



九州大学
KYUSHU UNIVERSITY

MAGDAS at Sumatra: Latest Installation and Possible Scientific Study

**2012 ISWI & MAGDAS
School on Space Science
Ciloto, Indonesia
September 17-26, 2012**

**Presented by:
Nurul Shazana Abdul Hamid (Zana)
Kyushu University**

Outline

- ▶ **Pre-installation:**

MAGDAS-9 Magnetometer

Sensor hut and Preamp hut

MAGDAS test station at Sasaguri, Japan

- ▶ **MAGDAS installation Sumatra:**

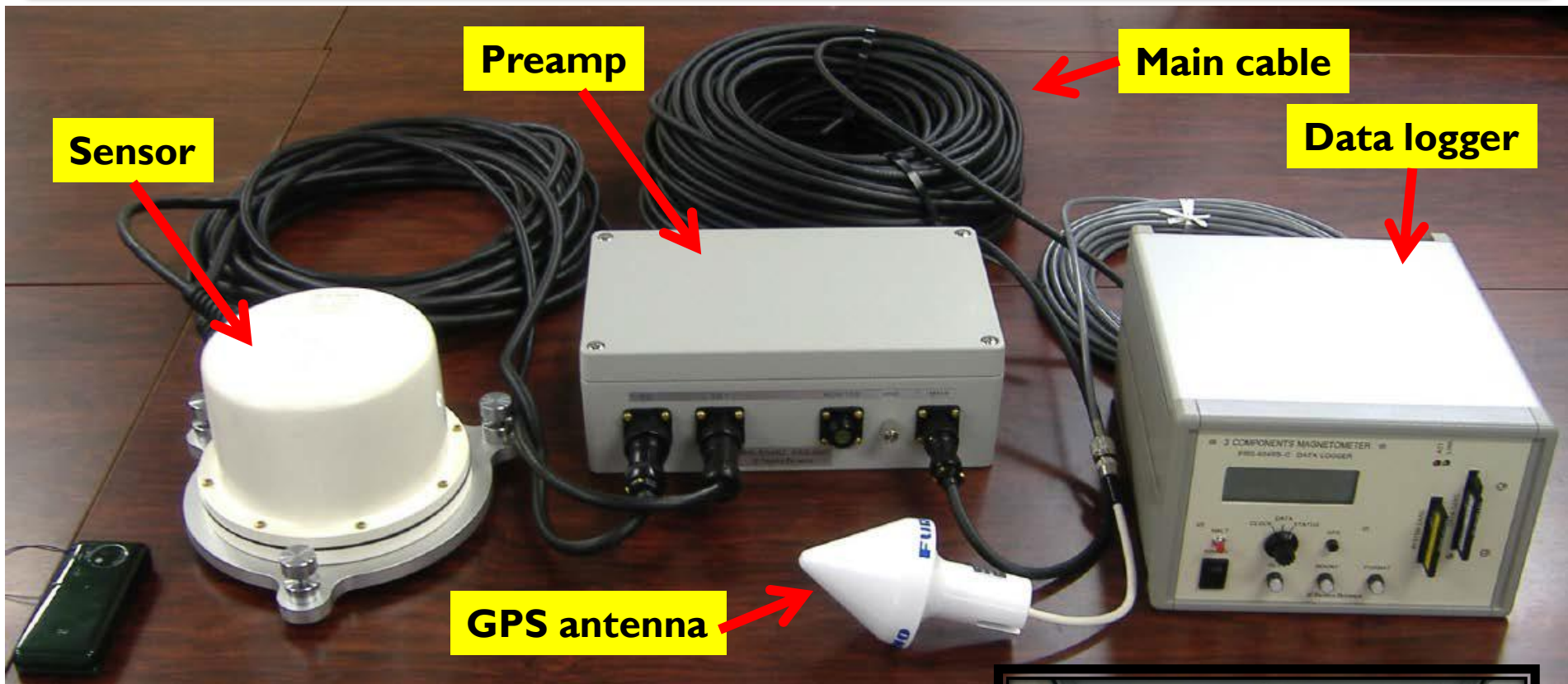
The people

The stations

- ▶ **Possible Scientific Study**



Pre-installation: MAGDAS-9 Magnetometer

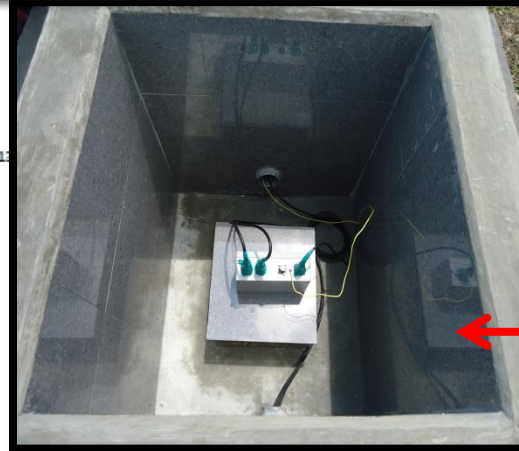
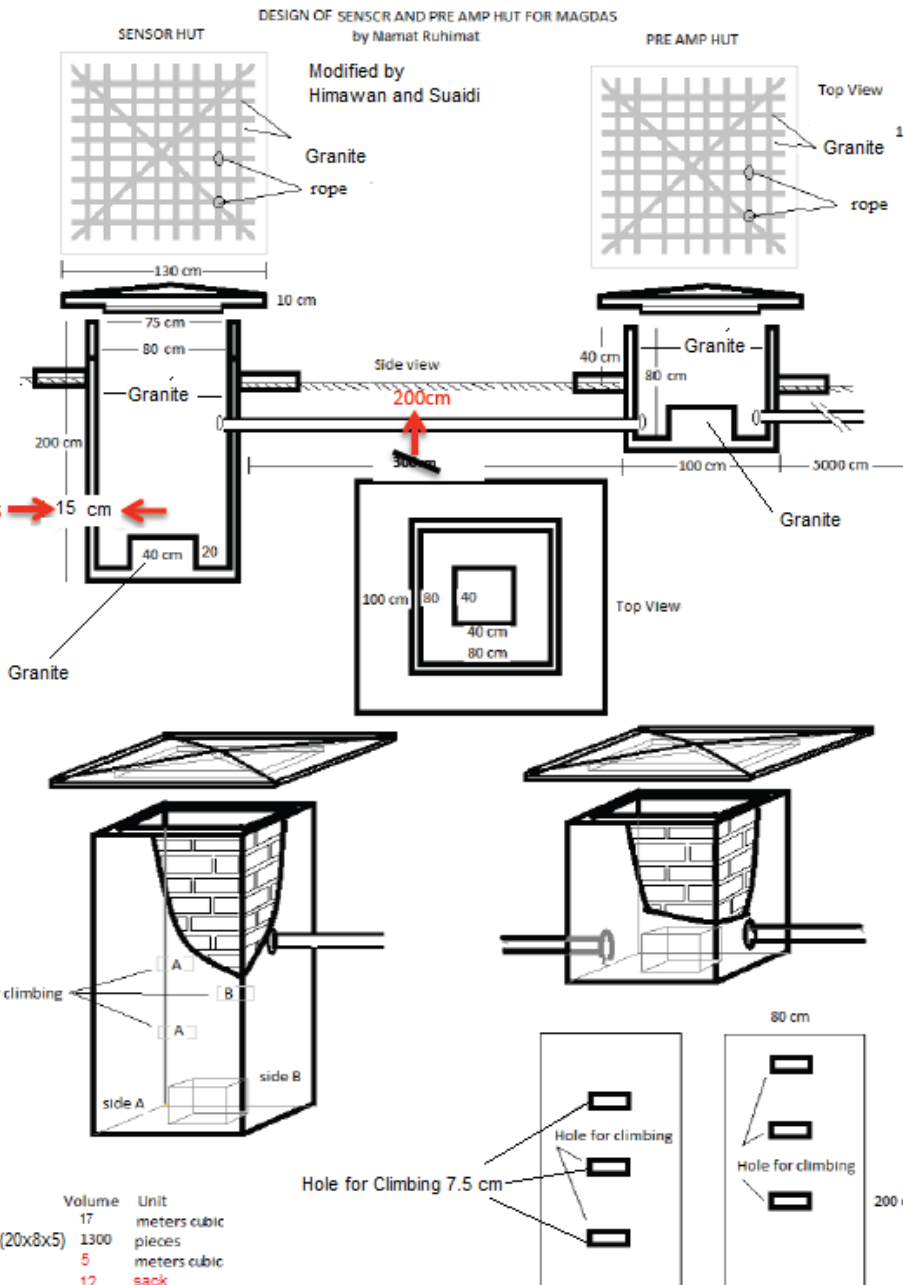


- ▶ **Sensor + 7 m cable; 2.9 kg + 1.7 kg**
- ▶ **Preamp; 2.9 kg**
- ▶ **Main cable; 70 m, 4.5 kg**
- ▶ **GPS antenna + cable; 0.85kg**
- ▶ **Data Logger; 2.6 kg**

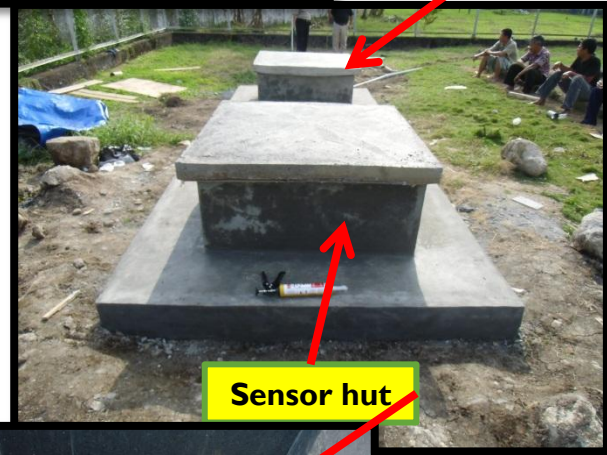
- ▶ **Total weight: 15.5 kg**



Pre-installation: Sensor hut and Preamp hut



Preamp hut



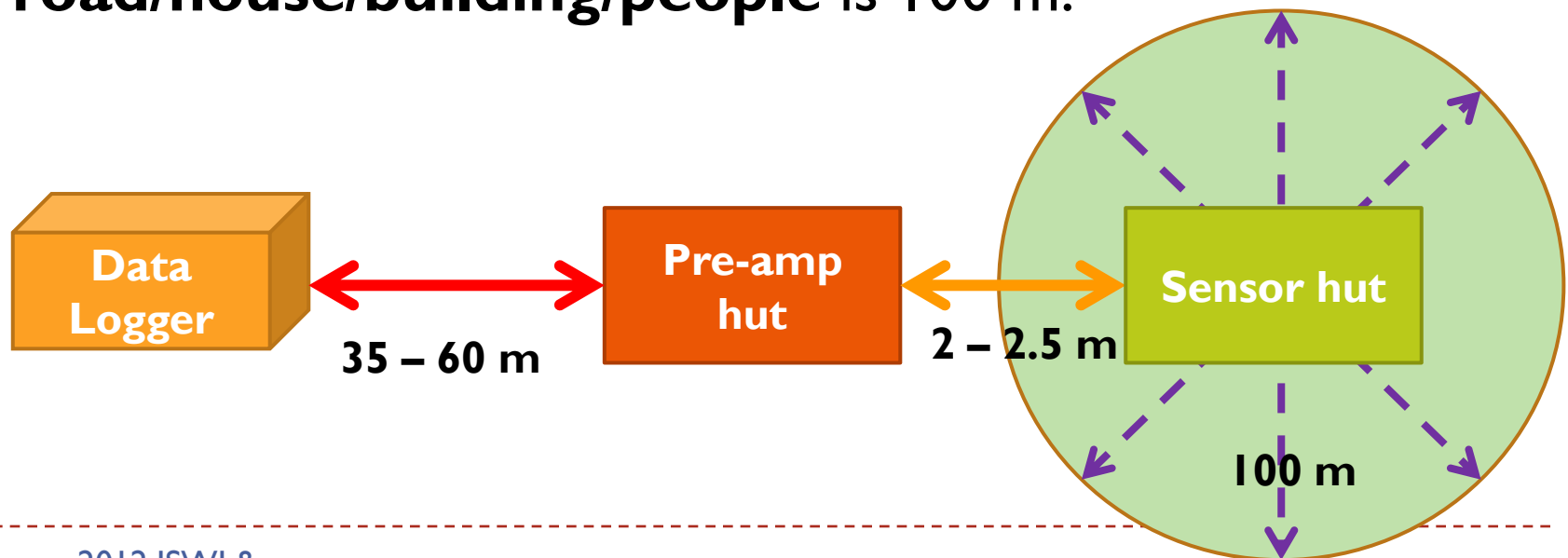
Sensor hut



200 cm deep is to maintain same temperature during day and night

Pre-installation: Sensor hut and Preamp hut (cont..)

- ▶ Distance from **data logger** building to **preamp hut** should be between 35 m to 50 m.
- ▶ Distance between **sensor hut** to **preamp hut** should be between 2 m to 2.5 m.
- ▶ The ideal minimum distance from sensor hut to any **main road/house/building/people** is 100 m.



Pre-installation: Testing the equipment

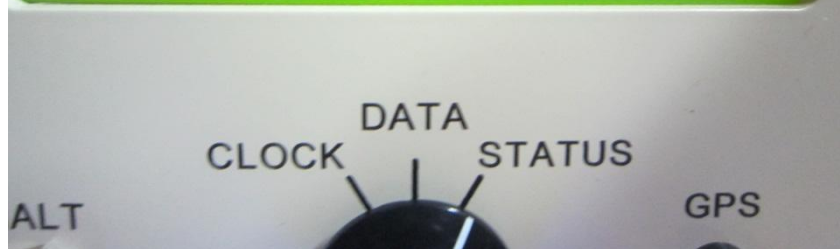
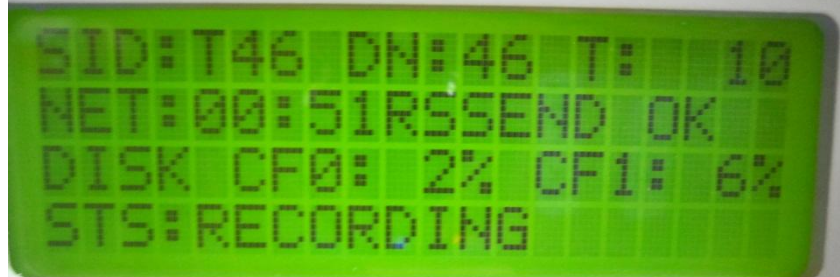
MAGDAS test station at Sasaguri, Japan



Testing the MAGDAS equipment



Equipment is working well



Packing the equipment



MAGDAS installation at Sumatra-The people

▶ ICSWSE team



George Maeda

Member of staff,
ICSWSE

**Nurul Shazana
(Zana)**

Graduate student
of Kyushu Univ.



Satoshi Ohta

Graduate student
of Kyushu Univ.



▶ BMKG team



**Budi Waluyo
(SCN)**

Head of Centre for
Technical Seismology,
Potential Geophysics
and Time Signal, BMKG

**Hasanudin
(BKL)**

Head of Potential
Geophysics and Time
Signal Division, BMKG



**Suaidi Ahadi
(LWA)**

Member of staff,
BMKG



MAGDAS installation at Sumatra-The stations



**1) SCN- Sicincin,
Padang (August 30 –
September 02)**

**2) BKL- Bengkulu
(September 03 - 07)**

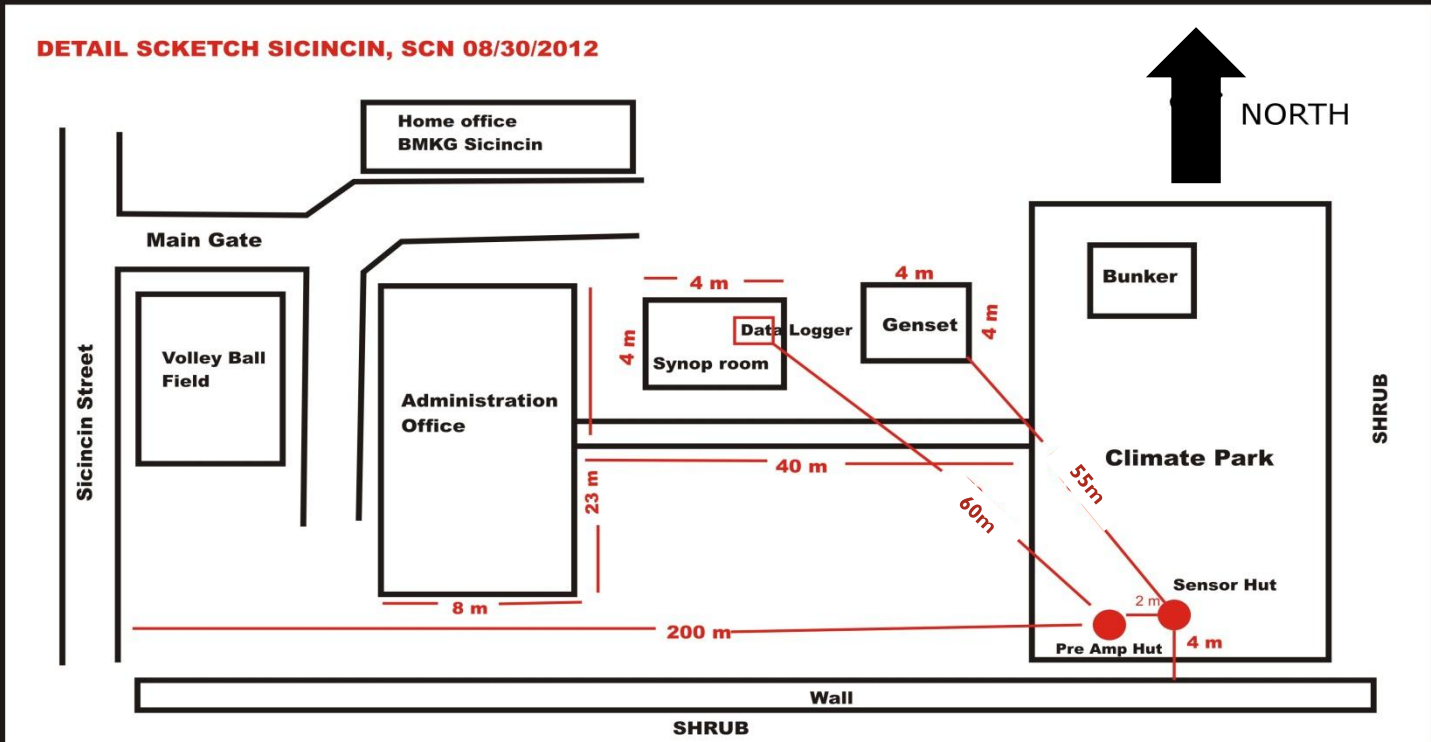
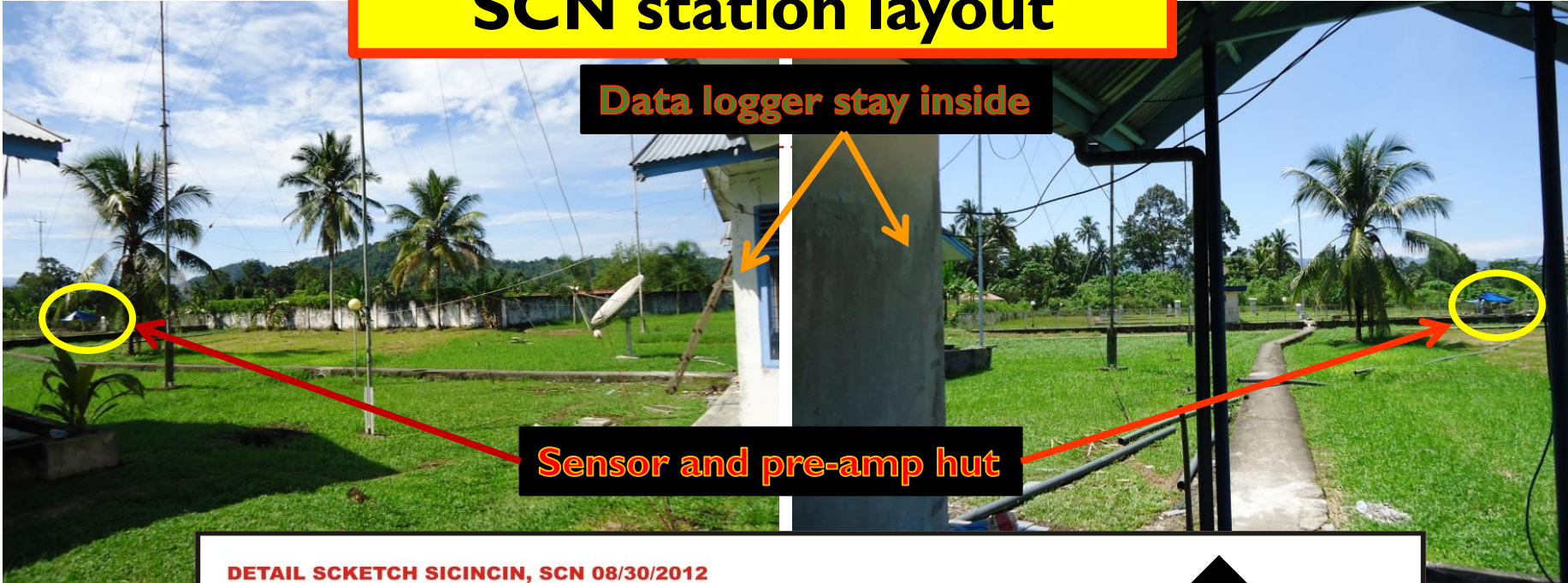
**3) LWA- Liwa, Lampung
(September 08 – 13)**

SCN station

Location	BMKG Climatology Station of Sicincin	
Coordinate	Latitude	Longitude
Geographic	0.55 S	100.30 E
Geomagnetic	12.11 S	171.66 E



SCN station layout



Construction process

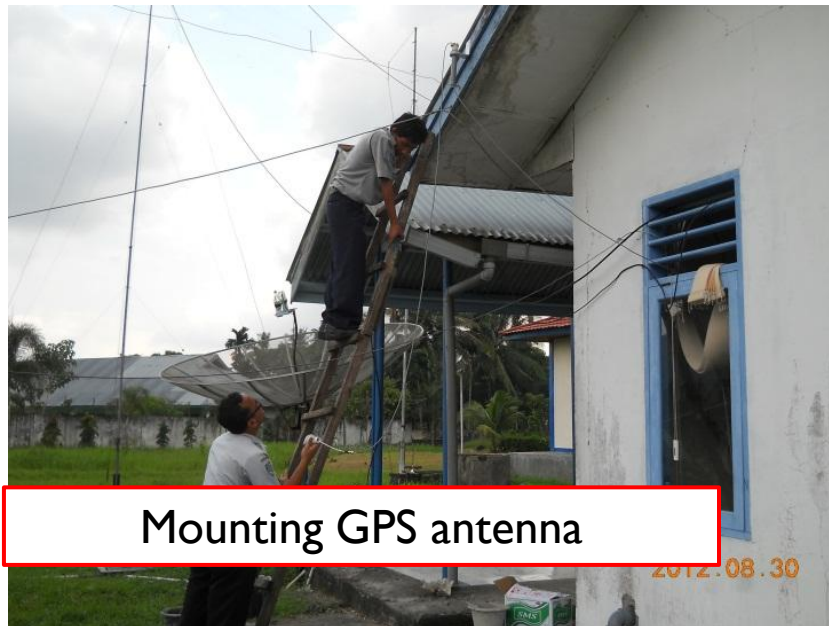
SCN



Sensor hut and pre-amp hut



Granite walls of the sensor hut



Mounting GPS antenna

MAGDAS School



Knocking a hole in the data logger building for the sensor cable

Burying the tubes for the main cable

SCN



Capacity Building

SCN



Sensor adjustment training



Data logger training



Data plotting training





Temporary installation of pre-amp



Temporary installation of sensor



Temporary cover of the sensor hut



24 hour test

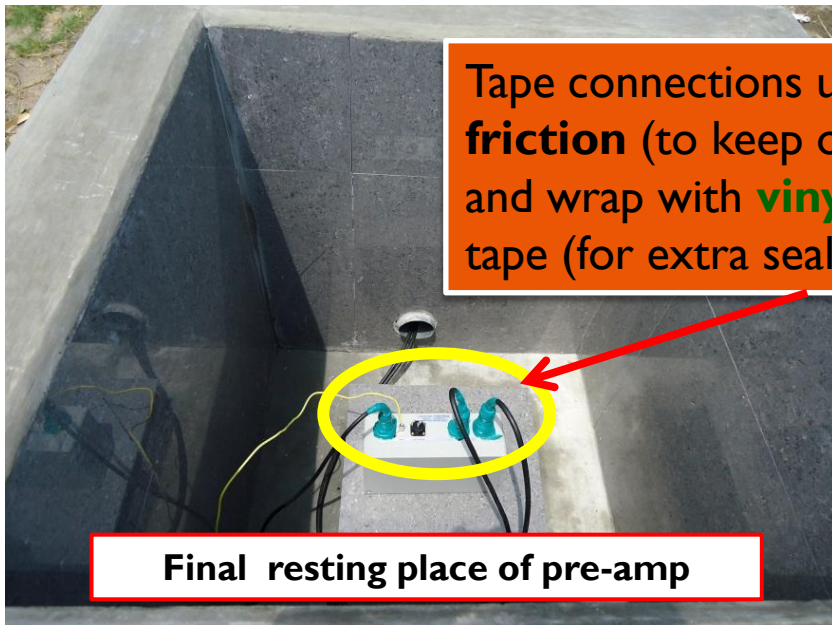
Final installation



Installing the sensor

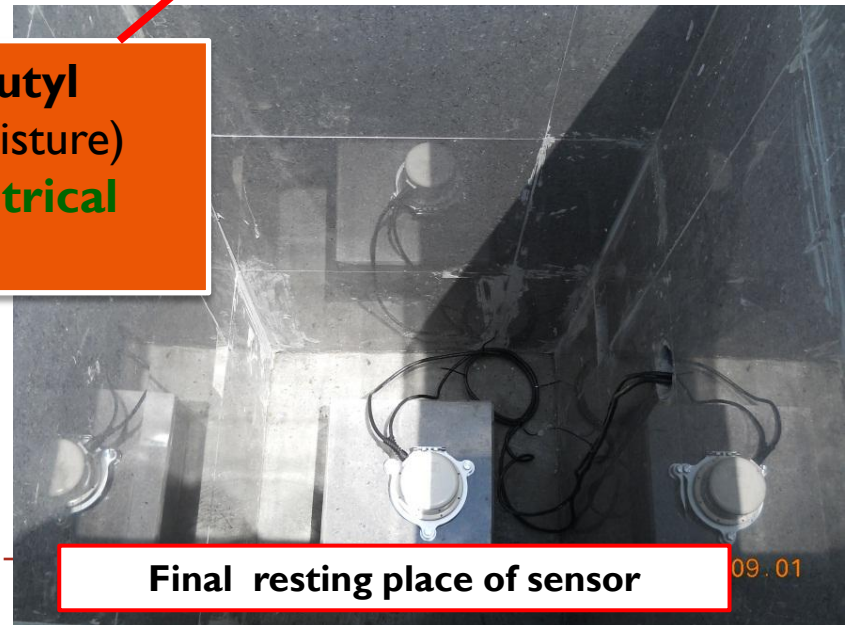


Installing the pre-amp



Tape connections using **butyl friction** (to keep out moisture) and wrap with **vinyl electrical** tape (for extra sealing).

Final resting place of pre-amp



Final resting place of sensor

Sensor hut cover and pre-amp hut cover

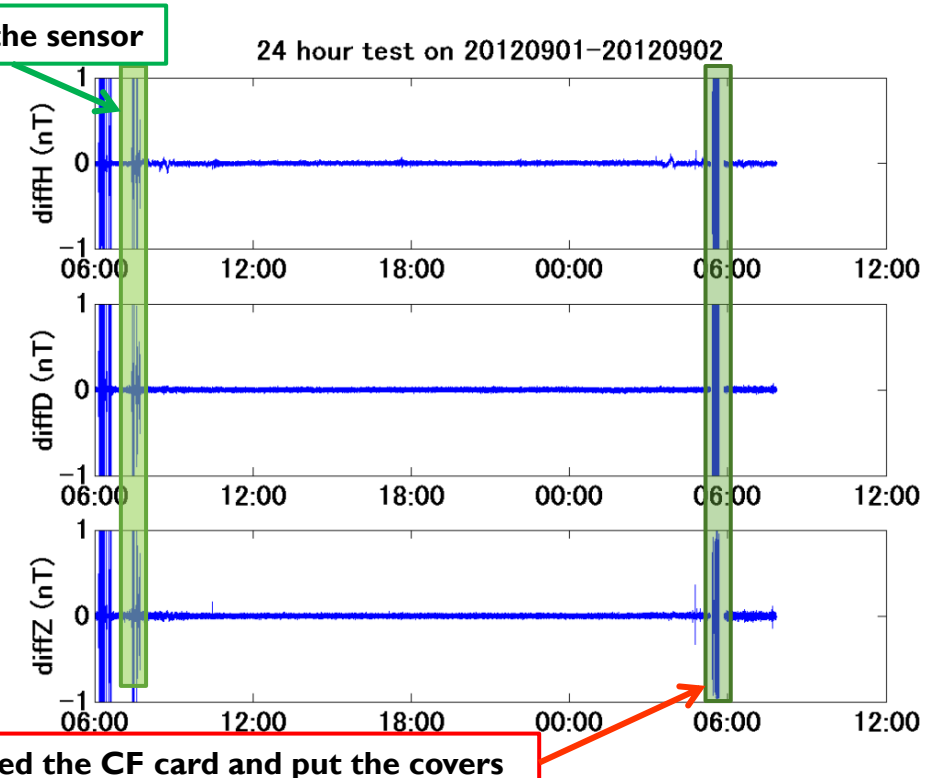
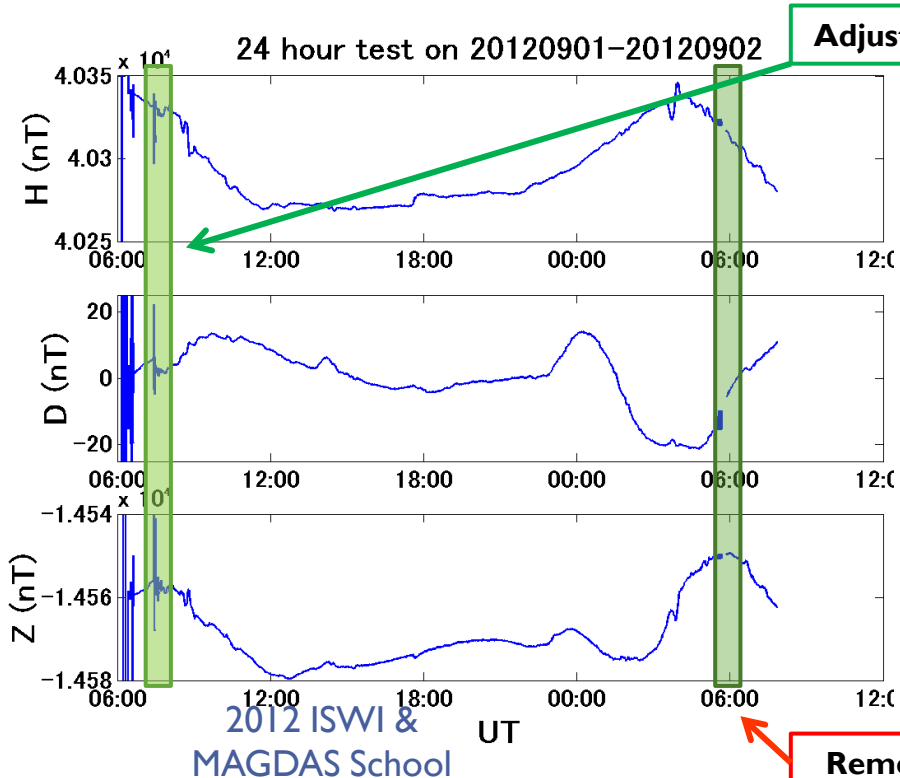
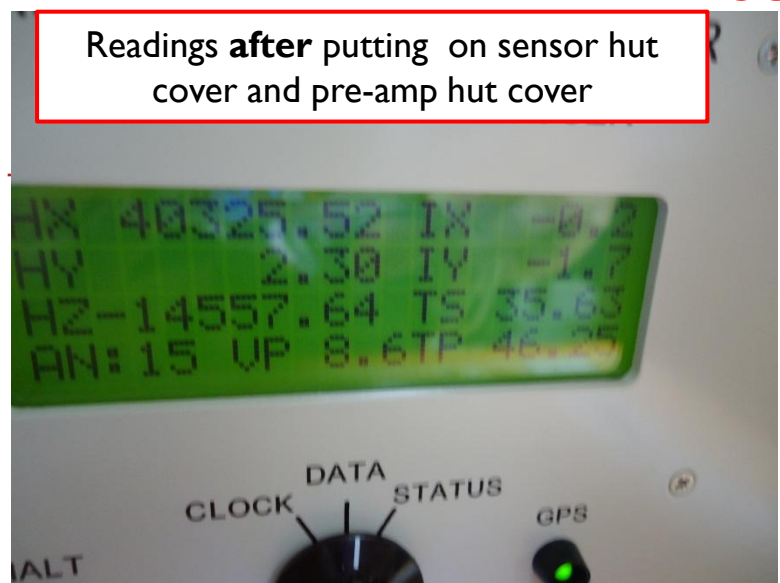
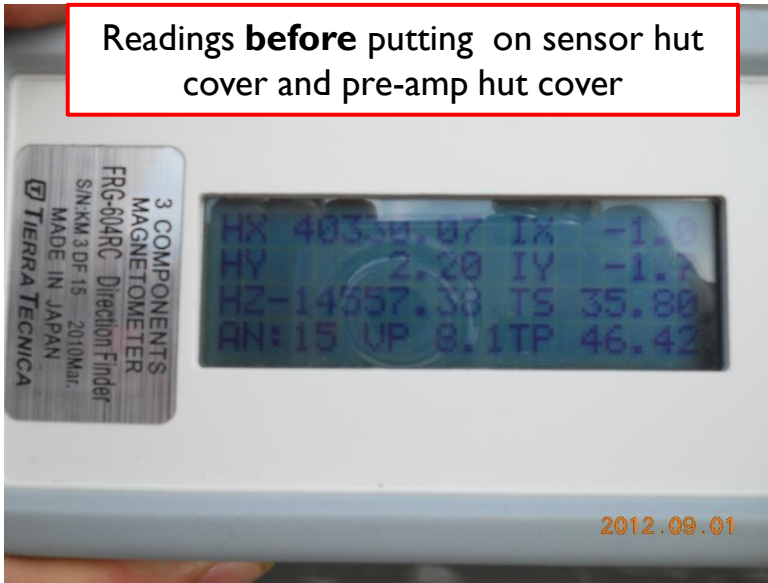
SCN

Sensor hut



Pre-amp hut





MAGDAS installation at Sumatra-The stations



1) **SCN- Secincin,
Padang (August 30 –
September 02)**

2) **BKL- Bengkulu
(September 03 - 07)**

3) **LWA- Liwa, Lampung
(September 08 – 13)**

BKL station

Location	BMKG Climatology Station of Pulau Baai Bengkulu	
Coordinate	Latitude	Longitude
Geographic	3.86 S	102.31 E
Geomagnetic	15.13 S	173.60 E

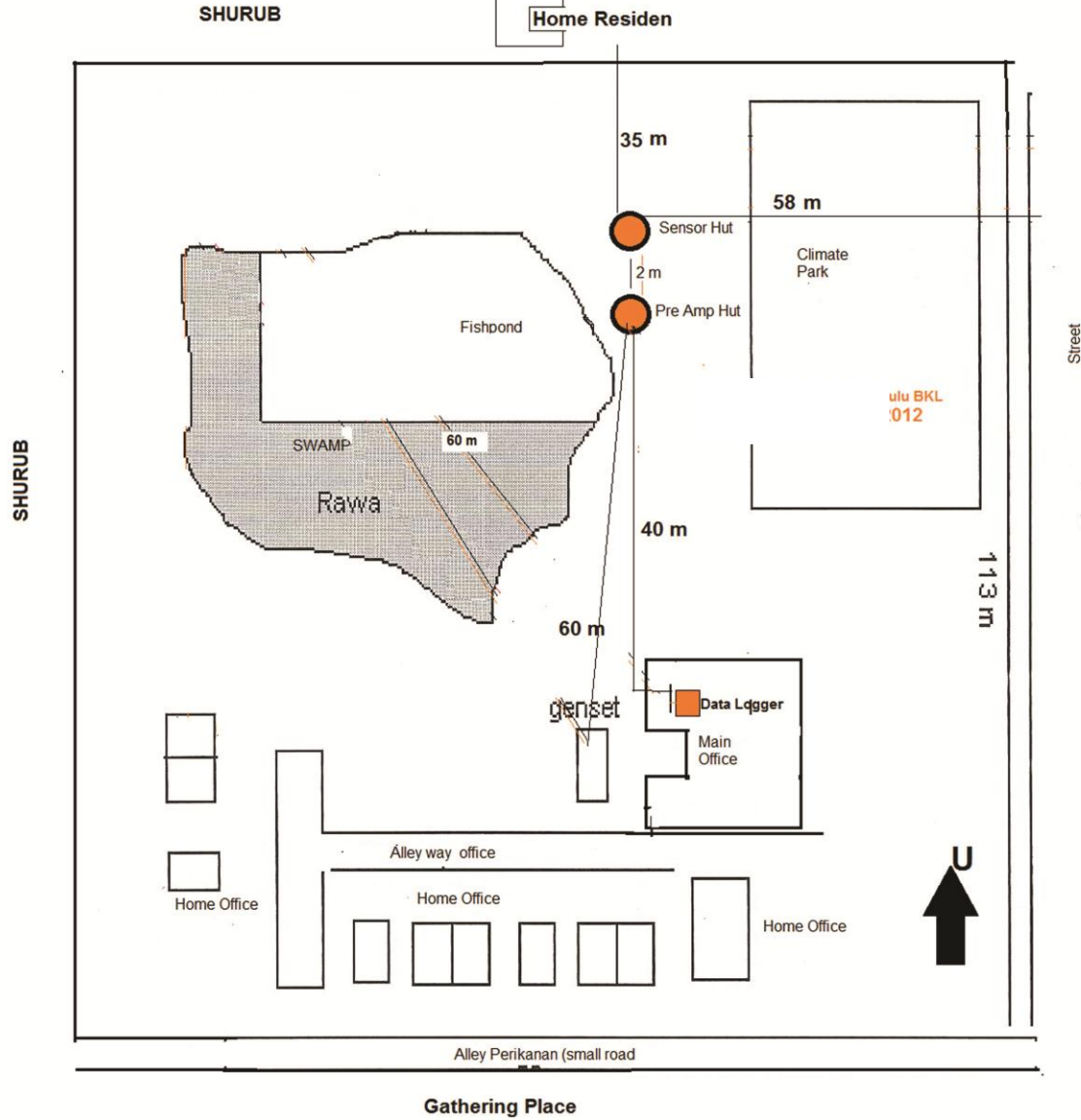


BKL station layout

Data logger stays inside

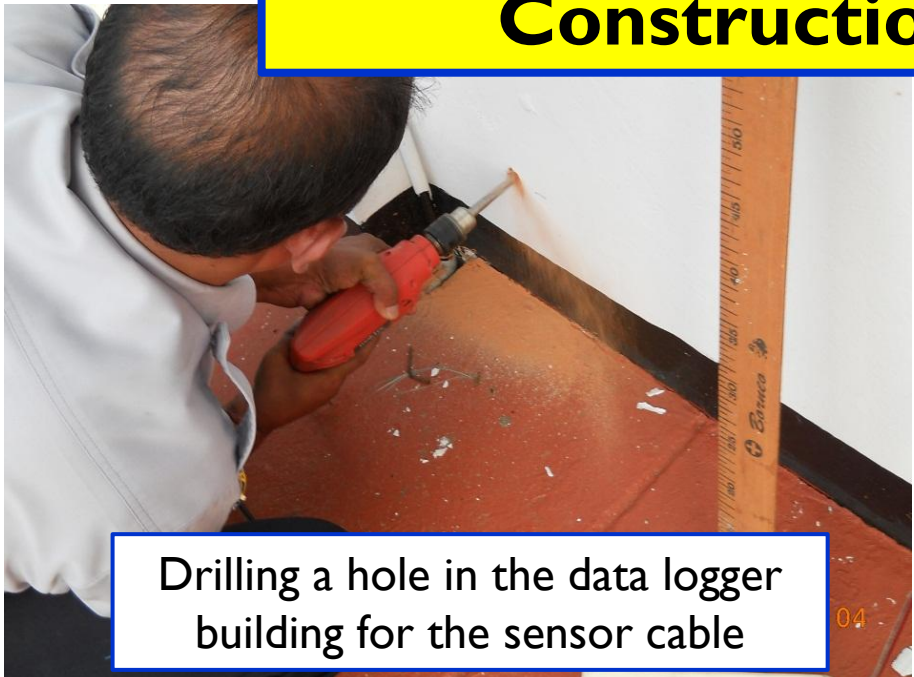


Sensor and Pre-amp hut



Construction process

BKL



Drilling a hole in the data logger building for the sensor cable



Frames for the concrete covers

2-m- deep sensor



Mounting GPS antenna



Dropping the cable down to pre-amp hut

Installation of the tubes for the main cable

Wall clamps for the orange tube



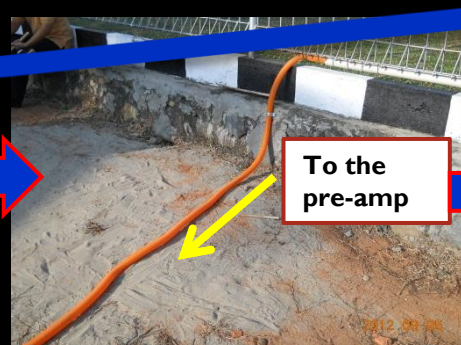
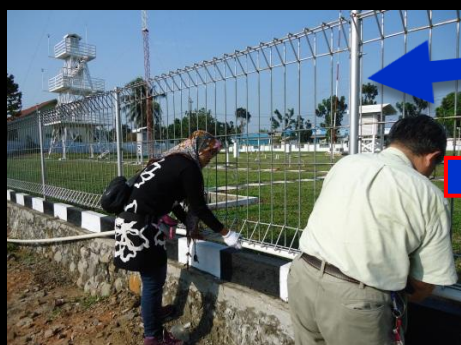
Orange tube inside the data logger room



Temporary arrangement



Passing the cable through the orange tube

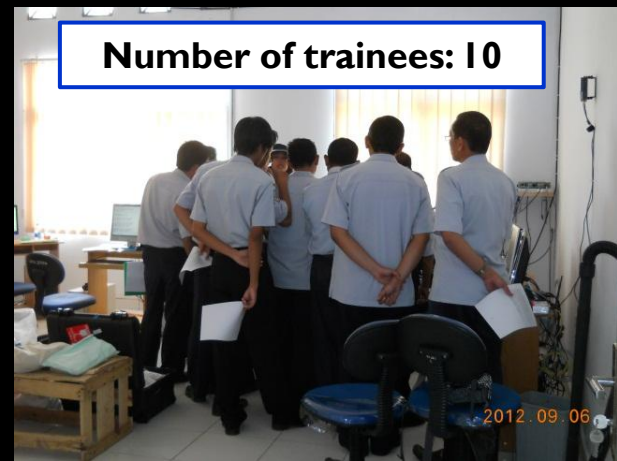


To the pre-amp



Orange tube after being buried





Number of trainees: 10

Instruction sheet for data card exchange, written in Indonesian.



Trainee tries it himself.

Capacity Building

Installation of pre-amp and sensor



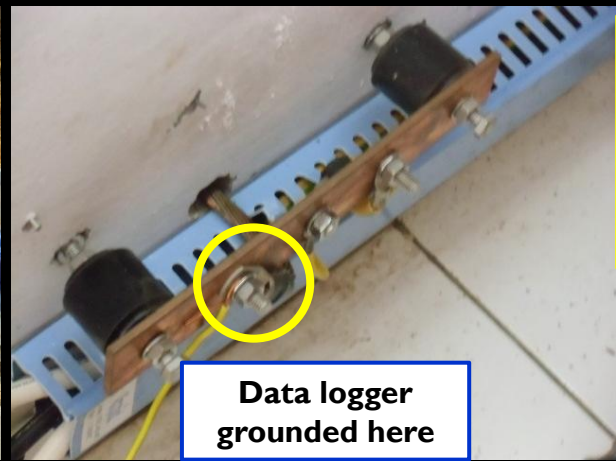
Final stretch of the sensor cable



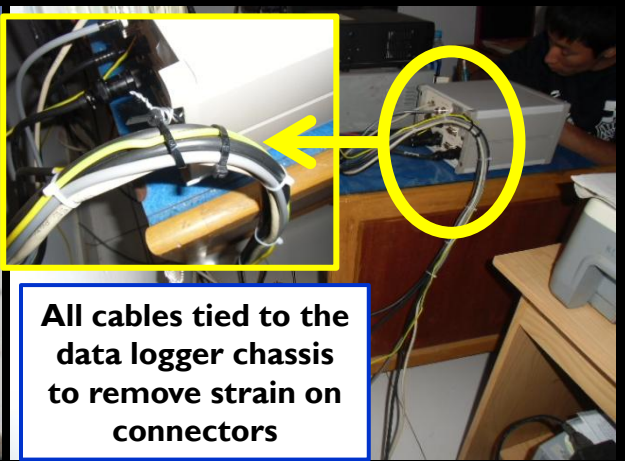
Final adjustment of the sensor



Support for blue sheet cover



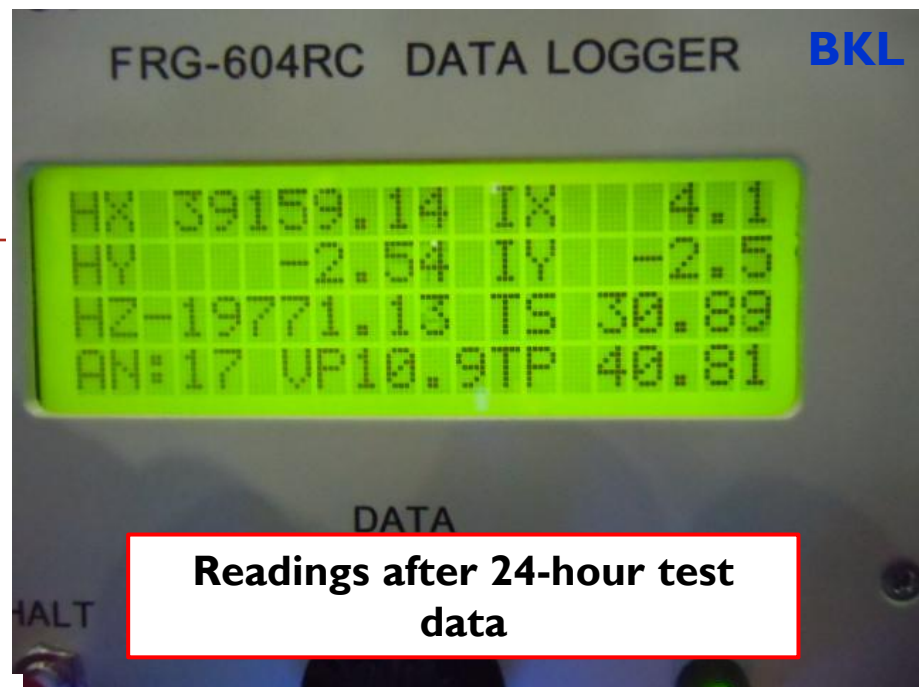
Data logger grounded here



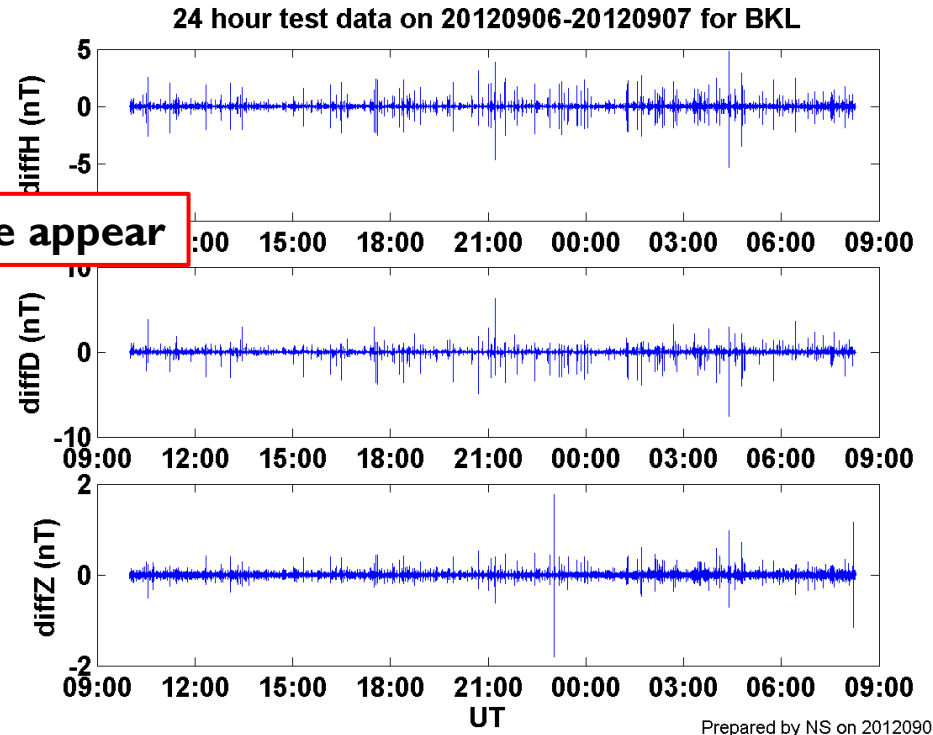
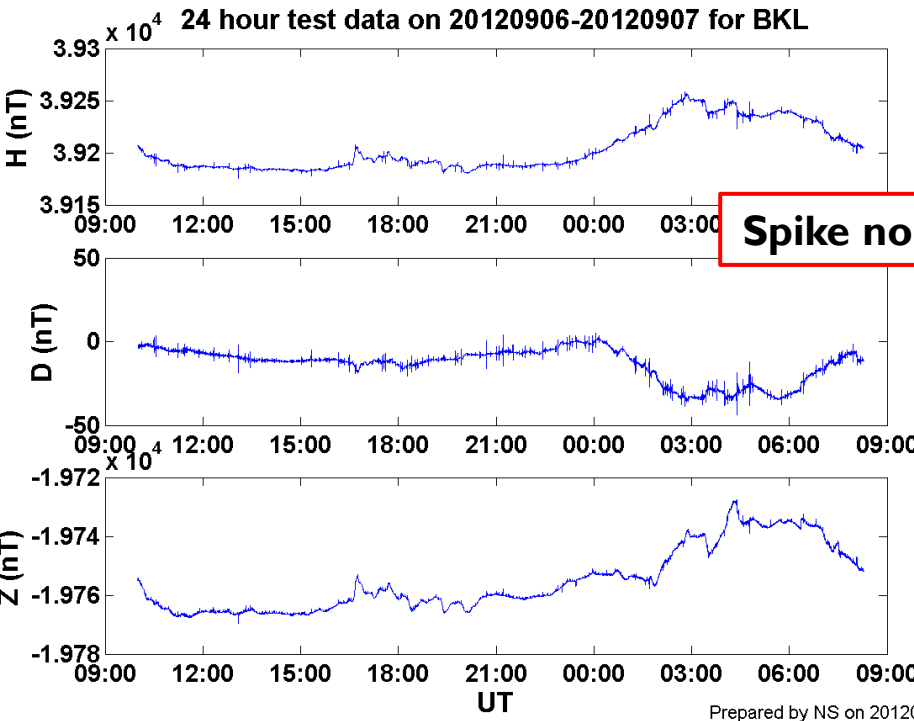
All cables tied to the data logger chassis to remove strain on connectors



Data Logger in action



Readings after 24-hour test data



MAGDAS installation at Sumatra-The stations



1) **SCN- Secincin, Padang (August 30 – September 02)**

2) **BKL- Bengkulu (September 03 - 07)**

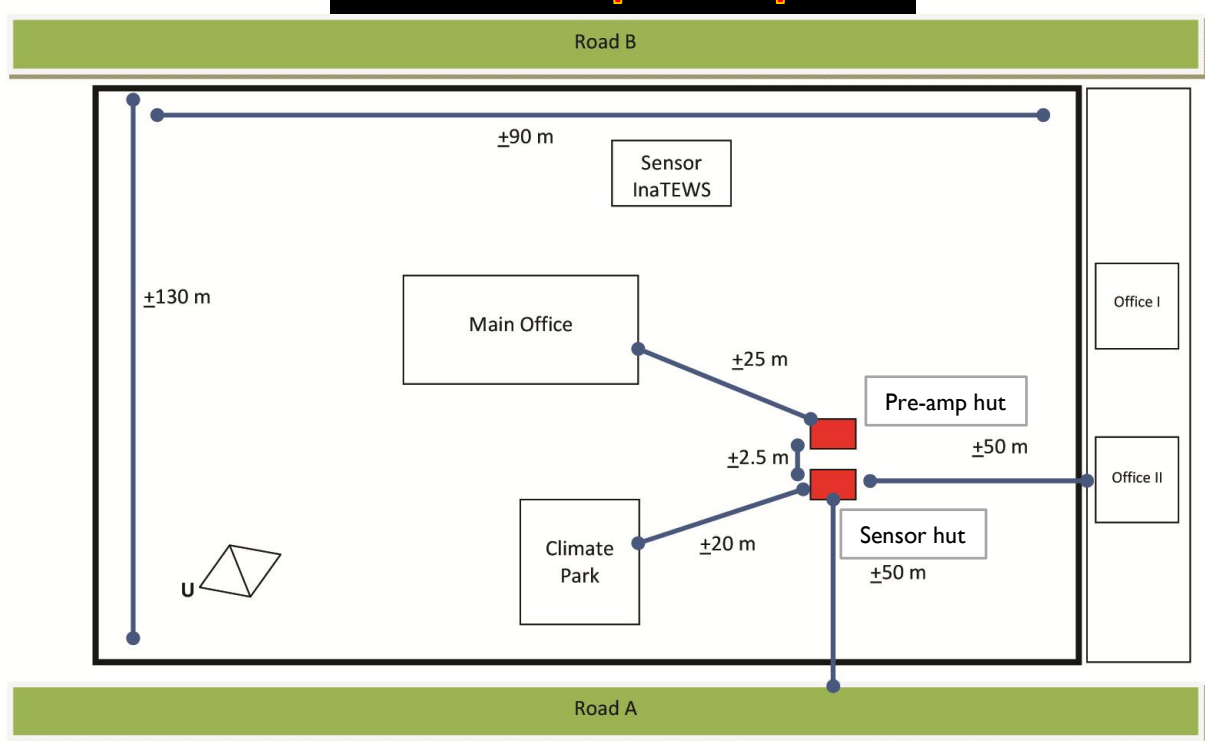
3) **LWA- Liwa, Lampung (September 08 – 13)**

LWA station

Location	BMKG Meteorology and Geophysics Station of Liwa	
Coordinate	Latitude	Longitude
Geographic	5.02 S	104.06 E
Geomagnetic	16.19 S	175.33 E



LWA station layout



Sensor Hut and Preamp Hut under construction

LWA



Installation of the main cable



Knocking a hole into the wall of the Main Building



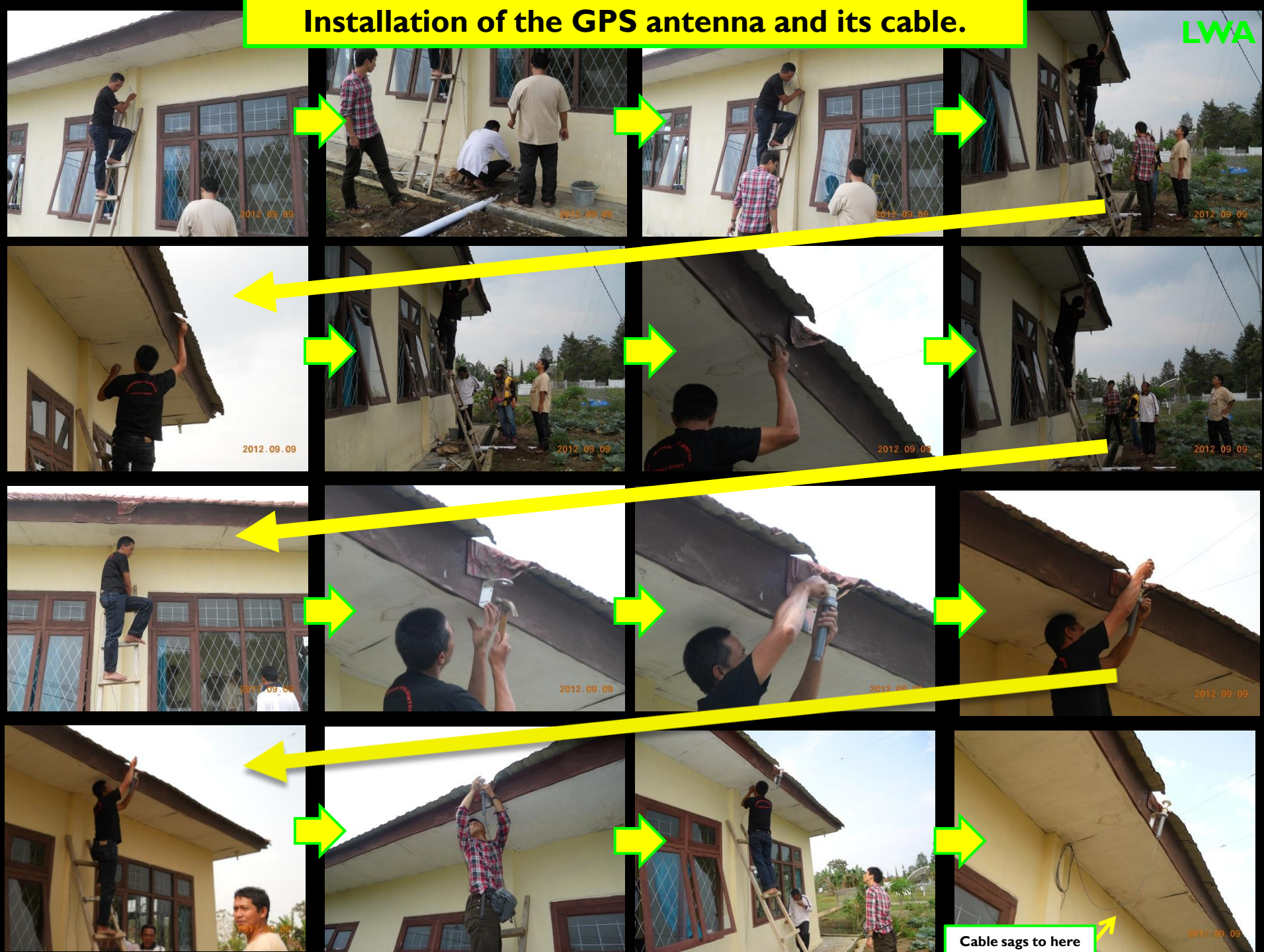
Pre-amp hut



Hard tube running through the cabbage patch.



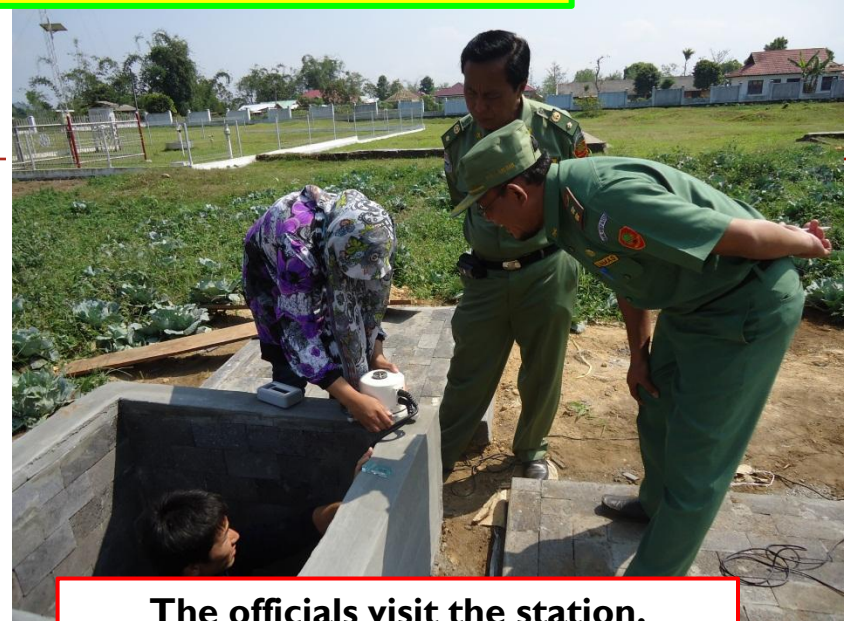
Installation of the GPS antenna and its cable.



Site visit by Local Government Officials of Liwa



Meeting with local government officials.



The officials visit the station.



Capacity Building



First day of training



Second day of training



Installation of Pre-amp and Sensor

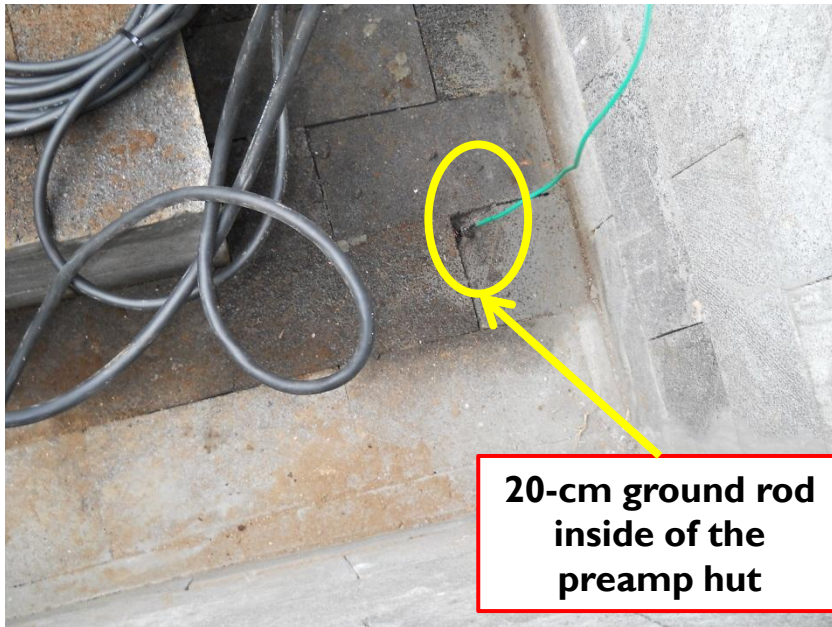


Final installation of the preamp.



Go in for the final adjustment of the sensor.

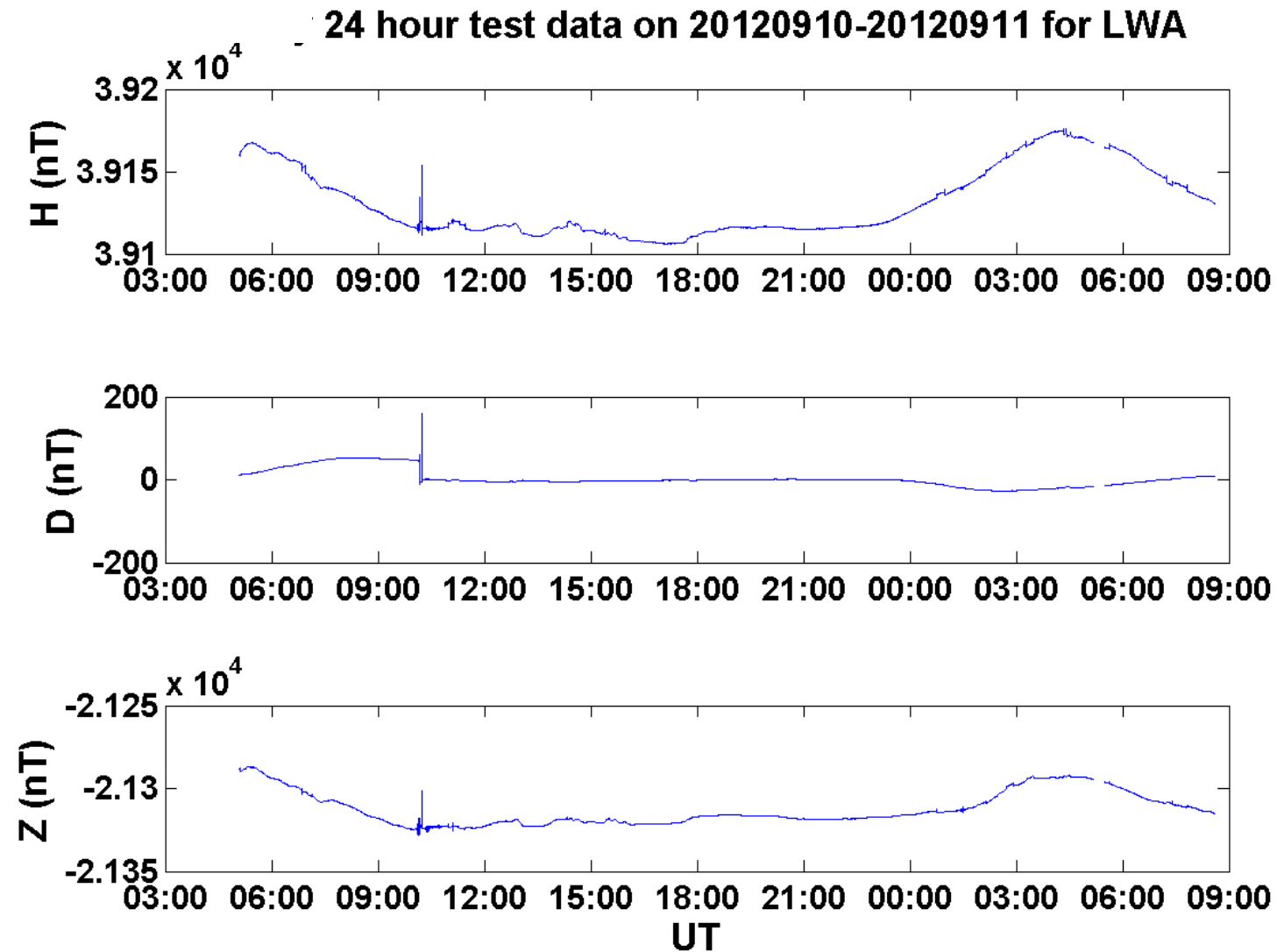
2012 09 10



20-cm ground rod inside of the preamp hut

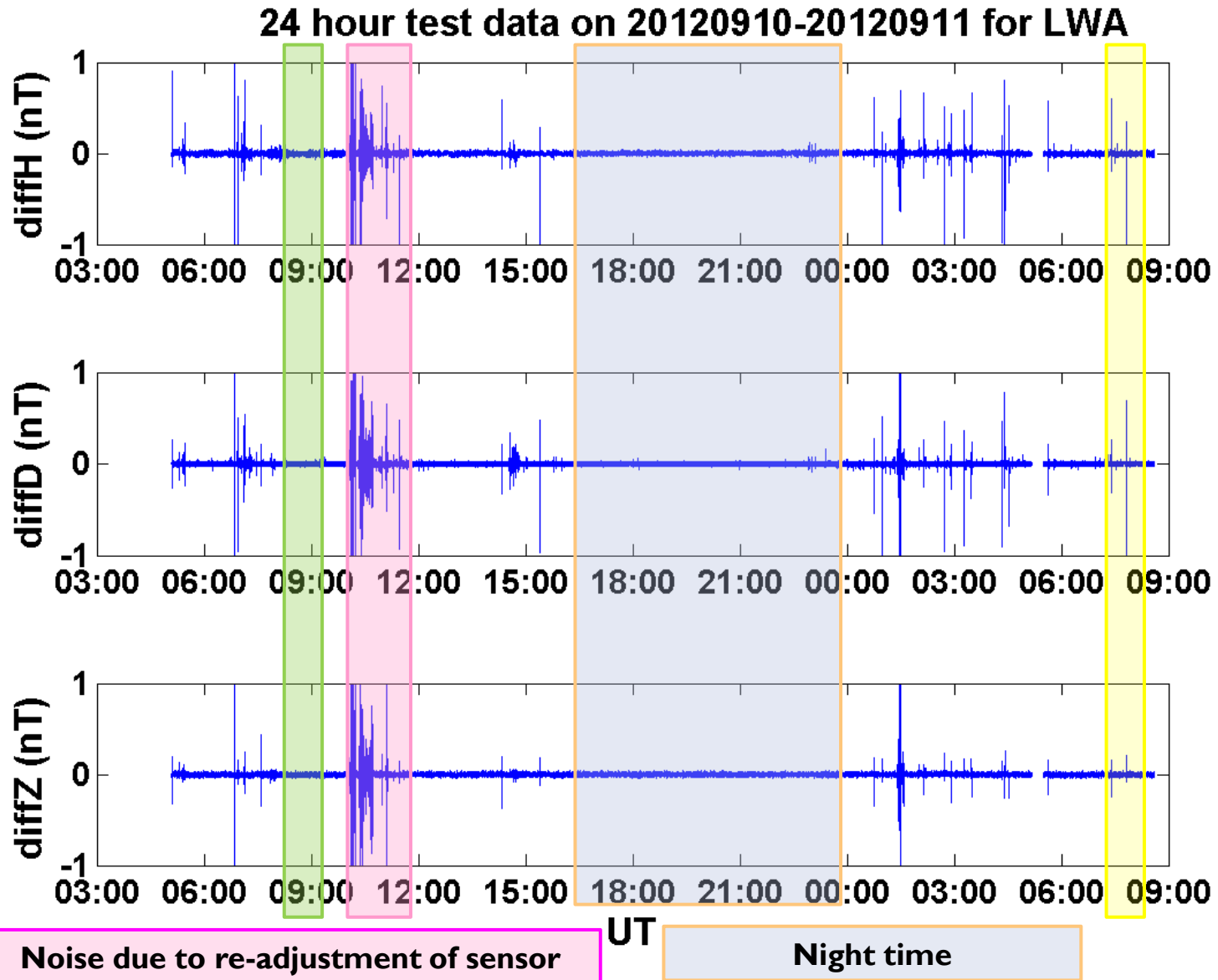


Two temporary covers (blue sheets)



Running the station Gen Set shows no effect

Running on battery shows no noise benefit

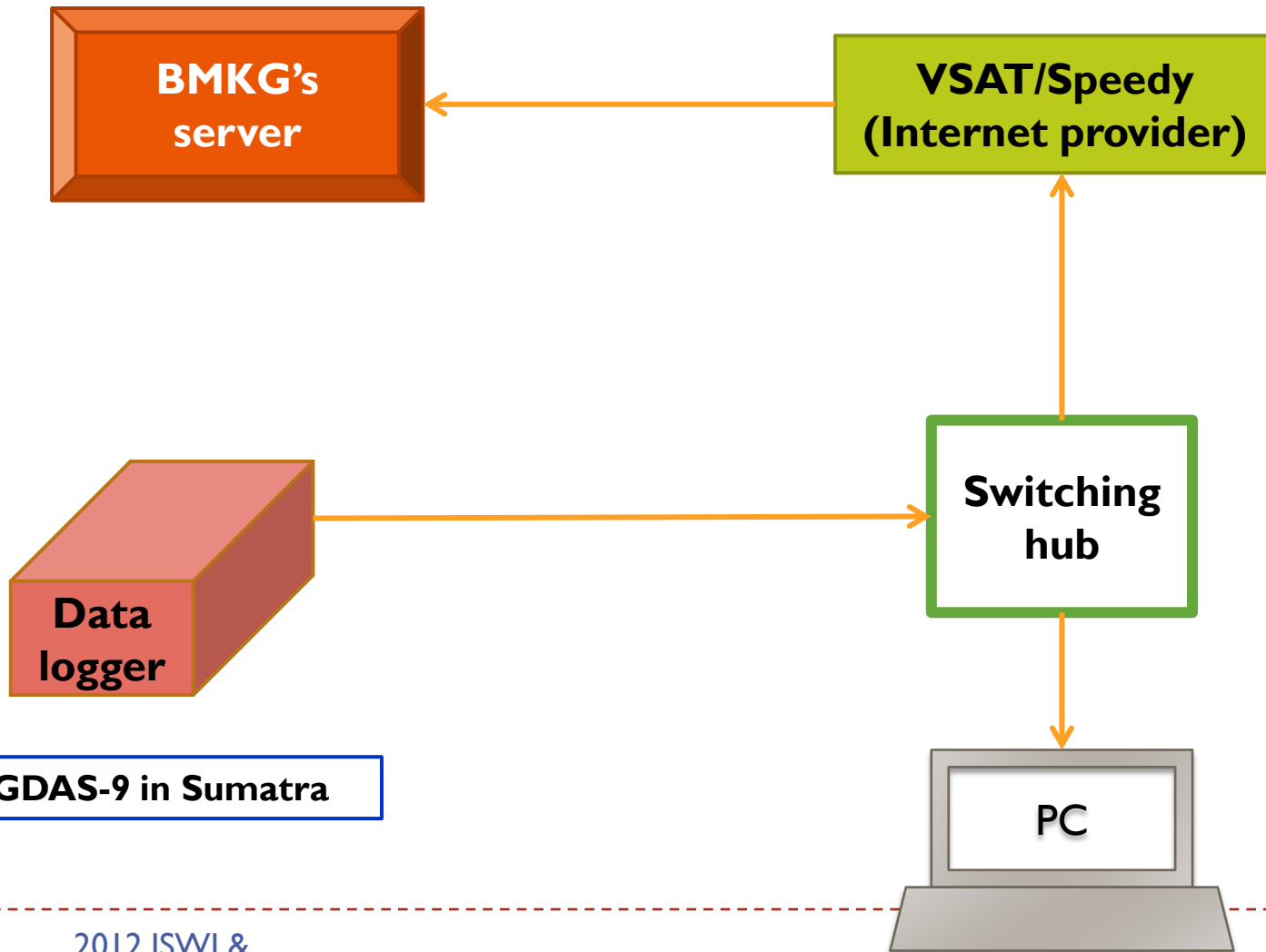


MAGDAS Training Certificate

- ▶ Development of **Capacity Building**:
 1. **Instrument** capacity: Maintenance of MAGDAS
 2. **Data analysis** capacity: Data processing of MAGDAS



General Internet Configuration of MAGDAS 9



MAGDAS-9 in Sumatra

Real time online data

▶ SCN

http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/mag9_SCN.png

http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/diff9_SCN.png

▶ BKL

http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/mag9_BKL.png

http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/diff9_BKL.png

▶ LWA

http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/mag9_LWA.png

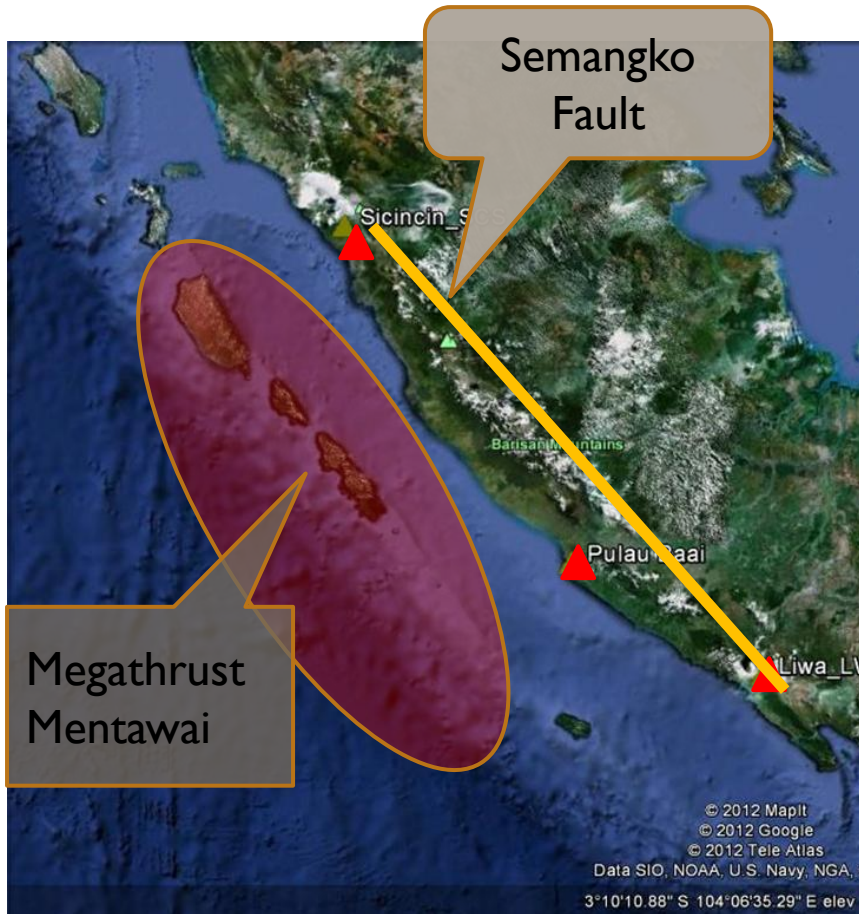
http://magdas2.serc.kyushu-u.ac.jp/realtime/fig/diff9_LWA.png



Possible Scientific study Using MAGDAS data (esp. Sumatra data)

- ▶ 1. Earthquake precursor at West Sumatra, Indonesia
Suaidi Ahadi, ITB student and BMKG staff
- ▶ 2. Equatorial Electrojet Current

Research Earthquake Precursor associated ULF emission based on MAGDAS-9 Sumatra Cluster



Data:

MAGDAS-9 Sumatra

- Sicincin, SCN
- Bengkulu, BKL
- Liwa, LWA

Stage-I

Target : Study and Monitoring ULF emission
earthquake precursor in Seismic Gap
Megathrust Mentawai and Semangko Fault

PhD Research and Collaborations BMKG,
ICSWSE, LAPAN and ITB

Suaidi Ahadi

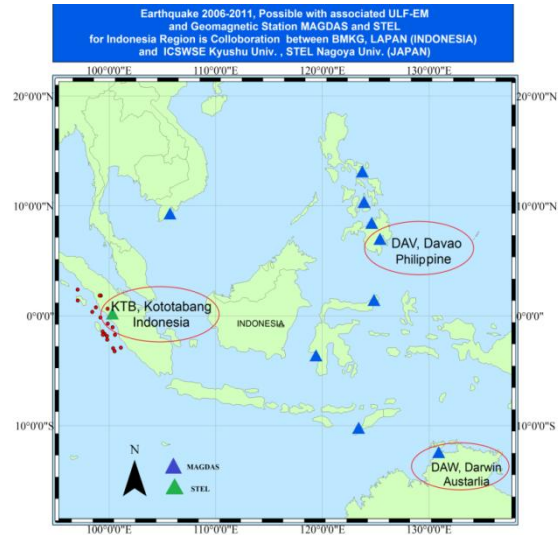
Supervisors:

**Prof G. Ibrahim, Prof. K. Yumoto
and Prof. S. Saroso**



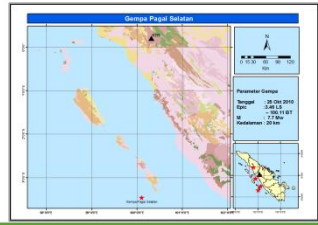
Characteristic of ULF Emission for Determination Earthquake Precursor for Strong Earthquake Sumatra period 2006-2011

Data Collecting

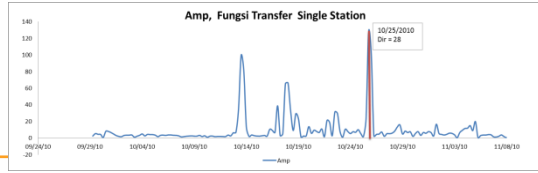
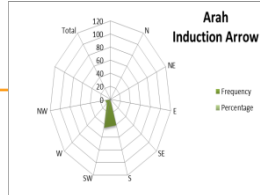


Analyze

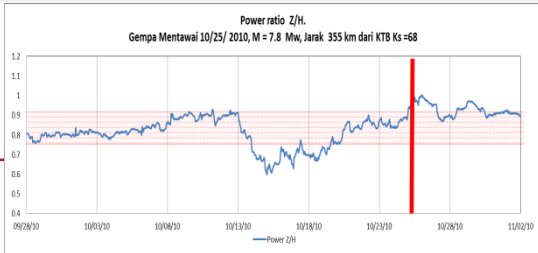
Mentawai Eq. Mw = 7.8 Hypo- Distance to KTB 358 km



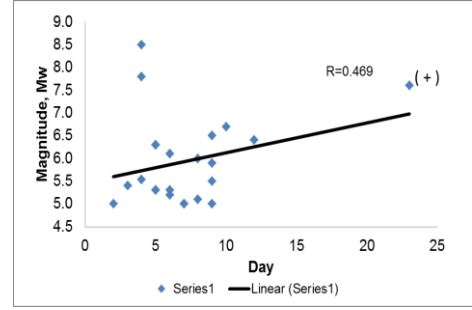
Transfer Function-Single Station



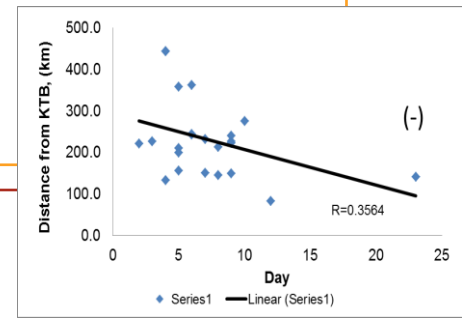
Polarization power ratio Z/H



Result



Trend (+) for Magnitude and Anomaly ULF

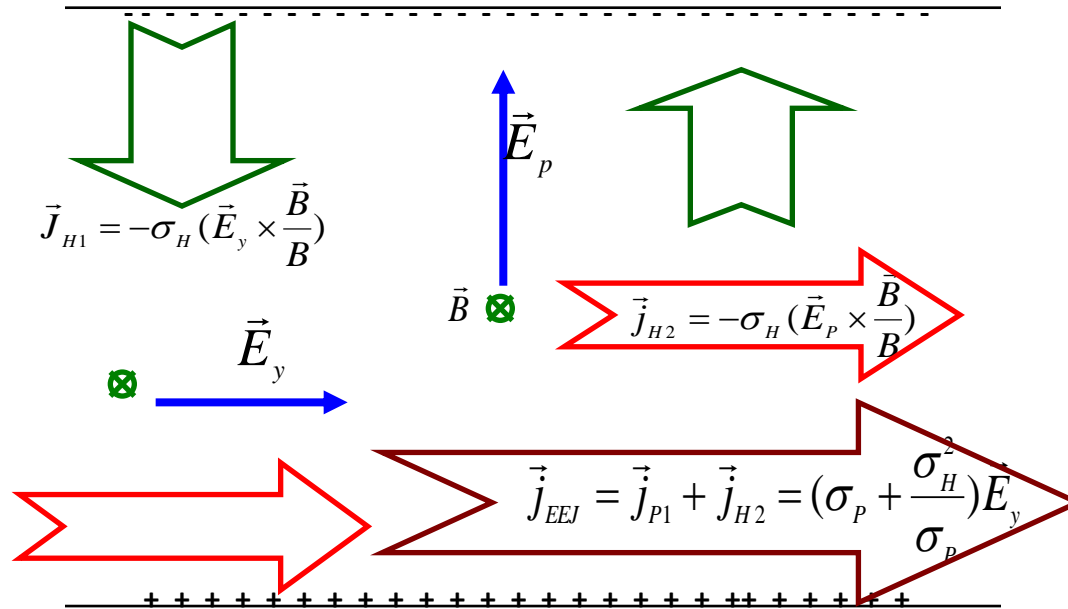


Trend (-) for Distance Hypo and Anomaly ULF

By Suaidi Ahadi

Equatorial Electrojet Current (EEJ)

Dynamo region



Cowling conductivity: $\sigma_c = (\sigma_p + \frac{\sigma_H^2}{\sigma_p})$

West

Formation of EEJ

East

Estimation of EEJ using 2 stations method

▶ Consider:

1. Station **I** within EEJ band ;

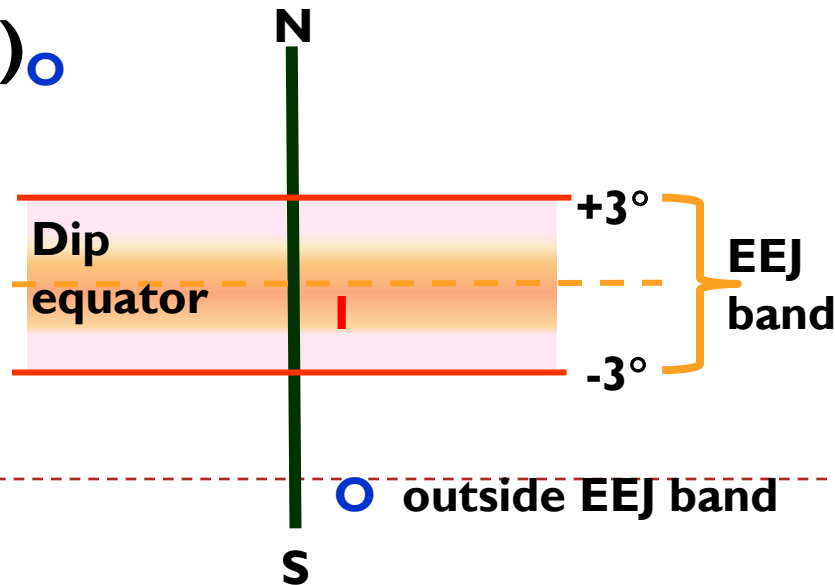
→ $Sq(H)_I$ is under **EEJ+Sq+external disturbance**

2. Station **O** outside the EEJ band ;

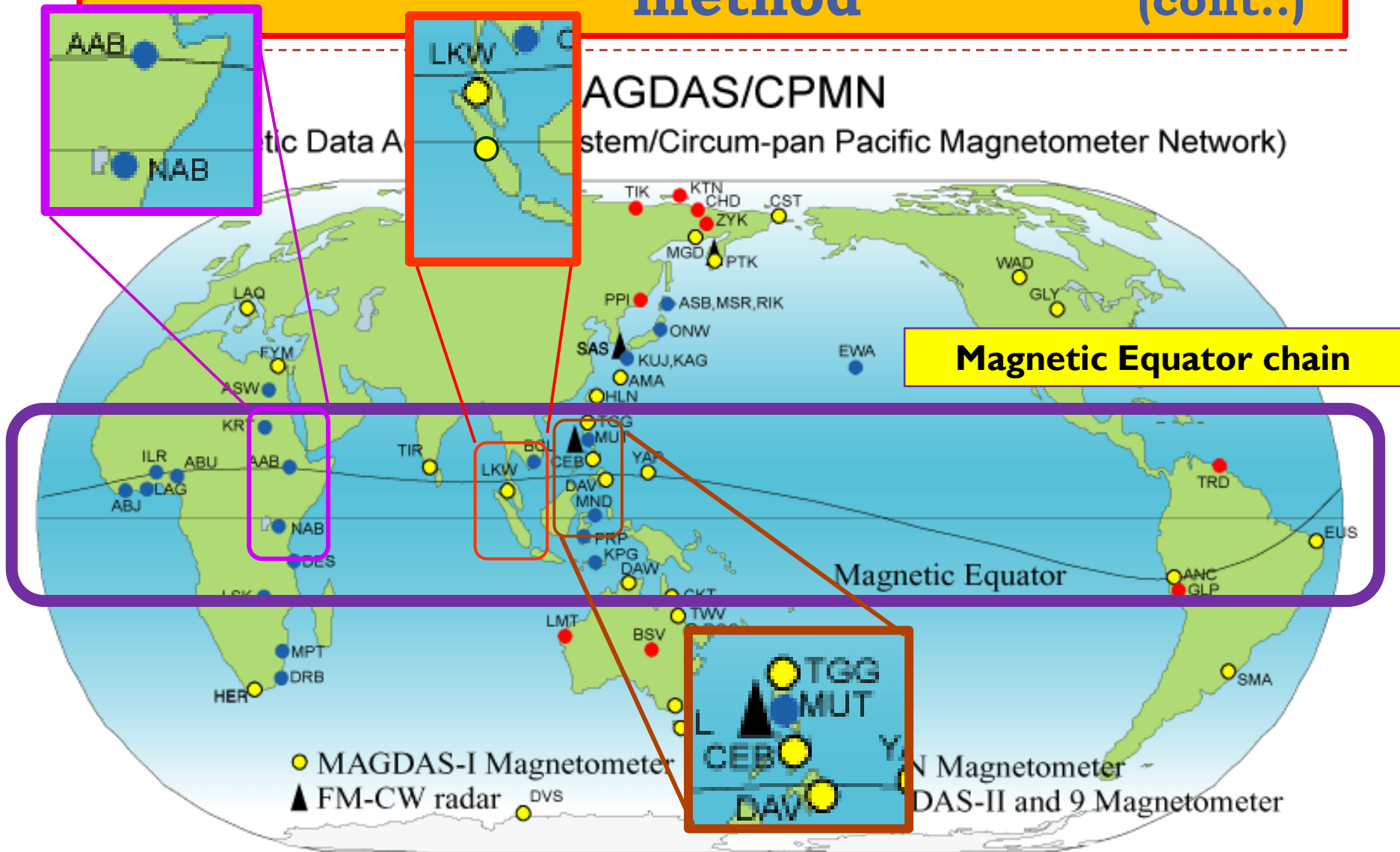
→ $Sq(H)_O$ is under **Sq+external disturbance**

3. Stations must be **along** (or very close) the **same longitude**.

▶ $EEJ = Sq(H)_I - Sq(H)_O$



Estimation of EEJ using 2 stations method (cont..)

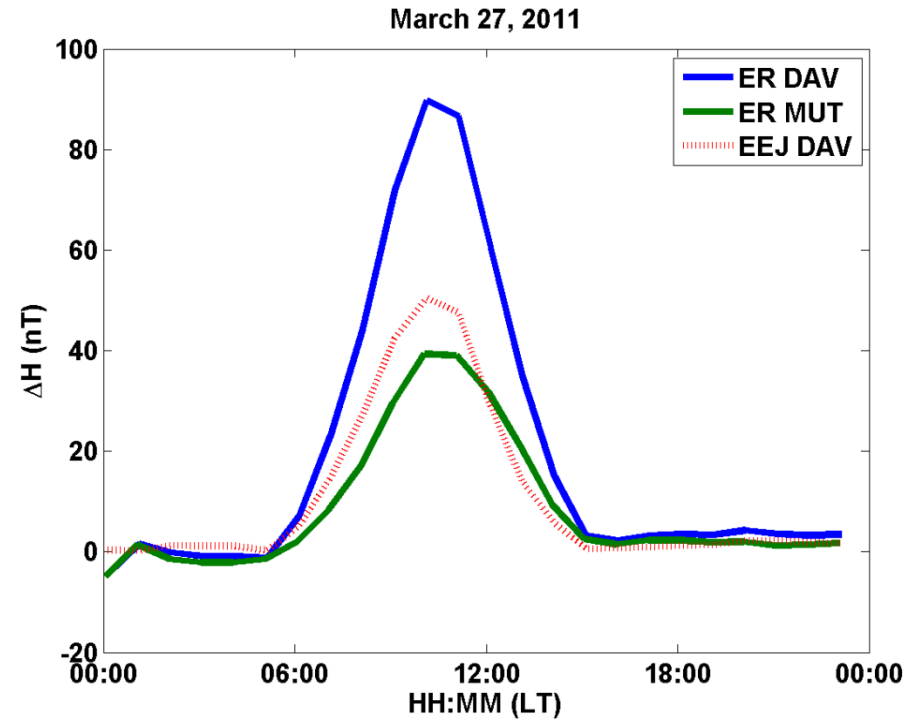
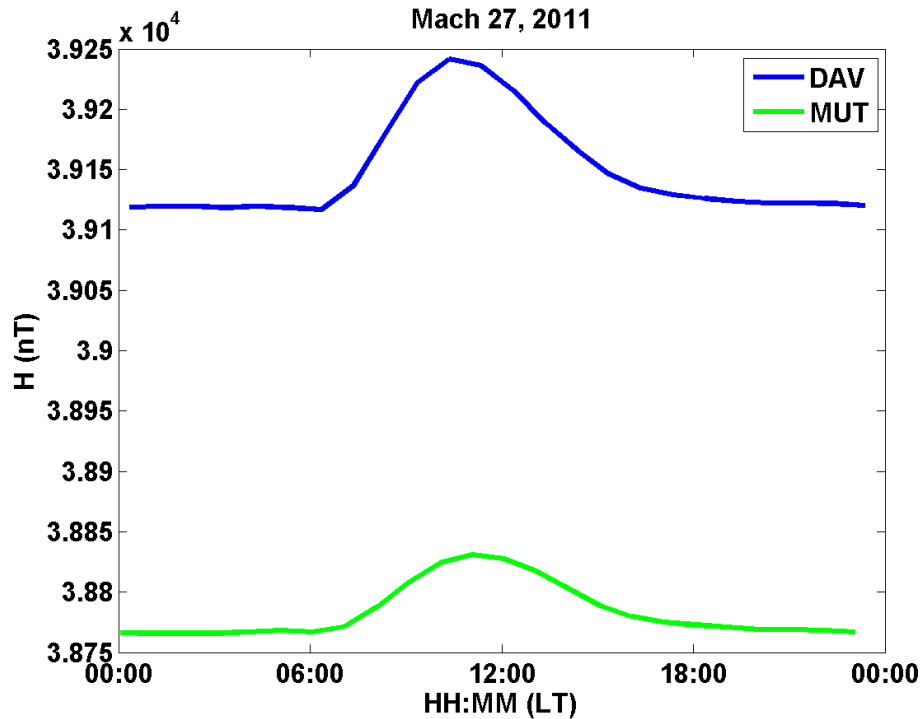


MAGnetic Data Acquisition System (MAGDAS) stations

Estimation of EEJ using 2 stations method (cont..)

	DAV	MUT
Station Name	Davao	Muntinlupa
Latitude	-1.02	6.79
Longitude	196.54	192.25

$$EEJ = Sq(H)_{DAV} - Sq(H)_{MUT}$$



Fukuoka Airport, day of departure

福岡空港検査支隊
FUKUOKA AIRPORT INSPECTION DIVISION
福岡入国検査支隊
FUKUOKA IMMIGRATION OFFICE
福岡検査所
FUKUOKA INSPECTION OFFICE
福岡検査所
FUKUOKA INSPECTION OFFICE
福岡検査所
FUKUOKA INSPECTION OFFICE

2012.08.28

SCN

SCN

Durian fruit

THANK YOU FOR YOUR ATTENTION!!



SCN

BKL

Airport of Lampung Province

Fort Marlborough

2012.09.01