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UNIVERSITY
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DAAD
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UNU-EHS and DAAD International Special Seminar

Disaster Risk Reduction and Sustainable Development
in Tsunami Affected Countries

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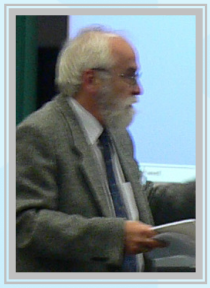








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UNITED NATIONS UNIVERSITY

REPORT ON THE UNU-EHS AND DAAD SPECIAL SEMINAR "DISASTER RISK REDUCTION AND SUSTAINABLE DEVELOPMENT IN TSUNAMI AFFECTED COUNTRIES"

OF THE UNITED NATIONS UNIVERSITY
INSTITUTE FOR ENVIRONMENT AND HUMAN SECURITY (UNU-EHS)

IN COOPERATION WITH AND SPONSORED BY THE
DAAD (GERMAN ACADEMIC EXCHANGE SERVICE)

HELD ON
JANUARY 10-12, 2007
AT UNU-EHS AND GUSTAV-STRESEMANN-INSTITUTE
BONN, GERMANY

Content

UNITED NATIONS UNIVERSITY

1) PROGRAMME

10 January 2007 – Tsunami, Coastal Hazards and Vulnerability		
9:30 – 10:00	***Arrival at Gustav Stresemann Institute + Coffee***	***At GSI***
10:00 10:20	Welcome by UNU-EHS and DAAD *Ms. H. Bossmann / Head DAAD South East Asia/Asia Division* *Ms. Susanne Kammmueller / DAAD South East Asia / Asia Division*	
10:20-10:35	Welcome and Introduction of UNU-EHS and the Programme *Dr. Jörn Birkmann / UNU-EHS*	
10:35-10:45	Overview of Seminar Logistics *Ms. Carlota Schneider/UNU-EHS*	
10:45 – 11:30	Tsunamis and other Coastal Hazards *Prof. Torsten Schlurmann / Univerity of Hannover / UNU-EHS*	
11:30 – 12:00	Vulnerability and Recovery of Coastal Communities After the Tsunami - *Dr. Jörn Birkmann / UNU-EHS*	
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11 January 2007 – Environmental Vulnerability and Early Warning		
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11:00 – 11:30	GITEWS – Indonesian-German Early Warning System and New Insights in Tsunami Detection and Early Warning *Prof. Jochen Zschau / GFZ Potsdam*	
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16:00 – 16:30	The Psychological Adjustment of School Children and Adolescents Affected by the Tsunami (Post-Traumatic Stress Disorder) *Samudra Senarath /DAAD scholar*	
16:30 – 18:00	Moderated Discussion Chair: *Prof. Janos Bogardi / Director UNU-EHS*	

12 January 2007 – Disaster Risk Reduction in Coastal Regions		
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10:30 – 11:00	Seismic Resistant Design of Structures *Sasmal Saptarshi/ DAAD scholar*	
11:00 – 11:30	Disaster Management and Sustainable Development *Prof. David Alexander / University of Florence*	
11:30 – 12:30	Discussion	
12:30 – 13:30	***LUNCH***	
13:30 – 14:00	Move to Disaster Management Centre (GMLZ) of BBK (Bundesamt für Bevölkerungsschutz und Katastrophenvorsorge [Federal Agency for Disaster Prevention]) in Ahrweiler by bus	
14:00 – 16:00	Visit of the GMLZ	***In Ahrweiler***

2) INTENTION OF THE SEMINAR

The seminar "Disaster Risk Reduction and Sustainable Development in Tsunami effected countries" was organised by the UNITED NATIONS UNIVERSITY, INSTITUTE FOR ENVIRONMENT AND HUMAN SECURITY (UNU-EHS), in co-operation with the DAAD Tsunami Special Programme for capacity building in all fields of disaster prevention/ preparedness and crisis management. It was intended to give the DAAD scholars, PhD and Master students from tsunami affected countries the opportunity to deepen and exchange their knowledge in various aspects of vulnerability, disaster prevention, sustainable development, and people centred early warning. During the seminar, the scholars had the chance to join the UNITED NATIONS network specialists, as well as to extend and consolidate their network with DAAD staff and scholars from South and Southeast Asia.

3) INTRODUCTION OF THE SEMINAR AND THE PARTICIPANTS

Mrs. Bossmann warmly welcomed all participants on behalf of the German Academic Exchange Service (DAAD). She outlined the intention of this meeting which should create greater awareness of the interdisciplinary challenges of disaster risk reduction and sustainable recovery of tsunami affected countries in South and Southeast Asia. Moreover, she expressed her interest in receiving more applications to the DAAD for studies supervised by the UNU in the not too distant future.

All participants of the DAAD scholarships were from the tsunami affected countries in South and Southeast Asia, mainly from Indonesia (10 scholars) and also from Sri Lanka (5), Thailand (4) and India (3). The group of the DAAD PhD students encompassed various scientific backgrounds and research topics, ranging from natural to social sciences and engineering. Topics included are, for example, toxicology of the environment, surface motion as tsunami prediction, relocation issues after the tsunami, ethnology in policy development, etc.

In his introduction, Dr. Birkmann from UNU-EHS emphasized the good mixture of interdisciplinary PhD students and speakers from Europe and Asia attending the seminar, which were all related to tsunami research. He encouraged the participants to create an interactive environment for information exchange and discussion. He also gave a short introduction to the structure and finance model of the UNU and its intention to function as a bridge between the scientific community world wide and the UNITED NATIONS.

4) PRESENTATIONS AND DISCUSSIONS

4.1) Tsunamis and Coastal Hazards

This first thematic block focused on coastal hazards from a rather technical perspective. Prof. Schlurmann presented meteorological coastal hazards like storm surges at the German North Sea coast. He emphasized that storm surges will intensify with the climate change. Mr. Armigliato drew the attention to the tsunami risk in the European Mediterranean region. Mr. Srisutam gave an insight into a possible impact-modelling through tsunami deposit analysis. Climate change issues and its consequences for coastal management were also intensively discussed in the presentation of Dr. Rothstein.

Tsunamis are a series of very long waves generated by any rapid, large-scale disturbance of the sea. Most are generated by sea floor displacements from large undersea earthquakes. Tsunamis can cause great destruction and loss of life within minutes on shores near their source, and some tsunamis can cause destruction within hours across an entire ocean basin.

(NOAA, 2007)

Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create a storm tide, which can increase the mean water level 15 feet or more.

(NOAA, 2007)

The comparison of the recent mega-disasters in the South and the North shows that the high economic losses due to natural disasters occur mostly in the USA and Europe while in contrast the high death tolls arise in developing countries.

Example:

2004 Indian Ocean Tsunami
- 240.000 casualties
- 10 bn $ losses

2005 Hurricane Katrina
- 1322 casualties
- 125 bn $ losses

4.1.1 Tsunamis and other Coastal Hazards – Impacts in Coastal Zones

The European coastline has approximately a length of 185.000 and about 560.000 km² are counted to be coastal areas. Apart from the fact that population density is on average already 10% higher in coastal areas than in the inland, the

population in these areas continues growing in almost all countries, in some of them significantly.

The Intergovernmental Panel on Climate Change (IPCC) predicts a sea level rise and for this and also for more severe weather condition reasons a rise in occurrences of storm surges that will all have direct impacts on the European coastlines. In Germany a great part of the coastal hinterlands are below sea-level and therefore at risk during storm surge.

Strategies to reduce risk can be taken either by adaptation or defence measures. In Germany the discussion focuses mainly on defending engineering structures like second dykes, increased dyke foreland, storm surge barriers or artificial reefs.

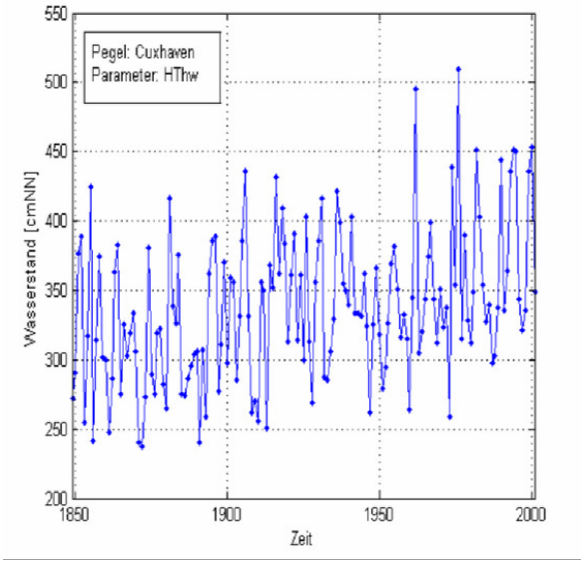


Fig. 1 Time series of astronomically driven highest storm surges have a clear trend since the beginning of recording in Cuxhaven, Germany (Jensen and Mudersbach, 2004)

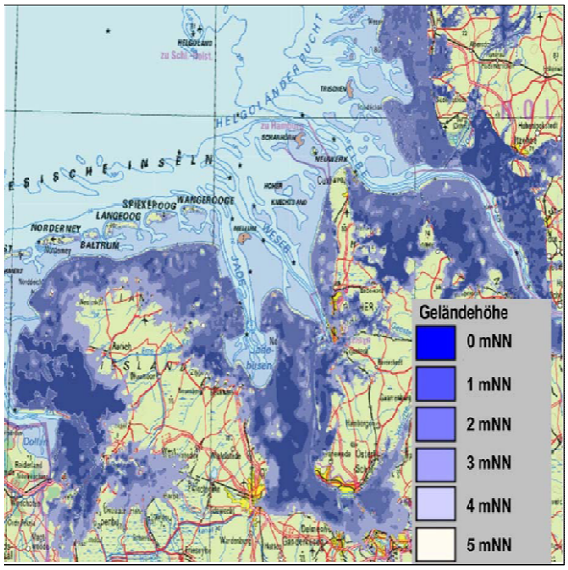


Fig. 2 Scenario of the German North Sea coastal hinterlands under sea-level during storm surge should a large scale dyke failure would occur. (Mai, 2005)

Existing dykes in Germany have all been built with a height calculated based on a deterministic approach which means that their failure probabilities vary significantly along the coastline. Prof. Schlurmann outlined that failures of the dykes are not caused because they break, but because water overflows and erodes them. Since no long-term measures are available for appropriate deterministic calculations, a probabilistic approach is now used to model the wave conditions on German coasts numerically and to design new structures for a 200-year return period. Other countries like the Netherlands design their dykes for a 10.000-year return period.

Hydro-numerical models are needed to address the question whether these 'conventional' defence structures as described above are reliable and feasible towards possible geophysical coastal hazards such as tsunamis. Looking at the tsunami wave mechanics and dynamics studies done so far after the 2004 Indian Ocean tsunami some problems occur. The tsunami simulation for Padang city, Indonesia, by Borrero et al. (2006), for instance, is based on a very dense grid but lacks specific data about the coastlines, which is indispensable for a reliable model. Several field studies show that small scale spatial variations in inundation and run-up are remarkable and depend on the bathymetry and topography as well as the absence or presence of mangroves and coastal reeves. Lessons learnt from these studies include that conventional coastal hazard mitigation measures are completely different from those that have to be taken for tsunami risk. Therefore, it does not make sense to export this knowledge to tsunami prone areas as recipes but to co-operate with partners on site.

Major outcomes of the discussion:

- Mitigation measures cannot be implemented in a schematic way but need to be adjusted to specify the context of the region and the local characteristics and needs. However, methodologies to model these measures can be transferred.
- Sometimes it may not be convenient to build dykes if people live directly on the shore. In this case, other strategies like improving the knowledge and behaviour have to be implemented.
- The UNESCO Intergovernmental Oceanographic Commission has accepted that local wisdom needs to be acknowledged in the research and implementation of risk mitigation measures.
- Local wisdom about tsunamis can be found in mythology as well as the knowledge to put attention to animal behaviour which may sense instinctively the approach of an upcoming wave.

4.1.2 Tsunami Risk in the Euro-Mediterranean Region

The European coastlines have long been recognised to be seriously exposed to the tsunami risk. Tsunami catalogues as well as palaeo-tsunami investigations clearly indicate that almost all the relevant coastal areas of Europe have experienced tsunamis in the past, generated by earthquakes, landslides and volcanic activity, and that some of these events were catastrophic (Armigliato, 2007). As a first attempt to tackle the

numerous problems associated with the tsunami hazard and risk assessment in Europe the EU projects GITEC (Genesis and Impact of Tsunamis on the European Coasts) were launched in the 90s. After the 2004 Indian Ocean tsunami, the need for the implementation of a Tsunami Early Warning System (TEWS) for Europe was clearly recognised, and several initiatives were started both at single-country and at European level. One of these initiatives, the EU-funded project TRANSFER (Tsunami Risk ANd Strategies For the European Region) involves 29 partners including different EU countries, Turkey, Israel and the UNITED NATIONS UNIVERSITY Institute for Environment and Human Security (UNU-EHS). The main goal of the project is to contribute to a better knowledge and understanding of the tsunami processes in the Euro-Mediterranean region, to the assessment of tsunami hazard, vulnerability and risk, and to identify the best strategies for the reduction of the tsunami risk (for more information see: www.ehs.unu.edu or www.transferprojekt.eu). Particular attention is devoted to the recognition of gaps and needs toward the implementation of an efficient TEWS in the Euro-Mediterranean area.
Relating to the tsunami hazard assessment, which is one of the key problems faced by the TRANSFER project, two tools can help in quantifying the tsunami hazard for the European coasts. The first tool is represented by numerical simulations of historical events and scenarios.

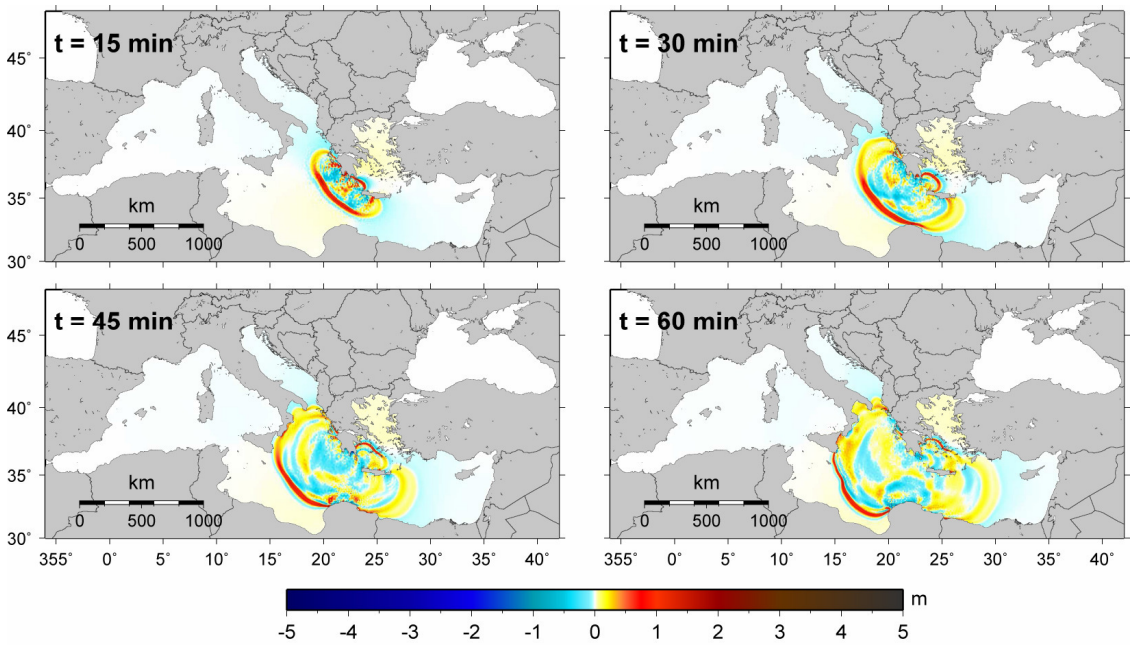


Fig. 3 Scenario of tsunami generated by large-scale seismic structures in the Hellenic Arc (after Tinti et al., 2005a), which is among the sources having the potential to trigger catastrophic trans-Mediterranean tsunamis in the future.

An example of a scenario tsunami generated by a two-segment thrust fault running parallel to the western Hellenic trench, which is one of the areas with the highest seismogenic and tsunamigenic potential in the Mediterranean, was calculated (see Tinti et al., 2005a for further details). The tsunami is simulated by means of the finite-element

code UBO-TSUFE, developed by the Tsunami Research Team at the Department of Physics of the University of Bologna, Italy (see in detail: www.eng.unibo.it/PortaleEn/default.htm). The main results are: 1) a mega-tsunami can produce devastating effects both at local and at trans-Mediterranean distances; 2) local coasts are attacked in a very short time (few minutes); 3) the tsunami waves take about one hour to cross the basin and to hit the distant coasts placed opposite to the source; 4) source directivity and bathymetry are the main factors determining the directions of focusing/defocusing of the tsunami energy.

A second group of tools is represented by the statistical/probabilistic approaches. An example is provided by the hybrid deterministic-statistical method recently described in Tinti et al. (2005b). The basic idea is that the number of events contained in the European tsunami catalogues is too small to be handled by statistical instruments. But observing that the largest part of tsunamis are generated by earthquakes one can think of formulating the problem of the tsunami hazard assessment for a given region in terms of the probability estimation of tsunamigenic earthquakes occurrence. The method we propose provides as a final result the number of tsunamis expected to produce wave heights exceeding a given threshold in a given time interval along the coasts of a selected geographic area. The information on the number of events can be easily translated into exceeding probability estimates if a suitable probability distribution function is adopted.

Major outcomes of the discussion:

- Although tsunamis represent a major threat for the European coastlines, tsunami awareness in Europe still lacks behind. The tsunami issue only came up as a topic in public after the Indian Ocean tsunami in 2004.
- Historical data, paleo-tsunami investigations, mapping of seismic and non-seismic tsunamigenic sources on one side and the development/improvement of numerical, statistical, probabilistic tools on the other represent the basic scientific knowledge-base needed for the simulation of future hazard scenarios. For risk assessment, hazard scenarios and vulnerability estimations are needed.
- Tsunami Risk ANd Strategies For the European Region (TRANSFER) is an end-user focused project: the efforts to involve all stakeholders in different test-areas from the very early stages will help to create useful solutions. Stakeholders include civil protection organisations and industrial companies. (More information: www.transferproject.eu)

4.1.3 Tsunami Deposit Characteristics at the Thai Andaman Coast

The prediction of exact wave dynamics and the potential impact of anticipating tsunamis are difficult. Local conditions at the shoreline and onshore strongly influence wave dynamics. To gain better predictability of the impact, one possibility is to study the traces a former tsunami had left behind on-site. Apart from many direct indications that disappear during the clean-up operation soon after a tsunami struck, tsunamis leave geological traces in the form of deposits, which can be analysed even decades after an event (Srisutam, 2007).

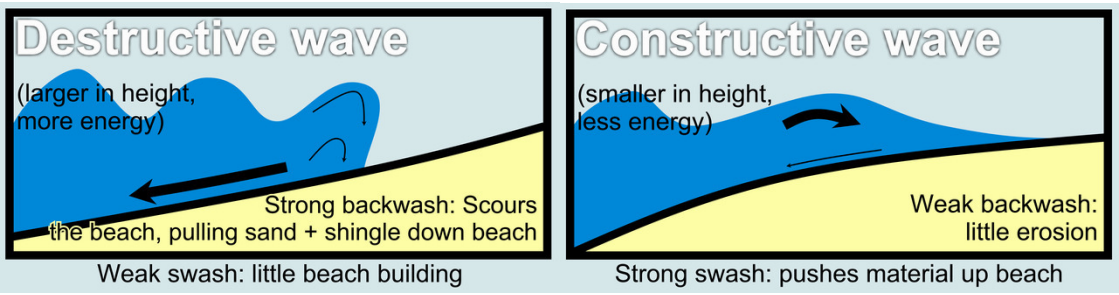


Fig. 4 Ocean waves and their effects on sedimentation (http://en.wikipedia.org/wiki/Swash)

The study of tsunami deposit characteristics is an alternative tool for the calibration of numerical tsunami wave dynamics modelling. Highly specific features of a certain sediment sample such as grain size distribution, grain shape, sequences of deposition, mineralogy and chemistry provide evidence of the dynamics of the approaching wave offshore and of the decelerating wave onshore. The samples can also be traced back to a distinctive place of origin. The interpretation of tsunami deposit data attempts to

answer the following problem set: Where do tsunamis occur? How strong are these events? How far do they reach onshore? How often do they occur?

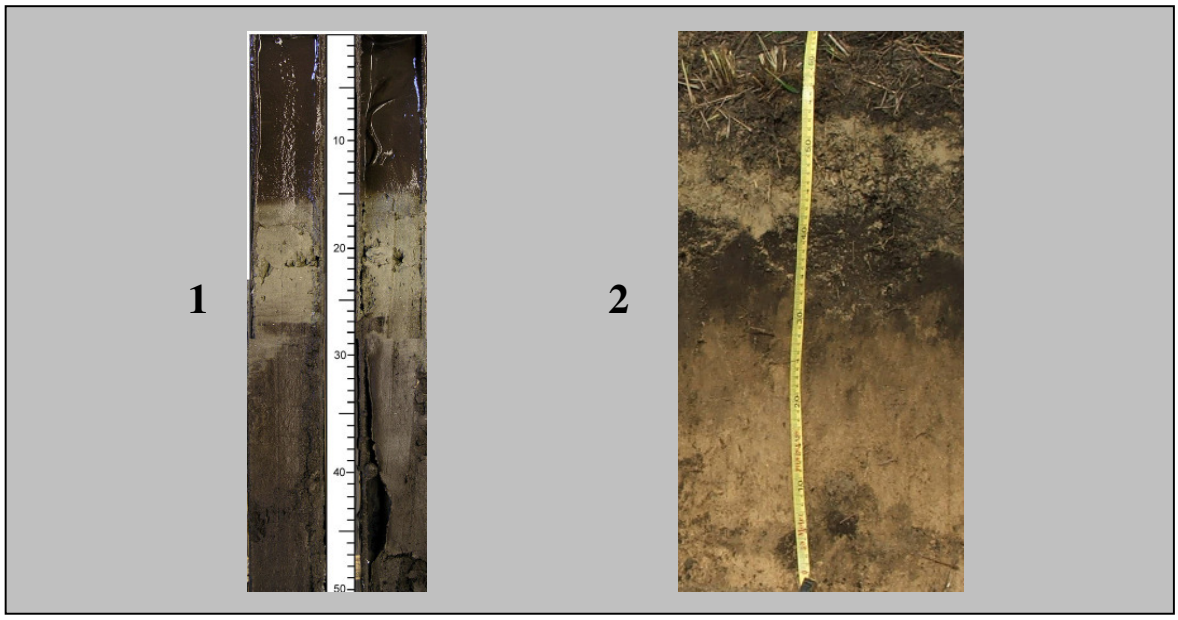


Fig. 5 Preliminary study of tsunami sediments from two tsunami events (1: Chilean tsunami 1960, 2: Sumatra Tsunami 2004) (Srisutam, 2007)

Distinctive layers of sediment observed in soil profiles along the Thai Andaman Coast correspond to the energy load of waves. Waves of higher or lower energy and height produce thicker or thinner layers of sedimentation, and also move the sediment far or near from the beach, respectively. The implementation of sediment and soil profile analysis can help to improve risk assessment in terms of coastal development, which include emergency facilities, evacuation planning, wave energy dissipater structure and beach forest planting.

Major outcomes of the discussion:

- Secondary impacts of tsunamis can be losses of crops due to the erosion of the top soil.
- Mapping of primary and secondary hazards would be a helpful tool; also satellite image inundation data could be implemented as modelling parameters.
- A contamination of tsunami deposits with dangerous minerals is rare.
- Deposits can be easily associated to a tsunami in the laboratory, but it can be difficult to analyse its origin.

4.1.4 Climate Change and its Implication for Coastal Regions

Facts about climate change:

- Current concentration of CO2 has not been exceeded during the last 420.000 years; and not likely in the last 20 million years.
- Current growth rate has never been higher during the last 20.000 years.
- Increasing CO2 concentration because of human activities (IPCC 2001).

The sea level as well as the sea surface temperature is rising. The troubling consequences of a rise in sea level, provoked by higher water temperatures and melting ice among other reasons, are salinisation as well as an increase in storm surges (Rothstein, 2007). The formation of tropical cyclones will be more frequent and also more intense with an increase in sea surface temperature (See also IPPC report 2007).

Tropical cyclones are storm systems fuelled by the heat released when moist air rises and the water vapour in it condenses.
Various terms: hurricane, typhoon, tropical storm, cyclonic storm, tropical depression.

Climate change will create additional stress on the marine ecosystems due to higher water temperatures and ocean acidification (IPCC 2001). These impacts will add to the existing threats on fish stock, which is a main protein intake basis of 2.6 billion people (FAO, 2004). The main part of global warming during the last 50 years depends on a rise in greenhouse gas concentration. Without the factor of „human activities“, the strong temperature rise of the past decades is not explainable.

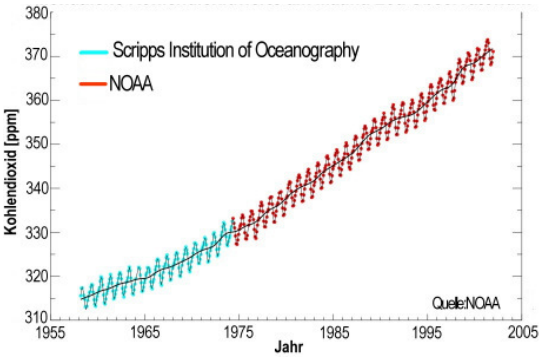


Fig. 6 Monthly CO_2-concentration [ppm] at Mauna Loa Observatory (http://www.cmdl.noaa.gov/obop/mlo/)

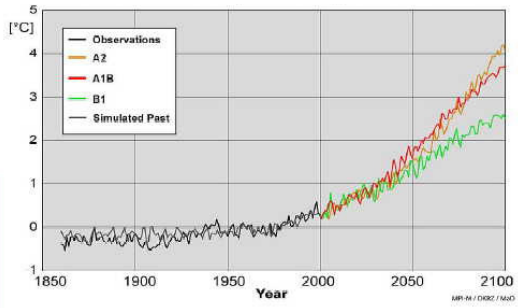


Fig. 7 Future temperature change scenarios related to CO_2 output. Even if CO_2 output would stop now, no change in the curve would be expected before 2030 (yellow: negative, green: positive trend) (Max-Plank-Institute for Meteorology, 2006).

"It's not important to forecast the future, but to be prepared for it. "
(Perikles, 500 years BC)

Major outcomes of the discussion:

1. Scientists today generally agree that global warming is indisputable. The human effects on climate change are strong and more enduring than possible natural events like volcano activity, which can influence global climate awhile.
2. Two solutions need to go hand in hand: the reduction of CO_2 as well as effective mitigation measures. A CO_2 reduction can only be achieved if a win-win-strategy is created for all countries and stakeholders.
3. Adaptation measures do not need to be newly invented, but existing measures need to be adapted to the climate change conditions. This means that hard and soft construction techniques have to be upgraded as well as that an improved crisis management has to be set up.
4. The strategy for the reduction of CO_2 in developing countries must be a mixture of sustainable energy systems in a decentralised energy sector.
5. Downscaling is very important for climate change research: new results of modelling today have a resolution of 10x10 km.

"We need to bring the different disciplines together; there is an urgent need for a multi-type disaster preparation."
(Zschau)

"Weather will become more variable and weather related phenomena will have worse effects with climate change."
(Rothstein)

4.2) Social, Economic and Environmental Vulnerability

Having dealt with the origin of tsunamis and coastal hazards, it is important to think about, how we will be able to cope with such hazards. This leads to a further question: "how vulnerable are we?" The ability to measure vulnerability is increasingly being seen as a key step towards effective risk reduction and the promotion of a culture of disaster resilience (See Birkmann, 2006). In the light of increasing frequency of disasters and environmental degradation, measuring vulnerability is a crucial task if science is intended to support the transition to a more sustainable world (Kasperson et al., 2005).

In this second thematic block the concept of vulnerability, hazard and risk, the conceptual framework and different dimensions of vulnerability were explained who elaborated with a particular case study on revealed vulnerability and recovery of coastal communities after the tsunami in the cities of Galle and Batticaloa, Sri Lanka by Dr. Birkmann. Further discussion on social vulnerability was supplemented by Prof. Hettige who brought up the issue of community development as a neglected aspect of the tsunami recovery process, and by Mr. Fernando, who pointed out at some pros and cons on relocation as a strategy for vulnerability reduction. Other interesting insight were presented by Ms. Senarath on the psychological adjustment of children and adolescents affected by the tsunami. Lastly, Dr. Renaud discussed the environmental dimension of vulnerability to tsunamis.

4.2.1 Concepts and Framework of Vulnerability

According to the United Nations Development Programme (2004), vulnerability is a human condition or process resulting from physical, social, economic, and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard. Moreover, Wisner (2002) defines it as the likelihood of injury, death, loss, disruption of livelihood or other harm when an extreme event occurs, and/or unusual difficulties in recovering from such events (For more information see Birkmann, 2006). That means risk is also a product of the interaction of the hazard in question and vulnerable conditions (See Fig. 8).

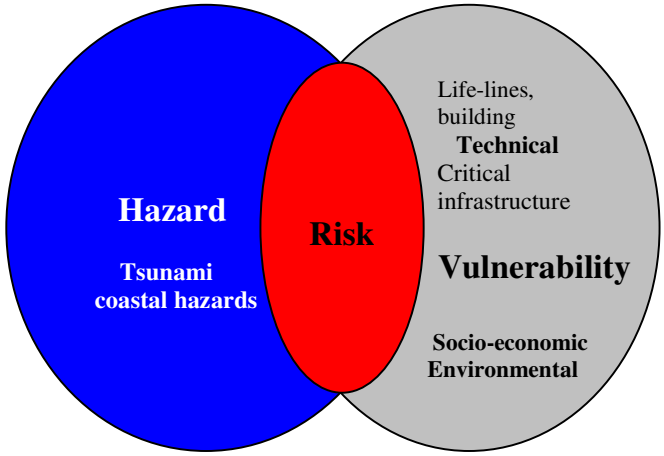


Fig. 8 Risk as a Result of the Interaction of Vulnerability and Hazard (Birkmann, 2006)

Hazard: A potentially damaging physical event, phenomenon, and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

(ISDR, 2002)

Coping capacity: The means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general this involves managing resources, both in normal times as well as during crisis or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards.

(UN/ISDR, 2004)

There are several dimensions of vulnerability:

- **Social Vulnerability**
  Vulnerability of different social groups; Role of social networks (coping)
- **Economic Vulnerability**
  Vulnerability of different economic sectors such as fishery and hotel business in Sri Lanka
- **Environmental Vulnerability**
  Environmental fragility (groundwater, land); dependency on environmental services
- **Institutional Vulnerability**
  Effectiveness and failure or structures and institutions

There are several frameworks related with vulnerability, hazard and risk; one of them is the BBC framework conceptualized by Bogardi and Birkmann (2004) and Cardona (1999 and 2001). The BBC framework stresses the fact that vulnerability analysis should go beyond the estimation of deficiencies and assessment of disaster impacts in the past. In contrast to risk analysis, the main focus of the BBC conceptual framework is on the different vulnerable or susceptible and exposed elements, the coping capacity and the potential intervention tools to reduce vulnerability. Furthermore, the framework underlines the necessity to focus on social, environmental and economic dimensions of vulnerability, clearly linking and integrating the concept of sustainable development into the vulnerability framework. The BBC framework distinguishes between the different responses that are needed before and after disasters occur. While during the disaster emergency management and disaster response units play a crucial role, vulnerability reduction through preparedness should happen before an event happens.

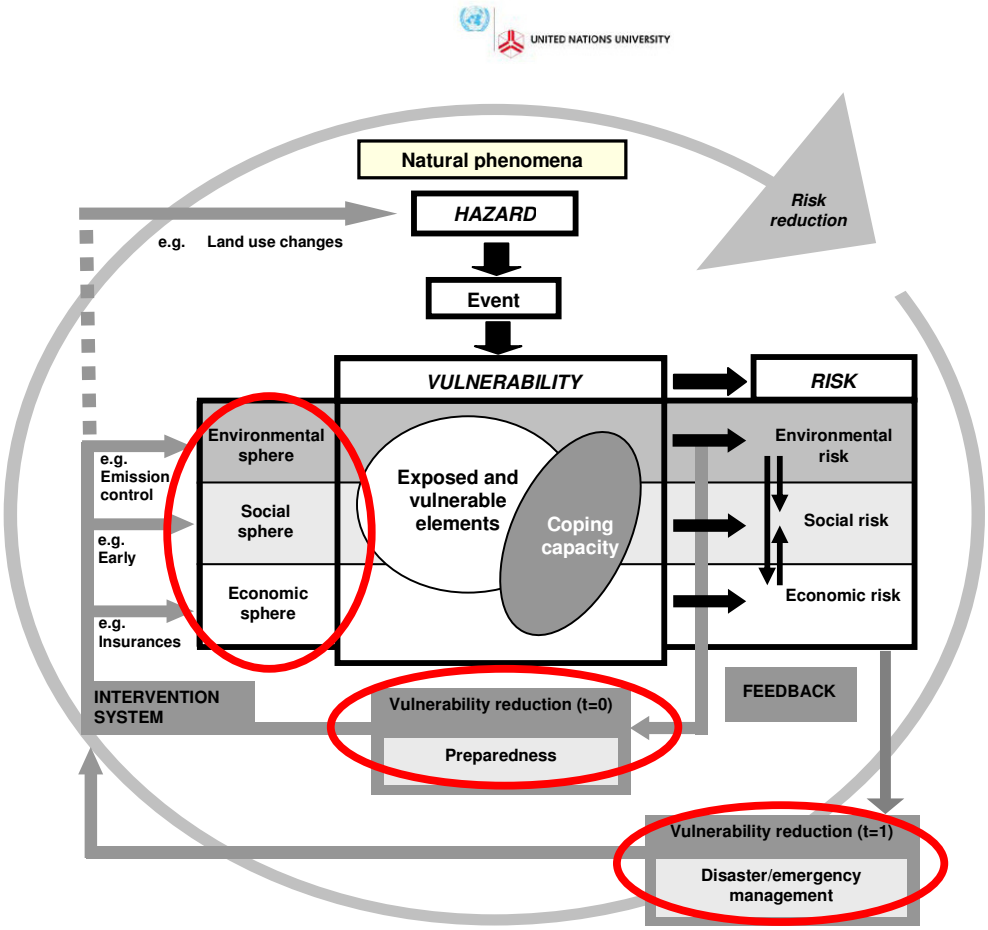


Fig. 9 The BBC Framework (Bogardi and Birkmann, 2004 and Cardona, 1999/2001)

4.2.2 Recovery of Coastal Communities after Tsunami: Case Study in Sri Lanka

A study in the cities of Galle and Batticaloa, Sri Lanka, funded by UN/ISDR-PPEW, was conducted by UNU-EHS jointly with several universities in Sri Lanka. It was intended to explore various characteristics of vulnerability of different social groups, economic sectors, critical infrastructure and environmental services and hereby also to analyse the recovery process.

The study combined four different methodologies:

1. Assessment of the built environment with remote sensing.
2. Critical infrastructure and sector vulnerability.
3. Vulnerability of different social groups (questionnaire–based).
4. Vulnerability of social group and economic sectors (census).

The study areas selected were municipal areas affected by the tsunami in the southern and eastern province of Sri Lanka and were investigated in order to have three locations with different impact intensity. From the study of vulnerability of different social groups, it was found that gender played an important role with

regard to the likelihood of being killed by the tsunami; the number of females missing or dead both in Galle and Batticaloa showed much higher values than for males (See Fig. 11).

The household survey also showed that people within the 100 meter zone from the sea suffered higher degrees of damage than those located within the 100-300 meter zone. Moreover, a higher proportion of deaths (65%) were reported within the 100 meter zone than in other areas (35%), see Fig. 10. Therefore, the Sri Lankan Government declared a strip extending 100 meters from the sea as a buffer zone of high risk for tsunami waves in the south and a 200 meter buffer zone in the north and the east of the country. This intervention tool is still in debate (See more in the Sub-topic 4.2.3).

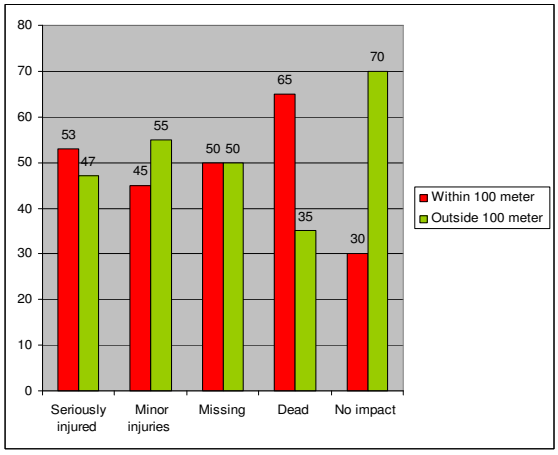


Fig. 10 Impact on humans relating to the vicinity to the shoreline

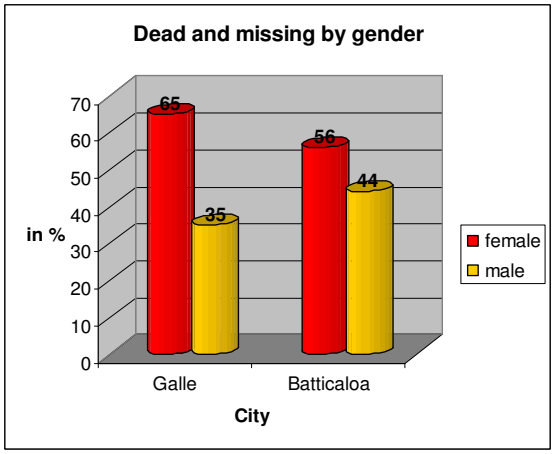


Fig. 11 Number of females and males missing or reported dead in the districts of Galle and Batticaloa.

Besides vulnerability, also coping capacity and recovery were dealt with. Social capital, such as social networks and families played a huge role in coping with the tsunami, since they were the first ones to help the victims before the government or NGOs came. Furthermore, it was found that some social groups were having unusual difficulties in recovering. In the city of Galle, the recovery time ranged between 1 day to 12 months and being not able to recover at all. The social groups of housekeepers (33 months) and fishermen (20 months) are the ones still taking the longest time to recover. Based on geographic characteristics, the majority of the people in Batticaloa (60%), located in the eastern part of Sri Lanka, where internal conflicts hinder the recovery process, need more than 25 months to recover or are even unable to recover at all. Moreover, getting financial support for the rebuilding of damaged houses required the ownership of a plot of land,

> The social network (family, friends, and neighbours) was the main source of loans and first aid-especially during the time right after the tsunami event.

which went to the detriment of encroachers (people occupying the land without land ownership), who encountered additional difficulties in the recovery process. Based on a simulation model developed by UNU-EHS, households who owned land would theoretically need around 7 months to recover while the people without a legal title to own land would need on average around 44 months to replace their housing losses.

Major outcomes of discussion:

- The conclusion derived from the case study, which was focused on the identification of indicators for vulnerability assessment was that social capital played a big role in coping with tsunami events, as social network were a source of first aid right after the event.
- A negative impact of intervention may be the discouragement of people in their effort.
- Spatial planning is needed in the recovery process. It is a good opportunity to see and decide whether everything should be built as it was before the event or to make some changes, especially to take vulnerability reduction into account. One important issue is that the process should be transparent and respect the equity issue.

4.2.3 Community Development: A Neglected Aspect in Tsunami Recovery and Resettlement Process

Already two years have elapsed since the 2004 Tsunami disaster struck much of the coastline of Sri Lanka. The long-term recovery process is ongoing with the intervention of both state and non-state actors. Resettlement and rehabilitation of affected families became the main thrust of the recovery process. Though many families are already resettled either in the same locations or in new housing schemes, some families are still in temporary shelters. Moreover, not all of those resettled families are fully satisfied with their present place of residence due to various reasons explained by Fernando and Prof. Hettige. The interventions by state and non-state agencies have been mostly aimed at meeting the housing and other needs of the affected families. There was no effort to balance individual and collective community interests. Inequality among resettled families was created. This

situation led to further social problems such as jealousies, disparities, frustration and even conflicts.

The current quantitative assessments only provided the overview of the macro-picture but nothing about the qualitative aspects of the recovery process. Therefore, a community-based study in several affected coastal settlements was undertaken, namely in seven settlements in Southern and Eastern Sri Lanka. The study has combined several methods of data collection and provides a first empirical basis for an in-depth understanding of issues of recovery and resettlement.

The recovery and resettlement process has depended mostly on interventions by various external agencies, which had great influence on the decision-making process. The arrangements were made directly by central government with the external agencies involved. Local level democratic institutions such as the elected local councils were not integrated into the organizational structure. In the absence of a community level planning and coordinating unit, the Divisional Secretariat level, which covers a vast geographical area and population, has played a loose and often ineffective coordination function. The lack of effort to address community development issues has brought about two adverse impacts:

- Competition rather than cooperation among affected families to overcome their individual problems.
- Concentration only on individual/household needs ignoring community issues such as environmental sanitation, inequality, community participation, vulnerable groups, a persisting sense of insecurity, and social problems.

"We need to set in motion a process of community development in post tsunami settlement."
(Hettige)

From the research findings, incidence of poverty has increased substantially after the tsunami in all communities surveyed (Hettige, 2006). As an example, in Galagodawatta, only 22% of the people were considered poor before the tsunami, whereas after tsunami, 80.9% of the people saw themselves as poor (based on self assessment). This also applied to the case study, which showed that people generally had lower income and fewer work opportunities after the tsunami.

"Is relocation a strategy for disaster management and vulnerability reduction?"
(Fernando)

One highly controversial issue during the recovery process in Sri Lanka was the declaration of a buffer zone of 100 meters in the south and 200 meters in the north and the east. The authorities did not allow reconstruction or new construction of housing units in this area. But in contrast with that, a waiver was granted to commercial institutions and businesses, who constitute the major source of tax revenues,

allowing them to reconstruct or construct within the buffer zone. Owing to this situation, some settlers who lived in the buffer zone before the tsunami disaster and are now being required to relocate into other settlements have requested government authorities to reconsider reducing the 100 meter buffer zone. As a consequence, the buffer zone was later reduced to 50 meters in the South. Nevertheless, as a consequence of the enactment of the buffer zone, most people needed to be relocated elsewhere.

Social Problems during the Sri Lanka Recovery Process (Fernando, 2007)

Livelihood and social infrastructure
Inadequate attention to livelihood and social infrastructure issues can give rise to serious social problems in the long run. Poverty and lack of access to education and livelihood opportunities can lead to high rates of youth unemployment. This may encourage youth to engage in illicit economic activities such as illegal alcohol production, drug peddling, theft, extortion, and burglaries. Spread of such activities in a settlement makes life difficult for others as well. In fact, a whole settlement can get labeled as such by outsiders and law enforcement authorities.

Top-down planning
The settlement planning process has mostly been a top down affair. There has been little or no beneficiary participation. New settlements consist of highly standardized housing units that take no account of diverse household needs depending on family structure and size, nature of the previous dwelling unit, occupational background, individual tastes, etc. The victim families have had no say in the construction of their own houses.

Lack of community consultations
Though the victims had their diverse needs and desires regarding place of residence and the type of house, most of them had no financial strength to decide where and how they wanted to settle down. Those who were living within the buffer zone often had no choice but accept what was offered to them by donors. For instance, families dependent on fishing also moved into settlements located far away from the coast, though this was going to create serious problems for their livelihoods.

Relocation, which was used as one the recovery and vulnerability reduction strategies, has also its negative sides. Instead of reducing vulnerability the relocation strategy rather promoted inequalities and gave rise to challenges in various dimensions. As described before, an arrangement was made between the government and the NGOs, where the government provided the land and NGOs built the houses. Various competing national and international NGOs built houses that differed in regard of standards at times reaching an even

inappropriate level and thus creating inequalities. Some unfair selection processes for people to be given houses were also practised. Furthermore, the attention was only given on provision of land and housing, and left the gap of other infrastructure and community needs open. This reality was the background of a further research on whether relocation is a good solution to reduce vulnerability, or whether it could make it even worse. A study in Galle is currently being conducted in order to explore more in-depth it entails the implications of 100 meter buffer zone and the relocation pressures (IPS, 2005).

There are few major points planners need to take into account when discussing the issue of relocating communities:

1. Resettlement losses including land deprivation and less tangible ones such as social networks/services and cultural identity
2. Vulnerable groups such as widows, orphans, the elderly, the poor and the disabled are left in need of long-term income support
3. New relocation sites away from original homes can cause stress and tensions. Furthermore, living with the host population can cause additional conflicts in terms of employment, use of common property resources, natural resources and social services amongst natives and the resettled.
4. Income Restoration **-** Affected people who lost housing as well as income sources may be most at risk. When displaced people are worse-off, they risk impoverishment and alienation, which may result in landlessness, joblessness, homelessness, marginalization, loss of access to common property assets and social disorganization. Therefore, planners need to take account of the links between relocation and income generation activities.
5. A major problem in resettlement management and implementation is the lack of an appropriate institutional framework at both the agency and field levels.

There are two types of resettlement institutions:

- Government agencies include government line agencies, training institutions, coordination committees, etc
- International donor agencies, INGOs, NGOs, CBOs, affected persons resettlement committees, and resettlement monitoring and evaluation agencies.

It is important to ensure that appropriate agencies are mandated to plan and implement compensation, income restoration, and rehabilitation programs.

Major outcomes of discussion:

- During the recovery and relocation process, many new issues and unusual difficulties in recovering emerged. One significant issue is the question of landownership. From the study, it was evident that the "encroachers", especially the once living in the 100 meter zone before the tsunami were having difficulties in getting their housing in the new settlement. Moreover, people without a land title do not receive grants for rebuilding their houses due to the lack of land (See Birkmann, 2006). Another issue was that the tenants were also affected by the tsunami. It may be problematic in deciding who had the right to receive support, the owner of the house or the tenants.
- Relocation, if not well coordinated and done without consultation with the local communities can yet cause another disadvantages, which is inequality. In the Sri Lankan case, the competing NGOs built different types of houses even in the same neighbourhood, and people with networks to the higher society/politicians were privileged over others. There should be a local-level community planning and monitoring.
- In promoting sustainable development, consultation with communities is necessary. The communities should be not only passive recipients but be active in participation. Some participatory measures such as public assessment during planning and implementation are important, i.e. those implemented in Banda Aceh, Indonesia.
- The strategy to link such community based studies with the decision makers needs to be taken into account, for instance through the media, presentation to the decision makers, etc.

For more information see:
(Birkmann, Fernando, and Hettige, 2006)
(Hettige, 2006)
(Birkmann and Fernando, 2007)
(Birkmann, 2007)

4.2.4 The Psychological Adjustment of School Children and Adolescents Affected by the Tsunami

"While the affected countries are now moving forward in some aspects of reconstruction, the progress in mental recovery is relatively slow."
(Samudra Senarath)

As a result of the tsunami disaster in 2004, people have to cope with a variety of traumatising events. These include threat to life, exposure to death and the dead, bereavement, loss of property, stigmatization, injury, physiological disruption (sleep, food and water deprivation), separation, loss of community and work etc. Research has shown that the vast

majority of children and adolescents who survive a natural disaster will suffer from some negative effects and experience diverse psychological problems. Many will develop psychological symptoms of distress, which are normal human reactions to severely traumatizing life experiences. Some adolescent survivors report significantly high rates of post traumatic stress disorder (PTSD), anxiety and depression; some become clinically depressed, have suicidal thoughts and take over-doses in the long term after experiencing such disaster.

As treatment for PTSD for children and adolescents, researchers have suggested medicines, cognitive-behavioural therapy, group treatment and counselling. Many people recover in the ensuring months, but in sizeable subgroups the symptoms persist, often for years. While the affected countries are now moving forward in some aspects of reconstruction, the progress in mental recovery is relatively slow.

The study from Samudra Senarath intends to investigate the psychological wellbeing of children and adolescents affected the tsunami in Sri Lanka. It will examine their psychological adjustment and their coping behaviours. In particular, the study will investigate the incidence of young people suffering from symptoms of PTSD. The objective of this study is to identify the psychological needs of children and adolescents that may be served by counselling interventions such as therapeutic counselling and to develop counselling approaches and treatment (teach the teacher approach). The findings of this research will support initiatives to sustain a balanced healthy life, facilitate psychological adjustment, enable treatment and prevention, strengthen coping ability, and develop social competence for children and adolescents affected by the tsunami.

Major outcomes of discussion:

- In order to conduct a study to examine psychological adjustment of children and adolescents, one should take into consideration some influencing factors like the communication ability of the children, whether or not we should consult with the family, self-recovery of the children (without treatment), their different circumstances, i.e. living in resettlement areas. Other factor is the time needed for the treatment since it is a long-term process.
- Teachers are to be trained to provide special treatment for the disaster affected children (psychotherapy), so that they can help children in need of counselling during a certain period of time.
- A community-based healing process could be another alternative to help children to adjust psychologically. As an example, in Indonesia a story telling how children had survived from a disaster like the tsunami became an encouragement for them.

4.2.5 Environmental Vulnerability to Tsunami

When assessing the vulnerabilities of communities, the environmental sphere cannot be separated from the social and economic spheres (See BBC Framework in Subtopic 4.2.1) because of the mutuality between human beings and the environment: humans shape their environment and in turn the environment plays a major role in shaping the economic activities and social norms of human beings as outlined by Dr. Renaud. A vulnerability assessment framework developed by Turner et al. (2003), views vulnerability in the context of a coupled human-environmental system. In the context of the tsunami, we can see the ecosystems from two different points of view, firstly the role of ecosystems as a buffer to tsunami waves and secondly the sensitivity of the ecosystems facing a tsunami with trickle-down consequences on human livelihoods.

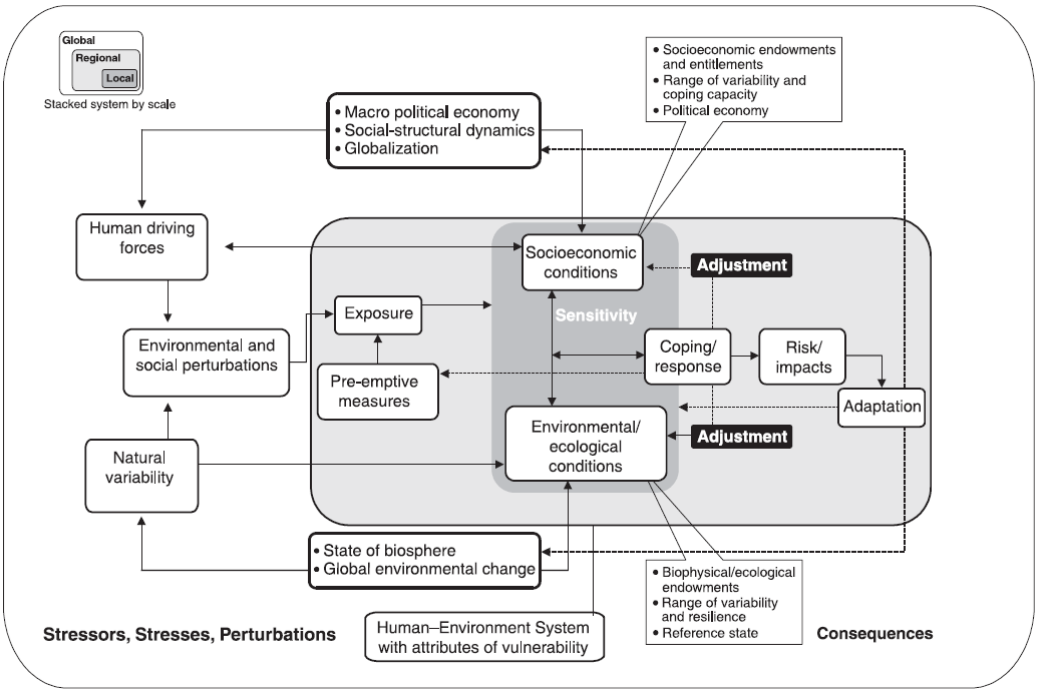


Fig. 12 Coupled human-environment system. (Turner et al., 2003)

Coastal features such as mangroves, sand dunes, sea grasses and coral reefs may contribute to reduce the exposure of the population (e.g. increased distance of settlements from the coastline). The specific effects of these ecosystem components are being scientifically debated.

On the other hand, the tsunami has caused the degradation of the ecosystem, which consequently affects other dimensions of vulnerability and coping capacity, e.g. it degrades soils and water resources affecting income generation in rural areas. Moreover, a high dependency on specific environmental resources can affect coping capacity if that particular resource is affected by a hazardous event.

As an example, the tsunami during the Maha season had adverse impacts on the local agricultural sector in Eastern Sri Lanka. The losses of agricultural assets were the standing crops, human resources, temporary salinisation of soils, salinisation of shallow groundwater (irrigation), debris deposits, loss of equipments, and financial assets.

There was a gap in the recovery process of the farmers, dependant on the assets, impacts and support, but there was no long-lasting effect on the soils of the area. Some farmers could recover quickly.

In contrast, the impact on groundwater due to destruction of wells, salinisation, and possible pollution by other contaminants tended to be more prolonged in some areas. This is significant since the peri-urban and rural communities rely on groundwater for their everyday freshwater supply. Some remedial measures were carried out, such as wells reclamation, desalinisation and purification, provision of water using water tanks and other water sources, but the situation improved only slowly. Many communities were stressed for a long time and some are still under stress today.

Those examples show us the necessity of capturing the environmental dimension of vulnerability but also of highlighting that all dimensions of vulnerability are interlinked. The ecosystems are almost never in steady state but their severe degradation can limit the provision of essential services as well as affect the vulnerability to hazard. From the "Risk" point of view, it should be considered how the ecosystems degradation increases the hazard side of the equation (but this is seldom the case in terms of tsunamis) and the exposure of the community, while from the "Sustainable Development" point of view and the perspective of the livelihood approach, the natural capital as an important factor should be taken into account.

Major outcomes of discussion:

- In connection with impact of tsunami on the agricultural sector, another question arose on whether it would be better to implement remedial measures or to relocate the farmers. Of course, the latter one requires to consider of some other factors, like availability of land, not only for housing but also for cropping, and has further implications as described in the previous sections.
- The environmental problems in the coastal areas cannot be separated from the activities done in the upland/other areas. In other words, there are always interactions. For example, the mangrove destruction was also caused by the consumption of shrimps by people in other areas.

4.3) Early Warning

In her presentation, Dr. Dannenmann pointed out that early warning needs to be a people centred undertaking. The German attempt to build an early warning system in Indonesia was illustrated by Prof. Zschau. Finally, Mr. Zentel gave an insight into the activities of the German National Platform for Disaster Reduction.

4.3.1 Strengthening Early Warning Capacity – How to bring the message to the people

The UN International Strategy for Disaster Reduction (UN/ISDR) has launched an Early Warning Platform (PPEW) with the aim to build a disaster risk reduction movement within the Hyogo Framework for Action (2005-2015). Its objectives are the reduction of disaster risk focusing on both national and local community levels.

Hyogo Framework for Action 2005-2015

1. **Governance**: Ensure that disaster risk reduction is a national and local priority with strong institutional basis for implementation
2. **Risk Identification**: Identify, assess and monitor disaster risks and enhance early warning
3. **Knowledge**: Use knowledge, innovation and education to build a culture of safety and resilience at all levels
4. **Reduce Risk**: Reducing the underlying risk factors
5. **Be Prepared and Ready to Act**: Strengthen disaster preparedness for effective response

Early warning is a major element of disaster risk reduction. But it is important to realise that it is more than just a technical or scientific prediction.

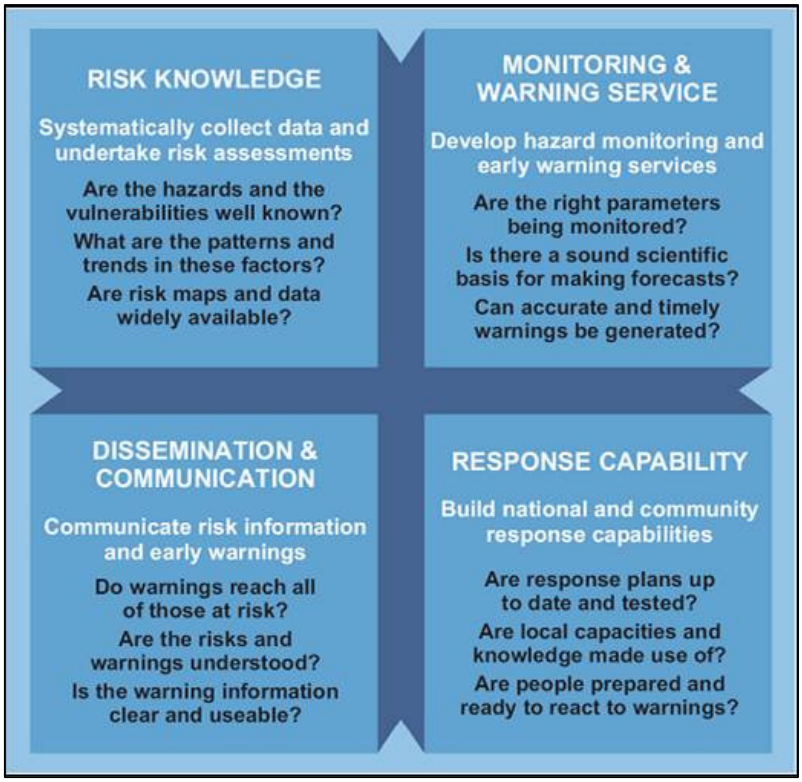


Fig. 13 Components of a complete and effective early warning system

The Early Warning Platform aims to improve the international dialogue and good practice and to develop improved tools and systematic approaches. Two examples are a checklist for the development of early warning systems to help governments and communities to implement effective people-centred early warning systems and a global survey of existing early warning systems.

In relation to the Indian Ocean Tsunami Early Warning System, one of the challenges is to urge governments to integrate tsunami early warning into their national plans. The aspect of tsunami coordination is still missing in most countries. In the Indian Ocean, 26 countries receive tsunami warnings, but only a few operate a national tsunami warning centre.

In July 2006 an earthquake off Java, Indonesia, caused a tsunami, which killed several hundred people. The tsunami warning reached all official contact points in the Indian Ocean, but the warning was not passed on by the Indonesian Government to the people on the coast because they feared unnecessary panic in the case of a false alarm. The important lesson learned from this event is the inalienability of education and information of the people to allow them to react to the signs of a tsunami even if official warnings fail.

Major outcomes of the discussion:

- The lack of money is often a problem for the implementation of awareness raising programmes in local communities; UN/ISDR provides free material to download.
- A major problem with donor money is that it is almost always destined to special hazards, and the organisations are not able to use it for other development activities.
- UN/ISDR and its system partners support governments to work out national plans and to improve their own possibilities in their countries, for example if they need special training programmes.
- "We warn – you evacuate" does not work as a fixed recipe for many regions. An effective end-to-end warning system needs to take many factors (e.g. culture, gender, age) into account. Working directly with local communities is very important to find successful strategies.
- In a short time window after a disaster people are willing to do and pay a lot, but afterwards it is very difficult.

"It is easy to document what has failed during and after a disaster, but it is very hard to find out and prove what has worked."
(Dannenmann)

"The biggest problem with global initiatives is that governments are swift to sign them, but the implementation never happens."
(Hettige)

4.3.2 Breaking the Waves – Tsunamis and Early Warning Systems

The first tsunami warning centre was built in Hawaii in 1949 after the Aleutian tsunami. It was not until 1965, after the great Chile and Alaska earthquakes, when tsunami warnings were internationalised and the Pacific Tsunami Warning System was built. Today there is still no tsunami warning system available for the Atlantic/Mediterranean and Indian Ocean regions, where respectively 30% and 5% of the tsunamis occur. The occurrence rate of tsunamis worldwide is about one in 10 years with a height of more than 30 m and eight in 10 years with a height of more than 8 m.

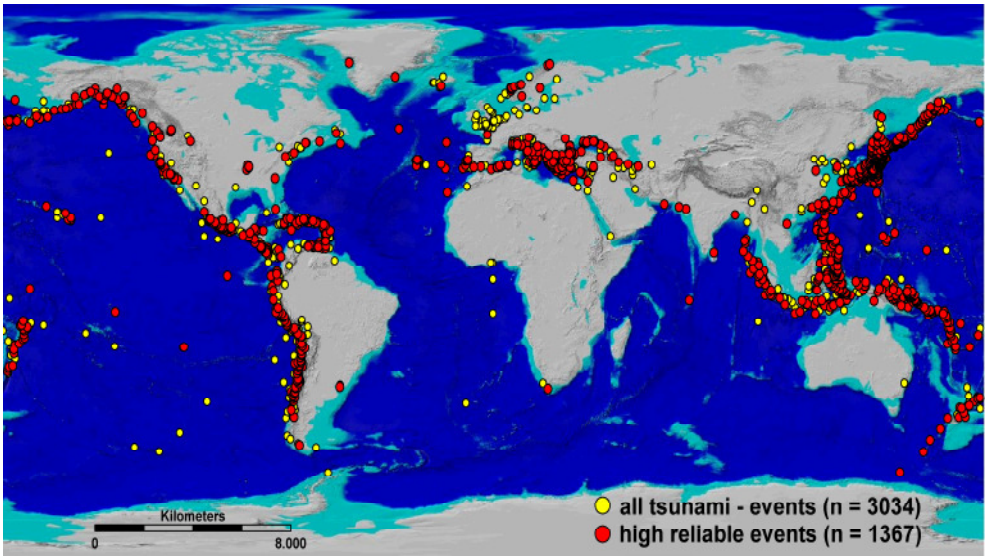


Fig. 14 Tsunami distribution 2000 B.C. to 2004. (Zschau, 2007)

After the 2004 Indian Ocean tsunami, the German government has been supporting the development and installation of the German Indonesian Tsunami Early Warning System (GITEWS).

Making the warning chain work

All the following components need to work within a few minutes:

- Detect the earthquake.
- Determine the earthquake size.
- Monitor the rupture process.
- Measure the tsunami height.
- Model the tsunami propagation.
- Manage the data flow.
- Cover the “last mile”.

Rapid earthquake detection and analysis will be achieved with the worldwide GEOFON seismograph network. Additionally, 40 new stations are deployed around the Indian Ocean with 22 of them in Indonesia. With a newly developed GPS tracking system ("GPS-Shield"), the rupture process can be followed with a just a few minutes delay (Sobolev et al., 2006). The new technology of GPS reflectometry could be a useful tool for the monitoring of water levels, but still more GPS satellites are needed.

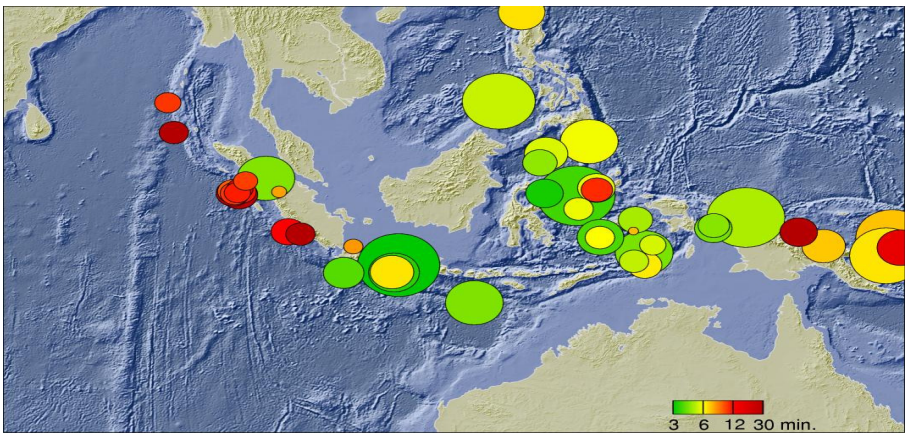


Fig. 15 With the new instrumentation the detection time for earthquakes is reduced from 30 down to 3 minutes in many parts of Indonesia.

With the modelling of stress accumulation from strain measurements of satellite-geodesy as well as predicted future stress accumulation due to plate movement, considerable stress accumulation in the southern segments of the Sumatran subduction zone has been detected, which could lead to a future earthquake event. The attempt to numerically model this earthquake and a relating tsunami in Southern segments of Sumatra shows a disastrous scenario (Politz et al, 2006).

Beyond the technological aspects it is important to bridge the gap between science and its applications. People need to be trained and be ready to take responsibility. A new culture of prevention has to be developed in which people do not ignore the hazards, learn from the past, and act before they are forced to react.

"**Last Mile**" of an end-to-end tsunami warning system: The Padang Project

Objectives: Development of a numerical tsunami early warning and evacuation system. Optimisation and implementation of basic disaster mitigation methodologies for the city of Padang.

Tools: Detailed earth observation data and techniques. Hydro-numerical modelling of small-scale flooding and inundation dynamics of tsunami scenarios. Evacuation simulations in the urban coastal hinterland (taking time- and site-dependant forecasts of the evacuation behaviour and traffic flow into account).

Example area Padang: Tsunami-prone coastal stretch in West-Sumatra, approx. 1 mill. inhabitants.

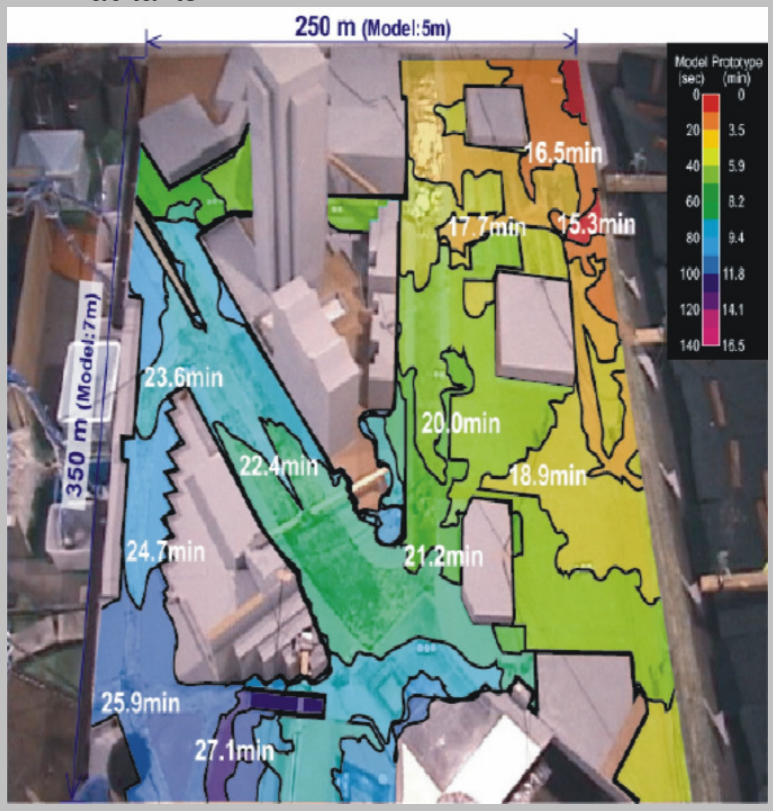


Fig. 16 Inundation of an urban area within 4 min in the physical model (=28 min reality) (PARI, Japan).

Notes: The project is headed by Prof. Schlurmann, former staff of UNU-EHS. The UNU-EHS will conduct high-resolution and in-depth vulnerability assessment for the city of Padang.

Contact: Prof. Torsten Schlurmann (schlurmann@ehs.unu.edu)
Dr. Jörn Birkmann (birkmann@ehs.unu.edu)
Neysa J. Setiadi (setiadi@ehs.unu.edu)

Major outcomes of the discussion:

- The information flow is one of the weakest links in the warning chain, and still needs to be developed. Information has to reach people on all levels, down to the local level. But the recognition of weak points should not mean we should stop developing the others.
- Rapid earthquake magnitude estimations are often inexact, because the fastest wave does not include all energy from the earthquake. New magnitudes need to be developed to ameliorate, e.g. based on ground motion.
- German support will carry on with training and capacity building for 2-3 years after the system is built, then the Indonesian government will have to take over responsibility and allocate a budget for the sustainability of the warning system. Support will be given up to 10 years.
- Theoretical frameworks will always differ from actual facts on the ground, they should just be recommendations. The local communities need to assume responsibility to drill their people to know what to do and promote emergency awareness. It is a matter of repeated training to raise people's confidence in themselves instead of worrying them with new technologies and knowledge of hazards.
- Not only local wisdom and knowledge but also local adaptation strategies need to be incorporated in the “last mile”.

4.3.3 Vulnerability Reduction, Disaster Preparedness – DKKV – the National Platform for Disaster Reduction in Germany

Germany as a federal country has the principle of subsidiarity, which means that the community takes care of what it is capable of tackling. The responsibility for disaster management is divided into many governmental institutions and at various levels. Therefore, a national platform is needed in order to bring all these institutions together.

The Deutsches Komitee Katastrophenvorsorge (DKKV) or German Committee for Disaster Reduction was founded as a national platform for disaster risk reduction within the International Strategy for Disaster Reduction

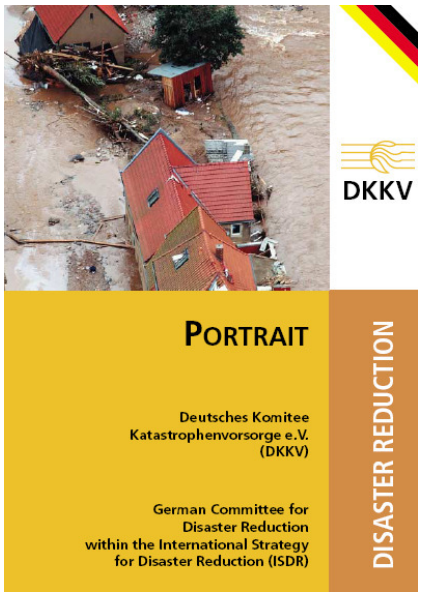


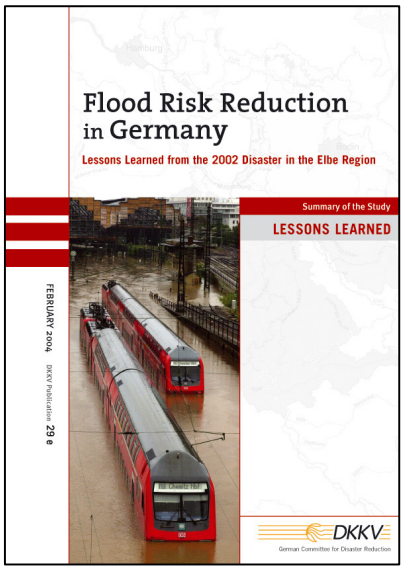
Fig. 17 Portrait of the German Committee for Disaster Reduction (DKKV)

(ISDR) in 2000 as a follow up agreement of the German IDNDR Committee. Its nature is a non-governmental and non-profit organization, which provides multi-sectoral and multi-stakeholder fora, with its headquarter in Bonn. Its members are development and humanitarian aid organizations and NGOs, civil protection organizations, governmental agencies, scientific institutions, insurance companies, private sector and media.

DKKV Guiding Principle: The German Committee for Disaster Reduction regards itself as responsible for firmly establishing disaster risk reduction in the awareness and actions of policy-makers, industry and administration. The aim is to render society capable of dealing with the risk of disasters and to prevent human, social, economic and ecological losses.

The members of DKKV and the board members work on voluntary basis and are elected on a 3-years turn. The DKKV supports mainly interdisciplinary research in the area of disaster risk reduction and prevention, development of instruments and information dissemination of information about disaster risk reduction. Furthermore, it calls for the implementation of existing knowledge on disaster risk reduction, further development of specialist, cross border cooperation and media related strategies in this field. In order to fulfil its mission, DKKV uses the following instruments:

- Involving the policy-makers by political lobbying.
- Networking to bring people to have and create necessary understanding in the disaster management.
- Scientific studies, publications, databases, education materials.
- Workshops, conferences.



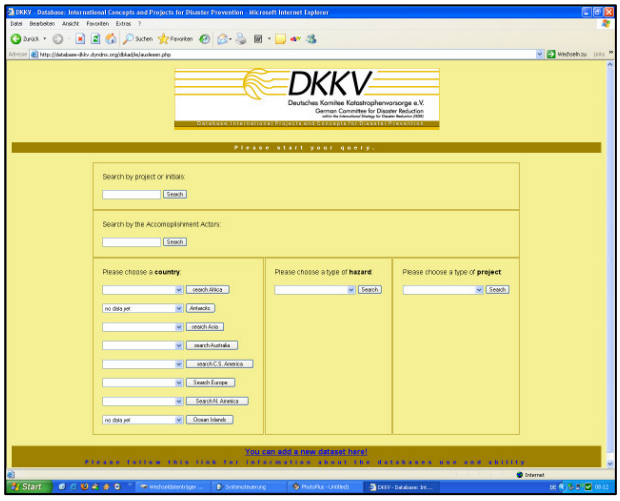


Fig. 18 DKKV print and web materials (DKKV website: www.dkkv.org).

So far, some progress has been achieved, like the increasing incorporation of disaster risk reduction in development programme and humanitarian aid, research programmes, hazard specific risk mapping, and study programmes offered (Bachelor and Masters) in this area. Some constraints still exist due to the complex governmental structure, the huge number of actors, and increasing decision making power on the level of regional political units (European Union). It is a challenge and a work in progress for DKKV to bring all actors together, stimulate the information exchange and bridge the gap among all actors.
For further information see: www.dkkv.org

Major outcomes of discussion:

- DKKV functions as a network that stimulates information flow; it is not an implementing agency. It is still difficult to measure the success of its activities. But some impacts can be seen, such as changes in the warning system of the meteorological agencies.
- The possible approach to the decision-makers can be done by lobbying activities with good arguments or through the media to build public opinion and pressure to the government.
- The best chance to influence decision-makers to engage in disaster reduction is unfortunately during the time after disasters occurred, because it is very difficult to draw attention to disasters which are not happening. Even so, we need to find ways to build awareness at a higher level.

4.4) Disaster Risk Reduction and Sustainable Development

In the last subject area of this meeting, Dr. Warner introduced a new concept for a global insurance scheme for disasters. Mr. Saptarchi gave insight into the earthquake resistant engineering of buildings. The paradoxical situation of today's disaster response as civil defence versus civil protection was the topic in the final presentation by Prof. Alexander.

4.4.1 Insuring the Uninsurable: Design Options for a Climate Change Funding Mechanism

With the issue of increasing losses resulting from disasters due to global climate change the development of an alternative approach to ensuring natural disasters in disaster prone developing countries is necessary. Current disaster financing models include a variety of post-event mechanisms, primarily by allowing governments and victims to absorb the costs and to some extent by relying upon external donor assistance. The proposed design features of a Climate Change

Funding Mechanism (CCFM) aim to rectify numerous deficiencies of the existing post-disaster model. The CCFM is proposed to be an insurance mechanism that can secure development and help ameliorate the negative impacts of climate change. The mechanism aims to provide financial support for countries, which suffer catastrophic economic damages due to climate change impacts and cannot recover on their own due to a lack of financial resources.

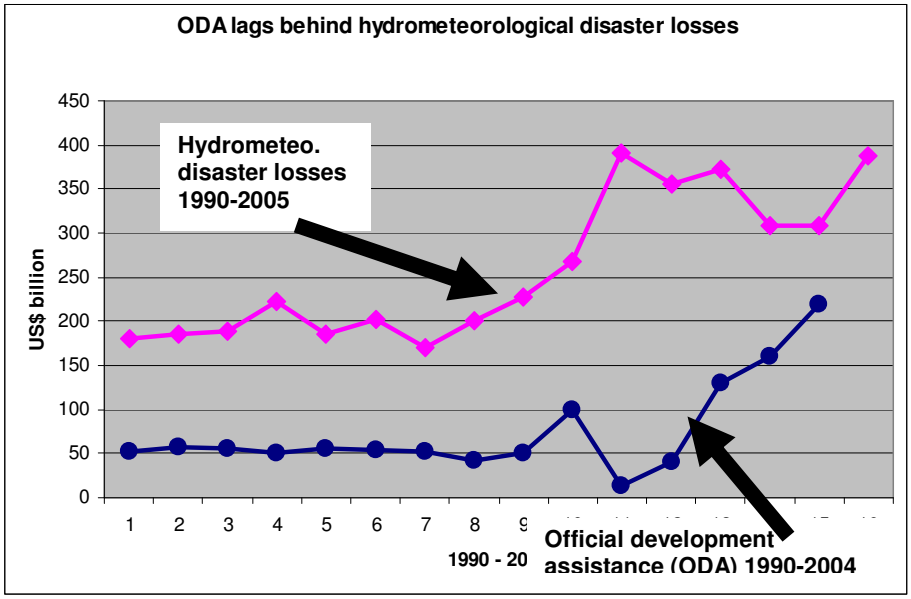


Fig. 19 Hydro-meteorological disaster losses versus official development assistance in billion US $ in 1990-2004/5 (WDI, 2005)

Key issues for the design of CCFM:

1. **Eligibility**: All developing countries are eligible, voluntary, negotiations must be established in advance.
2. **Coverage**: Public assets to start with, extension to private assets at later stage.
3. **Structure**: Damage threshold defines pay-out.
4. **Incentives for risk reduction and adaptation**: Pay-out only in severe events, others have to be financed by the country; consequently they will invest in risk reduction.
5. **Participation of developed countries**: Political good will, limitation of legal liability for damage caused by global climate change, targeted post-disaster assistance.
6. **Operation**: Independent public-private partnership, with governments and regional authorities as key partners.
7. **Financing**: Premiums (based on risk exposure), UNFCCC parties (e.g. based on their CO2 emission), general development assistance.

The advantages of such a funding scheme are a consistent financing approach that does not rely on media attention to raise money, a guaranteed coverage mostly free from political considerations, and a new dialogue about risk. The focus on risk transparency and the communication about acceptable risks as well as possible actions to limit exposure to risk is superior to the current ex-post system of funding natural disasters. One of the ideas is that developing countries can reduce their payment if they invest in risk reduction programs.

Challenges for such a scheme include the inability of poor countries to pay premiums, the design of an equitable and efficient risk finance mechanism and the lack of political will. Developed countries may be reluctant to support CCFM out of the concern that such support would be perceived as a formal acknowledgement of their responsibility for climate change, which in the future can result in adverse legal consequences. And developing countries may have to be prepared to absolve the CCFM sponsoring countries from any or part of the legal responsibility for the adverse impact of climate change on their economies in the future.

Major outcomes of the discussion:

- The visions of CCFM are equity, fairness and efficiency. The amounts of premium and payment should be set up independently, which is part of the negotiation process before an event. In reality the argumentation after a disaster will probably look different.
- The calculation of the premium is based on risk assessment, risk exposure and the ability of the country to pay the premium.
- It will be a difficult process to convince the developed countries to join in the CCFM. Their reliability towards climate change can be a factor; a political reason could be reduction of migration.
- In order to be able to finance the impact of a severe natural disaster, a large pool of countries is needed. The risk should be spread geographically. Example: Vietnam, which has a very long coastal area, has set up a national insurance scheme. Since usually only one part of the coast is affected by a natural hazard the risk is spread geographically and thus enough money can be accumulated to sustain the insurance system for the whole country.

4.4.2 Seismic Resistant Design of Structures

The majority of the existing structures in developing countries were designed and constructed at a time when relevant codes of practice had no specific design provisions, or when these provisions were inadequate according to the current state of knowledge. These structures may suffer severe damage due to extreme loads as evident by natural disasters experienced in the recent past, which compels the research community to address issues like improved design of concrete structures and the upgrading of existing structures to the level of prevailing standards. To advance, structural components and regions of reinforced concrete structures are identified, which are vulnerable to extreme lateral loads. A review of detailing specifications in various national and international codes of practice for seismic resistant design of structures shows that no uniform codes exist. A comparative study of these specifications is important.

Both engineered and non-engineered buildings lack important factors:

Engineered

- Quality of construction and construction materials
- Lack of seismic considerations
- Lack of monitoring
- Building codes

Non-Engineered

- Awareness and governance weakness
- Lack of awareness about seismically resistant design
- Insufficient knowledge of safe construction
- Socio-economic condition

In general, structures are designed for gravity loads and may not be able to sustain the effect of horizontal load due to an earthquake. Seismic resistant design aims to predetermine the critical locations in a building and to size parts with the correct amount of reinforcement. The incorporation of seismic resistant design features would provide buildings with a greater resistance against a collapse. Two important guidelines provided by American Society of Civil Engineers (ASCE) towards greater resistance are:

- Continuity of reinforcement
- Confinement of members for ductility

Ongoing research:

- State-of-the-art review on analytical models for structures with geometrical and static discontinuities subjected to seismic loading.
- Identification and evaluation of criteria for seismic resistance.
- Development of modified models identifying failure mechanisms.
- Experimental verification of the models.
- Development of guidelines for seismic resistant design of structures and elements.

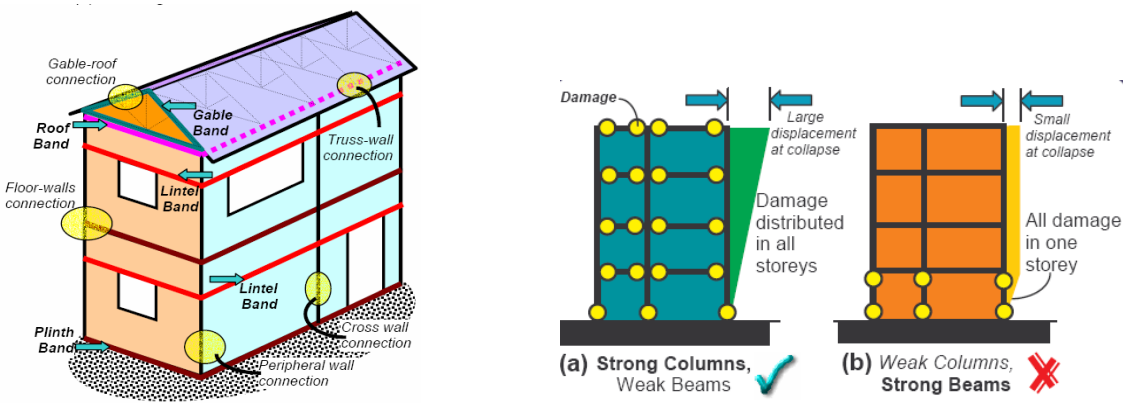


Fig. 20 Effective horizontal bands for structural configuration, (a/b) behaviour of a framed building in an earthquake (National Information Center of Earthquake Engineering at IIT).

Major outcomes of discussion:

- A combined approach to building codes for different hazards is difficult because of the contradicting forces of earthquakes or wind (lateral) and the water masses of floods or a tsunami.
- There is no single answer to whether steel or concrete structures are safer, since concrete is rigid, but brittle and steel structures are light, but not so stable. It is important for both types to consider a seismic resistant design.
- A seismic resistant enhancement of buildings does not involve substantial costs. There are very simple rules to follow and guidelines for a “do it yourself” approach will be developed.

4.4.3 Disaster Management and Sustainable Development

With the entry in the New Millennium we witness the emergence of a new category of disaster: terrorism, having an intentional so-called teleological dimension. Not only there is a new defined category, additionally to existing increasing natural disaster categories, but also a shift of paradigm and priorities in regard to disaster response. The epitome of all this is the remilitarization with the resurgence of civil defence, which is rather centralised and authoritarian, as against decentralised and participatory civil protection. There are different ways to assess emergencies, depending on the systems that produce them. For instance, in Italy civilian volunteer forces are the first ones that come into place in respect to emergencies, man-made or natural. In the UK, police is the major force that reinstalls public order after an event producing chaos. While in the United States the military or paramilitary forces like the National Guard take control in view of natural events or human-induced threats (See Fig. 21).

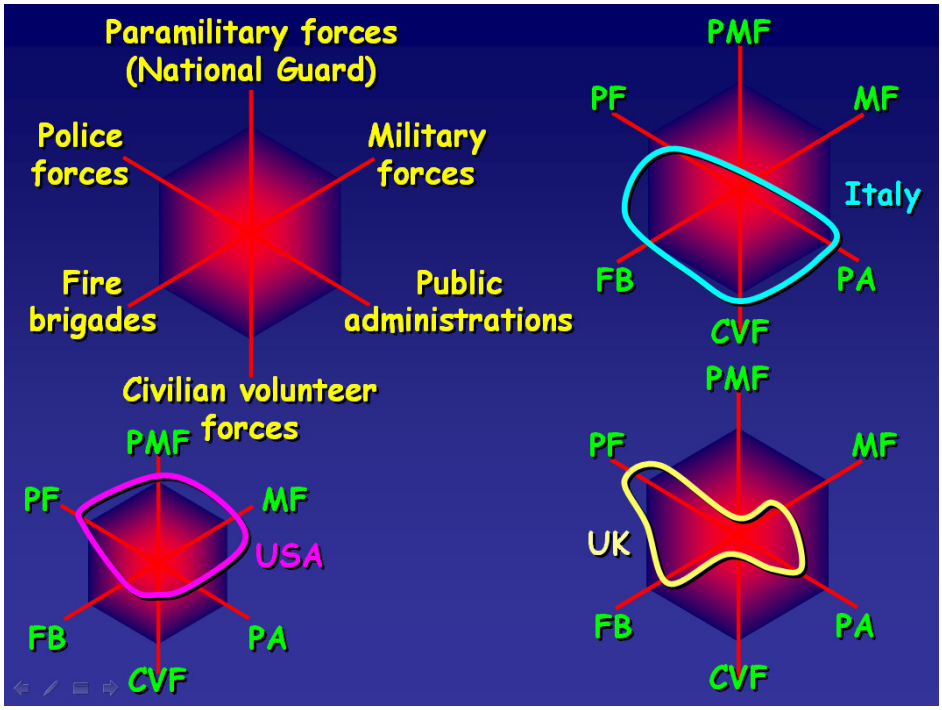


Fig. 21 Different Emergency Management in Different Countries (Alexander, 2007)

In principle, the former connotes devolution and the latter central control. Therefore, the concept of emergency management is a diverse one - the concept of how an emergency, a state of instability, is approached. In a society where the military constitutes the reacting force, institutions adopt a rather authoritarian top-down methodology. Whereas societies strengthening integration preparedness are predominantly prone to coordination, collaborative networks take local self-sufficiency into account.

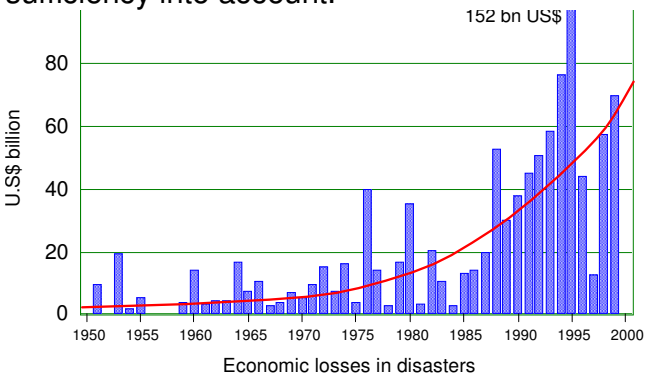


Fig. 22 The trend in disaster losses is unsustainable. This applies to the total costs (figure), but also to the number of affected people, the number of recorded disaster and others. (Munich Re, 2001)

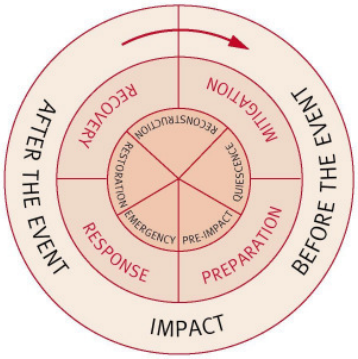


Fig. 23 The Disaster Cycle. (Alexander, 2002)

Focusing on the differences between the two approaches we can see that the resurgence of the civil defence, best manifested by Hurricane Katrina, further marks a turning point in its objective. Instead of protecting civil society from the disaster, the civil society became subject of defence. This characterises the major difference: Where civil protection consisting of mutual and locally rooted participation stands in contrast to civil defence implementing law and order due to command and control mechanisms. Hurricane Katrina showed that there is not necessarily a clear distinction of whether a developed country is intrinsically more advanced to tackle emergencies in contrast to less developed countries. Moreover it depends on the ideological attitude that defines the logic of acting. Not to mention pre-disaster planning that in fact ignored impact scenarios thus leading to inadequate emergency plans and evacuation. Katrina showed that class matters. Pre-disaster inequalities were revealed in the state of pre-, present- and post-disaster emergency management. Therefore it is of high importance that inequalities need to be eliminated and that a new culture of civil protection will be created.

Major outcomes of the discussion:

- Example of "class-quake" in the case of hurricane Katrina victims showed the incomprehensiveness of policies, where the micro-policies only tackles individuals instead of the community. Moreover, the local level effort was very weak due to lack of resources planning, although the same scenario had actually been published before Katrina occurred.
- In disaster management, it is necessary to make available and make use the information in order to plan for things that may happen and how to response appropriately.
- The decentralization (local approach) is more effective in dealing with natural disasters, but this approach is very difficult when we face man-made disasters (such as terrorism).

4.4.4 Sustainable Development and Human Security from Ethnological Perspectives

In Sugandi´s presentation, she pointed out that in the light of sustainable development and human security, it is necessary to have a balanced kind of approach that is culturally compatible with designing development policies, and that both really accommodates local wisdom, including norms and cultural values, and represents local needs. Development can be described as economic growth, modernization, distributive justice and socio-economic transformation. But at the

same time, there should be a more inclusive access to assets and a greater authority granted to local institutions in order to better protect assets and people and to facilitate the latter's well-being.

> *"Impeded development:*
> - *declined living standards and increased poverty level;*
> - *local autonomy diminished as linkages with the world system increased;*
> - *production rose followed by horizontal inequalities;*
> - *a shift from a subsistence economy to a cash economy led neither to a better diet nor to more leisure time for most people "*
>
> (Sugandi, 2007)

Exclusive development policies that have low civil participatory and human security levels could lead to an impeded instead of a sustainable development. Thus, we need to take a look at the group dimension, particularly where there is horizontal inequality in the development process. In creating cultural inclusiveness, we should use a Socio-Anthropological approach and value cultural diversity and community related effects, instead of a technicist, unilinear evolutionary approach that adopts Western models and methods and homogenization strategies and that neglects cultural elements. The contextual traditions of the indigenous people should not be ignored. In the "realist policy" indigenous people must surrender their political and economic autonomy and be integrated into dominant state societies, which implies assimilation and a hierarchical perception. Such macro approaches focus more on individuals instead of groups and neglects the elements of cultural diversity and community related effects. This is actually a violation of the cultural rights as a basic human right.

Moreover, there is often a marginalization of cultural rights in practice, such as enforced development, ethnification, neglecting of indigenous knowledge, lands issues, people's failure to identify themselves with technologically advanced societies and so forth. This marginalization is manifested by an imbalance of power, an ignoring of collective identities, humiliating strategies and the emergence of global cultural inferiority complexes. Such processes may eventually lead to economic and cultural ethnocide, a disintegration of the State at local level and collective violence.

> *"Effective development draws on indigenous cultural practices and social structures (Ethno-development). It acknowledges the local communities, their traditional cooperative patterns and their solidarity based on kinship and descent. These must be treated as partners in, not obstacles to, the development process. A realistic development effort promotes change but does not enforce innovation; it respects cosmological orders and takes a holistic approach."*
>
> (Sugandi, 2007)

Collective dignity adheres to collective identity, cultural rights and cultural capital of the community in question.

It determines their participation in social change/development processes. The acknowledgement of collective dignity is the necessary condition of any idealist policy approach towards reaching culturally compatible development policies. Such a notion of collective dignity is especially significant in collectivist - or 'holistic' - societies such as Indonesia. The science of ethnology/social anthropology provides the paradigms and models for eliciting such representations of collective dignity. These enable us to analyse the symbolic cultural idioms, that is, the objects of production and exchange whose social meaning is, culturally constructed, the forms and norms of social participation, and the cultural processes and social and religious relationships that are rooted in local values and knowledge. Development policies therefore should engage in dialogues with local communities and allow them to define their own ideals of progress, as these are grounded in local knowledge and communicated in symbolic cultural idioms. Only in this way will development policies adopt a locally specific character and be culturally compatible with different value systems and with traditional forms of social organization.

Sugandi addresses this issue of collective dignity in the context of sustainable development and human security by means of a field study in the Balim Valley, Wamena, Papua, Indonesia. Apart from the fact that Papua is a culturally rich and pluralistic area, Wamena has a very high poverty rate, a low human development index, a high disparity resulting from vertical and horizontal conflicts, a limited social communication, social deviations and low levels of civil participation. The Balim valley people have been subject to an imposed collective identity, to an ongoing interface between modernization and local tradition, to marginalization and negative outward looking perceptions, to warfare (ritualised, it is true, but also generating atmospheres marked by taboo and fear), and to structural violence following upon pacification processes. Her main research aim is to identify and analyse this complex notion of collective dignity and its manifold ramifications amongst the Balim Valley people in Wamena.

Major outcomes of discussion:

- Sustainable development and human security require a dialectical process/dialogue between policy makers and beneficiaries (community in question). General development paradigms that focus on individuals should be transformed into those that take the group dimensions into account and focus more on community related impacts. Ensuring sufficient space for local communities to define and direct development is important to create such distributive justice and support human security. This requires that ethnological/socio-anthropological models are applied in designing development policies.
- Local cultural values are important to consider also in the case of emergency aid. Resettlement or relocation programmes that neglect cultural dimensions will cause confusion about cultural identities. Such was the case in Madura island, Indonesia, where people were resettled following upon internal conflicts. This generated serious difficulties in adapting to the different cultural environment.
- Both in development implementation and in disaster management, dialogues are needed. We need to allow people to speak up, to tell us what they expect from us and to direct the way of the development. This effort is worthwhile, because it will reduce the human costs and enable us to reach a common ground of compatible value systems of both the policy makers and beneficiaries of the development.

Excursion to the German Joint Information and Situation Centre (GMLZ) in Ahrweiler

"From the Federal Government and the Länder, for the Federal Government and the Länder"

Particularly after flood disasters in September 2001 and August 2002, the awareness that new challenges in the crisis management need to be tackled integratively and in wider dimensions has emerged. As a response to it, the German Center of Crisis Management (BBK) installed the German Joint Information and Situation Centre (GMLZ) on October 1st , 2002. The GMLZ is financed by the Ministry of Interior and is aimed to improve the cooperation among national level and the federal states, various federal authorities, with national, inter- and supranational organizations, also between Germany and other countries, in overcoming significant threats and disasters.

Thus, the mission of GMLZ is to process and provide relevant data on hazards, vulnerabilities and risks, decision support in the scope of the disaster management of the responsible decision –makers and especially regarding the compliance with international commitments. To fulfil this mission, an emergency information system called deNIS is operated. At the moment, there are 2 independent systems, deNIS I and deNIS II. deNIS I is an internet portal addressed for public use, while the latter one contains "protected" data and serve as closed intranet system to be used only by relevant agencies.

Fig. 24 Mr. Andreas Hermentz from GMLZ explains the work of the GMLZ staff to the seminar participants.

For more information see:
www.bbk.bund.de/nn_402322/DE/02__Themen/05__Krisenmanagement/03__GMLZ/GMLZ__node.html__nnn=true

5) FURTHER RECOMMENDATIONS AND RESEARCH DIRECTIONS

This seminar has given the participants the opportunity to discuss different topics from various disciplines, which are all related to disaster risk reduction and sustainable development. It was also very interesting since the participants come from different tsunami affected countries with different research interests and shared their experiences within a common overall topic tsunami risk reduction.

Based on the topics presented and also the overall discussions, some conclusions and recommendations are delineated.

Prevent, rather than respond
The experience from the recent disaster events shows that we have to develop and apply more preventive actions as well as to develop more effective and sustainable post-disaster assistance. We need to invest more in disaster risk reduction, such as gathering necessary information, resources planning, vulnerability reduction, building finance mechanisms to secure development from natural disaster, and many others. Moreover, it is important to create awareness of disaster risk at another level and to instigate decision-makers to be involved in disaster risk reduction through the media or any other instruments. Additionally it was acknowledged that also universities need to play a more important role in disaster prevention and disaster recovery. Capacity needs to be developed in the countries and in the context of international cooperation.

Need for progressive interdisciplinary research in disaster risk reduction
There is a need for progressive interdisciplinary research that not only acknowledges other disciplines but also incorporates different approaches in its methods. Moreover, disaster preparedness should not be focused on one disaster type; the different scientific communities need to start an efficient dialogue.

Participation of the local community and inclusion of the local wisdom
Experiences during the recovery process in Sri Lanka and also in Indonesia showed that meeting community as well as individual needs, which are of highest

importance, necessarily means community involvement and active participation in the planning and implementation process. The 'givers' and 'receivers' paradigm should be abolished, since the term 'development' itself should be neither an import of western models and values nor a mere export of technological knowledge but rather an attempt to improve collaboration, creativity and dialogue. Local wisdom and knowledge, characteristics, and value systems, need to be explored and then incorporated in the whole strategic framework of disaster risk reduction. Neglecting such aspect would mean unsustainable development, which could lead to higher vulnerability of the people involved. Here, the cooperation of the government and NGOs is needed, where interaction and dialogue takes place for a better coordination.

Coordination between government, NGOs and the people

In many cases, NGOs may be considered to be able to work faster and show more tangible support in the short and medium term, but the coordination and role of the government should not be ignored to ensure sustainable development in the long-run. Intervention without coordination, transparency and monitoring could hurt the value system and socio-economic situation in the affected areas. A lack of coordination between NGOs and the government as well as among different NGOs is a serious problem in recovery processes. It may lead to confusion and inequalities, which will consequently affect other dimensions of vulnerability of people. That way, also the competition among central government, local government, and NGOs could be reduced.

Vulnerability reduction as an integral part of disaster risk reduction

The definition of vulnerability given and discussed within the seminar reflects the fact that vulnerability is only partially determined by the type of hazard, it is also driven by precarious livelihoods, the degree of self-protection or social protection, qualifications and institutional settings that define the overall context of a person or a community. This concept is also manifested by the experiences from Hurricane Katrina that it is not only the magnitude and size of the hazard which determines the impact, but that also the overall context of the individual or the community itself plays a big role.

Therefore, it is important to always take into account vulnerability reduction as an integral part of risk reduction. How we can conduct application of an early warning system technology, for instance, is also influenced by the socio-economic, institutional and also environmental situation of the affected regions.

Bridge the gap between science and application

We need to address the lack of implementation of scientific achievements. Media as source of information and means to build public opinion may be one approach to persuade the decision- and policy-makers to take part in disaster risk reduction. Furthermore, (financial) support in sustainability of technology and disaster management operations especially in developing countries is still needed.

Likewise, science should play a more active role in disaster risk and vulnerability reduction. In this context, the following is needed:

Further **social** research -

- to derive a better model of coordination and monitoring during planning and implementation of recovery process;
- to measure the vulnerability before a disaster event in order to provide sound information for decision making;
- to know how to "pack" the scientific findings in order to address them to the policy and decision making process, while building public opinion.

Further **environmental** research -

- to determine how the natural features influence the tsunami intensity or buffer the tsunami wave;
- to determine how the environmental degradation may influence the other dimensions of vulnerability in different scenarios.

Further **technical** research -

- to ensure basin-wide tsunami and other coastal hazards detection and information dissemination;
- and to improve technical measures on hazard mitigation.

In addition, further dialogue and practical research is needed in order to match the theory with the reality and the model with the experience. In this context the special seminar of UNU-EHS and DAAD offered to a considerable extent a platform to discuss different research proposals, ongoing projects and practical applications of disaster management (in Germany).

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ANNEX C) WEBLINKS

UNU-EHS	http://www.ehs.unu.edu/index.php
DAAD	http://www.daad.de/en/index.html
UN/ISDR	http://www.unisdr.org/ppew/ppew-index.htm
DKKV	http://www.dkkv.org/
GFZ Potsdam	http://www.gfz-potsdam.de/index-en.html
BBK/GMLZ	http://www.bbk.bund.de
DeNIS	http://www.denis.bund.de/
ReliefWeb	http://www.reliefweb.int
UNFCCC	http://unfccc.int/2860.php

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