STATEMENT

on the Greatest Earthquake and Tsunami of the Early XXI Century and the Need for Urgent Action to Reduce the Effects of Natural Disasters in the Indian Ocean Region and Elsewhere

The following statement sets forth the basis for the position of the IUGG Geophysical Risk and Sustainability (GeoRisk Commission), and illustrates the importance of urgent measures to reduce the effects of natural hazards in the Indian Ocean region and elsewhere. The following statement was adopted by the IUGG GeoRisk Commission on January 7, 2005. The Commission believes that this statement summarizes the views of geophysicists with expertise in matters related to risk and sustainability.

A magnitude 9 great earthquake occurred on December 26, 2004 off the west coast of northern Sumatra, South Asia. Huge tsunamis were triggered by this great earthquake, and the coastal zones around the Indian Ocean were assailed by these tsunamis. More than 150,000 people lost their lives in a dozen countries, 500,000 were injured, and up to 5 million are lacking for basic services. This has been a great tragedy of the early XXI century!

It is common knowledge that timely warnings save lives. It is also common knowledge that tsunami warning systems in the Pacific Ocean proved to be effective over several decades. It was thus a surprise to many to learn that there are no regional tsunami warning system and stations in the Indian Ocean. In all affected countries, the level of preparedness for the disaster events of December 26th turned out to be extremely low. *These days the world faces tragedies caused by ignorance and irresponsibility*.

The IUGG Commission on Geophysical Risk and Sustainability *recommends*:

1. The countries around the Indian Ocean to set up a Disaster Management Center in order to monitor land, ocean and atmosphere in relation to all kinds of natural hazards, especially those related to coastal regions. Such Centers should be established in any disaster-prone coastal regions where they do not already exist (e.g., Mediterranean Sea and Atlantic Ocean).
2. A Tsunami Warning System to be set up in the region. This would be costly, but information is the only way to save human lives. The tourist and other industries in the areas affected should urgently assist financially the national and international institutions in order to install monitoring and early warning systems. Before such systems are in operation in the region, the Pacific Tsunami Warning Center in Hawaii should extend its warnings to cover all vulnerable areas in the Indian Ocean.
3. Multidisciplinary and multinational research programs and research networks on geophysical hazards and risks to be developed in the Indian Ocean countries in order to integrate diverse data streams, to improve understanding of the natural phenomena associated with the disasters, to develop predictive modeling capability, and to generate and to disseminate timely and accurate information needed by decision makers and the public.

The IUGG Commission on Geophysical Risk and Sustainability *considers*:

4. Information alone cannot save human lives if no management procedures, public preparedness, hazards maps, evacuation routes and shelters are prescribed prior to any natural disaster. Research on temporal changes of vulnerability to natural disasters is essential to update periodically natural hazard and risk maps.
5. A coordination of observation systems and data will reduce the losses due to natural disasters. An integration of InSAR technology for topography into disaster warning and prediction systems is crucial for floods and coastal hazards. Real-time monitoring of submarine seismic and volcanic activity and tsunami propagation should be developed including re-use of submarine telephone cables. Extensive

use of satellite data as well as airplane laser scanning data is an important component of the disaster management. Space Agencies should release the data to scientists and disaster agencies.

6. After a disaster occurs, rescue agencies and civil defense managers need immediate quantitative estimates of the extent of the disaster and losses. Recent technological and communication advances are improving the speed and accuracy of loss estimates immediately after natural disasters (e.g. earthquakes, tsunamis, etc.) so that injured people may be rescued more efficiently. In many developing countries, urbanization and population are increasing at an unprecedented pace. Therefore, it is necessary for loss estimation to include information on the present population as well as current quality of buildings and the soil properties.
7. Scientists can and should help to save human lives by providing governmental institutions with accurate predictions on natural disasters with a good lead-time. Reduction of predictive uncertainty is the most important scientific challenge in natural hazards mitigation.

Furthermore, the IUGG Commission on Geophysical Risk and Sustainability *considers*:

As the global population continues to increase, our vulnerability to natural disasters is magnified with each passing year. The tragic events at the end of 2004 have illustrated once more the vulnerability of humankind to natural threats. Scientists must apply their expertise and experience to the mitigation of these disasters. To mitigate and adapt to large-scale disasters, the scientific community must be involved in an extensive campaign of knowledge exchange and communication with the various groups involved including government officials, the general public, etc. Risk evaluation must rely heavily on modeling and visualization of physical, technological, biological and social processes and their implications. The results need to be easily grasped by emergency planners, the insurance industry, policy makers, and the public.

Living in an often turbulent and unpredictable public environment, scientists can contribute to decision-making through a risk management framework that examines natural, technical and social issues related to sustainability and consists of the following:

- Anticipates natural and human-made risks through widespread *consultation*.
- Determines *concerns* by using risk assessment techniques for various scenarios.
- Identifies the *consequences* by systematically cataloguing hazards.
- Undertakes *calculations using* appropriate models.
- Evaluates the *certainties***,** uncertainties, and the probabilities involved in the calculations of the vulnerability and of the exposure.
- Determines and acts on options to *control***,** mitigate and adapt to the risk.
- *Communicates* the results to those who need to know.
- Promotes and guides *monitoring* systems to collect, assimilate and archive data relevant to the determination of sustainability and risk, now and in the future.
- Integrates the knowledge and understanding from all relevant disciplines to provide society with the tools to *review* the sustainability and the risks of proposed policies and plans.

Though rational scientific methods hold the promise of an improved science of risk and sustainability, it must be remembered that the priorities for analyses are likely to be heavily influenced by the public and political agenda of the day. This means that implementation of risk management to achieve sustainability can be reached only through an interaction of theory and praxis.