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The Indian Ocean tsunami of 26^{th} of December 2004: the role of numerical tsunami simulation models

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The December, 26 2004 Indian-Ocean tsunami was a shock for the entire world with its tragic number of casualties, exceeding 220,000 nowadays, of missing people, of homeless, and the wide-spread understanding that a tsunami warning system could have saved so many lives. The tragedy put on the newspapers first page the event tsunami, that was probably only roughly known to most and totally unknown to many.

Numerical modelers of tsunami worked timely to provide tsunami simulations in the early post-disaster days and made their results available on the web to the media, to the general public and to all the operators engaged in the emergency actions. This made clear two main functions of numerical models: 1) they serve as a powerful educational tool to explain what a tsunami is, how it is generated, how it travels across the ocean and propagates over large distances, how large its propagation speed is, why its first arrival can be a flooding wave or a sea water withdrawal; 2) it can provide the rescue teams with the map of the areas where the tsunami energy is expected to be destructively large and damage is most severe. In addition to this tsunami models can be used to answer specific scientific questions that are of paramount importance. What was the source of the tsunami? Can the tsunami source be identified with the seismic source? This is a classical question that has generally found the answer that the sources are reasonably coincident, but there are exceptions in the literature. The present case seems to be one that has to be added to the list of exceptions. For such a big earthquake, plenty of seismic records exist and the seismic source can be determined through the ordinary inversion techniques. Preliminary results seem to provide a fault, placed in the Indian Ocean with rupture length of 400-500 km almost paralleling the northern tip of Sumatra. But this or similar sources are not satisfactory for the observed tsunami effects, that apparently can be reproduced only by invoking sources

displacing the sea bottom also in the region to the north of Sumatra. More research is need to reconcile these conflicting points, and here the role of numerical tsunami simulations is fundamental.