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Analysis of the preliminary results based on the first source solutions for the 29th September 2009 Samoan tsunami: hints for a tsunami early warning system strategy

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The 29 September 2009 Samoan tsunami was triggered by a strong earthquake (Mw=8.1) that occurred at 17:48 UTC offshore south of Samoa Islands. This earthquake represents an example of the so-called "outer-rise" earthquakes, that occur in the subducting plate before it enters in the subduction zone and their fault mechanism is normal instead of thrust as expected inside the subduction zone. The areas most affected were the south coasts of Western and American Samoa, where maximum peak-to-peak height of about 3.5 meters and 1.5 meters were recorded by tide-gauge stations respectively at Pago-Pago (American Samoa) and at Apia (Western Samoa). Almost 200 persons were killed and run-up heights were measured in excess of 5 meters on several locations along the coast. This "anomalous" event is considered here "a posteriori" as a good case to test (and to open a discussion on) the today strategies used to forecast tsunami characteristics in the frame of Tsunami Early Warning Systems. In this work different fault models based on the focal mechanism solution proposed by Harvard CMT and USGS immediately after the 2009 Samoan earthquake are considered and tested by comparing some recorded signals (three offshore DART buoys and the two coastal tide gauges located at Apia and Pago-Pago) to the synthetic signals resulting from the numerical simulations provided by the UBO-TSUFD code, that is developed and maintained by the Tsunami Research Team of Bologna University. The analysis found out that all the considered sources lead to some discrepancies between observed and computed signals, though some of them reproduce some of the records quite well. These results suggest some important considerations on the tsunami forecast methods as well as on the difficulty and need of issuing timely and reliable warning in case of complex hazardous situation, which is a task that may require sophisticated decision-making platforms. This work has been conducted in the frame of the European project DEWS.