DPRI *Neusletter* Disaster Prevention Research Institute Kyoto University No.13 1999年8月 京都大学防災研究所

オクラホマ大学での10ヵ月

1998年9月から1999年6月の10ヵ月間、文部省在 外研究員としてオクラホマ大学土木環境工学科の中 にあるEMGIS (Environmental Modeling and GIS) 研究室に滞在しました。受け入れ教官は防災研究所 にこれまで3回来られたことのあるVieux助教授で す。この研究室のキーワードはGIS、Advanced distributed runoff model、Radar rainfall、Digital mapsといった言葉で表すことができます。主要な 研究課題は洪水流出予測手法の高度化です。滞在中、 私は降水の時空間分布やモデルパラメータの空間分 布が洪水流出シミュレーション結果に及ぼす影響に 関する研究に従事していました。

ノーマンでの生活

オクラホマ大学はオクラホマシティーから約30マ イル南にあるノーマン市にあります。ノーマン市の 人口は約8万人、そのうちオクラホマ大学の学生が 約3万人という大学町です。キャンパスは市の中心 部から南に広がっており、市の面積の

1/10程度をキャンパスが占めます。キャ ンパス内にはバスターミナルがあり、市 内を走るバスはすべてここから発着しま す。主だったところはバスで行くことが できるため非常に便利です。キャンパス 内には大学が運営する大型のアパートが 3ヶ所にあり、アパートには夜11時まで バスが運行しています。これらのアパー トに住んでいると車をほとんど必要とし ません。実際、私は車を所有することな く10ヵ月を過ごしました。

この町の印象を一言でいうと、非常に 静かな町ということでしょうか。大学町 であるために治安もよく、深夜でも自転 車でアパートに帰る学生もいます。お酒を買うとき もIDを求められることはありませんでした。TCを 使うときも全くノーチェックです。もう少し、チェ ックしたらとこちらが感じるくらいでした。



オクラホマ大学のキャンパス

オクラホマでの自然災害とそれに関連する研究施設

この地で発生する主な自然災害は、竜巻と局所的 な豪雨によって発生するFlash Floodsによる風水害 です。竜巻の発生個数は全米の州のうち、オクラホ マ州がもっとも多く、1961年から1990年の間では、 年間平均47個の竜巻が報告されています。オクラホ マ州の場合、竜巻の発生は4月から6月に集中しま



メゾネットノーマン観測地点

す。このような気候を持つ土地であるため、オクラ ホマ州には、風水害による被害を防止・軽減するた めの気象観測施設が充実しています。その一つがオ クラホマ・メゾネットです。これはアメダスのよう なルーチン気象観測システムであり、観測項目が非 常に多いのが特徴です。15分間隔で様々な気象デー

タを測定しており、オンラインでデータをダ ウンロードすることができます。これらのデ ータは気象の現況把握・予測に非常に威力を 発揮しています。また、これらのデータは農 業や道路交通に関する情報を発する場合にも 用いられています。オクラホマ州内部に約 100基設置されており(約1,000km に一つの割 合)、メンテナンスに一基、一年間で約100万 円かかるとのことです。つまり、全体のメン テナンスに一年間で約1億円の費用が発生 し、このお金は州政府の予算によって賄われ ているそうです。メゾネットのノーマン観測 地点は研究用サイトとなっているため、ルー チン観測以外にも、様々な測器が設置されて います。もう一つ、ノーマンにはNOAA(米 国海洋大気庁)のNational Severe Storm

Laboratoryの本部があります。ここではレーダーや 地球観測衛星による気象観測・予測や洪水予測に関 する研究を行っており、オクラホマ大学の気象学教 室や私が滞在したEMGIS研究室とも共同研究を行 っています。

1999年5月3日にオクラホマ州を襲った竜巻

観測史上、最大規模の竜巻が 5月3日に発生し、午後6時過 ぎにオクラホマシティーの南西 から北東に向かって通過しまし た。強風によって多くの家屋が 破壊され、残念なことですが、 現地のニュースが伝えるところ では43名の方が亡くなられまし た。竜巻の強さは風速によって F0からF5の6クラスに分類され ており、このときに襲来した竜 巻は最も強いF5クラス(風速 261~318mph、秒速にすると116 ~141m/sec)の竜巻でした。こ



竜巻による被害(Del city)



車につきささる木片(Midwest city)

の竜巻の強度分類はFujita tornado scaleと呼ばれて います。帰国後、大石先生(水資源研究センター) に教えて頂いたのですが、Fujita scaleはシカゴ大 学で教鞭を取っておられた藤田博士の発案によるも のだそうです。日本人の仕事が米国の防災現場で役 だっており、誇らしく感じます。

ノーマンには風水害に関する様々な研究施設があ ります。ここでの研究が防災に役立つことを願って やみません。今後ともこれらの研究機関と関係を保 ちつつ、水害の防止・軽減のための研究に取り組ん で行く所存です。

水災害研究部門 立川康人

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DPRI Newsletter

Final Report 1994-1998 IDNDR Project

The DPRI of Kyoto University has conducted special projects

PREDICTION AND MITIGATION OF NATURAL DISASTERS IN INDONESIA AND CHINA

in the framework of the International Decade for Natural Disaster Reduction (IDNDR) under the support of the Ministry of Education, Science, Sports and Culture, Japan

Subjects in Indonesia

- I-1: Igneous Process and Tectonics
- I-2: Disasters Caused by Volcanic Debris Flows, Floods and Beach Erosion and Their Mitigation

Subjects in China

- C-1: Prediction of Strong Earthquake Ground Motion, and Prediction and Mitigation of Earthquake Disasters in China
- C-2: Landslie Hazard Assessment of Lishan Landslide, Xian, China
- C-3: Mechanism of Viscous Debris Flows and Countermeasures against Them

Indonesian and Chinese Counterpart Organizations

Volcanological Survey of Indonesia, Bandung (I-1) Ministry of Public Works, Agency for Research and Development, Research Institute for Water Resources Development (I-2) Center for Analysis and Prediction, China Seismological Bureau, Beijing (C-1) Institute of Engineering Mechanics, China Seismological Bureau, Harbin (C-1) Seismological Bureau of Yunnan Province, Kunming (C-1) Earthquake Engineering Research Center, Hebei Institute of Technology Tangshan, (C-1) Lishan Landslide Prevention Office of Xian Municipal Government (C-2) Chengdu Institute of Mountain Disasters and Environment, Chinese Academy of Science (C-3)

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I-1: IGNEOUS PROCESS AND TECTONICS

Purpose

Sakurajima Volcano research Center has conducted seismic observation and ground deformation measurement at Guntur volcano, and tilt observation at Merapi volcano collaborating with Volcanological Survey of Indonesia to study eruption mechanism of volcanoes in Java. Research Center of Earthquake Prediction has repeated GPS and gravity measurements in West Java with Bandung Institute of Technology to study tectonics of West Java.



Merapi Volcano



Guntur Volcano

Results





Merapi volcano

Increase and decrease in tilt were successively observed from the distant station to near stations to the summit. This suggests upward migration of pressure source from the magma pocket at depth of 2km to shallower part beneath the summit.

Guntur Volcano

Volcanic earthquakes occurred at depth of 0-5km beneath the summit area and at depths of 5-10 km beneath Kamojang-Darajat geothermal area. The seismicity increase since May 1997 was accompanied with inflation around the summit crater.

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I-2: Disasters Caused by Volcanic Debris Flows, Floods and Beach Erosion and Their Mitigation

This project had been conducted as a joint research between DPRI and RIWRD (the Research Institute for Water Resources Development, Agency for Research and Development, Ministry of Public Works of Indonesia) for studies of flood hazards in the Brantas River Basin, beach erosion and its control in Bali and Java Islands, and comprehensive sediment management in a rivercoast system. The main research results are summarized below.

In the Brantas River basin study:

(1) Based on sampling bed materials at about thirty points in the basin, soil property and particle size were investigated. One- and two-dimensional be variation models were constructed for the middle reach of the Brantas. The 1-D model investigated the effect of channel width on bed variation and the effect of suspended load, and revealed that the rapid change in channel width causes greater river bed variation, which is critical for flood hazard. The 2-D model expressed the stream bifurcation process in the river and verified that river bed variation and particle size at the inner side become greater when taking the suspended load into account.

(2) Remote sensing images and geographic information systems (GIS) are used for establishing a distributed hydrological model for flood and sediment runoff. The model applied to the Putih river, one of the major tributaries, reproduced the sediment yield during seven years following the 1990 eruption of Mt. Kelud and estimated the effective infiltration depth that contributes sediment yield.





(3) A long- and short-term rainfall-runoff model was also constructed for the analysis of water balance and prediction of runoff discharge in the Sutami reservoir basin. This model can reproduce daily rainfall-runoff, using the VIC (variable infiltration capacity) model.

In the studies of beach erosion control and the prediction of coastal and sea bottom topography changes:

- (4) One-year simulation of tide- and wind-driven circulation in Java Sea, which is influenced by west- and east-monsoon, was carried out using a three-dimensional hydrodynamics model incorporating the influence of waves. A third-generation ocean wave prediction model, WAM, was employed to calculate the wave fields and the wave-dependent sea surface and bottom drag coefficients. Six hourly wind-field at 10 m above the sea surface were given by ECMWF's global climate reanalysis data as a representative wind. The trajectory of numerical tracers for one-year circulation was simulated to make clear transportability of materials at both the sea surface and bottom.
- (5) A 3-D beach change prediction model which consists of bore type breaking wave model, 3-D nearshore circulation model and sediment transport model, has been developed in this project. Its verification has been continued on coasts both in Japan and in Indonesia.

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- (6) Coastal monitoring and numerical prediction have been conducted in Pangandaran coast (South Java) facing the Indian Ocean, where the river short-cut works are under construction.
- (7) Tsunamis hazards caused by huge earthquake in the Pacific Ocean have been investigated in this project. Counter-measurers against tsunami hazards in Indonesia have also been studied by means of hydraulic experiment for tsunami run-up and land topography changes due to surges.

Details: Proc. of Symposium on Japan-Indonesia IDNDR Project, Volcanology, Tectonics, Flood and Sediment Hazards, 1998.



Fig.2 Three-dimensional simulation of tide- and wind-driven circulation in Java Sea. The left figure shows trajectory particles on the bottom driven by the west monsoon in 1996 and the right shows trajectory particles on the surface.

1/24 0-1111-4.1.1718 1/28 1/29 1/30 in the west monsoon season (Jan. 1995) 8/11 8/12 8/13 8/16 8/14 8/15 N 10 -8/19 8/18 8/20 8/21 8/22 8/23 8/24 N -8/27 8/28 8/29 8/26 8/30 in the east monsoon season (Aug. 1995)

Fig.3 Observed time series of coastal current vector at Jepara Coast 1n 1995. The upper shows currents under the west monsoon condition and the lower that in the east monsoon.

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C-1: Prediction of Strong Earthquake Ground Motion and Prediction and Mitigation of Earthquake Disasters in China

The C-1 research group has four sub-theme programs: 1)prediction of seismic activity in Hebei region, 2)prediction of strong earthquake ground motions in Tangshan region, 3) earthquake risk assessment of urban region on soft soil sediments,4)seismic damage assessment and urban aseismic planning, 5)application of advanced technology in earthquake engineering.

Prediction of strong earthquake ground motion in Tangshan region:

A five-year joint research program on this theme has been conducted under the research agreement between DPRI and IEM(the Institute of Engineering Mechanics of the China Seismological Bureau). Seismic observation network for strong motions has been deployed in Tangshan area in 1992 to 1996. We obtained a lot of records from M=2 to M=5.1 from the seismic network. Using these data and aftershock records of the 1976 Tangshan Earthquake, joint researches on strong motion prediction have been performed by DPRI and IEM.



On 28 July 1976, a destructive earthquake struck the city of Tangshan, in mainland China, 160 Km east of Beijing. The focal depth of the Ms=7.8 Tangshan earthquake was 10 Km. A prominent surface rupture crossed the city, almost completely destroying it and heavily damaging the surrounding areas.



Seismic observation network for strong motion deployed in Tangshan area and earthquake epicenters observed.



Seismic intensity map

Earthquake Risk Assessment of Urban Region on Soft Soil Sediments:

DPRI, Kyoto University and Seismological Bureau of Yunnan Province, China conducted array-observations of long-period microtremors, seismic-refraction and gravity explorations to investigate the subsurface structure of Lijiang basin, Yunnan. Special attention was given to the relation between the configuration of bedrock and the anomalous distribution of damage to wooden houses and RC buildings in the basin caused by the 1996 Lijiang Earthquake(M7.0, Feb. 3). The analyses show that, the bedrock subsides steeply along the west edge of basin, where runs the Xueshan fault: a probable seismogenic fault of the 1996 Lijiang Earthquake, suggesting that, the configuration of bedrock affects strongly the ground motions, consequently the anomalous distribution of damage. This situation reminds us of the similar damage distribution in Kobe-Hanshin area by the 1995 Kobe earthquake. In consequence, it is impossible to overemphasize the importance of the study on 3D-configuration of bedrock for microzoning sedimentary basins.

Topographical map of Lijiang basin and location of seismic exploration profiles(a). Comparison between observed(X) and calculated(+) P-wave travel times from NW-shot for NW-SE profile(b) and model for bedrock and ray diagram(b). Note the steep subsidence of bedrock up to 700m at the west of basin.



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Reproduced seismograms (AR: seriously damaged area, YT: slightly damaged area)



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C-2: Landslie Hazard Assessment of Lishan Landslide, Xian, China

The Imperial Resort Palace, known as the Huaqing Palace, Xian, Shaanxi Province, China (Fig. 1), had a famous history in the ancient age of the Tang dynasty (618-907 A.D.), in which the Empress Yang-Que-Fe enjoyed the hot spring at the palace. There are no volcanoes near Xian, however, many active faults can be found near the Huaqing Palace. The hot spring continues to produce hot water and the Huaqing Palace is nowadays one of the most popular tourist resorts in China . Every year about three million tourists visit this resort. The palace is located at the toe of a steep fault cliff, called Lishan mountain ("shan" means mountain), as shown in Figs.1 and 2. Beginning in 1985, slope deformation has become obvious; indications of movement are given by small slope failures at the foot of the slope, subsidence at the head of the cliff, and many cracks in the slope and structures. The Xian municipal government established the Lishan Landslide Prevention Observatory (LLPO) in 1986 to start monitoring of the Lishan slope for protection management of the cultural heritage and tourists. In 1991, This joint research project between DPRI and LLPO started with purposes of (1) to clarify whether this



Fig. 1 Location of Lishan, Xian, Shaanxi Province, China and photo of Huaqing Palace.



Fig. 2 Plan map of Lishan landslide and Huaqing Palace.

deformation is landslide or fault movement, (2) to assess catastrophic landslide hazard of the Lishan slope.

A Short-span extensioneter (10 m, Ex. 1 in Fig. 2) monitoring record of over 6 years shows that the slope movement corresponds to precipitation (Fig. 3). This implies that the slope movement is not caused by the fault activity, but due to landslide movement. Total



Fig. 3 Record of the Short-span extensometer (Ex. 1 in Fig. 2) during 1992-1996.

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DPRI Newsletter



Station monitoring eveals that part of the slope is dragged along with wide area ground #subsidence including he Huaging Palace which is mainly caused by hot water pumpingup Monitoring by GPS survey of stations widey distributed around the Lishan slope detected no obvious displacement. Thirteen series of long span extensometers (Fig. 4) of 40-60 m

Fig. 4 Long-span extensometer installed on the Lishan slope.

span for each, were installed along A- and B- Lines (two red lines in Fig. 2). The poles on which the pulleys were positioned, are made of concrete and are 14 meters high. Extensometers and super-invar wires are installed inside metal boxes and pipes to prevent thievery. The monitoring records reveals (1) Examined with field investigation, the Lishan landslide consists of three blocks, (2) the Block 1 which is adjacent to the Huaqing Palace is most active because both extension at the head and contraction at the foot of the block of about 10 mm were observed corresponding to precipitation (Fig. 5). Taking into consideration with fresh fault gouge of low angle found inside invesigation tunnel on the slope, there is no doubt about the deep potential landslide on the fault gouge which is now at the initial creeping stage. Landslide simulation tests using ring shear apparatuses of alluvial deposits taken from inside the Huaqing Palace were carried out. Obtained data were used for landslide runout



Fig. 5 A record of the Long-span extensometer in 1996 which implies large block movement induced by heavy rainfall.

simulation by computer based on geotechnical model for each block. These simulation results suggest that this huge landslide would result in catastrophic destruction of central part of Lintong county where about 700 thousands people are living. These joint research reports gave enough reason for starting prevention works by Chinese government of about three million USD (Fig. 6). It is important to note that enough investigation and observation can make reliable risk assessment of largescale landslides and prevention works based on the assessment is possible. This joint research project will continue further as a UNESCO-IGCP project **International Geological Correlation Program** (IGCP) No.425 "Landslide Hazard Assessment and Mitigation for Cultural Heritage Sites and Other Locations of High Societal Value" for further study on real-time monitoring, warning, and prevention work suitable for Chinese situations. For more information about the IGCP425 can be accessed at

http://landslide.dpri.kyoto-u.ac.jp/igcp/



Fig. 6 Landslide prevention works under construction.

Selected Bibliography

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Fukuoka, H, K. Sassa, Q.J. Yang, and B.E. Song. 1997. Extensioneter Monitoring in the Lishan Landslide, Xian, China. Landslide News, No.10, pp.23-25.

国際防災

C-3: Mechanism of Viscous Debris Flows and Countermeasures against Them

Purpose

Peoples suffer from the disasters by various types of debris flows in the world. The studies on debris flows of viscous type had not been sufficient while the boulderrich ones had been well studied. The mechanism of viscous debris flow and countermeasures against them have been the objectives of this research with the Chengdu Institute of Mountain Disasters and Environment, Chinese Academy of Science.

The viscous type of debris flow is often found in the regions of the geologic settings composed of highly fractured slate, mudstone, limestone, or metamorphic rock in tectonically active zone. They frequently bring about significant disasters in rainy season.

Results

The cooperative studies based on the field observation of debris flows and the topographic surveys at Jiangjia Gully, Yunnan Province; a small tributary of the upstream of Chang Jiang, the studies by flume experiments, and numerical simulation have brought about the following results.

- The rainfall condition which is specialized by ε time lag for debris-flow occurrence from an onset of rainstorm suggested an accumulation process of debris materials to the source slopes.
- 2) The mechanism of liquefaction of slope-failure material to debris flow, being saturated with water.
- 3) One event of debris flow consists of many intermit-



Photo 1. Debris flow rushing down Jiangjia Gully. The left is the photo on 13 August 1991 and the right on 4 August 1998.



Photo 2. Drastic change in the channel topography by debris-flow repetition. The left is the photo on 20 August 1993, and the right on 3 August 1998.

tent surges (See Photo 2) whose number usually tends to several tens or a few hundreds with a long duration from a few hours to several hours. However four causes might be possible for such intermittent surges, the process of intermittent formation of landsliding dam and its breach should be most plausible among the four causes (Cause 1: Driving force overcomes the resisting yield strength of Bingham fluids or the strength of other viscoplastic fluids; Cause 2: Successive formation of landsliding dam and its breach; Cause 3: Instability of the flow itself; Cause 4: Sensitive response to an impulsive succession of strong intensity of heavy rainfall).

- 4) The rheology of viscous debris flow can be explained by Newtonian Fluid Model, not by Bingham Fluid Model. Though the latter model have been accepted broadly by researchers to explain the viscous debris flow, it was proved that the latter was not suitable to the viscous debris flows, because observation clarified the absence of plug in the flow which must be present if the flow should be Bingham Fluid.
- 5) Repetition of a large number of debris-flow surges caused a remarkable migration of stream channel (See Photo 2) and generated a vast inundation of debris materials on the fan. The mechanism of such changes in the channel and fan morphology due to repetition of debris flows were clarified.
- 6) The previous countermeasure works against debris flows were evaluated to have been effective in many cases being based on the long term field assessments, and new methods of systematic countermeasures were proposed through the field surveys and some experimental studies.
- **Details:** Research report of group C3 of Special Project associated with IDNDR sponsored by Ministry of Education, Science, Sports and Culture, Japan "Japan-China Joint Research on the Mechanism and the Countermeasures for the Viscous Debris Flow", 1999, DPRI, Kyoto University, 206 p.

Contents of this report are:

- Debris-Flow Hazards in Japan and China since 1994
 - 1.1 Situation in Japan

1.2 Situation in China

- 2. Observational Studies on Debris Flows
 - 2.1 Rainfall condition for the occurrence of debris flow in the Jiangjia Gully
 - 2.2 Stochastic analysis of rainfall for debris-flow occurrence in the Jiangjia Gully Basin
 - 2.3 Characteristics of the debris flow in the Jiangjia Gully
 - 2.4 Generation, movement and sedimentation of viscous debris flows
 - 2.5 Intermittent surges of debris flows
- 3. Model Experiments and Development of the Method for Surface Velocity Measurement
 - 3.1 Field and laboratory experiments
 - 3.2 Image analysis for the measurement of debrisflow velocity
- 4. Mechanics of Viscous Debris Flow
 - 4.1 Newtonian fluid model of viscous debris flow
 - 4.2 Two-dimensional simulation of the deposition process
 - 4.3 Prediction of the scale of the viscous debris flow
 - 4.4 The two-phase double-fluid mechanical model for viscous debris flow
 - 4.5 Analysis on characteristics of fluid and motion of debris flow at the Jiangjia Gully
- 5. Effect of Debris Flows on the Stream-Channel Morphology
 - 5.1 Topographic change in Jiangjia Gully by debris flow
 - 5.2 Scour and fill of viscous debris flows
- 6. Mitigation of Debris-Flow Hazards
 - 6.1 Evaluation of the Countermeasures against Debris Flow in Dongchuan City
 - 6.2 Counter measures against debris flow in Dongchuan City
 - 6.3 Environmental change in the area of viscous debris flow
 - --- A case study in the Xiaojiang River Basin, Dongchuan District, Yunnan Province
 - 6.4 Countermeasures against viscous debris flow

Authors of this report are:

TAKAHASHI Tamotsu, SAWADA Toyoaki, SUWA Hiroshi, MIZUYAMA Takahisa, and ARAI Muneyuki (Japanese side); KANG Zhicheng, WU Jishan, OU Guoqiang, and XION Gang (Chinese side)

International Symposium, Workshop and Research Reports

Symposium on Japan-Indonesia IDNDR Project, Volcanology, Tectonics, Flood and Sediment Hazards



September 21-23, 1998 Bandung, Indonesia Proceedings, 485p.

> August 21-23,1996 Yogyakarta, Indonesia Proceedings (ISBN: 979-8656-01-6), 253 p.



国際防災

Workshop on Disasters Caused by Floods and Geomorphological Changes and Their Mitigation

The First Japan-China Joint Workshop on Prediction and Mitigation of Seismic Risk in Urban Regions



October 11-13, 1997 Xian, China Proceedings, 261p.



July 13-16, 1997 Xian, China Proceedings (ISBN: 4-9900618-0-2 C3051), 421p.

International Symposium on Landslide Hazard Assessment

Japan-China Joint Research on the Mechanism and the Countermeasures for the Viscous Debris Flow



Research Report March, 1999, 206p.

Proceedings of International Symposium on Marchine Disaster Prediction and Mitigation International Symposium (Second Landson) Marchine Disaster Prediction and Mitigation International Symposium (Second Landson) Marchine Disaster Disaster Provention Research Institute Event Symposium (Second Symposium (Second Symposium) Second Symposium (Second System (Second System)

December 1-5, 1997 Kyoto, Japan Proceedings (ISBN: 4-9900618-1-0 C3051), 473p.

International Symposium on Natural Disaster Prediction and Mitigation

The Second Japan-China Joint Workshop on Prediction and Mitigation of Seismic Risk in Urban Regions November 14-16, 1998, Hikone, Japan, Proceedings, 200p.

International Workshop on Prediction of Landslide in Lishan July 20-August 5, 1994, Kyoto, Japan, Proceedings, 251p.

International Workshop on Lishan Landslide October 19, 1996, Xian, China.

> China-Japan First Workshop on Mechanism of Viscous Debris Flow August 1-2, 1996, Dongchuan, Yunnan, China.

China-Japan Second Workshop on Mechanism of Viscous Debris Flow July 27, 1997, Chengdu, China.

京都大学防災研究所公開講座

"21世紀の近畿地方の防災"

日 時	平成11年11月25日(木) 9:30~
場 所	建設交流館 グリーンホール
	(大阪市西区立売堀2の1の2)
応募資格	特に問いません
受講料	5,500円(テキスト代及び消費税を含む)
募集人員	250名
問合先	京都大学防災研究所 総務課 研究助成掛
	Tel: 0774-38-4010

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市バス 大阪駅前より ⑤ 系統 鶴町4丁目行
立売堀2丁目バス停まで約15分下車すぐ
(JR新大阪駅からは地下鉄・御堂筋線・本町駅で下車して下さい。)

編集後記

Newsletter No.13 をお届けします。文部省特別事 業「インドネシア及び中国における自然災害の予測と 軽減に関する国際共同研究」(IDNDR)が平成11年3月 で終了しました。本号はこの研究事業の最終報告とし ての特集号的なものとなっています。しかし、調査研 究活動や成果の全てをお知らせすることは到底できま せんので詳しいことは各グループが出されている Proceedings等をご覧下さい。日本と異なったきびし い環境、条件下での観測、調査活動は大変だったろう と思います。様々な成果もさることながら、東アジア 諸国との共同研究のパイプを開拓されたことは大きな 意義があると思います。ご苦労さまでした。

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