



## The intensity field of tsunamis

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Intensity scales measure the strength of natural events, e.g. wind intensity is measured by Beaufort scale. Seismic intensity was traditionally introduced since mid 19th century as a parameter to estimate the event impact in a particular location. This implies that the event intensity is spatially variable and that only maximum intensity may be a measure of the event size. After the introduction of the earthquake Richter magnitude and later of the seismic moment as physical measures of the earthquake energy and size, but not of the earthquake impact, the seismic intensity still remains as a valuable parameter, e.g. for the production of shake maps, for the estimation of the size of historical earthquakes as well as for the establishment of empirical intensity/ground acceleration relations. A first tsunami intensity scale was introduced by Sieberg (1927), while several attempts were made further to quantify tsunamis with modified or new scales. Some scales, however, are rather magnitude than intensity scales since they do not describe tsunami impact but only physical parameter of the event, e.g. tsunami height. Efforts to quantify tsunami size in terms of physical magnitude scales (Abe, 1979; Murty and Loomis, 1980) found very limited application so far. The most recent and detailed intensity scale proposed is the 12-grade one of Papadopoulos and Imamura (2001) which is of global use particularly after the 2004 Indian Ocean tsunami. We show that tsunami intensity is a highly valuable parameter for a number of reasons. The first is that it provides a basis to quantify modern and historical tsunami events and to perform statistics for risk assessment. Also, tsunami quantification through intensity makes realistic the investigation of relations between tsunami intensity and earthquake size, which may be useful in several applications. On the other hand, inundation maps is a popular and valuable tool which is currently in use for the description of tsunami hazard along coastal segments threatened by tsunamis. Inundation maps describe values of hydrodynamic parameters but they do not include elements of the expected tsunami impact, that is of the tsunami risk. Intensity is by definition a measure of the event impact and, therefore, tsunami intensity maps or other intensity attributes, may provide tools for the description of tsunami risk which is of particular value for disaster managers. To demonstrate the multiple usefulness of tsunami intensity we examined the intensity field of the 2004 big tsunami in the Indian Ocean, and of strong tsunamis in the Mediterranean Sea. In addition, we compiled a catalogue of tsunamis in the Mediterranean Sea occurring from the antiquity up to the present, quantify them in terms of the 12-grade tsunami intensity scale and perform statistics to assess repeat times of tsunami events of certain intensity range with interesting forecasting results. This is a contribution to the EU FP6-research projects TRANSFER, contract n. 037058 and SEHELLARC, contract n. 37004.