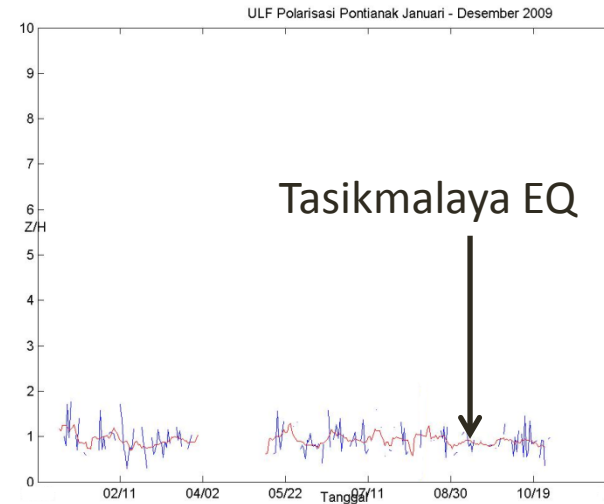
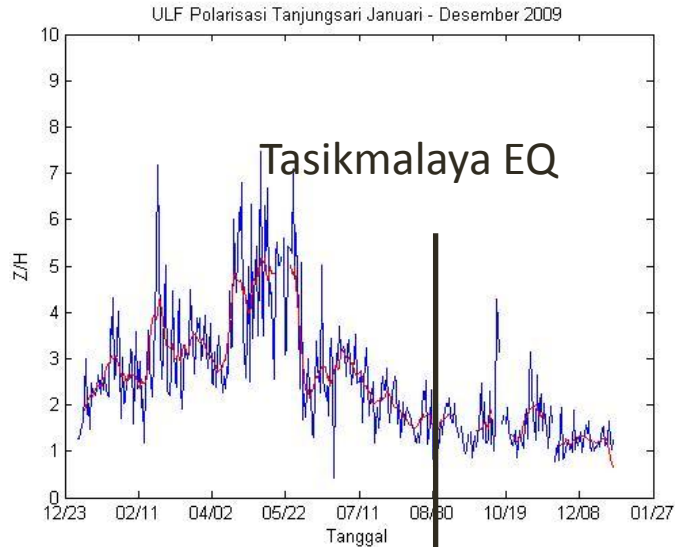


The study of magnetic pulsations is to understand:

- 1) Its relationship with substorm
- 2) Low-latitude Pi2's generation mechanism

ULF anomalies related to earthquake

Tasikmalaya (West Java) earthquake (7.3 SR) on September 02, 2009



Bandpass : 45 – 150 s

Z/H polarization

ACKNOWLEDGMENT

- Prof. K. Yumoto.
- Prof. Babatunde Rabi.
- Prof. Hans J. Haubold.
- The Local Organizing Committee (ISWI Workshop 2011).

Thank You