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# The South Sandwich circum-Antarctic tsunami of August 12, 2021: widespread propagation using oceanic ridges

Jean Roger[1], **Helene Hebert**[2], Anthony Jamelot[3], Aditya Gusman[1], William Power[1], and Judith Hubbard[4]

[1]GNS Science, Tsunami team, Lower Hutt, New Zealand (jeanrog@hotmail.fr)
[2]Laboratoire de Détection et Géophysique, CEA/DAM/DIF/DASE/SLDG, Bruyères-le-Châtel, FRANCE
[3]Laboratoire de Géophysique de Pamatai, CEA/DASE, Centre Polynésien de Prévention des Tsunamis, Papeete, TAHITI
[4]Earth Observatory of Singapore, SINGAPORE

On the 12th of August 2021 at 18:32:54 and 18:35:20 (UTC) a doublet of reverse faulting earthquakes of magnitude $M_w$ 7.5 and 8.1 were recorded by seismic observatories. These earthquakes were located on the South Sandwich Islands (UK) subduction zone, in the south Atlantic Ocean at 25.032°W/57.567°S and 25.327°W/58.451°S respectively (USGS locations). Initially, their temporal proximity (2'26") made clear distinction of the two events impossible and a tsunami warning was issued by the PTWC after the first earthquake only. In fact, a tsunami was clearly recorded ~800 km north-westward of the epicentre on nearby King Edward Point coastal gauge (South Georgia Island, UK) ~1.5 hours after the shaking, showing a maximum amplitude of ~74 cm. While tsunami waves were recorded by neighbouring gauges located in the south Atlantic Ocean and the south-west Indian Ocean, numerical simulations of wave propagation show that this tsunami appears likely to have reached far-field regions not only in the Atlantic Ocean, but also in the Indian and Pacific Oceans using oceanic ridges like the Mid-Atlantic and Atlantic-Indian ridges as waveguides. Analysis of 33 records from gauges located within the maximum amplitude lobes of the simulated tsunami validates the modelling and the nearly worldwide spread of this tsunami. Further tsunami simulations using high-resolution nested grids to refine the bathymetry around the gauges (e.g. La Réunion Island, Cocos, Hillary Harbour) are used to constrain the source model via tsunami waveform inversion, comparing the calculated results and the real records. Consequently, we highlight that this tsunami reached many places including the Canary Islands, Cape Verde and the Azores in the northern Atlantic Ocean, and French Polynesia, New Zealand, Hawaii and as far as the Aleutian Islands in the Pacific Ocean, making this subduction zone a source for further consideration in tsunami hazard assessments of these distant regions, especially in the case of a more energetic rupture. Although the largest known event in the instrumental period is the 27 June 1929 $M_{PAS}$ 8.3 earthquake, geological knowledge of the region suggests that this ~1000 km long convergence zone between the South American and the South Sandwich plates with a convergence rate of 69-78 mm $yr^{-1}$, is potentially able to produce a $M_w$ 9.0 earthquake. This is supported by recent studies showing that the sediment thickness of 2-3 km at the trench and the ~150 km wide subduction interface shallow dipping (< 20° in the forearc part) are positive factors for generation of earthquakes $M_w$ > 8.5. Results of simulation of $M_w$ 9.0+

scenarios rupturing most of the subduction zone are discussed as well as the particular role of the oceanic ridges in the tsunami propagation. Our research aims to improve understanding of tsunami hazard posed by this subduction zone, especially for southern hemisphere coastlines.