RECENT MERAPI VOLCANIC ACTIVITY & LAHAR MONITORING SYSTEM

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SATREPS-Yogyakarta 9 November 2015

"Integrated study on mitigation of multimodal disasters caused by ejection of volcanic products".

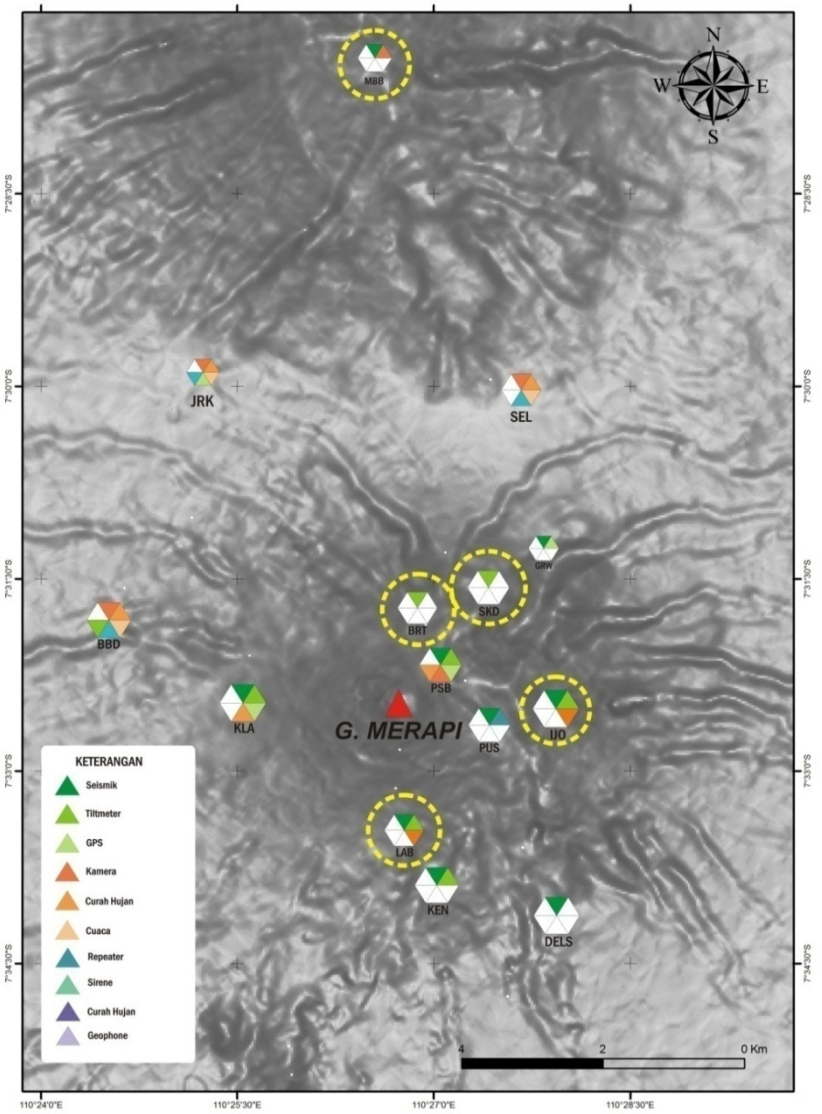
Balai Penyelidikan dan Pengembangan Tekonologi Kebencanaan Geologi

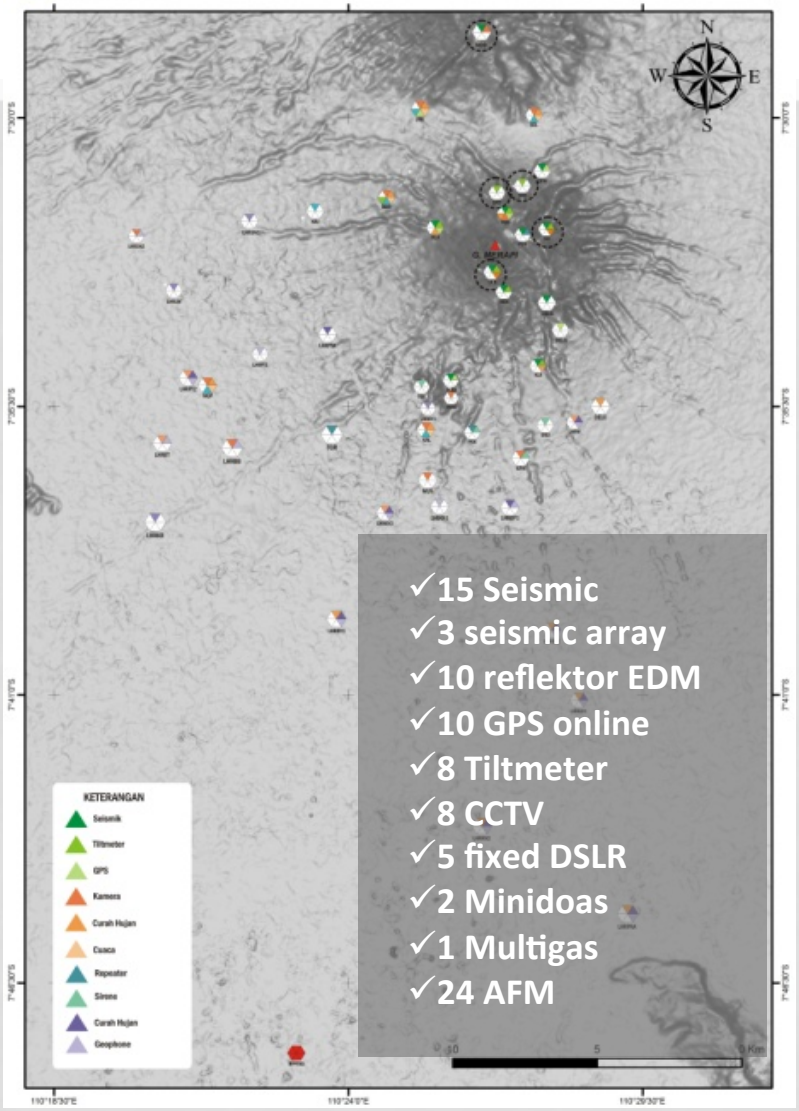
Pusat Vulkanologi dan Mitigasi Bencana Geologi

BADAN GEOLOGI

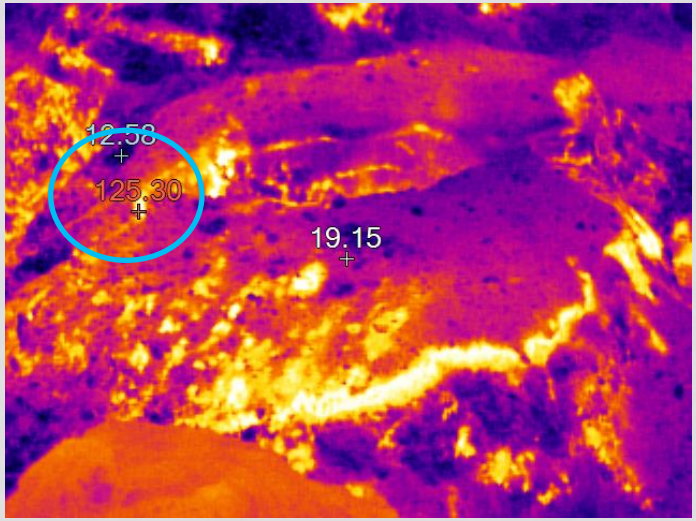
Jl. Cendana 15 Yogyakarta 55166

MONITORING METHODS





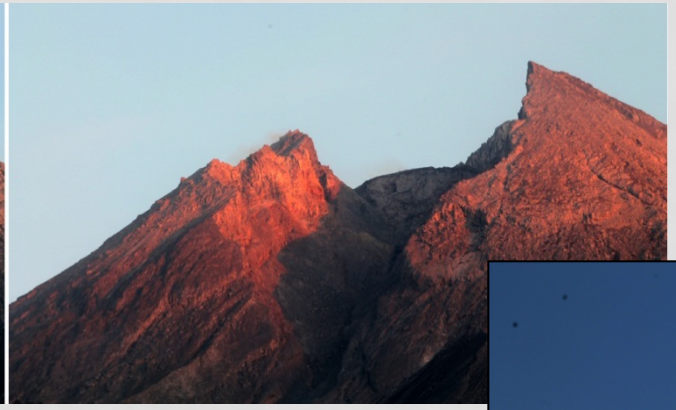
MORFOLOGICAL ANALYSIS



Taken from Fluke thermal imager

Stereoscopic view from Deles and Kalitengah

(4272×2848 pix² ⇨ resolution ~15 cm)

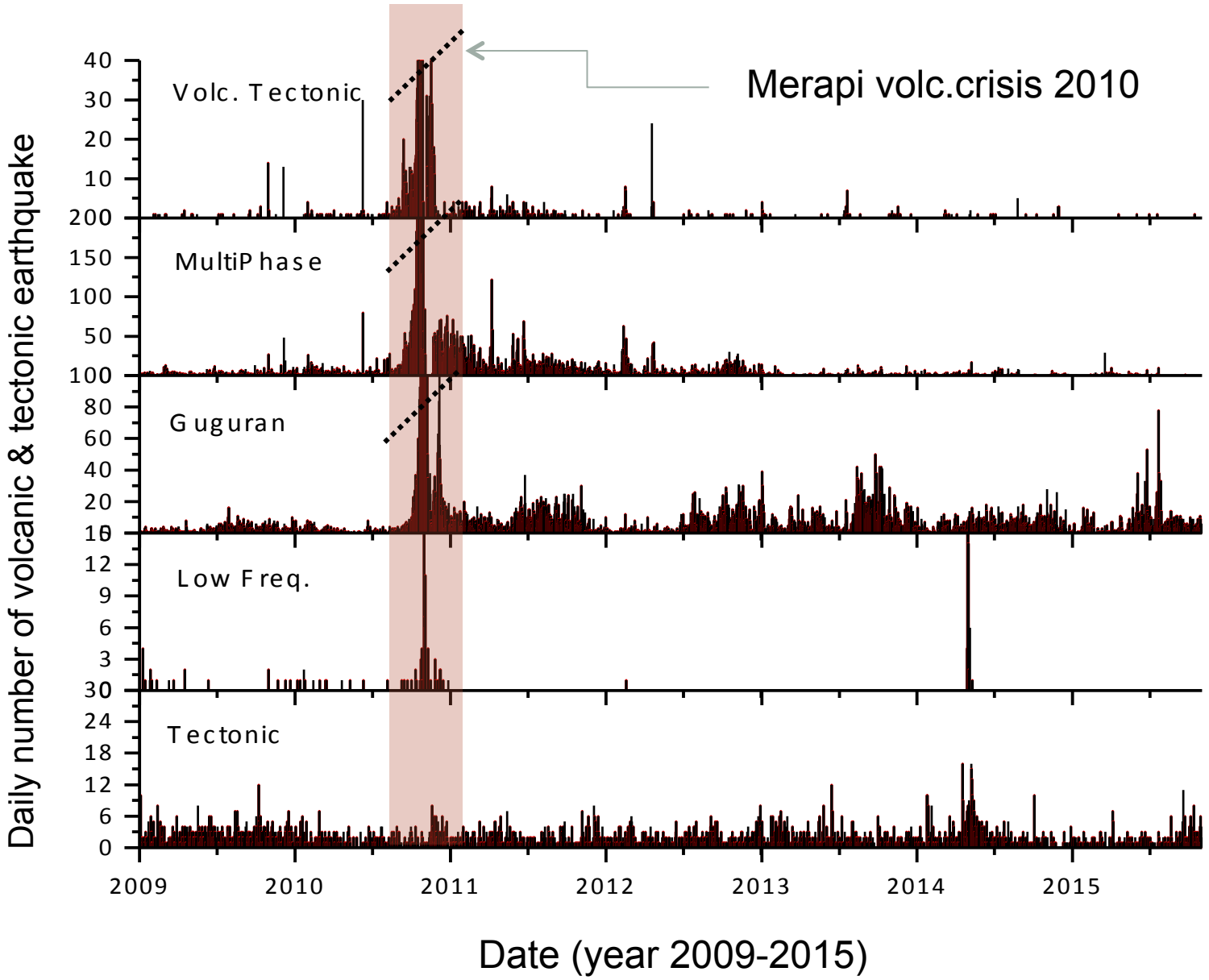


small collapse

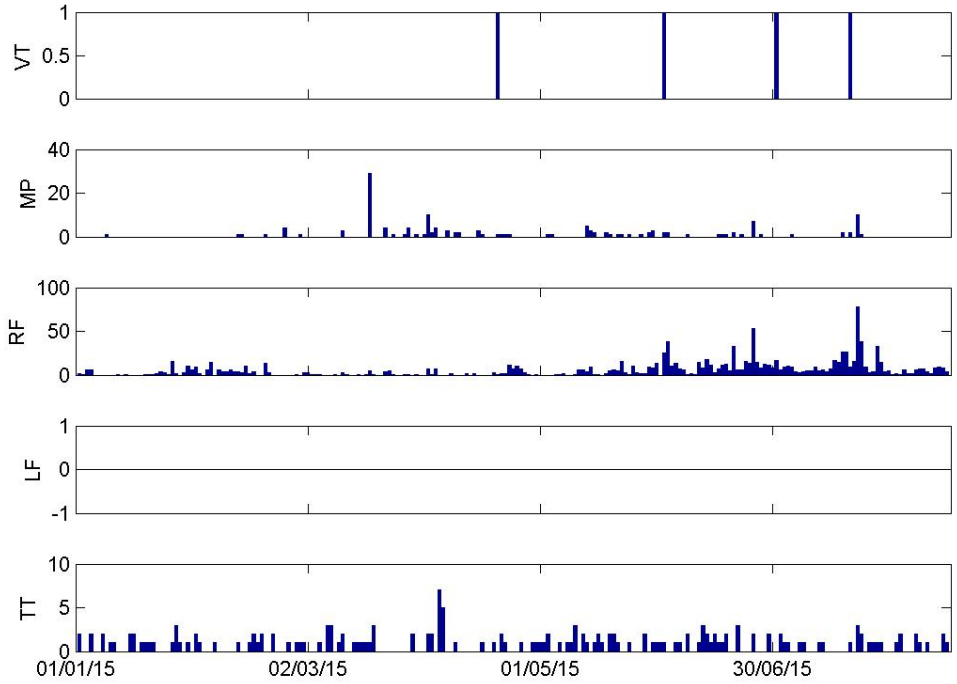
fallen rocks

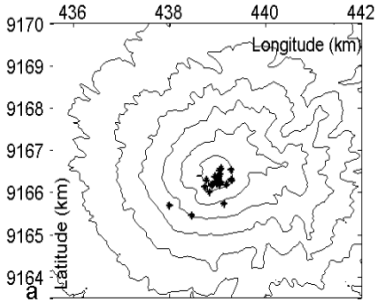
No significant morphological variations in one year.

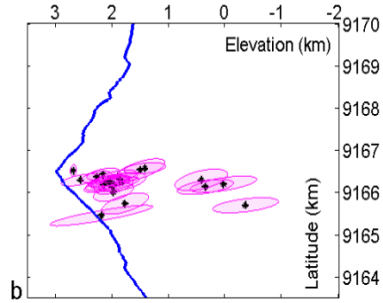
Daily Number of Seismicity Merapi

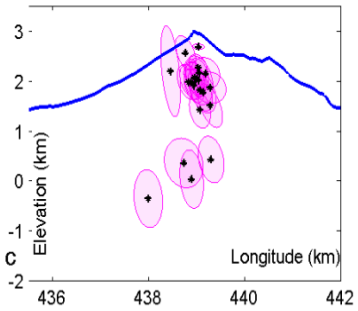


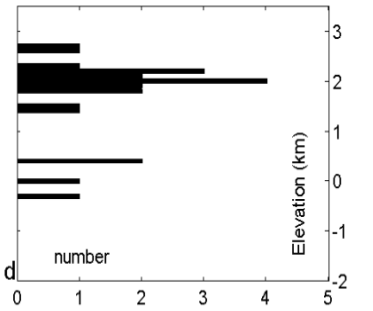
SEISMICITY











Type	May–Agu 2014	Sep–Des 2014	Jan–April 2015	May-Agu 2015
VT	13	10	1	3
MP	167	44	84	59
RF	769	714	268	**1029**
LF	24	0	0	0
TT	284	285	90	99

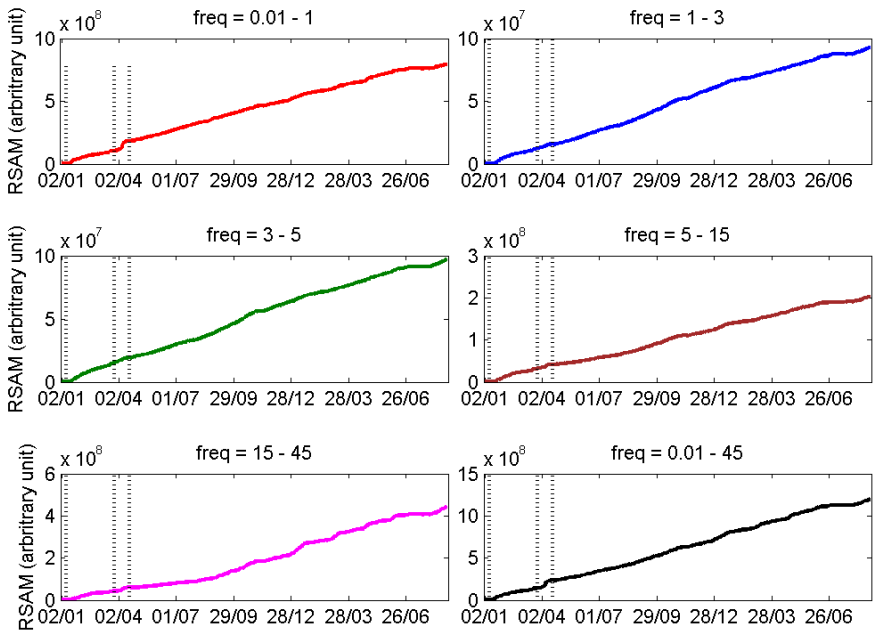
The seismic activity is at a low level

During the beginning of the 2010 Merapi crisis: VT = 1/ day, MP = 5/day.

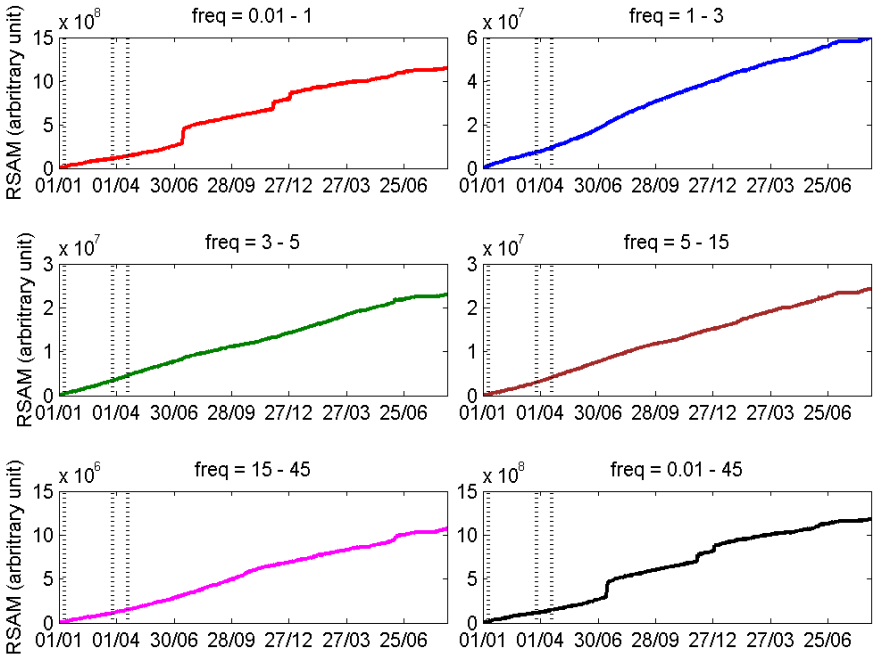
Rockfalls are dominant, could be weather effects?

REALTIME SEISMIC AMPLITUDE MEASUREMENT (RSAM-DAILY CUMMULATIVE 2015)

PASB Station



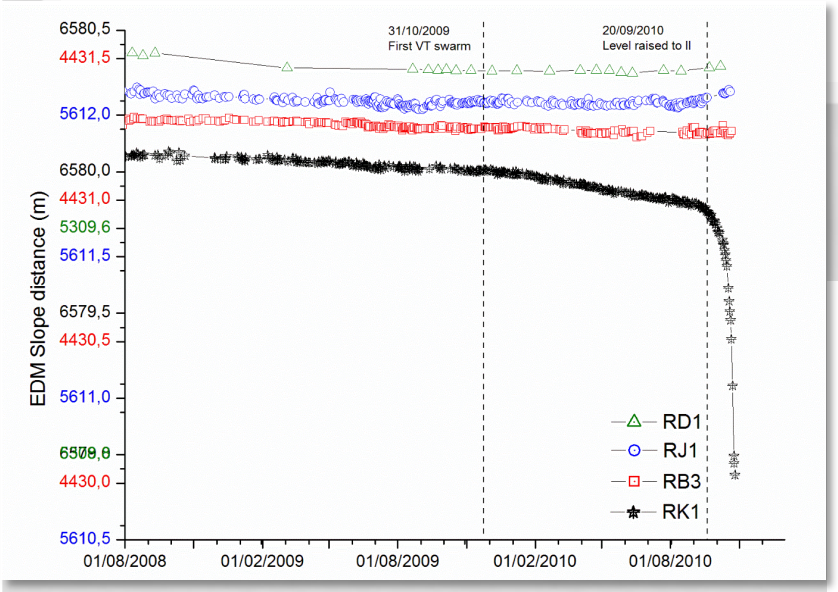
IMOB Station

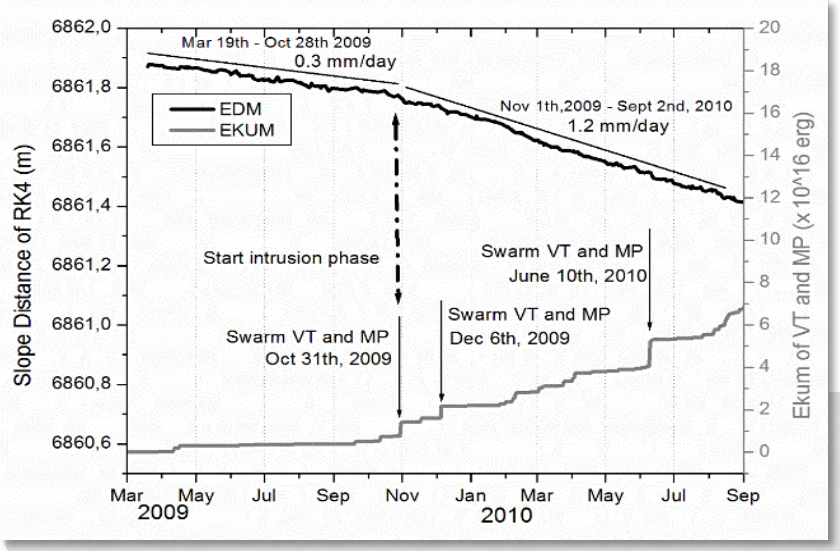


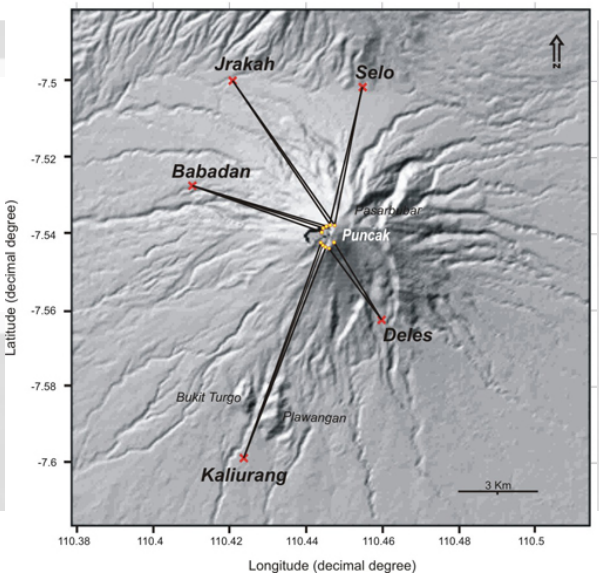
- Constant slopes indicate stable average daily seismic energy.
- An increase of High freq RSAM represents rockfalls activity during dry season.
- Flat means there is no data

Slope Distance Measurement (EDM)

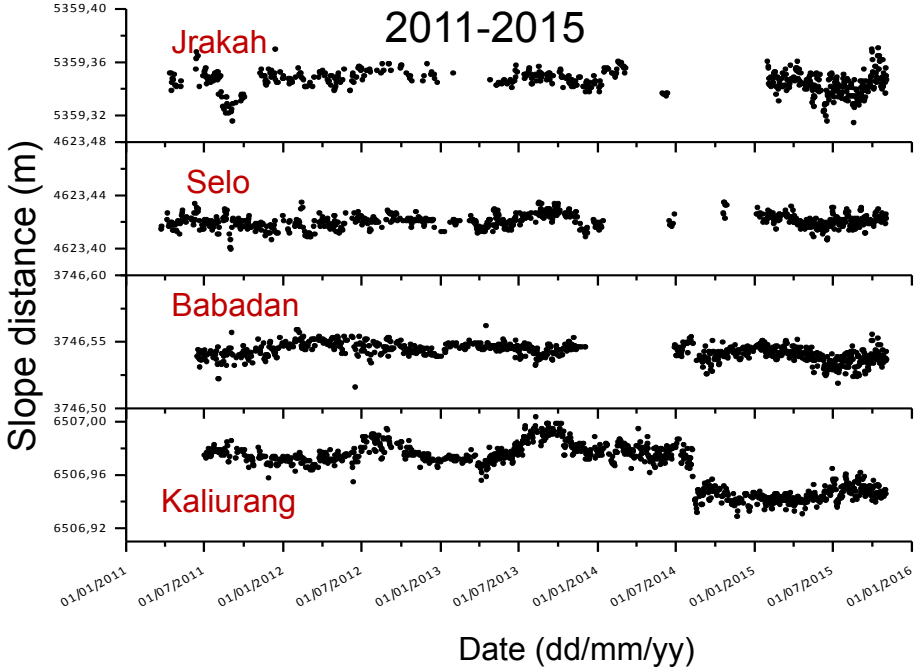
2008-2010





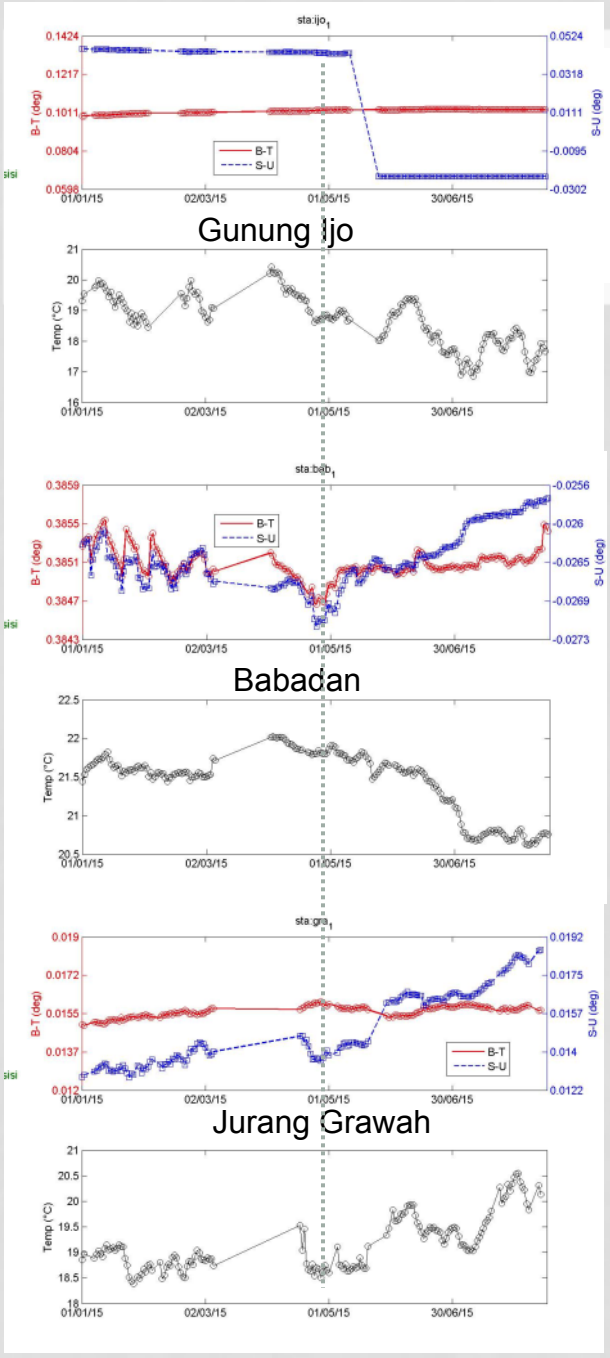


2011-2015



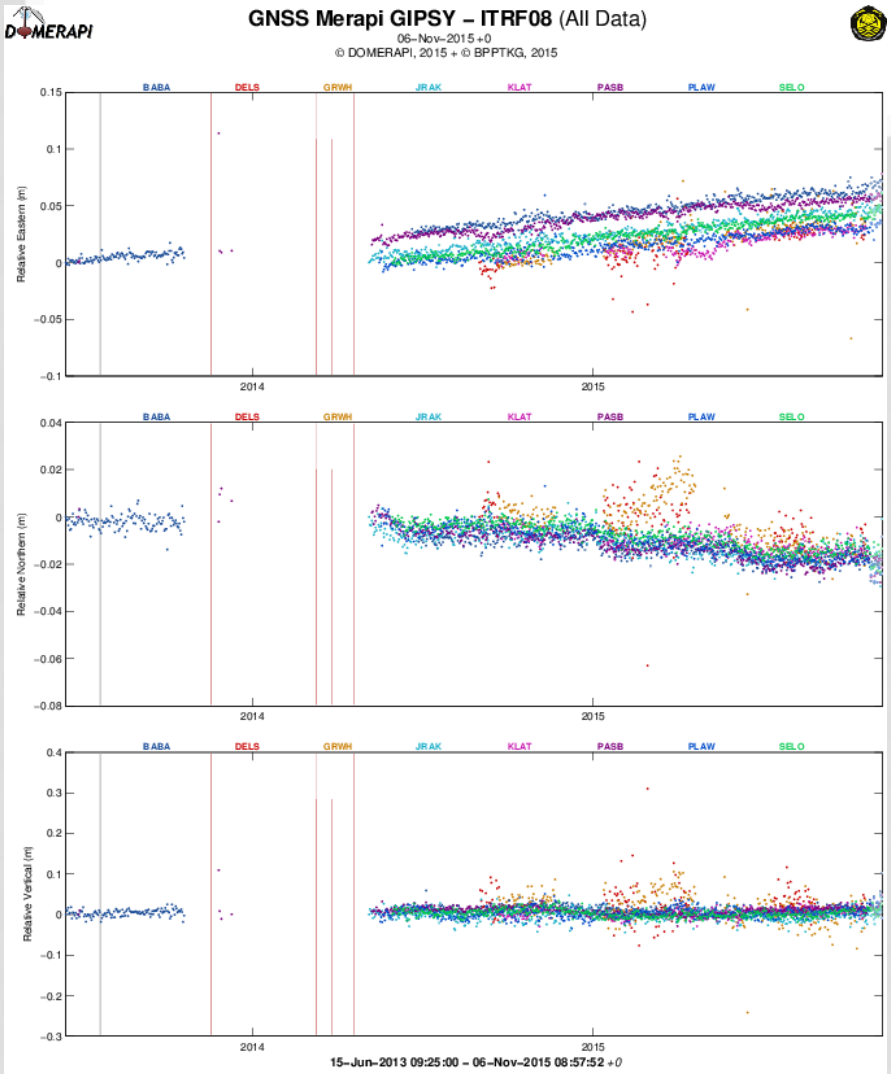
Daily variation of slope distance measurement from 2011-2015 show no significant change.

Electronics Tiltmeter Data 2015

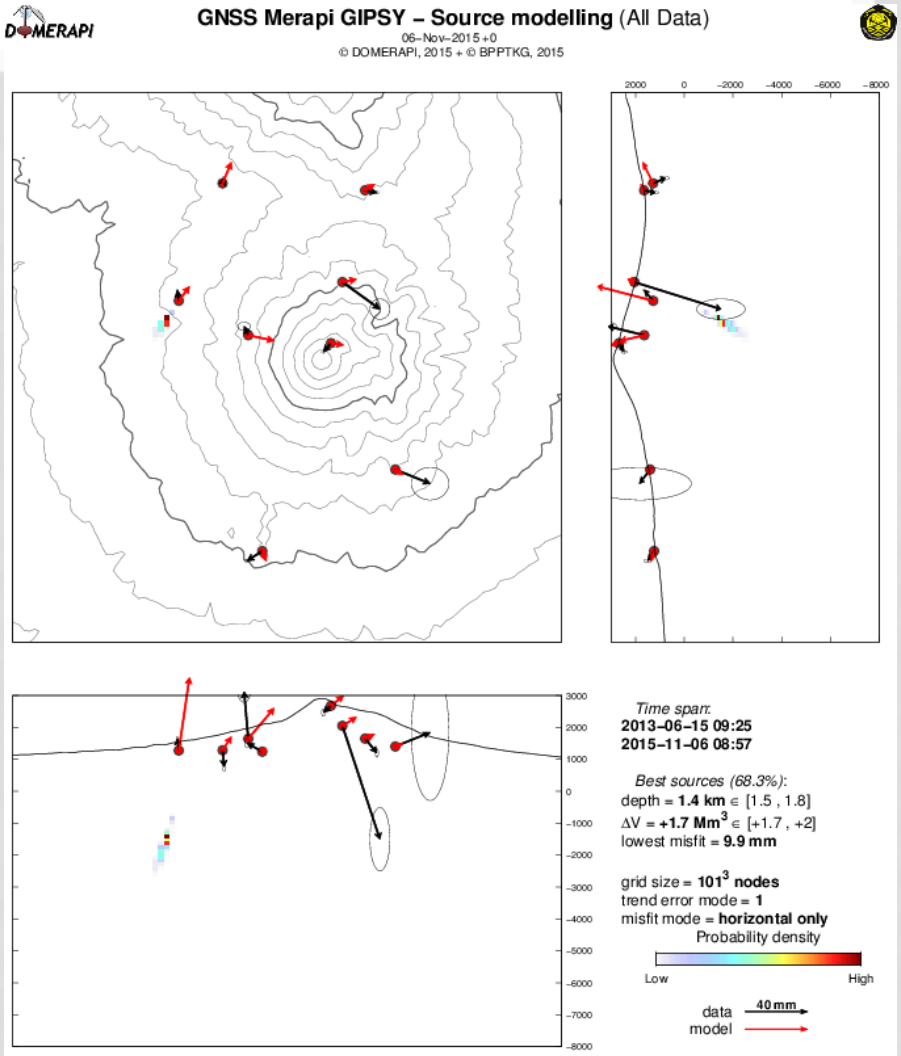


There might be a centralized pressure source since July 2015 or before ????

REAL-TIME GPS TELEMETRY - SOURCE MODELLING



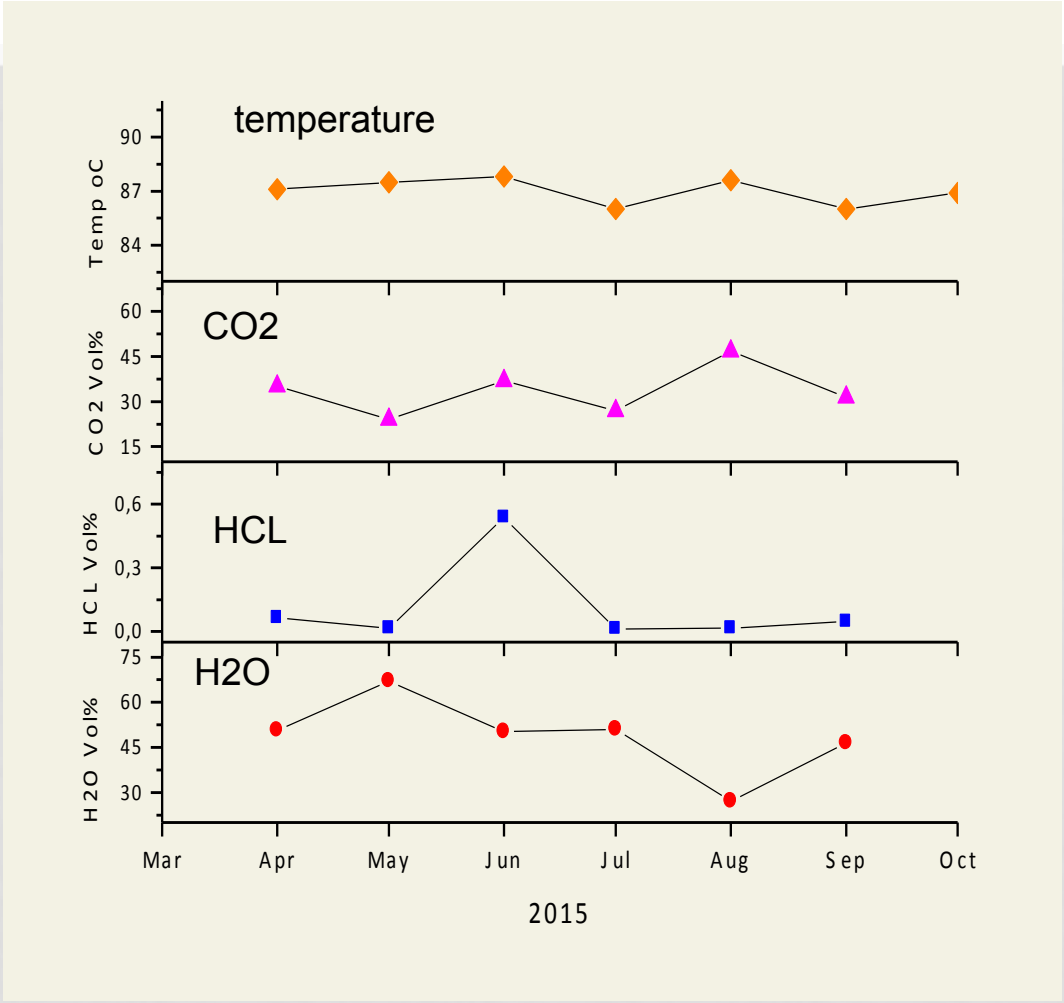
2013-2015



Mogi [1958] model with topographic correction *Williams & Wadge* [1998]

GPS data from DoMerapi and SATREP Project

Gas Measurement at Lava 53 (summit of Merapi)

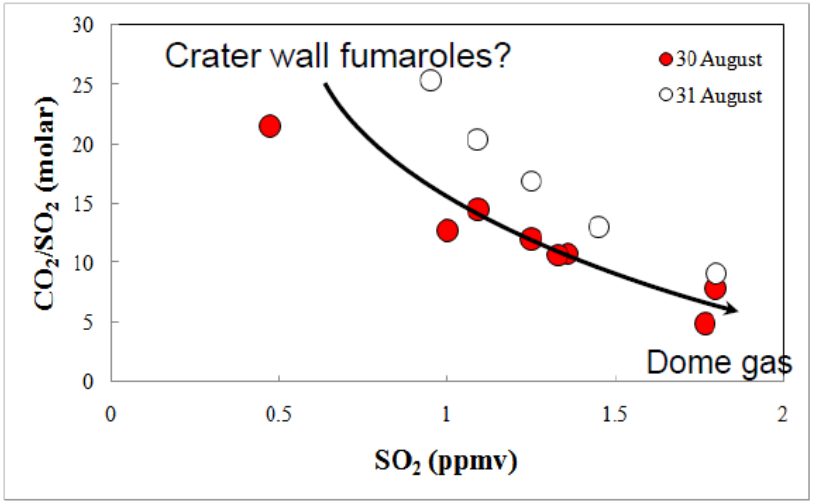


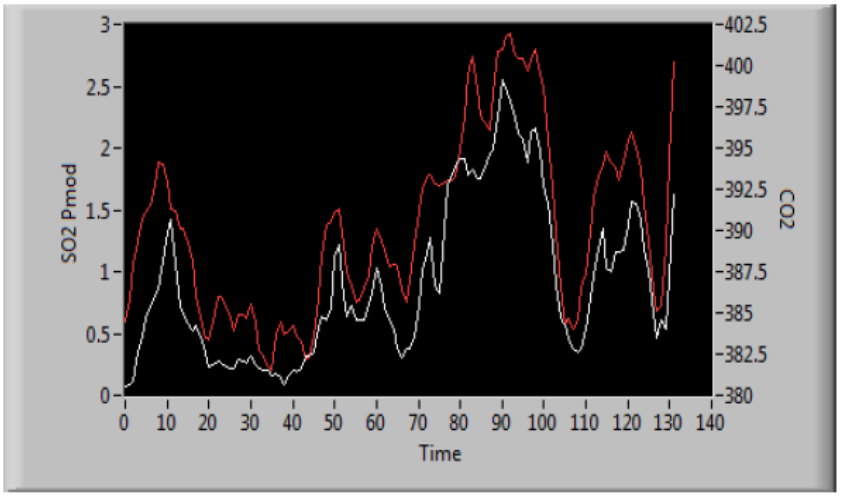
The permanent MultiGAS station on Merapi: Data Analysis

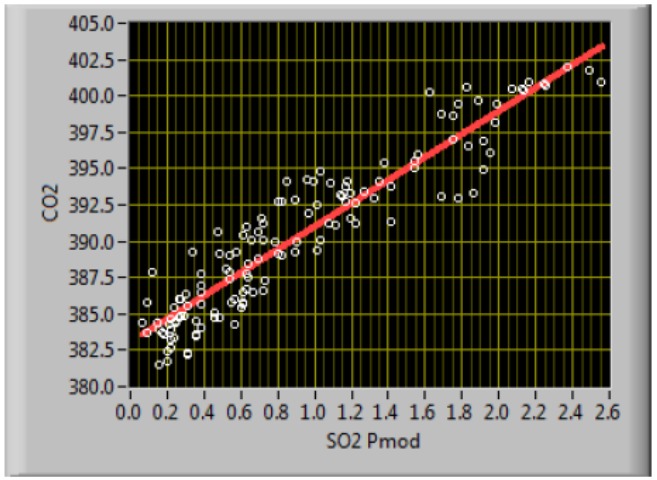
Ratio calc

Molar ratios 2014

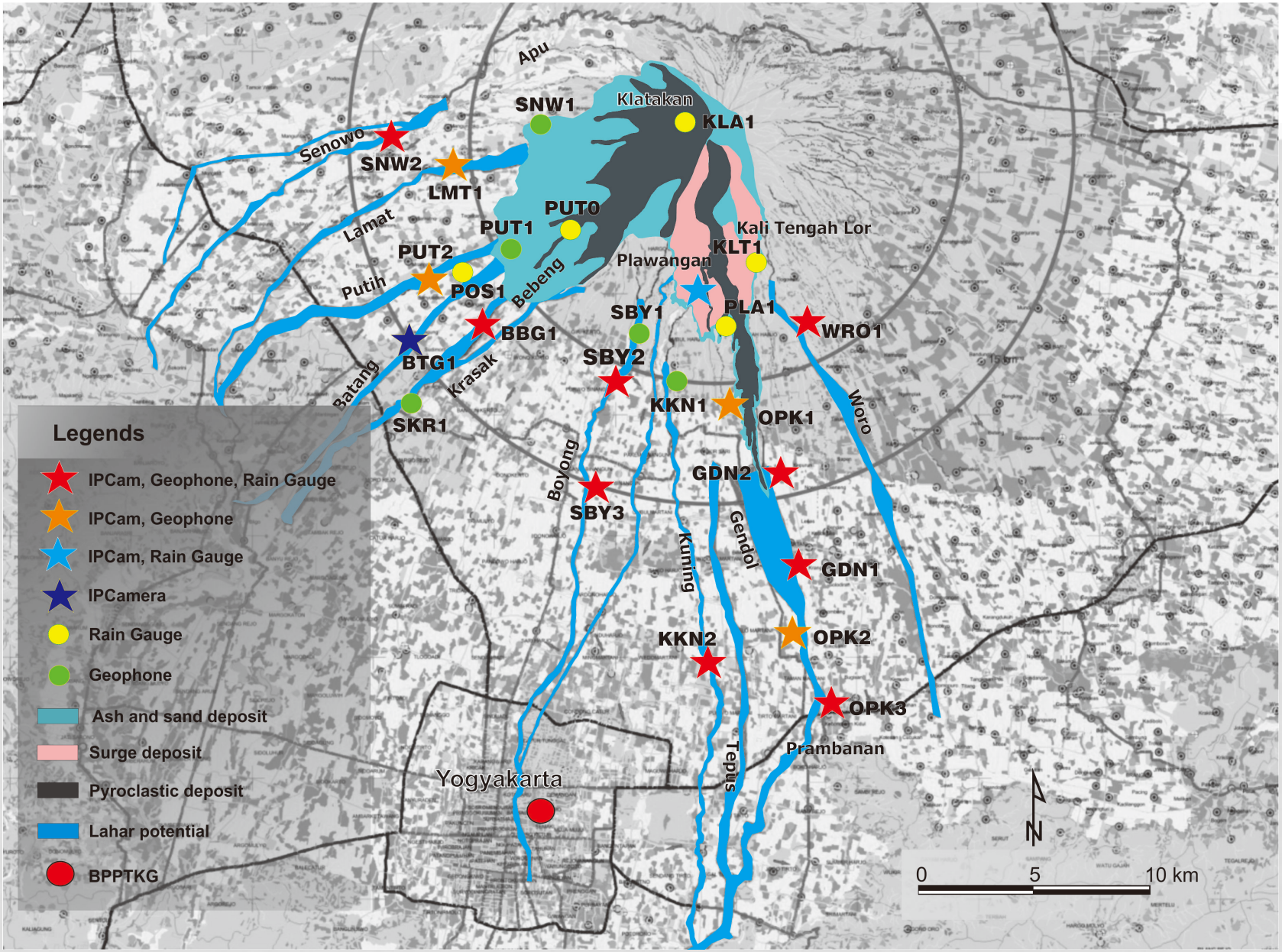
CO_2/S_{TOT} ~ 5
SO_2/H_2S ~ 8
H_2O/CO_2 ~ 55





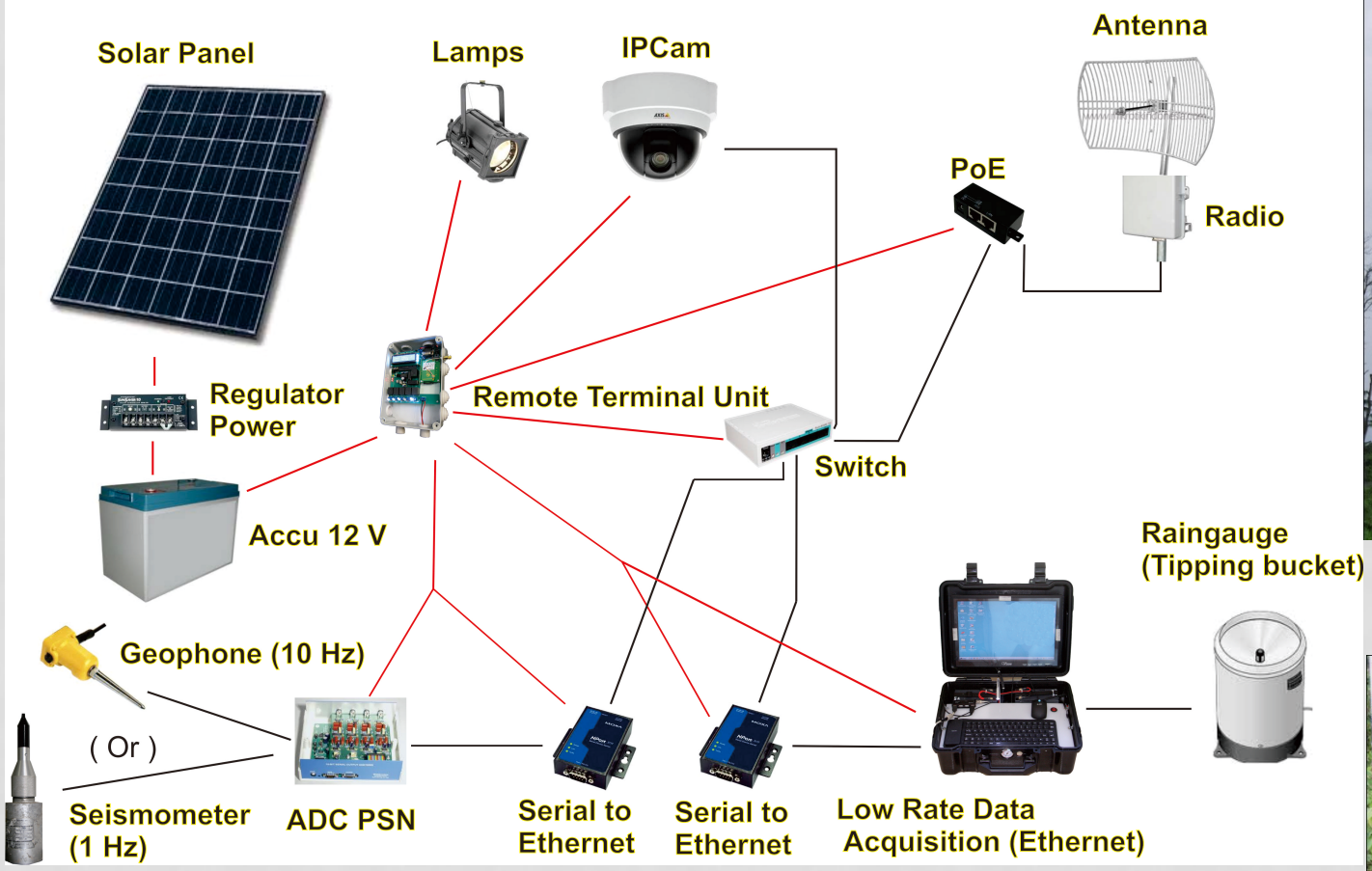


LAHAR MONITORING NETWORK

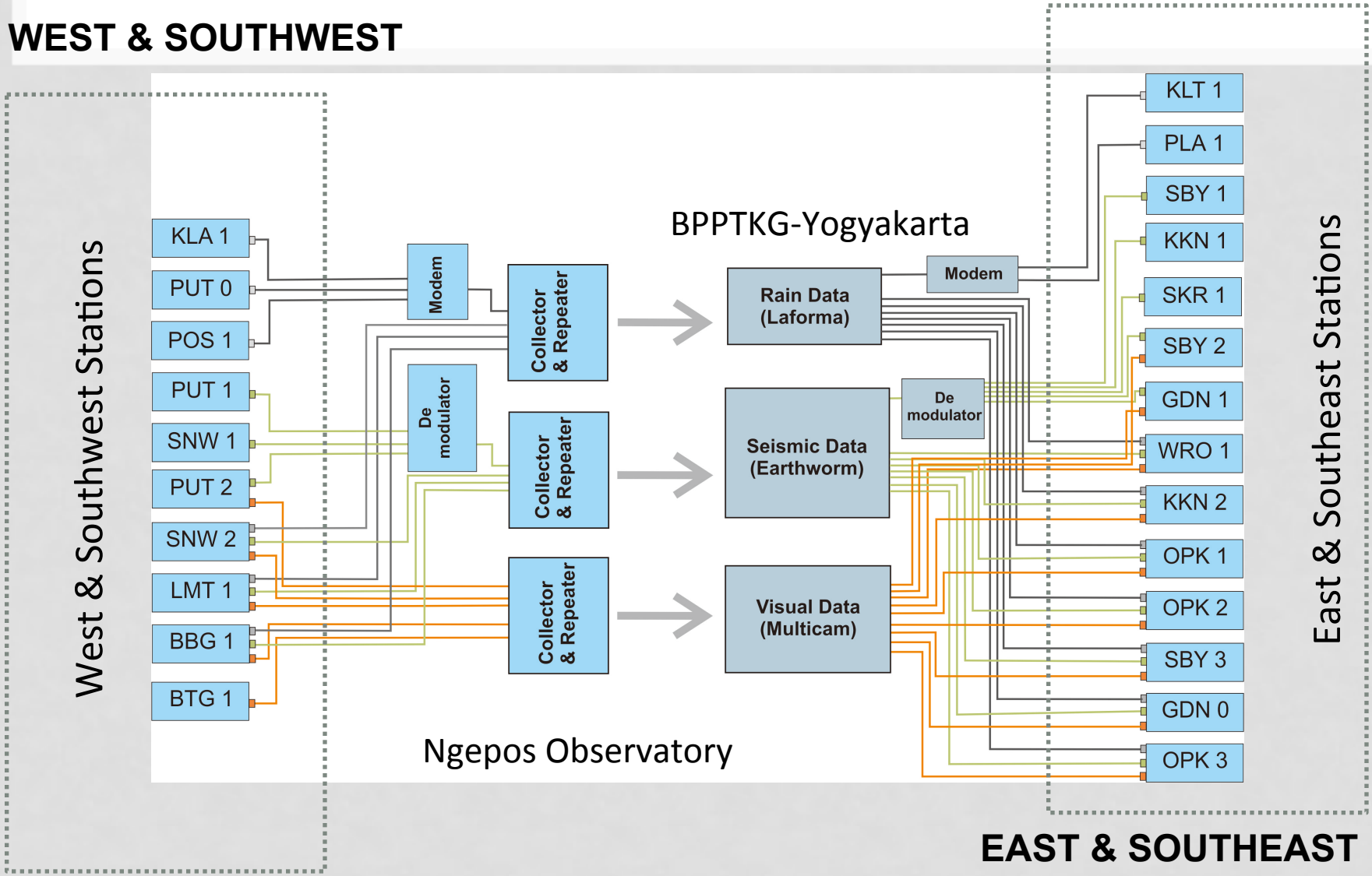


INSTRUMENTATION

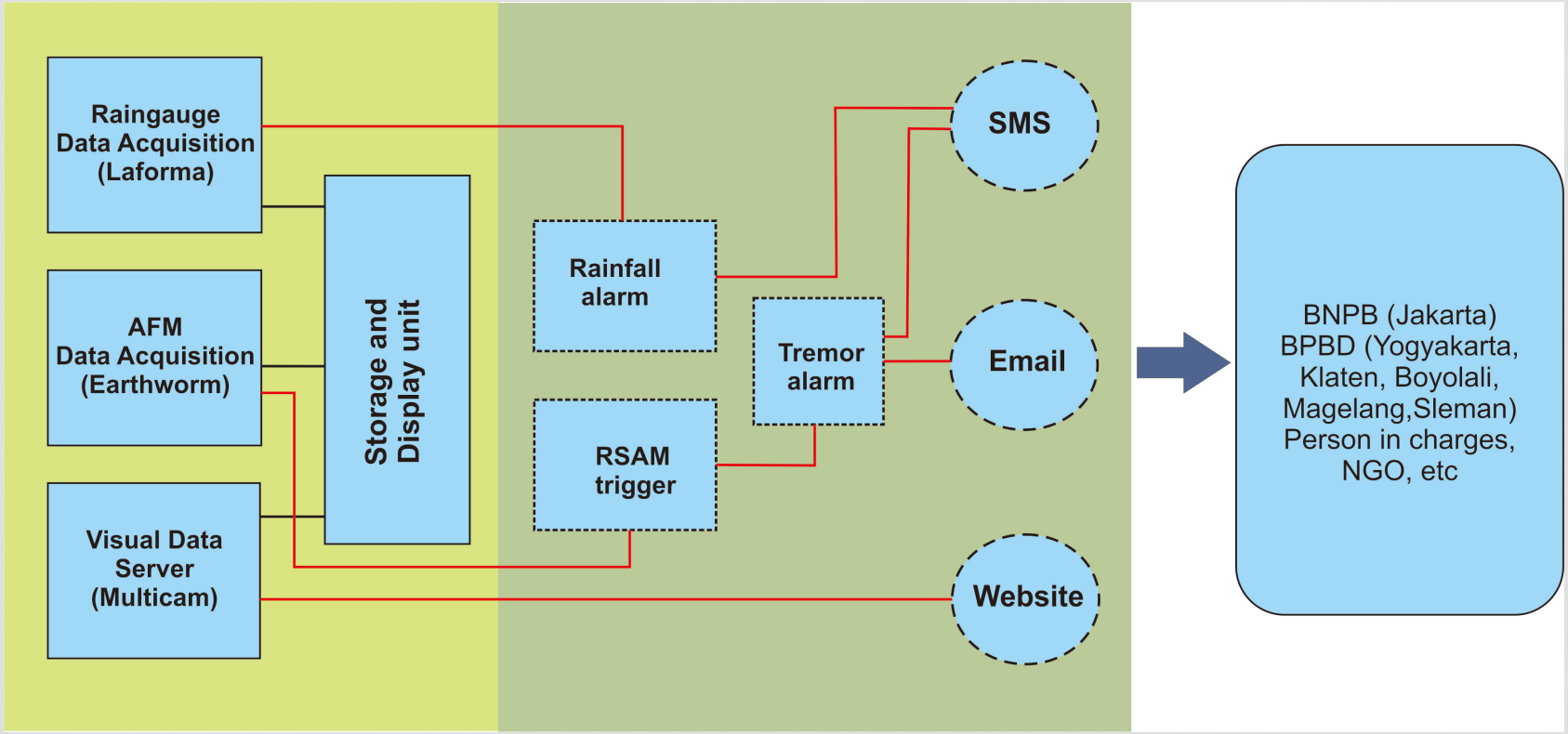
FIELD STATION DATA AND POWER FLOW DIAGRAM (LAHAR MONITORING – DIGITAL DATA TRANSMISSION)



TRANSMISION MAP OF LAHAR MONITORING NETWORK

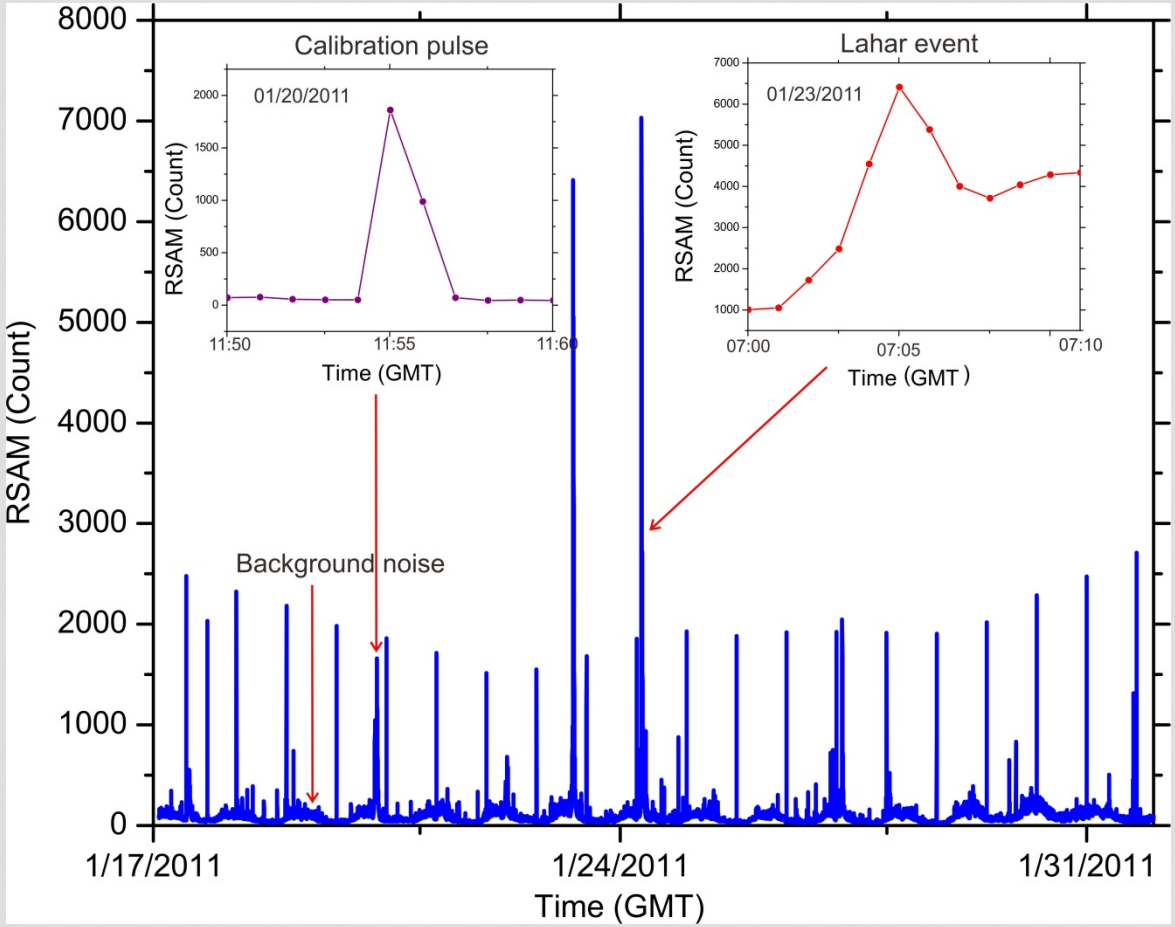


DATABASE AND LAHAR WARNING SYSTEM



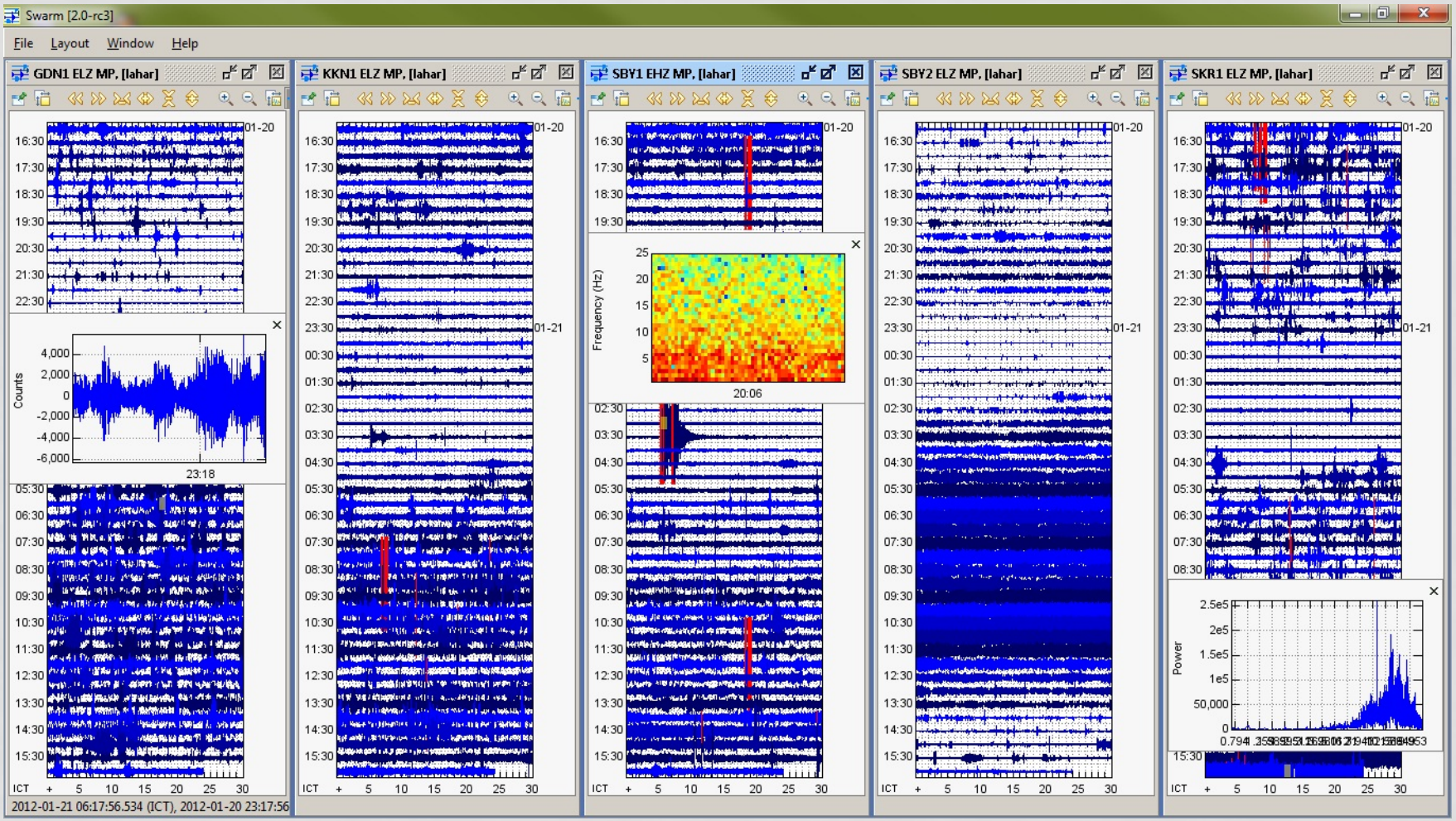
www.merapi.bgl.esdm.go.id

Threshold Criteria for RSAM Warning



Based on data evaluation for 1 month, we compare RSAM signal values for (1) background noise, (2) calibration pulse and (3) lahar events. The background noise usually has a smaller amplitude than the calibration pulse and lahar event. The system will give a warning if the amplitude exceeds a certain value and the difference value of two successive data points is more than 500 counts.

Screen Capture AFM signal (SWARM-2.0 rc3)

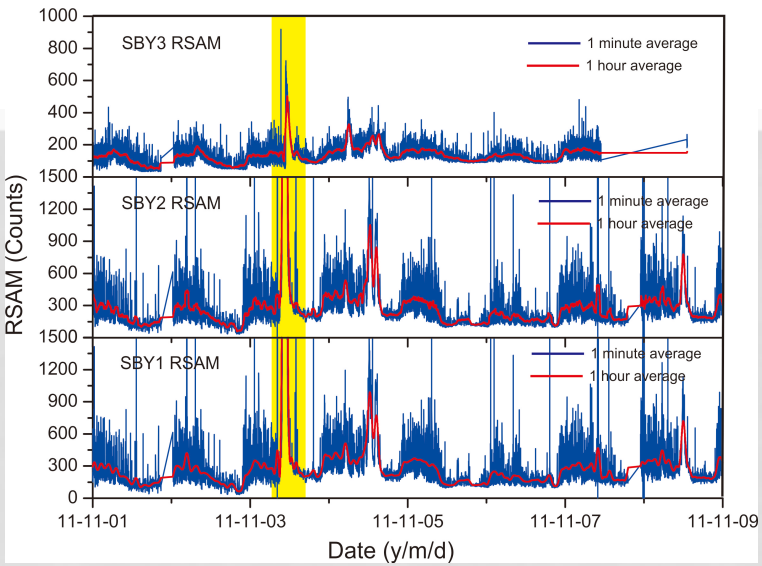


Gendol1 Kuning1 Boyong1 Boyong2 Krasak1

Screen Capture Visual Data Monitoring (Remote VideoTelemetry)

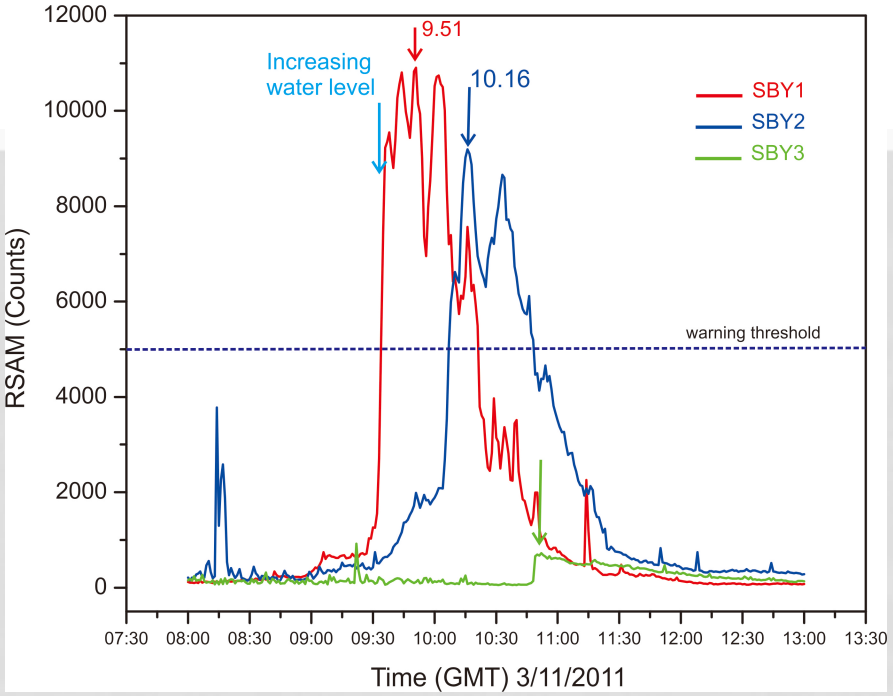
Lahar Monitoring

RSAM Sungai Boyong 01-09/11/2011



Example

RSAM Sungai Boyong 03/11/2011



Visual Data SBY2 (3/11/2011)

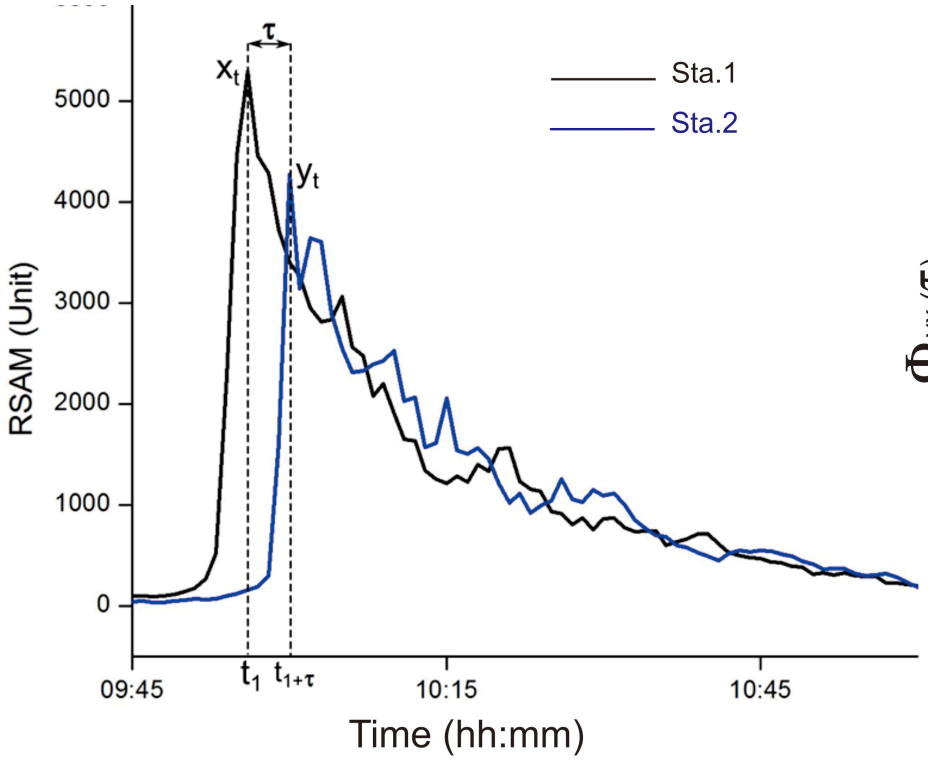
Measurements of debris flow velocity through cross-correlation of monitoring data

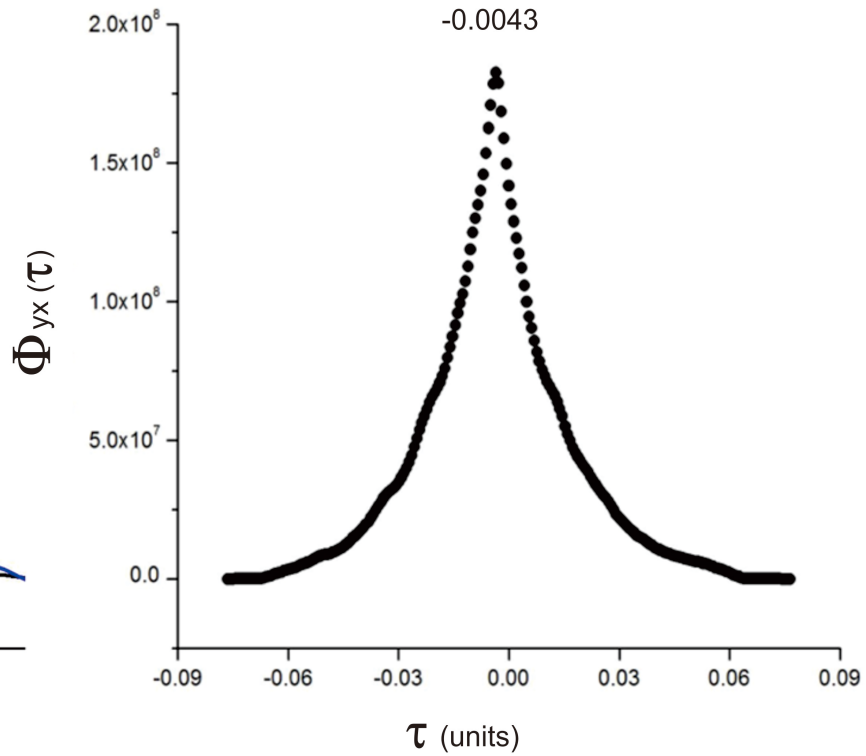
$[x_a] = [x_0, x_1, x_2, \ldots, x_{N-1}]$ (1)

$[y_a] = [y_0, y_1, y_2, \ldots, y_{N-1}]$ (2)

$$\emptyset yx(\tau) = \sum_{t=0}^{N-1} x_t \, y_{t+\tau} \quad (3)$$

(1), (2) signal data monitoring;
(3) cross corelation function
(4) Distance = Vel * Time





Conclusion

The level of the volcanic activity of Merapi after a catastrophic eruption of 2010, is low. There is no sign from all observations data indicate a new magma supply.

Preparedness for the next eruption

- Improve the quality of monitoring system
- Intensive capacity building for people living in the hazard zone.
- Improve hazard model: PDC and Lahar modelling
- Reconstruct the ancient eruption of Merapi in case of a worst scenario

TERIMA KASIH