



The 19 May 2023 tsunami near the Loyalty Islands captured by the new SWOT satellite

Yannice Faugère¹, Jean Roger², Antoine Delepoulle³, Gerald Dibarboure¹, and Helene Hebert⁴

¹CNES, Earth Observation, Toulouse, France (yannice.faugere@cnes.fr)

²GNS Science

³CLS

⁴CEA

During the last decades, trans-oceanic tsunamis have been captured by satellite altimeters on several occasions. The largest event ever measured by an altimeter was the 2004 Indian Ocean tsunami, captured by Jason-1, Topex/Poseidon, GFO and Envisat altimetry missions flying at that time

The new altimetry mission SWOT (Surface Water and Ocean Topography) developed by NASA and CNES, the US and French Space agency respectively, was launched in December 2022. SWOT embarks a novel instrument, a Ka-band Radar INterferometer (KaRIN), providing a 120 km wide swath Sea Level. On 19 May 2023, SWOT was able to measure the tsunami generated by the Mw 7.7 earthquake which occurred southeast of the Loyalty Islands (southwest Pacific Ocean) at 02:57:03 (UTC). SWOT flew over the region about 1 hour after the earthquake and captured the tsunami signature in several locations. For the first time, a 2D mapview image of the height of tsunami wavetrain was measured by a satellite.

The tsunami generation and propagation have been simulated using COMCOT model, using source parameters derived from seismic observations and empirical laws. Preliminary simulation results show that a simple fault plane with uniform coseismic slip allows to reproduce the regional coastal gauge and oceanic DART station records with a relatively good level of confidence, considering that the earthquake rupture was strongly not-double couple according to USGS. An array of virtual gauges was designed to cover the satellite pathway, allowing to extract the dynamic representation of the tsunami wavefield corresponding to the satellite propagation time (i.e., the sea surface deformation is observed over a period of time of several minutes, instead of being static at a given time). Comparison between the SWOT sea surface measurement and the simulation result is satisfactory, showing a good agreement between the location of the first wave peaks (propagating toward the southwest and the northeast, respectively), their amplitude and phase.

The objective of this study is first to present this unprecedented observation, and to analyze the level of consistency with simulations.