

GUEST EDITOR'S NOTE

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The disastrous tsunami of 26 December 2004 in the Indian Ocean attracted the interest of scientists and media, and opened two main questions soon after its occurrence: why was the coastal population totally unalerted even hours after the earthquake, and how could the world help countries that were hit by such a tragedy that killed more than 250,000 people? As a response, emergency programmes and reconstruction plans were launched by national and international organisations aiming at the quick rehabilitation of the affected areas. Moreover, it became clear that there is a need and urgency for a Tsunami Warning System in the region, and the result is that such a system is being implemented under the coordination of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning System (ICG/IOTWS) in the frame of the IOC-UNESCO.

That event was also a milestone for the world of science, and specialists in tsunamis, together with geophysicists, geologists, coastal engineers, ecologists..., were called to study such a giant transoceanic event that happened to be the largest tsunami observed in the modern instrumental era and the most disastrous, with the number of fatalities much larger than the toll due to the large 1960 Chilean tsunami in the Pacific Ocean.

The chief topic now is – what lesson one can learn from the 26 December tsunami in terms of tsunami propagation and effects in the Indian Ocean, and also in the general experience and knowledge that can be applied to other basins and other coastal countries. This special issue tries to provide a concrete contribution to this topic, by collecting together papers and technical notes that address the specific subject of the recent Sumatra earthquake and tsunami, but also articles treating tsunamis in other parts of the world where historical records testify that tsunami hazard and risk cannot be neglected at all.

This collection starts with a series of three papers devoted to the 26 December 2004 tsunami with special focus on: (1) the resistance of structures and infrastructures to the marine wave and debris impact in Thailand and in Indonesia from an engineering point of view and the perspective to define international standards (Saatcioglu et al.); (2) the wave impact and run-up heights determination along the most affected coastal segments in the Tamil Nadu province, India (Peterson et al.); (3) the numerical simulation of the tsunami generation and propagation and on the seismotectonic setting of the Sumatra region which turns out to be one of the most tsunamigenic zones in the entire world (Puspito and Gunawan).

The following two papers cover items of general relevance from a wider perspective, that is (1) an important aspect related to the efficiency of the Tsunami Warning System, i.e. the description and analysis of methods for a rapid determination of the tsunamigenic source parameters, that can be applied locally as well as in wide ocean basins (Geist), and (2) the study of the tsunami forces acting on coastal structures, which must be the basis for the establishment of international standards and codes for designing tsunami-resistant structures, plants, public and residential buildings (Koutitas and Karambas).

The rest of the papers treat tsunami events outside the Indian Ocean. A very interesting case is the study of the historical 1854 earthquake-induced tsunami in Suruga Bay, Japan, since it transported a very huge and unusual amount of marine sediments on land forming a sand dome that only recent research was able to associate with tsunami currents (Sugawara et al.). The Mediterranean Sea has a long history of tsunami occurrences and, due to its very long civilization, traces or hints of tsunami events have been found that go back to the Santorini volcano explosion in the Minoan times (more than 3500 years ago). An analysis of the most relevant tsunamis that occurred in this region according to the most recent tsunami compilations (Papadopoulos and Fokaefs) and the discussion of scenario examples of large tsunamis, elaborated through numerical modelling (Tinti et al., first paper), show that catastrophic events are expected to take place in this sea too, and to hit the coasts of densely populated countries in Europe, Asia and Africa in a very short time. Evaluation of tsunami hazard and estimate of occurrence probability of tsunami waves at the coast greater than a given threshold are problems of general interest and are at the basis of any policy of tsunami mitigation. A new method based on a hybrid statistical-deterministic

approach is illustrated here with application to the most tsunamigenic region of Italy (Tinti et al., second paper).

Central America is affected by tsunamis both from the Pacific Ocean and from the Caribbean Sea, and has to be prepared for tsunami attacks from both sides. Costa Rica, along with Mexico, is one of the countries with coasts that are watered by both oceans and an interesting paper (Fernández-Arce and Alvarado-Delgado) illustrates how to use the scientific knowledge of the tsunami history to implement educational programmes and tsunami preparedness plans in coastal communities of Costa Rica.

The special issue ends with three short papers or technical notes, two of which are contributions on the Sumatra tsunami: one considers the far-field propagation of the waves that were seen well outside the Indian Ocean and were recorded by gauges placed in all the oceans of the world (Murty et al., first technical note), while the other touches the socio-economic impact of the tsunami on the coastal communities of Tamil Nadu, India (Gokhale). The last technical note addresses the question of the reason why large trans-oceanic tsunamis that were observed in the last century in the Pacific and in the Indian Ocean are much less frequent in the Atlantic (Murty et al., second technical note), and the consideration that this difference is due to specific tectonic features rather than to statistical fluctuations leads to important strategic consequences in the implementation of tsunami warning systems: a central TWS is justified in the Pacific and in the Indian Ocean, but would be less justified in the Atlantic region.

As a final remark, it can be stated that this special issue on tsunamis will provide the reader with papers offering the state-of-the-art on the subject; it shows recent progresses, but it serves also to understand the advancement that are still required in this field, in terms of basic knowledge of tsunami sources and of tsunami propagation and impact, in order to achieve better evaluation means of (and better protection tools against) future large event occurrences.