

## Report Implementation of Research Cooperation between Disaster Prevention Research Institute and the Institute of Technology of Bandung

Joenil KAHAR

Department of Geodetic Engineering  
Faculty of Civil Engineering and Planning  
Institute of Technology of Bandung

### Synopsis

This paper briefly reports the involvement of the Institute of Technology of Bandung (ITB) on Japan-Indonesian research cooperation on Natural Hazard Prediction and Mitigation which was carried out under the program of the International Decade for Natural Disaster Reduction (IDNDR). During the period of 1991-1996, ITB involved in (1) Crustal movements monitoring by GPS and gravity change measurement around volcanoes and active fault system. (2) Volcanoes' deformation monitoring by GPS. To obtain significant result, this paper recommends a long term research cooperation, e.g. for ten years' periods. Because there was no formal research cooperation between ITB and Kyoto University, this paper suggests that the long term research cooperation may be worked out under an implementing arrangement between Kyoto University and ITB or under program of the Japan Society for the Promotion of Science (JSPS).

**Keywords:** crustal movement, gravity, joint research, IDNDR

### 1. Introduction

Started in 1991, under the program of the International Decade for Natural Disaster Reduction (IDNDR), the Disaster Prevention Research Institute (DPRI) of Kyoto University established research cooperation on Natural Hazard Prediction and Mitigation with some Indonesian Institutions. The establishment of research cooperation was carried out under Implementing Arrangements between

1. DPRI and the Research and Development Center for Geotechnology (RDCG) of the Indonesian Institute of Sciences.
2. DPRI and the Research Institute for Water Resources Development (RIWRD), Agency for Research and Development of the Ministry of Public Works of the Republic of Indonesia.
3. DPRI through the Sakurajima Volcanological Observatory (SVO) and Volcanological Survey Institute (VSI), the Directorate General of Geology and Mineral Resources (DGGMR) of the Ministry of Mines and Energy of the Republic of Indonesia.
4. DPRI and DGGMR.

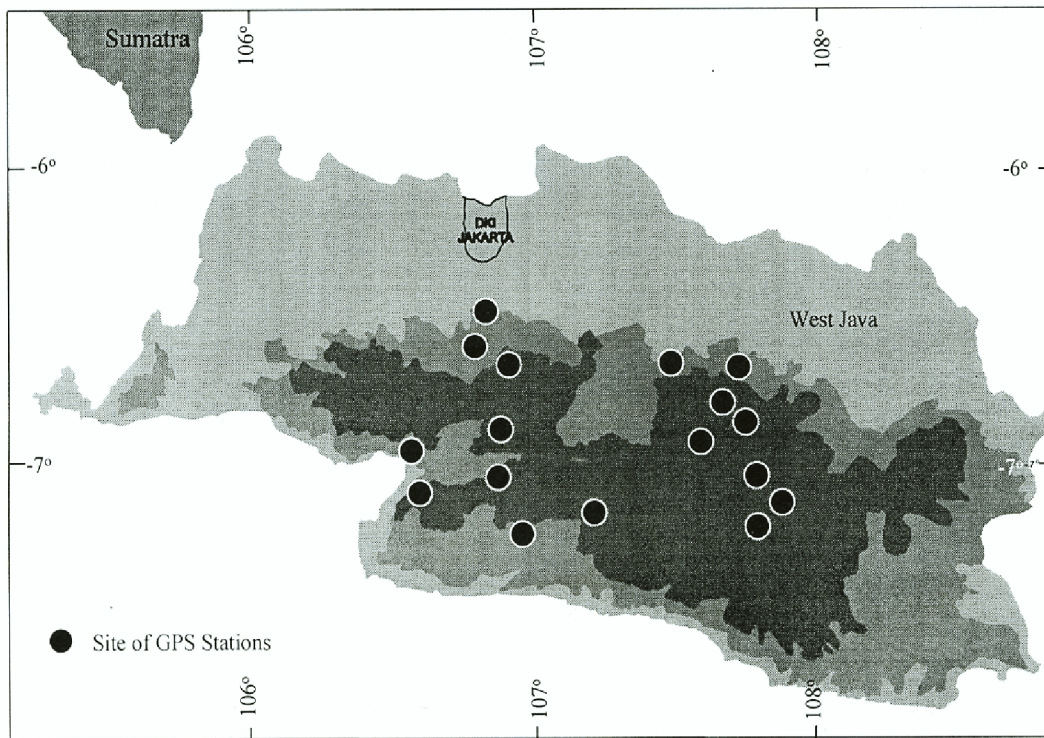
The Institute of Technology of Bandung (ITB) through the Department of Geodetic Engineering has been involved in the implementation of the program. ITB is actively involved in these two following programs:

1. Crustal movements monitoring by GPS and gravity change measurements around volcanoes and active fault system.
2. Volcanoes' deformation monitoring by GPS measurement.

The investigation area of those programs is West Java.

### 2. Crustal movements monitoring by GPS and gravity change measurement around volcanoes and active fault systems.

Crustal movements monitoring by GPS and gravity change around volcanoes and active fault system were started in 1991. From 1991 until 1993 this activity was worked out under Implementing Arrangement between DPRI and the Research and Development Center for Geotechnology (RDCG) of the Indonesian Institute of Sciences.



**Figure 1.** GPS Network for Crustal Movements Monitoring in West Java

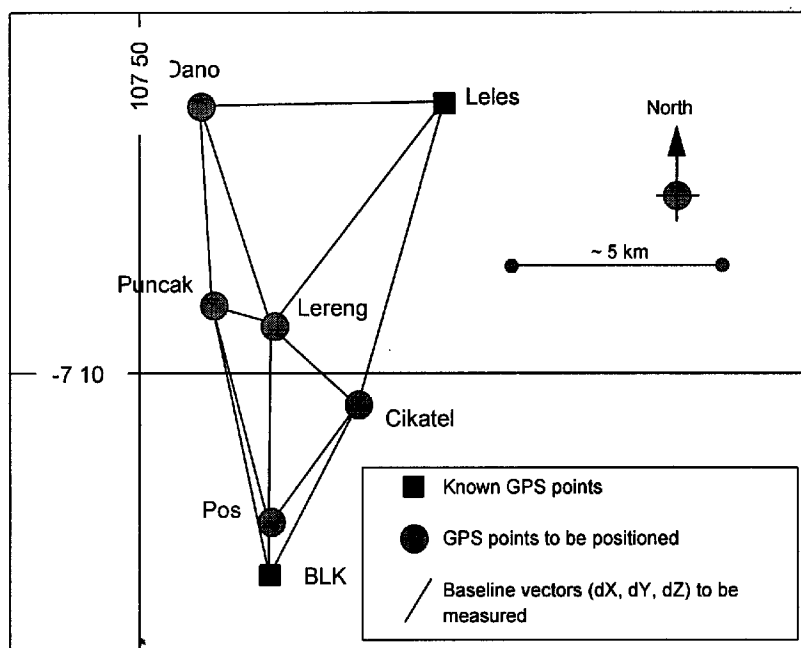
**Table 1** GPS Stations for crustal movements monitoring

Stations	Long		lat		Height (m)	Gravity (mgal)
	°	' "	°	' "		
BAKOSURTANAL	106	50 56.067	- 6	29 27.795	158.054	978115.007
ITB(*)	107	36 32.570	- 6	53 17.059	813.397	977970.118
Pelabuhan Ratu (*)	106	32 35.997	- 6	59 22.676	23.818	978236.034
Kiara Dua	106	35 27.594	- 7	05 50.418	746.030	978157.084
Bojong Lopang	106	48 04.482	- 7	03 25.249	531.844	978130.899
Sagaranten	106	53 00.632	- 7	13 06.138	391.521	978072.280
Sukanegara	107	07 51.913	- 7	05 51.974	890.727	978026.513
Cisaat	106	53 28.258	- 6	54 29.899	621.300	978079.532
Tugu	106	58 17.867	- 6	42 10.407	1122.403	977934.424
Ciawi	106	50 52.318	- 6	39 19.348	469.841	978055.743
Cikalong Wetan	107	26 42.363	- 6	45 25.137	666.233	977985.438
Ciater	107	39 38.834	- 6	43 07.957	860.989	977957.282
Lembang	107	36 58.596	- 6	48 50.725	1265.281	977871.572
Cibodas	107	41 11.424	- 6	49 29.060	1279.425	977878.274
Nagreg	107	54 05.250	- 7	01 45.990	850.978	977976.822
Leles	107	53 54.938	- 7	06 31.275	733.100	977986.044
BLK. Samarang	107	51 39.298	- 7	12 34.407	901.516	977950.042

GPS station network for this purpose was established in 1991. A National GPS permanent station of BAKOSURTANAL (National Agency for Surveys and Mapping) in Cibinong is the one station of the GPS network, and it will be used as reference station. The distance among stations ranges from

about 8 to 100 km. Figure 1 shows location of the stations.

GPS campaign for crustal movement monitoring of West Java region was started in 1992. GPS campaign in the period of 1992 - 1993 did not yet explain any crustal deformation (Kahar et al., 1994). The GPS campaign was carried out every year. Since



**Figure 2** GPS network for Mt. Guntur deformation monitoring

**Table 2** Survey arrangement of the first GPS Campaign

Session	Date of measurements	Occupied stations by 4 GPS receivers (R)			
		R-1	R-1	R-1	R-1
I	Nov. 23, 1996	Pos	Leles	Dano	BLK
II	Nov. 24, 1996	Pos	Leles	Cikatel	BLK
III	Nov. 25, 1996	Pos	Leles	Cikatel	BLK
IV	Nov. 26, 1996	Pos	Dano	Cikatel	BLK
V	Nov. 27, 1996	Pos	Dano	Puncak	Lereng
VI	Nov. 28, 1996	Pos	Dano	Puncak	Lereng

1994, GPS campaigns were carried out under Implementing Arrangement between DPRI with DGGMR as a part of research cooperation concerning research on physical volcanology and tectonics of Indonesia. A latest result of the crustal deformation monitoring will be shown by Setyadji et al. (1997).

Being started in 1993 the gravity measurements of this program were also carried every year. The gravity measurements were carried out not only at the GPS network but also along gravity lines which were established by BAKOSURTANAL and the Center of Research and Development of Geophysics (CRDG), an institution under DGGMR. A detailed information about the gravity survey was given by Nakamura et al. (1997).

Table 1 shows geodetic coordinates of crustal movements monitoring stations in WGS84 which were obtained from GPS measurements. All gravity values shown in the table 1 were obtained from gravity surveys in 1993, except gravity values of

Sagaranten and Sukanagara were obtained from gravity surveys in 1995.

### 3. Volcanoes' deformation monitoring by GPS

Volcano's deformation monitoring by GPS was an activity which was worked out under the Implementing Arrangement between DPRI and DGGMR. This activity was a part of research cooperation concerning research on physical volcanology and tectonics of Indonesia. Executing Agency for the Indonesian side was VSI and for Japanese side was SVO. VSI choose Mt. Guntur as object to be monitored. The reason why this volcano should be monitored was explained by Tjetjep (1997).

To monitor deformation of Mt. Guntur a GPS network has been established as shown in Figure 2. GPS stations of Leles and BLK Samarang, which were used for crustal movements monitoring, were chosen for known stations, so that the motion of other stations should be referred to the two stations.

Location of Mt. Guntur in relation to GPS network for crustal movements monitoring may be found in Figure 1. Table 2 shows an arrangement of the first GPS Campaign which was carried out in November 23 - 28, 1996 (Abidin, 1996).

#### 4. Concluding remarks

Since 1991, under the program of the International Decade for Natural Disaster Reduction (IDNDR), ITB is actively involved in Japan-Indonesia research cooperation on Natural Hazard Prediction and Mitigation. This project was realized through some implementing arrangements between DPRI-Kyoto University and some Indonesian Government Institutions as mentioned in the beginning part of this report.

The ITB is involved in two programs which are related to GPS surveys. As matter of fact DPRI, Kyoto University do not have an implementing arrangement with ITB. ITB is an Indonesian university which has some departments in geosciences as well as Kyoto University has.

Therefore it is feasible and recommendable that Kyoto University has a research cooperation with ITB as a supplementary or parallel program to the existing research cooperation as mentioned above.

A significant result of Crustal Movements and Volcanoes Deformation monitoring can be obtained after multiyear's investigation, e.g. for ten years period. Therefore, this report recommends a long-term research cooperation between Kyoto University and ITB should be established through an implementing arrangement between the two universities or under the program of the Japan Society for the Promotion of Science (JSPS).

#### References

- Abidin, H.Z. (1996): Volcanoes Deformation Monitoring using Repeated GPS Survey Method, *Status Research Report of Hibah Bersaing -V*, Dept. of Geodetic Eng. ITB (In Indonesian).
- Kahar, J., T. Tanaka, I. Murata, S. Suparka, F. Kimata, S. Okubo, K. Nakamura, K. Prijatna, P. Mentosumitro, B. Setyadji, S. Miura, K.J. Villanueva, K. Kamtono, A. Suwandito, S. Sudarman (1994): GPS Campaign for Crustal Deformation Monitoring in West Java. Indonesia. 1992-1993, *Proc. of the Eight International Symposium on Recent Crustal Movements (CRCM '93)*, Kobe, December 6 - 11, 1993.
- Nakamura, K., T. Tanaka, S. Okubo, I. Murata, J. Kahar, and Mipi. A. K. (1997): Precise Gravity Measurements in West Java. Indonesia, *Paper presented at IDNDR Meeting Kyoto University*, January 29 - 31, 1997.
- Setyadji, B., I. Murata, J. Kahar, S. Suparka, and T. Tanaka (1997): Analysis of GPS Positioning Data in West Java, *Paper presented at IDNDR Meeting Kyoto University*, January 29 - 31, 1997.
- Tjetjep, W. S. (1996): The Evaluation of Japan-Indonesian Cooperation in Volcanology, 1993-1996, *Paper presented at IDNDR Meeting Kyoto University*, January 29 - 31, 1997.

#### 要 旨

バンドン工科大学(ITB)は国際防災の10年(IDNDR)計画のもとで、自然災害の軽減と防御に関する日本-インドネシア共同研究に取り組んできた。ITBは1991年から96年にわたって、(1)活火山および断層周辺におけるGPSによる地殻変動および重力変化の観測、(2)GPSによる火山体の変形観測、の課題を推進してきた。この共同研究から真に有意義な結果を得るために、ここでは、たとえば10年計画といった長期の共同研究を提唱したい。現在、ITBは京都大学との間では諸般の事情で正式な共同研究の協定を結んでいないが、長期にわたる共同研究を一層推進するために京都大学とITBの間で協定を結ぶか、あるいは日本学術振興会の事業として推進することを提唱したい。

**キーワード:** 地殻変動 重力 共同研究 国際防災の10年