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***Edited by: Dr. Binaya Kumar Mishra, Dr. Ram Krishna Regmi & Dr.
Badri Bhakta Shrestha***

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INTRODUCTION TO 5TH GENERATION MOBILE COMMUNICATION NETWORKS

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Abstract

Research and experiments have recently begun to develop the next generation mobile communication networks, which are also referred to as the fifth generation (5G) wireless communication systems. 5G communication networks are targeted at commercial deployment in 2020 or beyond. They are expected to enable ultra-high-speed data transmission (>10Gbps) that would be about 1000 times the speed of current LTE (i.e. 4G) networks, connect massive number of devices (>50 billion) that would be 10-100 times the number of existing mobile phones, 10 times longer battery life, and 5 times reduced end-to-end latency. Not only the mobile phones and computers but also machines, home appliances, vehicles, sensors, etc. get connected to the 5G systems for enabling Machine-to-Machine (M2M) communications required for realizing the future network society. As the components of 5G wireless communication systems, various technologies such as utilization of new frequency spectrum (e.g. millimeter bands), cognitive radio, ultradense cell deployment, coexistence of heterogeneous access networks, infrastructure virtualization, software-defined networking (SDN), and device-to-device (D2D) communications are being studied. In the presentation I will summarised some of the recent research activities on the 5G network development.



INTRNET OF THINGS (IOT)

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Abstract

Internet of Things simply implies of the living or simply a thing that is connected to the internet world. The concept is not new but due to advent of IPv6 and low cost computing platform together with low powered radio technology, things connected to the Internet building a paradigm shift to the next generation information technology.

In this presentation , Er. Subedi will try to show the examples how IoT is evolving , its challenges and how the technology will affect our daily life in next few decades and how the technology will be helpful to the developing country like Nepal.



ENGINEERING IN MEDICINE AND BIOLOGY

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Abstract

General overview of medical and biological applications of engineering will be discussed. Discussions will be based on speaker's past and current research projects, viz.: i) computational prediction of the bimolecular networks in rice (as a model organism for cereal biology), ii) risk analysis and detection of blood clot in extracorporeal circulation systems (eg. hemodialyzer, cardiopulmonary bypass, ventricular assistance devices etc) by exploiting the electrical properties of blood and iii) biological cell manipulations using various electro-mechanical forces.



DO ACCESS TO TECHNOLOGY, MEDIA AND PRIVATE TUTION IMPROVE STUDENTS TEST SCORES? A GENDER AND CAST BASED EVIDENCE FROM SCHOOL LEAVING CERTIFICATE (SLC) EXAM IN NEPAL

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Keywords: School Leaving Certificate, Test Scores

Background

The School Leaving Certificate examinations (SLC) is the final examination in the secondary school systems of Nepal. It is considered as a "iron gate" for its importance to open up future avenues for the candidates so far as choice of discipline and career choice are concerned.

Issues for Nepal : SLC failures occur primarily in compulsory subjects like Math, Science and English and this is more problematic in girls and non-high caste candidates often leading to serious social problems such as depression and suicides. *Facts:* (1)Test scores of female candidates in SLC are significantly lower than male. (2)Access to technology and media such as computer, email, internet, television, newspaper at home is constrained more in case of female than male. (3)Access to technology and media such as computer, email, internet, television and newspaper at home is constrained more in case of low caste households than high caste households (See Tables in the slides)

Approach

Hypotheses:

H1: Has additional investment on education (Private tuition) helped improve the Test Scores?

H2: Do access to technology and media help improve the test scores?

H3: Who benefits more from Private tuition, technology and media?

- Male or Female;
- High Caste or Low Caste

Data and Methods: Repeated Cross Section (2002, 2003 and 2004) of Comprehensive SLC Survey Data set collected in 2005 by Ministry of Education, Nepal

- Econometric Model - Fixed Effect OLS Model:

Where Y is the SLC test score

X is the student Characteristics

F is family Characteristics

α is the School Fixed Effect

t is the time fixed effect

ϵ is the random error term clustered at school level

i is student, s is school and t is time period

$$Y_{ist} = \gamma + X'_{ist}\beta + F'_{ist}\theta + \alpha_s + t_t + \epsilon_{ist}$$

Note: I believe that the unobserved heterogeneity of a child to some extent will be taken care by the variable "Family Members passing SLC" if we assume that the ability is hereditary. Furthermore, I admit that the endogeneity issue primarily from reverse causality may yet remain which will be addressed in the final version of this paper using proper instrumentation.

Results/Findings

Private tuition does not improve the test score of male. Female reap more benefit. Computer, email and television plays a significant role in increasing the test scores in general. High caste candidates benefit more from email and newspaper whereas low caste candidates benefit more from computer and television. Private tuition, email and television help improve English score whereas computer helps improving both math and science test scores Female candidates increase English and Science test scores with computer at home whereas private tuition increase their Math and Science score. High caste candidate do not benefit from television at home since they lower their math and science score.

Policy Implication: A substitution to an ICT based education rather than on the stereotype tuition system that emphasizes rote learning. More human capital investment on female candidates with private tuition and access to technology through subsidized tuition fee. Poor and low caste candidates can access to computer only if the state subsidizes their purchase of computer.

Table 1: Fixed Effect OLS Model (Only impact on overall SLC test score reported in this Table)

VARIABLES	(1) Total Score		
<u>age_first slc</u>	-9.139*** (0.613)	High_caste*computer	-12.85** (5.480)
Male	19.96*** (2.78)	High_caste*email	10.23** (4.854)
High_caste	9.539*** (2.75)	High_caste*tuition	-2.246 (2.412)
<u>Dist_to_school</u>	-3.75*** (1.59)	High_caste*television	-4.414* (2.372)
<u>Private_tuition</u>	2.599 (3.23)	High_caste*newspaper	6.139* (3.372)
computer	14.76*** (5.31)	Time Fixed Effect	Yes
email	11.26** (5.43)	School Fixed Effect	Yes
television	4.129* (2.50)	Observations	13,873
read_newspaper	-1.036 (4.40)	R-squared	0.589
Male*computer	-6.521 (5.51)	Other Control Variables Closest_Friend_passing_SLC (+ve significant) <u>school_missed</u> (-ve significant) <u>con_exp</u> <u>con_exp_sq</u> <u>fam_size</u> (-ve significant) Family_members_passing_SLC (+ve significant) Family_language Medium_of_exam <u>Exp_division_slc</u> (+ve significant) <u>Cook_during_exam</u> (-ve significant) <u>Sick_during_Exam</u> (-ve significant)	
Male*tuition	-5.993** (2.67)		
Male*television	-1.033 (2.37)		
Male*newspaper	2.287 (3.41)		
Male*email	-2.317 (5.39)		

Cluster Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

References

- Casey, A., R. Layte, , S. Lyons & M. Silles: Home computer use and academic performance of 9-year-olds, *Oxford Review of Education* 38 (5), 2012, pp.617-634
- Dang, H., Rogers, F.H.: How to interpret the growing phenomenon of private tutoring: human capital deepening, inequality increasing, or waste of resources?, Policy Research Working Paper Series of The World Bank, 2008, No. 4530
- Mischo, C., & Haag, L.: Expansion and effectiveness of private tutoring. *European Journal of Psychology of Education*, 17(3), 2002, pp.263-273
- Zhang, Y. : Does private tutoring improve students' National College Entrance Examination performance? – A case study from Jinan, China. *Economics of Education Review*, 32, 2013c, pp.1-2



UTILIZATION OF COMMUNAL SPACES IN HISTORIC CITY PATAN AFTER 1934 THE GREAT EARTHQUAKE

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Keywords: 1934 the great earthquake 1934, courtyard, rest house, shelter, Nepal

Background

Nepal has experienced many destructive earthquakes. A 1934 AD earthquake is one of the largest earthquakes in Nepal which destroyed 20 percent and damaged 40 percent of the valley's building in Kathmandu valley. The seismic record of the region suggests that earthquake of this size occurs approximately every 75 years, and is likely to occur in the near future¹.

Ministry of Home, Ministry of Housing and Physical Planning, Department of Mines and Geology are the main government institutions involving for the earthquake risk management. Ministry of Housing and Physical Planning has implemented projects for the rehabilitation and reconstruction of earthquake damaged buildings, and also has formulated the national building code. In non-governmental institutions, NSET (National Society for Earthquake Technology-Nepal) and JICA are the few of the institutions, working for earthquake risk management. Although the simulation work related earthquake disaster by governmental and non-governmental section has been continuing, there are still lack of actual data related to life environment and recovery process story of past earthquakes.

In this paper, utilization of communal spaces and life environment after 1934 the great earthquake in historic city Patan is clarified through literature review and interview survey with the great earthquake experienced elderly people living in historic city Patan.

Approach

There exist only one book named "Nepalko Mahabhukampa 1990 saal" published in next year of the earthquake which has recorded the situation of all over the country including Kathmandu valley. The issues related with shelter inside the valley and immediate actions of government after the earthquake is extracted from this book as literature review.

Interview survey was conducted with four elderly persons who have experienced 1934 the great earthquake. The location of elderly persons' living place is shown in figure 1, which are Nagbahal tole, Ikhachhen tole and its surrounding area. Elderly from the localized area in the vicinity of Nagbahal area was selected so that the features of the specific space soon after 1934 the great earthquake could be clarified.

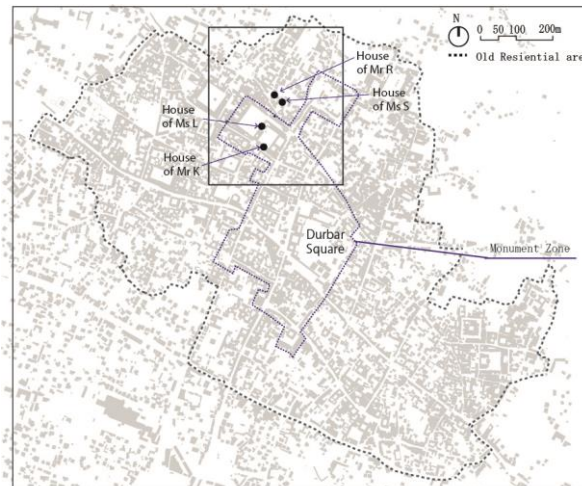


Fig1. Living place of the elderly who have experienced the great earthquake 1934

Results/Findings

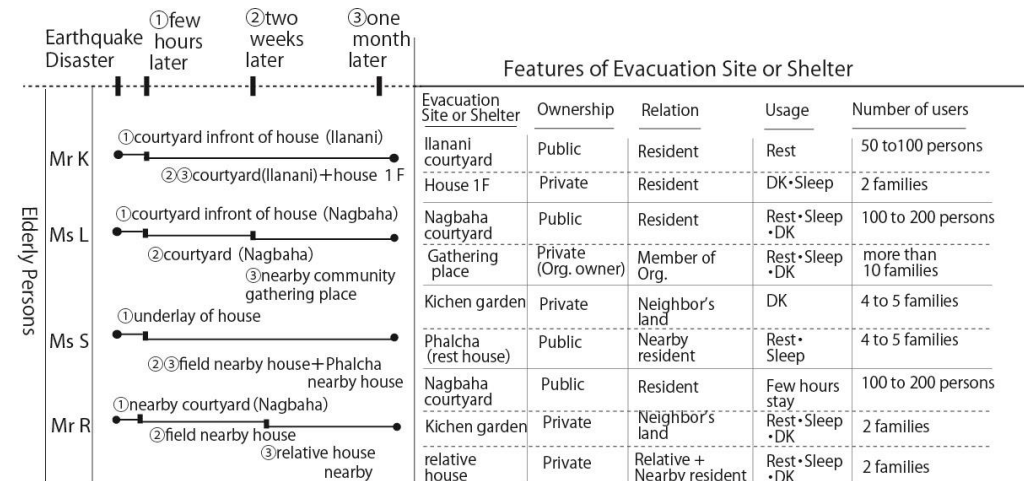


Fig2. Life environment of four elderly after 1934 the great earthquake

From figure 2, it can be clarified that communal spaces like courtyard, rest houses (Phalcha) were used as shelter. In addition, community house owned by Sangha (management organization of Buddhist monastery) was also used as shelter.

It is verified that people chose places for shelter nearby their properties so that they can take care of property as well as they can live together with their community. This fact provides an important hint for planning shelters and temporary housing for earthquake victims in case of devastating earthquake in future.

References:

- 1) NSET & Geo Hazards International (GHI) (1999) : The Kathmandu Valley Earthquake Risk Management Action Plan
- 2) NSET & GHI (1999): Kathmandu Valley's Earthquake Scenario. NSET, Kathmandu
- 3) Kathmandu Valley Earthquake Risk Management Project (2002): Project Completion Report, under the Asian Urban Disaster Mitigation Program, Asian Disaster Preparedness Center, Bangkok, Thailand
- 4) JICA(2002) : The study on Earthquake Disaster Mitigation, In the Kathmandu Valley, Kingdom of Nepal, final report
- 5) Bramhasamshera Jangabhadura rana (1935) : Nepalako mahabhukampa, 1990 sala



LARGE-SCALE LANDSLIDES IN THE NEPAL HIMALAYAS AND LESSONS LEARNT FROM THE JURE LANDSLIDE EVENT FOR LANDSLIDE HAZARD MANAGEMENT PRACTICE IN THE COUNTRY

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Abstract

The main and the core natural cause of large-scale landslide occurrences in the Nepal Himalayas is ever continuing mountain building process due to plate collision aided by heavy amount of precipitation and seismic activities. At the same time, uncontrolled human activities that mainly include settlement expansions and infrastructure developments have largely accelerated the land sliding process recently, and have resulted in massive loss of life and individual as well as public properties. However, the nation still lacks an effective disaster prevention law and people do not have adequate knowledge about staying safe from natural hazards and dealing with post-disaster situation. The government also does not have specific goals or plans to manage natural hazards and prevent disasters. Recent landslide and flood disasters all over the nation and the government's efforts to deal with the post-disaster scenario and chaos are evident that we still have a long way to go to have an effective hazard management plan. Most of our national roads pass through large-scale landslide slopes while the preventive measures we have applied at the roadsides are very traditional and ineffective such as gabion walls at extremely failure-prone areas. We do not even have an up-to-date map of existing landslides on roadsides as well as human settlements. We have never thought of the landslide safety of our people that are option-less and are compelled to live on landslide masses in remote mountain areas. We have never thought of the safety of fellow citizens that live on the flood-prone river banks. Our government officials together with the land brokers rather promote an unhealthy land business and develop riverbanks into newer urban settlements risking the dwellers' life. All these human activities have largely increased the disaster risk level in Nepal. In fact, as a mountainous country, Nepal does have a dense distribution of large-scale landslides that may or may not be in active state of sliding but our activities promote their reactivation. Despite our knowledge that the recent Jure landslide was in active state, we could do nothing before as well as after the landslide event of August this year. There are many locations in our national roads that have Jure-type landslide hazards, and learning from the chaos we had during the Jure landslide disaster, we urgently need to enact a truly scientific hazard management and disaster mitigation law. This presentation includes landslide occurrence scenario, large-scale landslide hazard, their scientific, engineering, and social importance, Jure landslide and landslide dam formation, its economic impact, government's response, and similar issues.



SOFT ROCK SLOPE WEATHERING DUE TO RAINWATER

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Abstract

Nepal is a mountainous country. The summer monsoon season in Nepal covers about 75% of annual precipitation from June to September, triggering many landslides. It rains almost every day resulting in a hot and wet weather which is a favorable environment for chemical weathering. The clear rainwater is slightly acidic in nature with PH-value ranging from 5 to 5.6 due to the presence of CO₂ in air. In rainwater, some rock minerals simply dissolve or some reacts with acid content of rainwater and the rock slope weathers. The simulation of such weathering process is being studied in this research work. The relationship between shear strength and shear wave velocity is developed for artificial sandstone made from silica sand, gypsum and CaCO₃. From this relationship, the negative ageing of the geo-material is easily understood. In addition, with field measured shear wave velocity, the shear strength of the slope is also determined. The weathering process is conducted in three cases 1) water only, 2) water with PH-5, 3) water with PH-4. For the first two cases, there is not much difference in the weathering trend. But with the solution of PH- 4, the weathering of the rock sample is relatively fast and the strength loss of sample is comparatively more.

Keywords: Rock weathering, chemical weathering, rainwater, PH, shear strength, shear wave velocity, negative ageing.

COUPLING RATIO OF COUPLED SHEAR WALLS

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Keywords: Coupled shear wall, Displacement based design, Coupling ratio, Non-linear time history analysis

Background

Coupled RC shear walls are efficient structural systems for resisting wind and seismic forces in multi-story buildings. This is due to the fact that, besides walls, coupling beams also take part in dissipating seismic energy through the formation of plastic hinges at two ends. The openings required in the buildings for lifts, doors, windows etc. also sometimes necessitate the use of coupled shear walls. The ratio of moment resisted by the coupling action to the total overturning moment is defined as the coupling ratio (β). Coupling ratio is one of the important parameters in the design of coupled walls (Priestley *et al.*, 2007). If this ratio is very small, the walls behave only as connected walls and if too large, the coupled wall behaves as a single cantilever wall. During the initial phase of design, based on the expected energy dissipation mechanism and behavior of coupled wall system, an appropriate value (usually 0.25 to 0.6) of this ratio is assumed. If the actual coupling ratio during real earthquake scenario is different from the initially assumed one, then the behavior of coupled wall system is significantly different from what is expected.

So, in this study, a comparison is made between the initially assumed and actual coupling ratio during real earthquakes for a number of coupled wall systems with varying heights and coupling ratios.

Coupled shear wall.

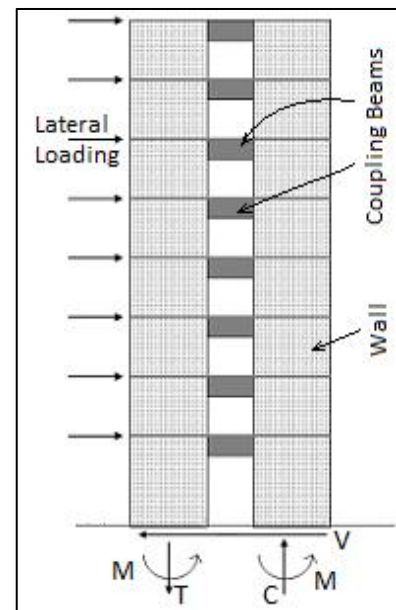


Fig. 1.

Approach

A number of walls of varying heights (4 to 24 stories) and coupling ratios (0.25 to 0.6) are designed using direct displacement design procedures outlined in Priestley *et al.* (2007) and DBD12 (Sullivan *et al.*, 2012). By employing capacity design principles, sufficient ductility is provided at wall base regions and plastic hinges are allowed to be formed at wall bases only ensuring the upper portions to behave elastically (Pauley and Priestley, 1992). Coupling beams are designed as diagonally reinforced as they have superior performance in shear during cyclic load over conventionally reinforced coupling beams (Pauley and Binney, 1974). SeismoStruct V7 software (Seismosoft, 2014) is used for non-linear modeling and analysis. Wall elements are modeled as inelastic displacement based fiber-section frame element. Two diagonal truss elements are used for modeling coupling beams. These elements are verified analytically comparing with

test results (Fox, 2014). Tangent stiffness proportional damping of 1% is used at first mode of vibration. These coupled wall models are then subjected to non-linear time history analysis for 10 number of design spectrum compatible ground motion records.

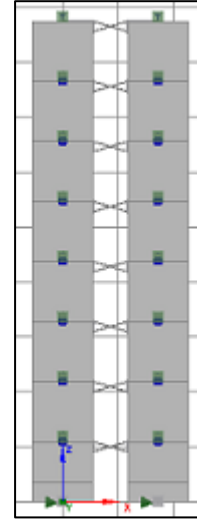


Fig. 2. SeismoStruct model of coupled shear wall.

Results/Findings

In this study, coupling ratios obtained from non-linear time history analysis results are compared with the initially assumed coupling ratios for a range of building heights as shown in figures below.

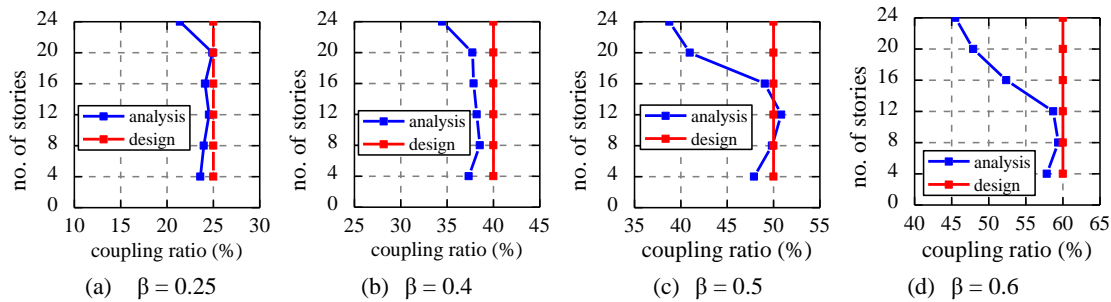


Fig. 3. Coupling ratio comparison.

Followings are some conclusions that can be drawn from the above results.

1. Due to nonlinear effects during earthquakes, it is hard to obtain the expected coupling ratio in reality. So, it is suggested to design for a bit larger coupling ratio than expected.
2. As the design coupling ratio increases, the difference in design and actual coupling ratio is more pronounced.
3. Higher the number of stories, larger is the deviation of actual coupling ratio from the designed one. This is due to the increase in wall moments due to higher mode effects in high-rise buildings.

References:

- [1] M.J. Fox, "Seismic Design of Coupled Walls," *Master Thesis*, ROSE Programme, UME School, IUSS Pavia, Italy, 2013.
- [2] M.J.N. Priestley, G.M. Calvi and M.J. Kowalsky, "Displacement Based Seismic Design of Structures", IUSS Press, Pavia, Italy, 2007.
- [3] Seismosoft, "SeismoStruct V7.0 – A computer program for static and dynamic nonlinear analysis of framed structures," 2014, available from <http://www.seismosoft.com>.
- [4] T. Pauley and J.R. Binney, "Diagonally Reinforced Coupling Beams of Shear Walls," *Publication SP-42*, American Concrete Institute 1974, pp. 579-598.
- [5] T.J. Sullivan, G.M. Calvi and M.J.N. Priestley (Editors), "A Model Code for Displacement Based Seismic Design of Structures, DBD12", IUSS Press, Pavia, Italy, 2012.
- [6] T. Pauley and M.J.N. Priestley, "Seismic Design of Reinforced Concrete and Masonry Buildings,"



DETERMINATION OF WATER QUALITY INDEX OF BAGMATI RIVER

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Abstract

Water Quality Index (WQI) is a valuable and unique rating to depict the overall water quality status in a single term that is helpful for the selection of appropriate treatment technique to meet the concerned issues. This method appears to be more systematic and gives comparative evaluation of the water quality of sampling stations. The present study intended to assess the water quality of the Bagmati River in Kathmandu, Nepal. The method consists of computation of the WQI on the basis of physical-chemical and biological quality parameters obtained from the different monitoring stations of the river during October 2012 to September 2013. A comparative analysis revealed the fact that there exists a significant difference in water quality between rural and urban areas. The quality of river water is extremely poor and not suitable enough for the purpose of agriculture.

Keywords: Water Quality Index, Bagmati River, sampling stations, physical-chemical parameters

DEVELOPMENT OF METHODOLOGY FOR LANDSLIDE AND DEBRIS FLOW FORECASTING SYSTEM

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Keywords: Landslide, debris flow, forecasting, snake curve, soil water index

Background

Rainfall and soil water are important indicators of rainfall-induced landslide and debris flow. In this paper, rainfall-based forecasting approach for landslide and debris flow has been presented. The relationship between rainfall and soil water index (SWI) has been analyzed for forecasting system by using hydrological distributed model. The soil water is an important parameter in the hydrological balance and is essential for understanding land-surface interactions [1]. The approach has been analyzed by using both ground-observed and satellite based rainfall data. The satellite based rainfall data could also be useful to get supplementary information for forecasting system. The Sabagawa river basin located in Yamaguchi prefecture of Japan was selected for case study. There was a heavy rainfall in the Sabagawa river basin in July 2009 and large number of sediment disasters occurred in the areas. The relationship between rainfall and soil water index was thus analyzed for rainfall event in July 2009.

Approach

The rainfall-runoff and temporal variation of soil moisture in the soil mass were computed by using Integrated Flood Analysis System (IFAS) model. The IFAS is a concise rainfall-runoff analysis system based on a hydrological distributed tank model (Fig. 1) [2]. In the model Global map elevation and land cover data were used. The three layer tanks (surface, subsurface and aquifer layers) were considered. The model was calibrated and validated by comparing simulated discharge with observed discharge. The rainfall event in July 2009 was used for calibration of model and the calibrated parameters were validated using rainfall event in September 2005. The absolute value of the soil water index was defined as the sum of water depth in each of the tank layers. The relationship between SWI and rainfall was analyzed by using ground-observed rainfall and satellite based rainfall data (3B42RT and GSMaP).

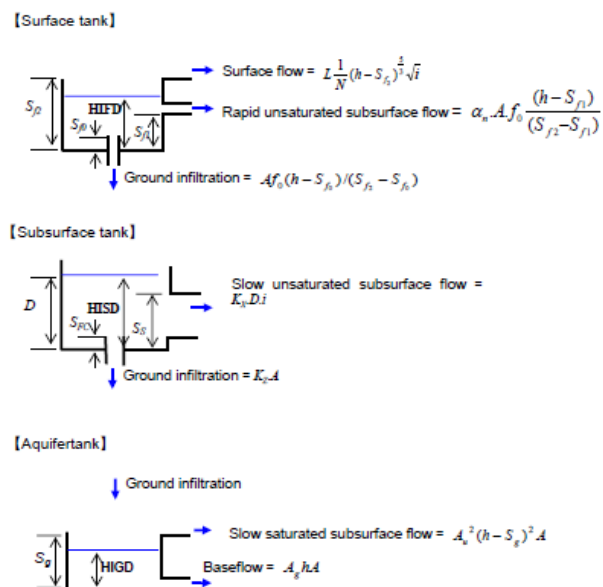


Fig. 1 Basic structure of a model

Results and Discussions

Figure 2 shows comparison of calculated river discharges with observed discharges at Manao station. The calculated discharges using ground rainfall and 3B42RT satellite based rainfall data are more agreeable with observed discharges. Figure 3 shows the relationship of rainfall and soil water index calculated by using ground rainfall and satellite based rainfall data at Manao station. The figures also show the calculated snake line which could be used for early warning and forecasting systems. The soil water index increases when rainfall intensity is increased, which can cause sediment disasters in the area. The satellite based rainfall data also could be useful to get supplementary information for forecasting and warning system of sediment disasters. The results show that results of SWI obtained using 2B42RT satellite based rainfall data are closer to those obtained using ground rainfall data than GSMaP rainfall.

The snake lines could be useful for forecasting and warning system of sediment disasters. To use snake line for warning system in sediment disasters, critical lines for warning criteria, alarm criteria and evacuation criteria should be determined based on past data of sediment disasters. The determination of critical line is very important for judging warning criteria based on snake line. The warning/alerting can be issued when snake line crosses the critical line. The lines inside red circle in Fig. 3 (b) could be critical line for possibility of sediment disaster occurrence.

References:

- [1] Hunt, E. D., Hubbard, K. G., Wilhite, D. A., Arkebauer, T. J. and Dutcher, A. L.: The development and evaluation of a soil moisture index, *International Journal of Climatology*, Vol. 29, pp. 747-759, 2008.
- [2] Sugiura, T., Fukami, K., Fujiwara, N., Hamaguchi, K., Nakamura, S., Hironaka, S., Nakamura, K., Wada, T., Ishikawa, M., Shimizu, T., Inomata, H. and Ito, K.: Development of integrated flood analysis system (IFAS) and its applications, *Proceedings of 7th ISE & 8th HIC, Chile*, 2009.

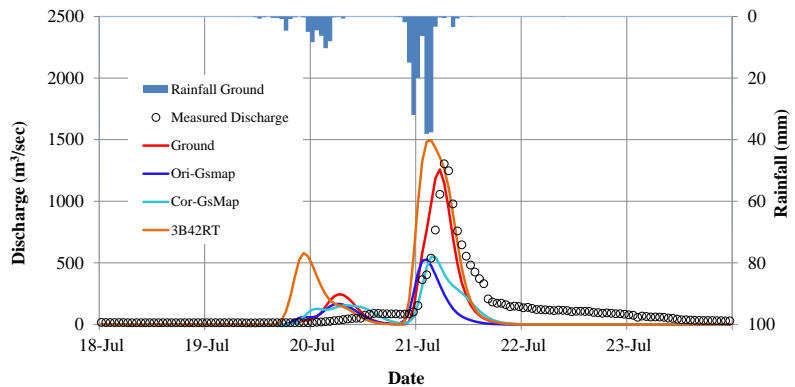


Fig. 2 Calculated and observed discharge at Manao station

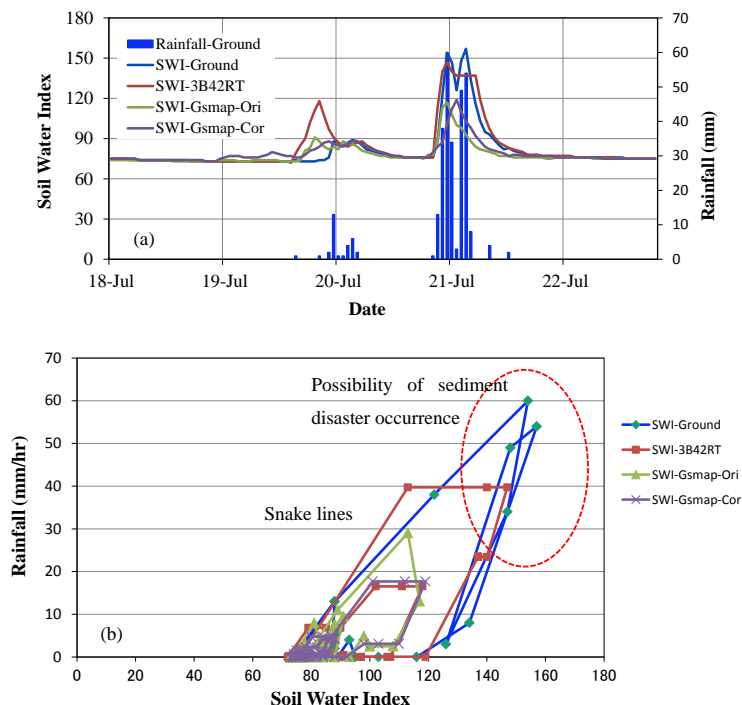


Fig. 3 (a) Relationship between rainfall and soil water index, and (b) Calculated snake lines using ground observed and satellite based rainfall data (at Manao Station).



EXPERIMENTAL EVIDENCE OF IMPACT OF FLOW DIRECTION ON DYKE BREACH CHARACTERISTICS DUE TO FLOW OVERTOPPING

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Keywords: Embankment, Dyke breach, Lateral widening, breach characteristics

Background

Dykes are among the most ancient and widely used defense structures against river flooding in the world. In the context of this work, we refer to dykes as to man-made earthen embankments built along a river parallel to the river flow and flow strikes the dike length in an angle but not perpendicularly. Flooding from embanked rivers may occur when the structural defense fails in containing the water flow inside the river banks. In the context of breach modeling, flood embankment failure is considered to be the situation where erosion or structural failure of the earthen embankment cause flood water to pass over or through the embankment in an increasingly uncontrolled manner, leading to a hole or breach in the dyke. There is a distinct difference in the failure processes regarding dyke breach and dam breach process (differentiated mainly by flow direction) which has to be considered when focusing on the breach characteristics analysis. Many researchers tried to use the embankment breach model to dyke breach cases but that concept is not right. Considering these facts, an extensive experimental study was done in Ujigawa Open Laboratory, Disaster Prevention Research Institute, Kyoto University, Japan to compare the breach characteristics for dyke and embankment breach cases with systematic variation of sediment sizes forming dyke or embankment materials. As the majority of dyke breaches are due to overtopping, this is investigated in detail in the current research.

Approach

Two different Experimental setups were developed considering the dyke breach and dam breach cases so that proper comparison can be performed with dimensionless parameters.

Experiment for case 1 (Dam breach)

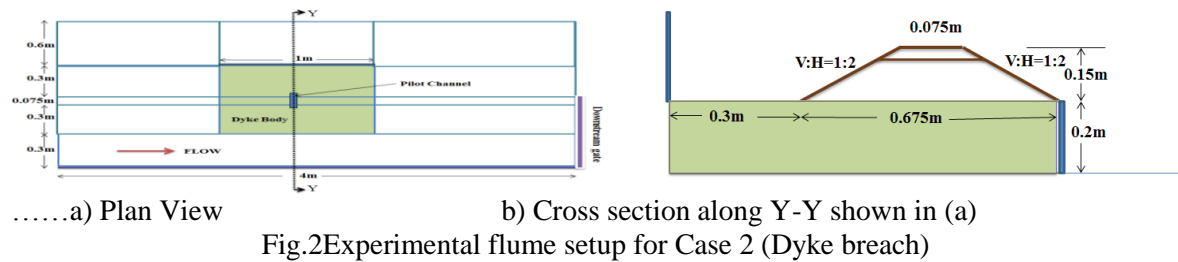
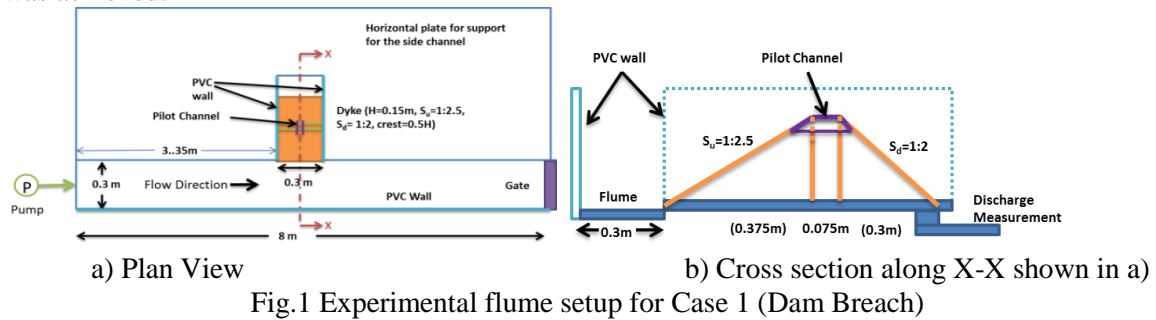
The nine breach tests were performed in a Poly Vinyl Chloride (PVC) sided flume as the river and the embankment were placed parallel to the river flow but since the embankment has also PVC walls both sides; the flow direction to the embankment becomes perpendicular resembling the embankment breach process. The details of the experimental setup are as shown in figure 1.

Experiment for case 2 (Dyke breach)

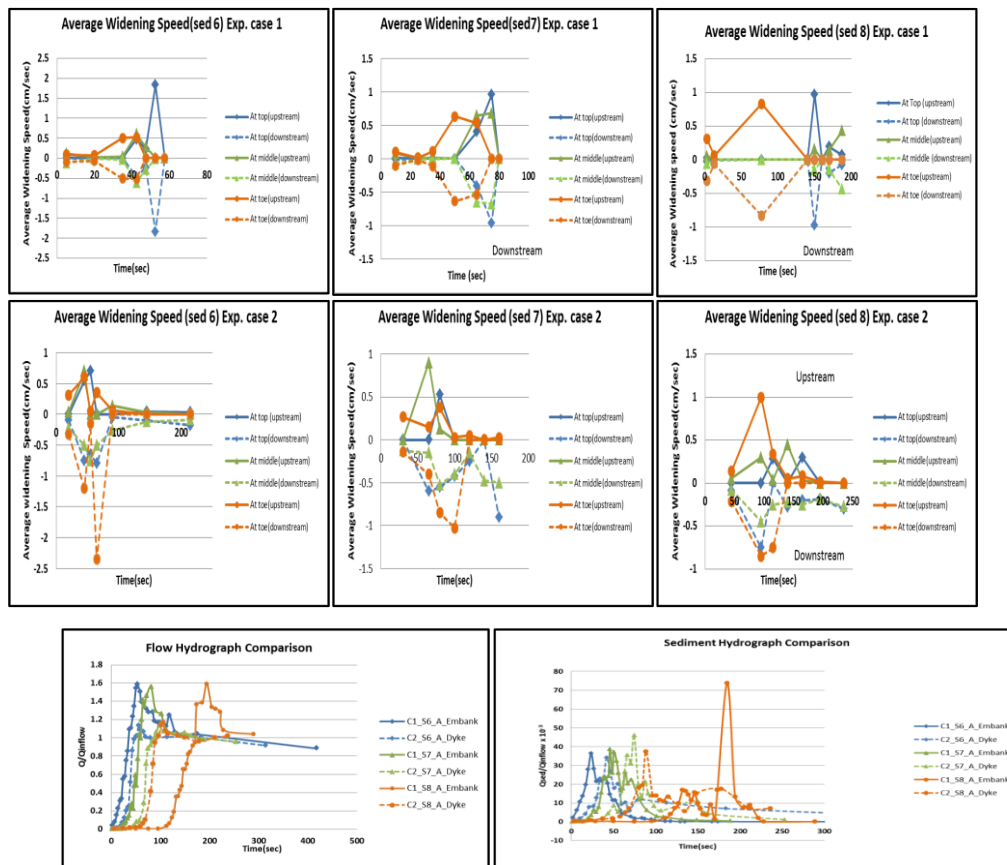
Here, the trapezoidal river flume was prepared with an embankment in conjunction with river side-slope so that flow river flow is parallel to the embankment; the flow were not perpendicular to the embankment length; the length of embankment was increased by three times resembling the realistic dyke model. The details of the experimental setup are as shown in figure 2.

All experiments were conducted using a constant flow discharge in a flume Q_{in} , referred to as the inflow, to obtain the simple boundary condition. The dyke material was initially provided with 5%

moisture content by weight and thoroughly mixed and then compacted with the help of a tamping plate and cylindrical roller by spraying water layer by layer until about approx. 90% compaction was achieved.



Results/Findings



References:

- [1] Chinnarasri, C., Tingsanchali, T., Weesakul, S., Wongwiset, S. (2003). "Flow patterns and damage of dike overtopping." Int. J. Sediment Res. 18(4), 301–309.
- [2] Bhattarai, P. K., Nakagawa, H., Kawaike, K. and Zhang, H. (2014). "Experimental Study on River Dyke breach Characteristics Due to Overtopping Flow", Journal of Japanese Society of Natural Disaster Science, Vol.33, 2014

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