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GNSS low-cost prototype on ship for caching tsunami wave propagation

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Ship navigation data records are proposed to be complementary information for monitoring offshore tsunami currents following great earthquakes. Offshore GPS measurements on the research vessel Kilo Moana of the University of Hawaii following the 2010 Mw 8.8 Maule earthquake have illustrated the potential of GPS kinematic positioning solutions, together with a filtering approach, for detecting the ship's vertical displacement promoted by the tsunami travel velocity. However, kinematic positioning of GPS observations on ships is challenging due to the load, ship speed, and wavefield changes on the open ocean that might produce fast changes in the ship's drift and vertical motion. Wavefield could also introduce additional noise frequencies to the GPS positioning, thus decreasing its precision. Herein, we present a dual-frequency Global Satellite Navigation System (GNSS) low-cost prototype based on the Septentrio Mosaic-X5 card and a low-cost AS-ANT2BCAL antenna. Such a low-cost GNSS station has been installed on a non-commercial ship fleet in order to assess the precision and noise content of offshore GNSS positioning and ionosphere Total Electron Content measurements. We discuss our preliminary results by comparing the precision of the multi-GNSS solution (GPS, GLONASS, Galileo) relative to the one from only the GPS solution using both long-baselines and Precise Point Positioning approaches in post-processing mode. In the second step, we simulate a real-time multi-GNSS positioning solution to evaluate their ability to catch wavefield changes. We finally discuss the detectability of tsunamis with the newly developed GNSS low-cost prototype under various conditions.