



# Construction of seismic and ground deformation observation networks of the target volcanoes



*The Project Seal*

★ *Sub Group 1-1 Volcano Monitoring*

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# Five Target Volcanoes of SATREPS Project



Group 1-1 “Volcano Monitoring” install and keep stations at the 5 target volcanoes.

The installation is finished by 2015. Keeping stations and data processing is on going at least during the SATREPS project term (until FY2018) and more.

# G1-1 Volcano Monitoring

## Objectives

- Develop observation system for prediction and real-time estimation of **discharge rate of volcanic products**.
- Ground deformation and seismic data will be used for evaluation of **volcanic activity** and **discharge rate of volcanic product**.

## Monitoring

- New GNSS will be installed at sites of Galunggung, Kelud and Semeru Volcanoes, and POSs.
- Two 3-comp. SP seismometers and one tiltmeter will be installed at sites of Guntur, Galunggung, Merapi, Kelud and Semeru Volcanoes.

# Basic data transmission of GNSS and new seismic data by SATREPS

For each volcano, 4 GNSS & 2 digital seismograph will be install.

GNSS were already installed at Guntur and Merapi by SATREPS 2008-2011 project

GNSS & Seismic

MSGT

WiFi 5.8GHz

SODN

CITS

Reference GNSS

POST

PC1  
GNSS Spider

PC2  
Seismic & tilt  
waveform  
display and  
storing

RINEX File created  
at a interval of 1s  
Automatic-base-line  
analysis at each 1  
hour.  
Position data base  
created

POS

Internet

CVGHM,  
Bandung



GNSS Receiver: Leica GR10

Data Logger: Hakusan LS7000XT

Seismometer: Seismotech SSV-002

Tiltmeter: Jewell 701-2

# New Instruments of Group 1-1

GNSS  
GR10 & AR10

**Leica**  
Geosystems



24bit Data Logger  
LS7000XT

**HAKUSAN**



Seismometer  
Seismotech  
SSV-002



1Hz 3-comp.

Tiltmeter  
Jewell  
A701-2A

**Jewell**  
Instruments



# Status of newly inputted instruments of G1-1

Instruments of SATREPS installed at all Wifi stations of 5 volcanoes:

Data logger “Hakusan LS7000XT”	10 installed / 10 purchased
Tiltmeter “Jewell A701-2A”	4 installed / 4 purchased
Seismometer “Seismotech SSV-002”	10 installed / 10 purchased
GNSS “Leica GR10 & AR10”	13 installed / 13 purchased

Instruments for mobile temporary observation:

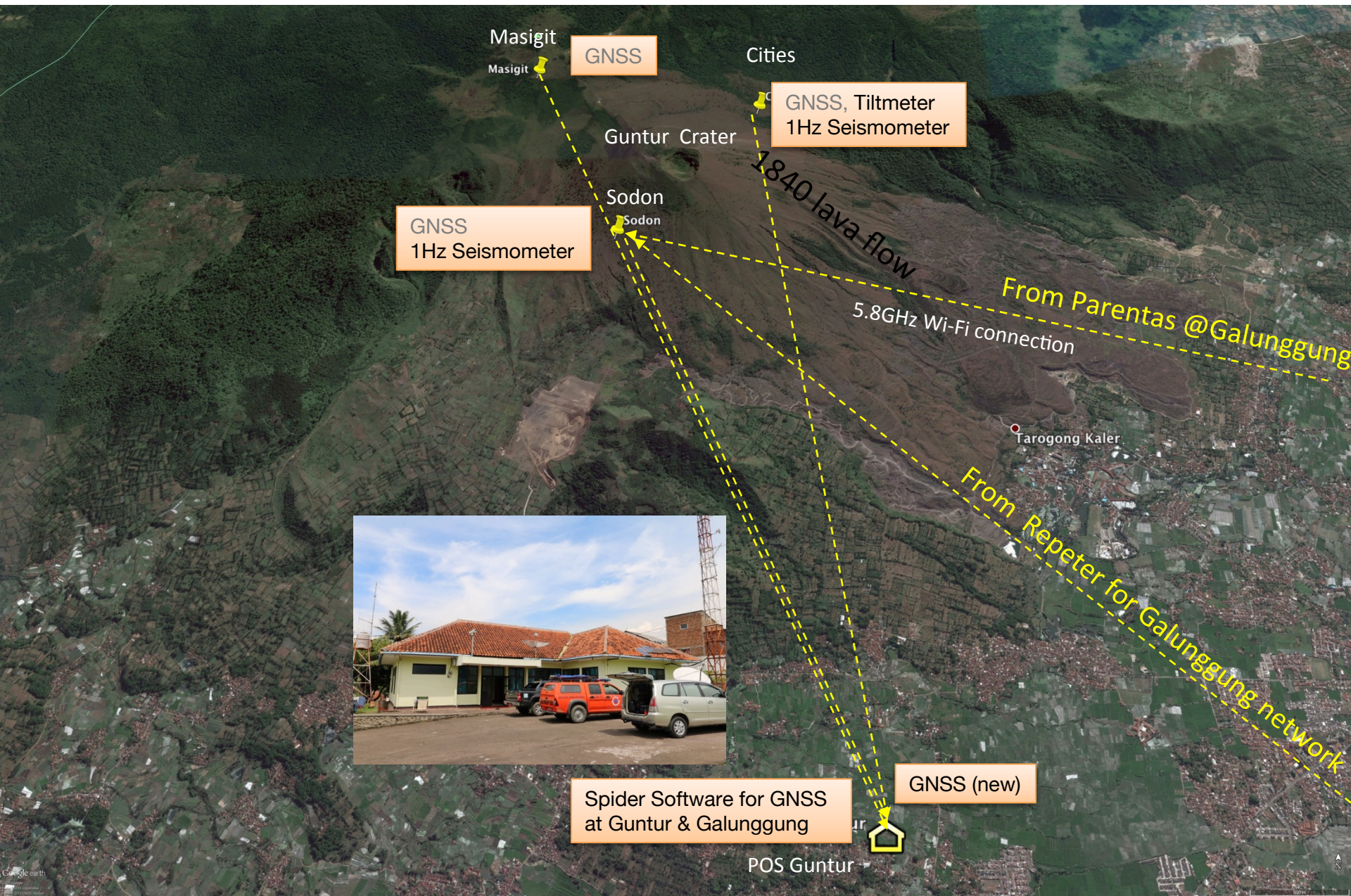
Broadband seismometer “Nanometrics 120PA”	4 installed / 4 purchased
Data logger “Hakusan LS-TP-8800”	4 installed / 4 purchased
Thermography “AVIO InfReC R300SR”	1 purchased
Laser distance meter “Vectronix VECTOR21”	1 purchased

# Time Table of Installation Equipment

FY2014 & 2015	Group 1 "Development of total observation system" Sub Group 1-1 "Volcano monitoring"											
	2014		2015									
	Dec.	Jan.	Feb	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.
Install Instruments: WiFi • GNSS • Seismic • Tilt	12/10-20 ↔ Kelud & Galunggung Wifi install (Nakamichi )	1/20-26 ↔ Guntur Seismic & Tilt install (Iguchi)		3/25-29 ↔ Kelud GNSS & Seismic (Nakamichi )	4/14-20 ↔ Galunggung Wifi, GNSS, Seismic & Tilt (Iguchi, Nakamichi)						9/16-23 ↔ Semeru GNSS, Seismic & Tilt (Iguchi, Nishimura & Ohkura)	
	12/18-23 ↔ Semeru Wifi & seismic (Iguchi, Nishimura)		3/25-29 ↔ Merapi GNSS & Seismic (Iguchi)									
Install Automatic Analysis System of Seismic Activity											Semeru	Galunggung & Guntur
Maintenance							6/9-11 ↔ Kelud (Nakamichi )					11/12-15 ↔ Galunggung (Nakamichi )

All instruments arrived in Indonesia in December 2014!  
Installation has conducted from Dec. 2014 and finished  
in September 2015.

# Guntur Volcano Observation Network



Construction Finished in January 2015



# Galunggung Volcano Observation Network



Construction Finished in April 2015

# WiFi Install at POS Galunggung



2 WiFi (Rocket 5M) set up on 12 Dec.

# Pasir Malang @ Galunggung



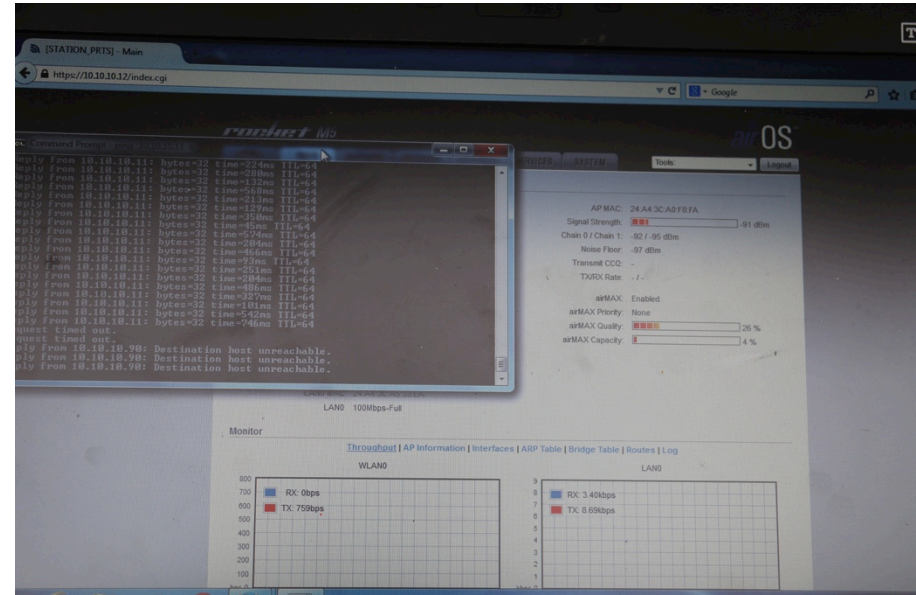
1 WiFi (Rocket 5M), 2 Solar panels (100W each),  
2 75-Ah Batteries, DC12-24V  
Maximum # of solar panels is 4.  
Not connected to POS Galunggung. Need  
repeater  
Set up on 13 Dec.

# Parentas @ Galunggung



1 WiFi (Rocket 5M), 2 Solar panels (100W each),  
2 75-Ah Batteries, DC12-24V  
Maximum # of solar panels is 4  
Connected to SODN@Guntur

Set up on 14 Dec.



# Malaganti @ Galunggung



1 WiFi (Rocket 5M), 2 Solar panels (100W each),  
2 75-Ah Batteries, DC12-24V  
Maximum # of solar panels is 4.  
Not connected to POS Galunggung. Need  
repeater.  
Set up on 15 Dec.

# Merapi Volcano Observation Network

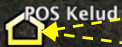


Construction Finished in March 2015

# Kelud Volcano Observation Network



POS Kelud



Spider Software for GNSS

GNSS



GNSS, Tiltmeter  
1Hz Seismometer

Sumberglatik

SBRG



GNSS  
1Hz Seismometer

Lirang

LRGB



Umbuk

GNSS



Bambangan

Kelud  
Kelud Crater



5.8GHz Wi-Fi connection

# GNSS and Wifi Installation at Kelud POS



2 Wifi Antennas direct to SB. Glatik and LIRANG

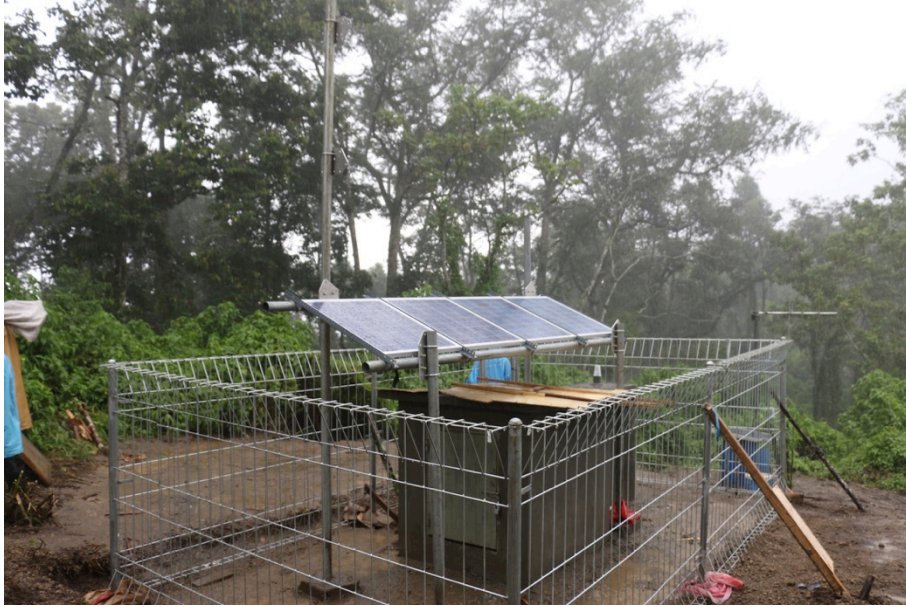


One GNSS Pillar in field near POS





# UMBK @ Kelud



1 WiFi (NanoBeam 5M), 4 Solar panels (100W each)  
1 seismometer box, 1 GNSS pillar, 1 hut  
Wifi directs to LIRANG



# LIRANG @ Keuld



2 WiFi (NanoBeam 5M), 4 Solar panels (100W each)  
One seismometer box, 1 GNSS pillar, 1 hut  
Wifi directs to POS and UMBK



# Sumber Glatik @ Kelud



2 WiFi (NanoBeam 5M), 4 Solar panels (100W each)  
One seismometer box, 1 GNSS pillar, 1 hut  
One bubble surface mount tilt meter is in the hut.  
2Hz seismometer  
Wifi directs to POS

Old Sumber Glatik station had been moved to New Sumber Glatik.



# Semeru Volcano Observation Network



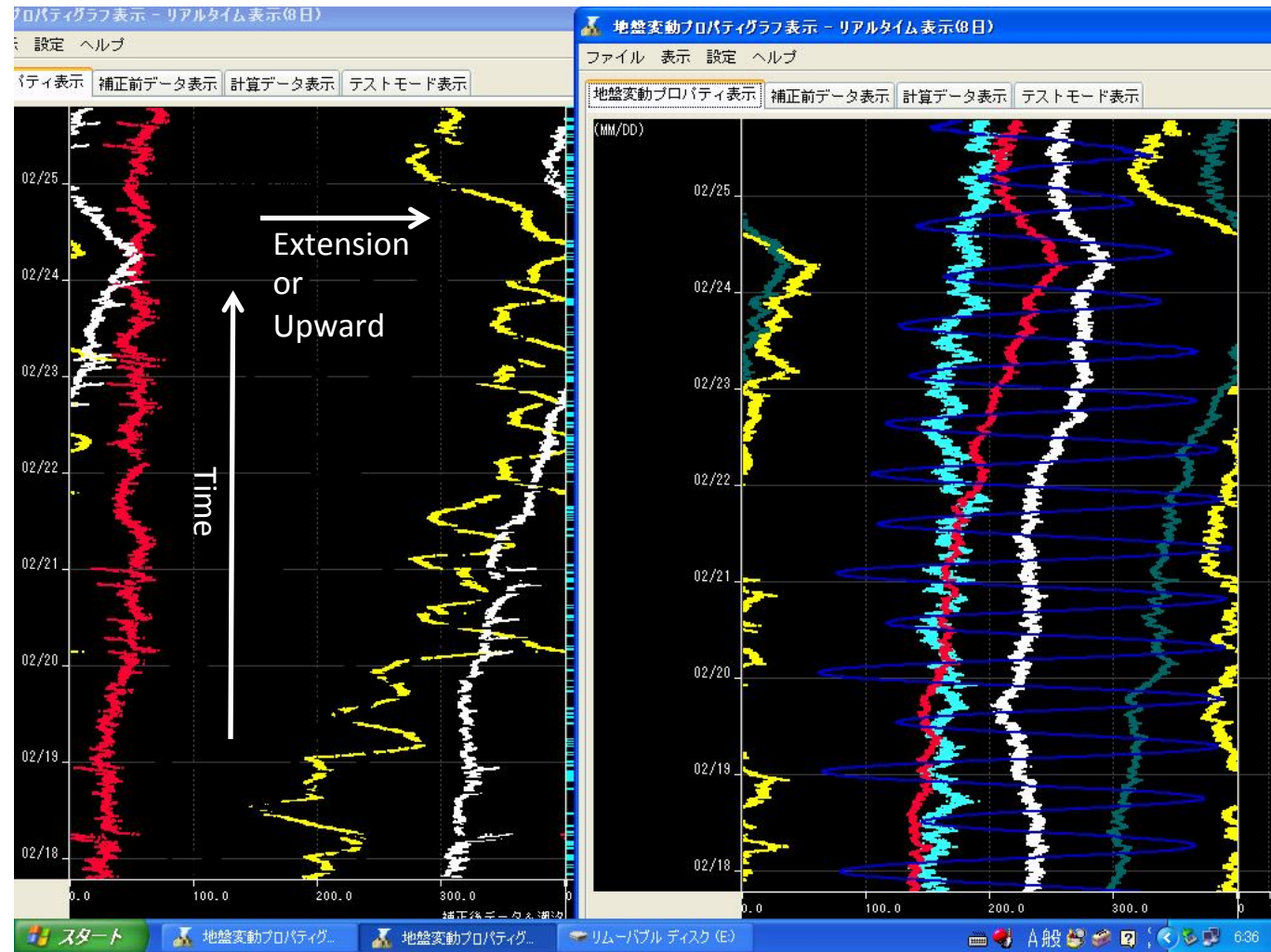
Construction Finished in September 2015

# Data Acquisition and Analysis System

## Requirements:

The System should be operating on Windows PC at POS.

1. GNSS Automatic Base-line Analysis Software “Leica Spider on Windows” (FY2015)
2. Seismic Data Acquisition and Analysis Software (FY2015)
3. Ground Deformation Data Acquisition and Analysis Software on Windows
4. For real-time estimate of discharge rate of volcanic products



Example. Display of ground deformation data at Sakurajima

This is a Java application, which works on Windows, Linux and OS X.

# Leica GNSS Spider @ POS

TeamViewer 編集 接続 その他 ウィンドウ ヘルプ

Spider PC Guntur POS

ファイル転送 操作 表示 音声/動画 その他

GNSS Spider - [Local Site Server]

File View Management Raw Data Status Tools Window Help

Management	Site Name	Site Code	Comm Activity	Data Receiv...	GLON... /	First Epoch	Data Rate	Last Gap	05.11.2015 17:00	05.11.2015 17:05
Local Site Server	MSGT	MSGT	receive data	99.7	No	05.04.2015 17:46:14	1.000 sec	04.11.2015 2		
	SODN	SODN	receive data	99.8	No	05.04.2015 17:46:14	1.000 sec	05.11.2015 0		
	CTSG	CTSG	receive data	99.4	No	05.04.2015 17:46:14	1.000 sec	05.11.2015 0		
	POST	POST	receive data	99.9	No	05.04.2015 17:46:02	1.000 sec	30.10.2015 1		
	PRTS	PRTS	receive data	99.2	No	17.04.2015 17:11:06	1.000 sec	05.11.2015 1		
	MLGT	MLGT	receive data	99.8	No	18.04.2015 12:53:48	1.000 sec	05.11.2015 1		
	PSML	PSML	connecting	0.0	No	23.10.2015 18:43:23	0.000 sec	05.11.2015 1		

Antennas  
Devices  
FTP Locations  
Operators  
Events

Site Map Site Sensor **Raw Data Status** File Products RT Products RT Positioning PP Positioning

Content	Site	User	Date/Time	Category	Text
All	PSML	Spider Server	05.11.2015 17:06:51	Sensor	Site 'PSML' Comm. message: No finished file available on sensor.
All Sites	PSML	Spider Server	05.11.2015 17:06:51	Sensor	Site 'PSML' Comm. message: The file transfer failed.
Query (Offline)	PSML	Spider Server	05.11.2015 17:06:51	Site	The file transfer failed.
	MSGT	Spider Server	05.11.2015 17:06:55	Sensor	Site 'MSGT' Comm. message: No response from sensor.
	MSGT	Spider Server	05.11.2015 17:06:55	Sensor	Site 'MSGT' Comm. message: Sensor status update failed.
	PSML	Spider Server	05.11.2015 17:07:06	Sensor	Site 'PSML' Comm. message: No response from sensor.
	PSML	Spider Server	05.11.2015 17:07:30	Sensor	Site 'PSML' Comm. message: No response from sensor.

TeamViewer Free license (non-commercial use only)

Session list

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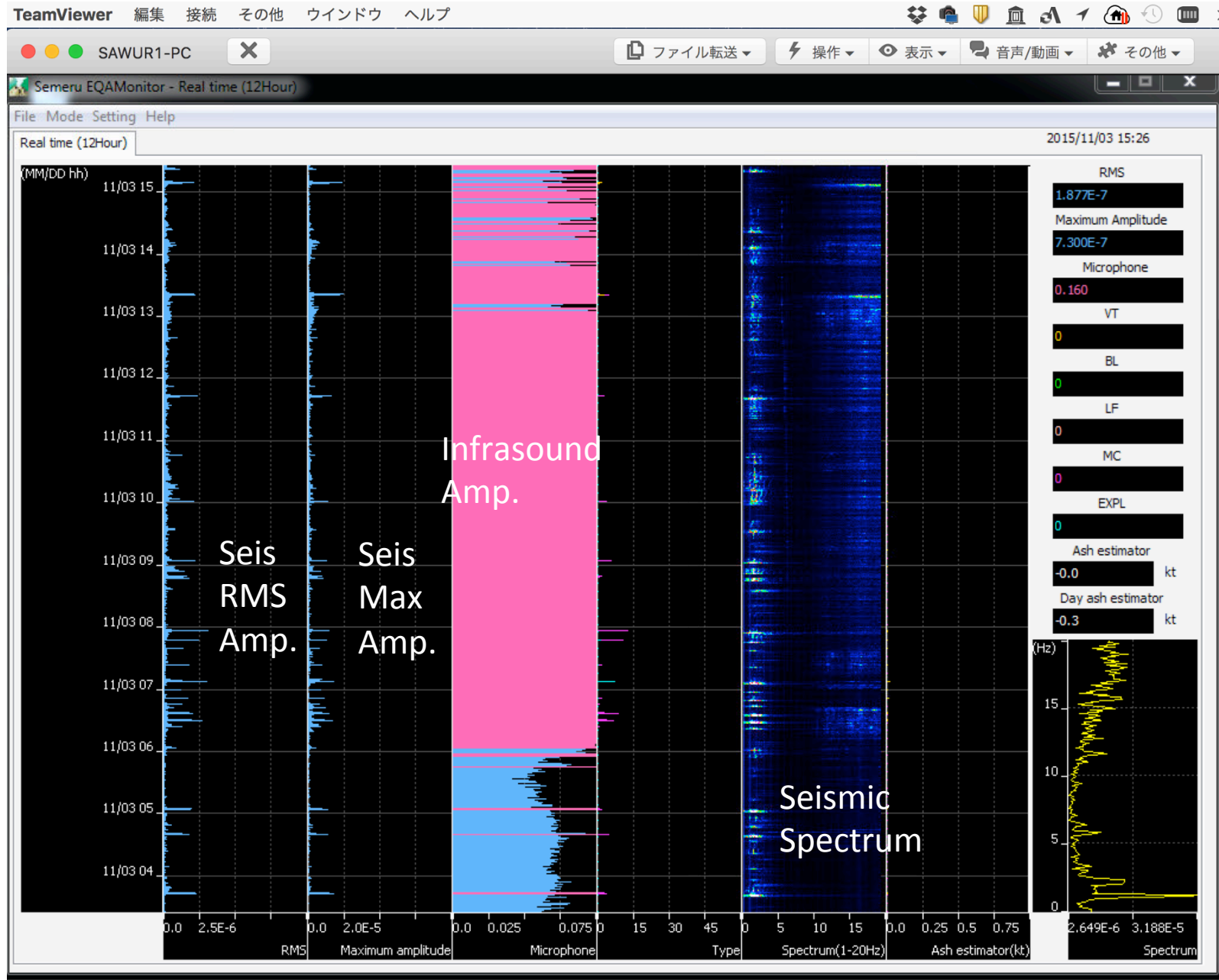
Remote Control using



GNSS Spider is an integrated software suite for centrally controlling and operating GNSS reference stations and networks.

# Seismic Data Analysis Software

POS Sawur  
Semeru  
Volcano



# Summary: Construction of Volcano Monitoring Network

- All instruments were installed until September 2015.
- Wifi networks were newly constructed at Galunggung, Kelud and Semeru volcanoes.
- GNSS were newly installed at POS Guntur, at 3 sites of Galunggung, BPPTK, 4 sites of Kelud, and 4 sites of Semeru.
- 1Hz seismometers and 24bit data loggers were installed at 2 sites of Guntur, 2 sites of Galunggung, 1 site of Merapi, 2 sites of Kelud, and 3 sites of Semeru.
- Surface mount tiltmeters were newly installed at 1 site of Guntur, Galunggung, Merapi, Kelud and Semeru.



End

**TERIMA KASIH**