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DECENTRALIZED DISASTER RISK REDUCTION IN INDONESIA

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ABSTRACT: This paper provides a preliminary result of the first attempt in the application of decentralized disaster risk reduction at the district level (Banda Aceh Municipality) in Indonesia. This exercise is very urgent as the on going disaster recovery operation should be in line with the priorities and key actions as given in the Hyogo Framework for Action (2005-2015). The approach for risk management was based on AS/NZS 4360:2004 standard, to allow a better perception for the whole involved stakeholders. Earth Observation imageries from ICSMD/UNOSAT were used to derived the risk assessment and identification process, and for future use in risk monitoring. The existing result provide the ground for further exercise and improvement if adequate resource were provided. The requirement for detail DEM derived from SAR interferometry (InSAR) process is affirmative, to provide good 3-D model for risk assessment of water related disaster (including tsunami). Further Differential InSAR (DInSAR) processing is also required for detection of ground surface deformation in the disaster impacted area. Effort is made so that all of these requirement could be fulfilled for Banda Aceh City, to be used as a model for decentralized disaster risk reduction in the coastal area.

1. INTRODUCTION

Development of a "Guide to Disaster Reduction on the Coasts of the Indian Ocean" should be based on the real experience of the countries affected by the December 26, 2005's earthquake and tsunami disaster in the region. The sharing of all these real experiences will provide a strong base for a comprehensive document which are scientific, sustainable, holistic, accessible and operationable. This tsunami disaster has increased the awareness of all impacted nations about the need for a strong Disaster Management Centre, as well as a good and pro-active Disaster Risk Reduction Plan. This awareness is more extreme for Indonesia, in relation to the recently earthquake event on 28 March 2005 in Nias and Simeuleu islands, with the epicenter not far from the 26 December 2004 earthquake epicenter (150 mile distance). Lesson learned from this tsunami disaster were : (1) most of the victims are the poor (women, farmers and fishermen), (2) space technology was monumental to support emergency response operation, (3) disaster management should be pro-active and community-based, and (4) it was clear that a space-technology based solution is needed for disaster risk reduction to anticipate possible natural disaster in the future.

This paper provides a first attempt in the application of disaster risk reduction approach in the district level (Banda Aceh Municipality). This approach is very urgent as the on going disaster recovery operation should be in line with the priorities and key actions given in the Hyogo Framework for Action (2005-2015). At the same time this exercise is a good opportunity also for decentralization and enhanced capacity for response at the provincial and district levels. It was initiated by the Working Group for Aceh Recovery (WGAR), Bogor Agricultural University, to provide a first hand real experience as an action in responding to the ASEAN Special Leader Meeting (6 Jan. 05), the Consultative Group on Indonesia Meeting (19 Jan. 05) and the World Conference on Disaster Reduction (18-22 Jan. 05).

The Working Group was activated on 1 January 2005, which then established a pro-active and community-based Participatory Disaster Management Centre (PDMC) as the backbone to support the emergency response,

recovery operation, and disaster risk reduction. The Centre gained access to the International Charter on Space and Mayor Disaster (ICSMD) for multi-mission Earth Observation (EO) satellite imageries. The whole imageries were downloaded from the ICSMD's Indian Ocean Tsunami (IOT) data bank via UNOSAT website, and was used for emergency response as well as clean up operation in Banda Aceh City. The imageries were also used for the existing recovery operation in the region, as well as for a decentralized disaster risk reduction exercise (provincial and district level).

2. DISASTER RISK REDUCTION

The new Regional Autonomy Law No.32/2004 has completely changed the environment in disaster management and operations in Indonesia. In the 19 January 2005 meeting of the Consultative Group on Indonesia (CGI), the Indonesia National Planning Agency (Bappenas)/World Bank assessment document of 26 December Indian Ocean Tsunami stated the need for long term investment to reduce the impact of future hazard. According to this document, the required disaster risk reduction capacity are : (1) institutional arrangements for disaster prevention to be integrated into the development practices of the line ministries, (2) strengthened technical capacity within Indonesia National Disaster Management Agency (Bakornas PBP) to assist in the integration of disaster risk elements of the development programs, (3) decentralization and enhanced capacity for response at the provincial and district levels, and (4) updated and comprehensive legal framework related to disaster management.

The above meting was held after the Special Leaders' Meeting of the Association of South-East Asian Nations on the Aftermath of Earthquake and Tsunami, held in Jakarta on 6 January 2005, and coincidence with the World Conference on Disaster Reduction (WCDR), in Kobe, Hyogo, Japan, 18 to 22 January 2005 [3], which both called for appropriate measures pertinent to disaster reduction. It was believed that lessons learned from this disaster are relevant to other regions. In this connection, a special session on the recent earthquake and tsunami disaster, was convened at WCDR to review that disaster from a risk reduction perspective. As its outcome the Common Statement of the Special Session on Indian Ocean Disaster: Risk Reduction for a Safer Future, was delivered. Based on the recent Indian Ocean Tsunami, Indonesia should pay more attention to disaster risk reduction, as most of its coastal line are vulnerable to tsunami (Fig. 1).

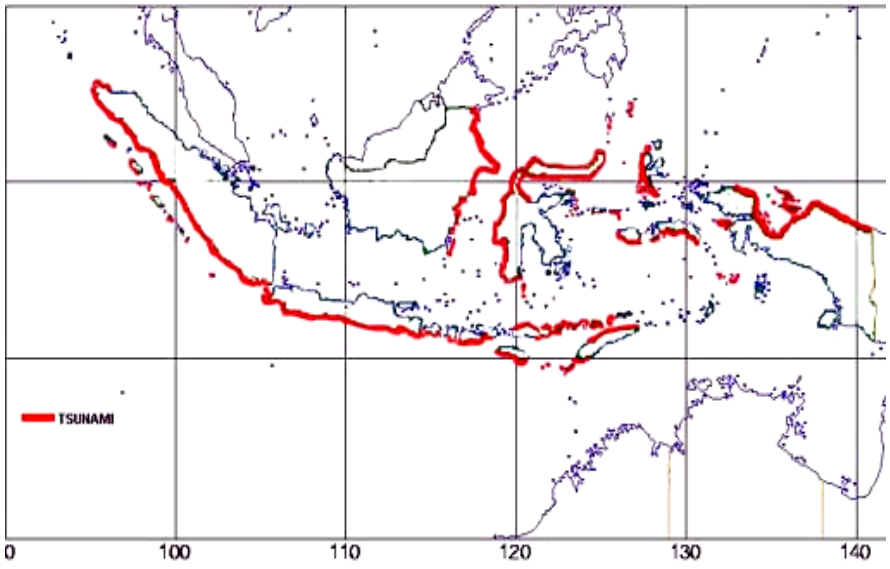

Fig. 1 The Coast of Indonesia (in red) which vulnerable to tsunami (Source : Bappenas)

3. DISASTER RISK IDENTIFICATION

The five HFA Priorities for Action (2005-2015) [3] are : (1) Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation, (2) Identify, assess and monitor disaster risks and enhance early warning, (3) Use knowledge, innovation and education to build a culture of safety and resilience at all levels, (4) Reduce the underlying risk factors, (5) Strengthen disaster preparedness for effective

response at all levels. The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge. To expedite this process the approach for risk management was based on AS/NZS 4360:2004 standard [1] [2], to allow a better perception for the whole involved stakeholders. The required seven steps for the implementation of this approach is given in Fig. 2. Identification of disaster risk is the main target of this exercise, as it provide the base for the others. The availability of multi-mission EO imageries from ICSMD/UNOSAT IOT database and downloaded into PDMC/WGAR facility, is an excellent opportunity to demonstrate the identification process.

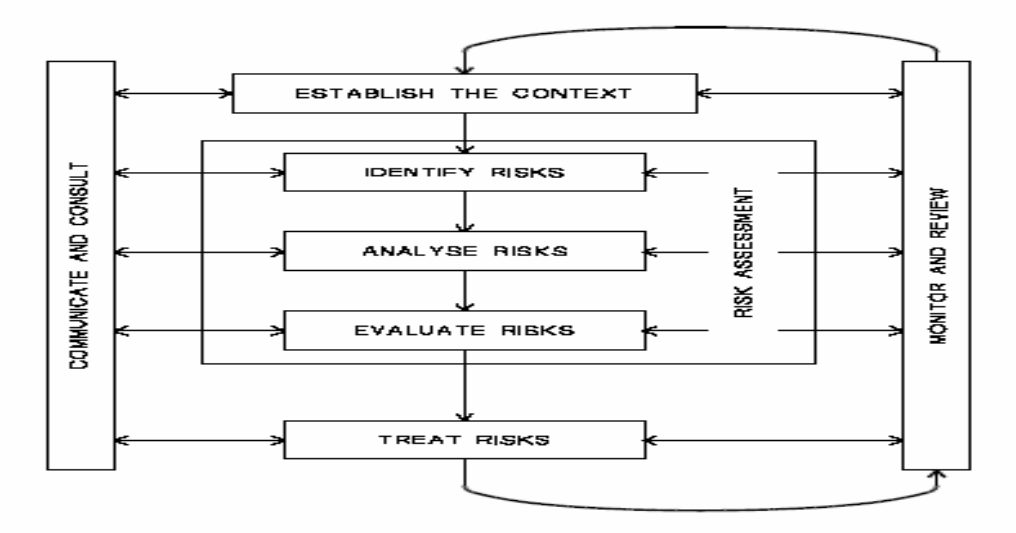

Fig. 2. Seven steps of risk management (Source : [1], [2])

3.1 Local Risk Assessment

The disaster risk reduction exercise is implemented in the Banda Aceh city of the Aceh Province (Fig. 3). The city was heavily affected by the recent tsunami, and the exercise gives the firsthand experience for the local government to prepare disaster risk reduction in decentralized environment. The role of local level government in effective risk reduction is important [4]. Preconditions for local governments to play this role include decentralization of authority and financial resources from the national level, existence of local capacity to govern, accountability and active participation of civil society. In other to assist for a better understanding of the risk assessment process, a 3-D virtual model of the city and its adjacent area was prepared by using Digital Elevation Model (DEM) derived from Shuttle Radar Topographic Mapping (SRTM) from USGS.

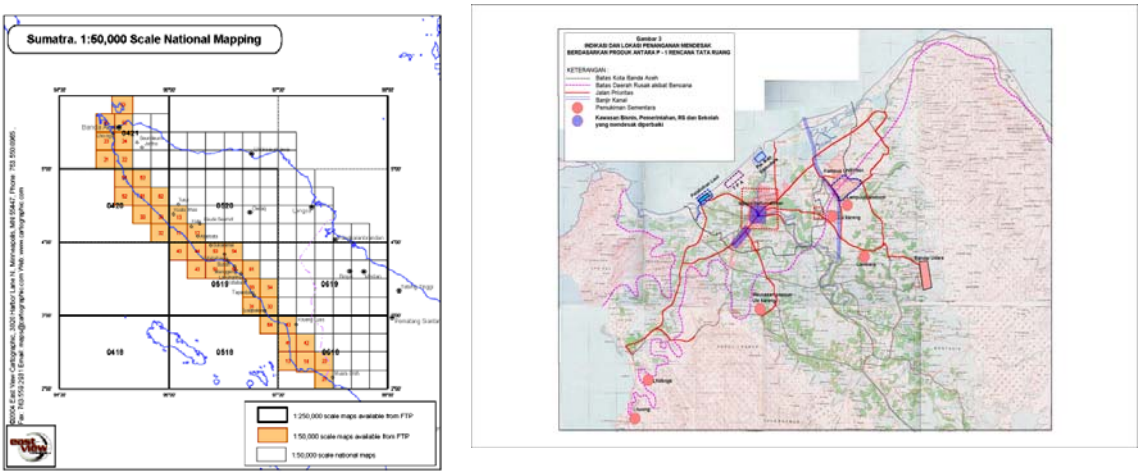

Fig. 3 Aceh Province (left) and Banda Aceh City (right)

3.2 3-D Virtual Model

The model was prepared on un-edited DEM with 3 arc-second posting (≈ 90 meter) derived from SRTM/STS-99 Mission of February 11-22, 2000, as displayed in Fig. 4 below. Based on this model, the following disaster risks were identified : tsunami, tectonic fault, flood/land slide and volcanic eruption. It was clear that the model was suitable for a broad view of the area. It was used also as a virtual disaster theater for emergency response operation. The same model was used to simulate simple tsunami inundation area by using post tsunami EO images. This was done by increasing the water level of the sea. This simulation clearly help the local government to be aware of the tsunami risk, and to be considered it in their recovery operation. Future improvement is required to calculate tsunami run up based on models as given in other papers in this Symposium. However, for detail view for a given part of the city a better DEM is required. To prepare this DEM, SAR Interferometry (InSAR) method is being applied by using Synthetic-Aperture Radar (SAR) images from IOT imageries database. Fortunately, SAR imageries from Envisat/ASAR and Radarsat are available for this area. This DEM will be used in combination with very high resolution satellite imageries (Ikonos or QuickBird) which is available in the most part of Banda Aceh City.

As an anticipation for the tsunami risk of the vulnerable coastal area in Indonesia, it is recommended that the coastal district/municipality has to prepare a minimum of the SAR interferometric pairs of their area. Tsunami disaster in Aceh gave a clear need also for detection of possible ground surface deformation in the coastline. Although this detection could be made by using an arrangement of GPS in the field, it found to be un-practice due to high risk for equipment loss. The Differential SAR Interferometry (DInSAR) is considered to be appropriate, but required more SAR image pairs to be processed. Study is now on-going to check the possibility for DInSAR processing of the existing SAR imageries, available in the IOT database. The result of this InSAR and DInSAR exercise will give an indication on interferometric image pairs required, especially for deformation purpose.

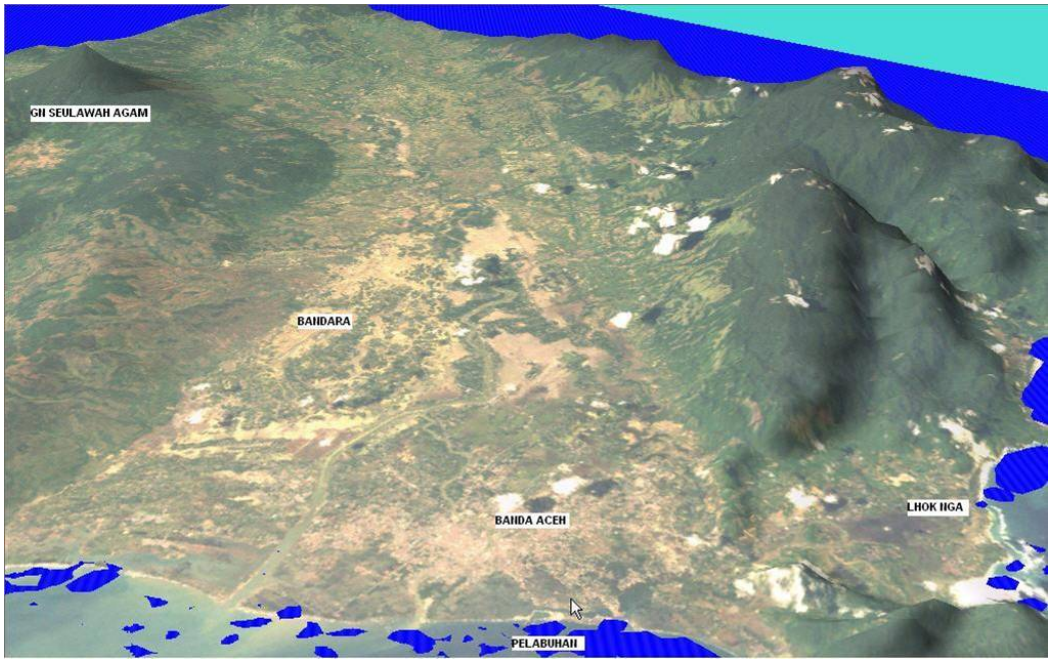

Fig. 4 Virtual 3-D Model of Banda Aceh City (South East look direction)

3.3 Capacity Building

The above exercise is just a beginning. A continuous support is required for the development and sustainability of the infrastructure and scientific, technological, technical and institutional capacities needed to research, observe, analyse, map and where possible forecast natural and related hazards, vulnerabilities and disaster impacts [3]. This include the development and improvement of relevant databases and the promotion of full and open exchange and dissemination of data for assessment, monitoring and early warning purposes, as appropriate, at international, regional, national and local levels. Other required capacity is the improvement of scientific and

technical methods and capacities for risk assessment, monitoring and early warning, through research, partnerships, training and technical capacity- building. The application of in situ and space-based earth observations, space technologies, remote sensing, geographic information systems, hazard modeling and prediction, weather and climate modeling and forecasting, communication tools and studies of the costs and benefits of risk assessment and early warning, need to be promoted. Further on, it is important also to establish and strengthen the capacity to record, analyze, summarize, disseminate, and exchange statistical information and data on hazards mapping, disaster risks, impacts, and losses. Development of common methodologies for risk assessment and monitoring is certainly a very crucial issue.

Enough resources and effort, therefore, are required for capacity building implementation. Assessment of existing local human resource capacities for disaster risk reduction at all levels is necessary to develop capacity-building plans and programs for meeting ongoing and future requirements. In addition to that, allocation of adequate resources is needed for the development and the implementation of disaster risk management policies, programs, laws and regulations on disaster risk reduction in relevant sectors and authorities, including budgets on the basis of clearly prioritized actions. Last but not least, community participation in disaster risk reduction through the adoption of specific policies, the promotion of networking, the strategic management of volunteer resources, the attribution of roles and responsibilities, and the delegation and provision of the necessary authority and resources, should be carefully.

4. CONCLUSION

This preliminary result gives the first experience for Indonesia in the implementation of disaster risk reduction in the local level under the decentralization environment. It provide the ground for further exercise and improvement if adequate resource were provided. The application of disaster risk modelling, including tsunami run up, gave a clear hazard for risk management as well as for engineering design consideration. The requirement for detail DEM derived from SAR interferometric pairs is affirmative, to provide good risk assessment for water related disaster (including tsunami). Further DInSAR processing is also required for detection of possible ground surface deformation in the disaster impacted area. Effort is made so that all of these requirement could be fulfilled for Banda Aceh City, as a model for disaster risk reduction in the coastal area of Indonesia. Last but not least, future partnership is highly required with other interested organizations, to accomplish this exercise.

5. ACKNOWLEDGEMENT

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6. REFERENCES

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