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Observing the Indian Ocean tsunami with satellite altimetry

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Purely by chance, the Indian Ocean tsunami was well observed by the altimeters of four different satellites during the first 9 hours after the December 26 Sumatra earthquake. Just at the time the wave front first hit Sri Lanka, Jason-1 and TOPEX/Poseidon travelled across the Bay of Bengal, showing a wave with a 70 cm amplitude travelling south at a depth of about 3 km. About an hour later Envisat observed the same area, showing the progress of the wave front into the southern Indian Ocean and several of the secondary and reflected waves in the northern part of the bay. Although GFO crossed the tsunami affected area only 7 and nearly 9 hours after the earthquake, the tsunami waves can still be seen travelling throughout the region.

Currently, altimeter satellites can not effectively serve as part of an early warning system: coverage of the oceans is too intermittent. Warning systems will continue to rely on models that estimate the propagation speed and amplitude of the tsunami based on the earthquake magnitude and mechanism. However, these altimeter observations serve us well as in-situ data in the deep Indian Ocean, where few other in-situ data are available. With these observations, models of tsunami wave propagation can be improved which will help warn coastal areas of impending tsunamis as well as reduce the chance of false alarms.

In this presentation we show the results of the tsunami model run by the Tsunami Research Program of NOAA/PMEL as well as the altimeter data collected and processed by the Laboratory for Satellite Altimetry of NOAA/NESDIS. We make comparisons both in the spatial and wave number domain in order to illustrate the quality of the model and observations as well as the challenges lying ahead.