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Large magnitude (M > 7.5) offshore earthquakes in 2012: few examples of absent or little tsunamigenesis, with implications for tsunami early warning

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We take into account some examples of offshore earthquakes occurred worldwide in year 2012 that were characterised by a "large" magnitude (Mw equal or larger than 7.5) but which produced no or little tsunami effects. Here, "little" is intended as "lower than expected on the basis of the parent earthquake magnitude". The examples we analyse include three earthquakes occurred along the Pacific coasts of Central America (20 March, Mw=7.8, Mexico; 5 September, Mw=7.6, Costa Rica; 7 November, Mw=7.5, Mexico), the Mw=7.6 and Mw=7.7 earthquakes occurred respectively on 31 August and 28 October offshore Philippines and offshore Alaska, and the two Indian Ocean earthquakes registered on a single day (11 April) and characterised by Mw=8.6 and Mw=8.2. For each event, we try to face the problem related to its tsunamigenic potential from two different perspectives. The first can be considered purely scientific and coincides with the question: why was the ensuing tsunami so weak? The answer can be related partly to the particular tectonic setting in the source area, partly to the particular position of the source with respect to the coastline, and finally to the focal mechanism of the earthquake and to the slip distribution on the ruptured fault. The first two pieces of information are available soon after the earthquake occurrence, while the third requires time periods in the order of tens of minutes. The second perspective is more "operational" and coincides with the tsunami early warning perspective, for which the question is: will the earthquake generate a significant tsunami and if so, where will it strike? The Indian Ocean events of 11 April 2012 are perfect examples of the fact that the information on the earthquake magnitude and position alone may not be sufficient to produce reliable tsunami warnings. We emphasise that it is of utmost importance that the focal mechanism determination is obtained in the future much more quickly than it is at present and that this information must be included in the operational procedures of warning systems. On the other hand, we stress the importance of a correct management of false alarms, which are almost impossible to avoid, both in the crisis and in the pot-crisis phases. These are topics whose solution represents one of the major efforts of the EU-FP7 TRIDEC Project, in the frame of which this study is conducted.