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Seismogenic structure of the subduction zone of the San Cristobal Trench

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Situated along the southern margin of the Pacific Ocean, the Solomon Islands witness the underthrusting of the Australian Plate beneath the Pacific Plate at a rate of around ~100 mm/yr in the N70E direction. Over the past fifteen years, the Western Solomon Islands megathrust has been the epicenter of two significant subduction earthquakes: the Mw 8.1 earthquake in 2007 and the Mw 7.1 earthquake in 2010. To understand the distribution of asperities on the megathrust, we initiated the first continuous GNSS network since 2009. Preliminary results from data collected between 2011 and 2014 indicate a coupling ratio reaching up to 73% around Ranongga Island, gradually decreasing afterward. However, the spatial resolution of this preliminary finding is limited due to the sparse distribution of GNSS stations. Since 2016, freely accessible Synthetic Aperture Radar (SAR) images from Sentinel-1 have provided additional geodetic constraints for the Western Solomon Islands. Despite the considerable challenge of phase unwrapping due to phase discontinuity across islands, we have successfully utilized GNSS observations to resolve ambiguity. Displacement time-series generated through both Small Baseline Subset (SBAS) and Persistent Scatterer Interferometric SAR (PSInSAR) approaches reveal anomalous displacement between stations MUDA and EAGN. Augmenting the new InSAR Line of Sight (LOS) velocities, we present a comprehensive overview of spatiotemporal variations in locking/creeping behaviors on the megathrust.

Keywords: San Cristobal Trench, subduction zone, GPS, SAR, Sentinel-1, fault behavior