Estimation of the fault model of the 2016 earthquake in central Australia and the implication of the low dip angle

*Kanami Sakamoto[1], Yo Fukushima[2]

1. Graduate School of Science, Tohoku University, 2. International Research Institute of Disaster Science, Tohoku University

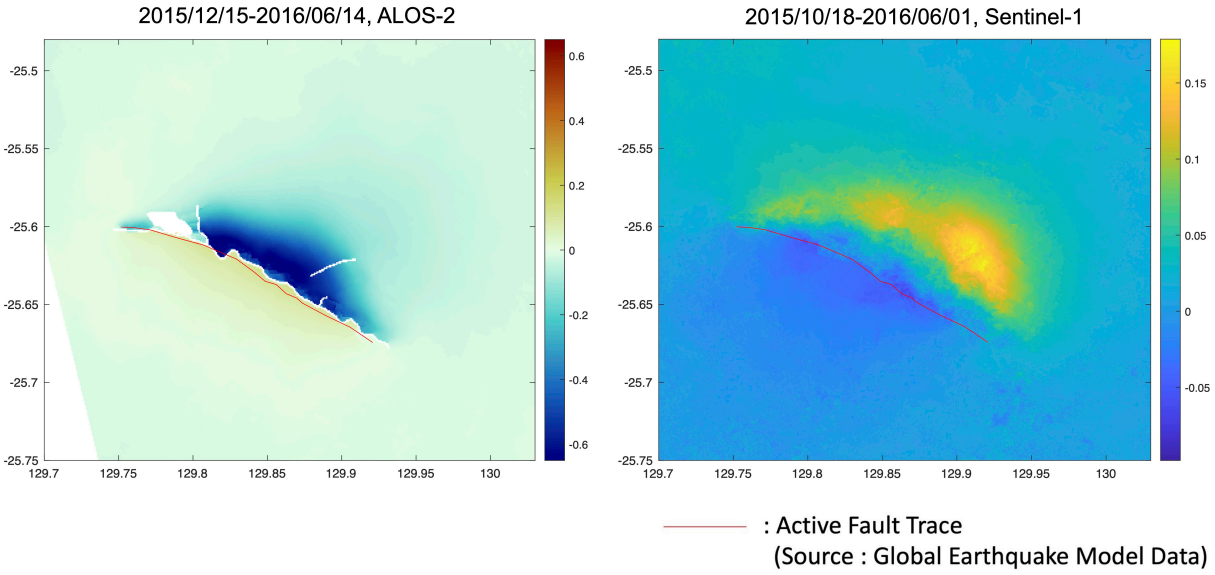
Our understanding of the fault structure and kinematics responsible for intraplate earthquakes in central Australia is poor partly because of the lack of seismicity (Polcari et al., 2018). We reported our initial results of a fault slip inversion of the central Australia earthquake along the Petermann ranges (Mw 6.0) using ALOS-2 SAR interferometry (Sakamoto and Fukushima, 2021, JpGU). In this study, we reanalyzed the fault slip by additionally using the Sentinel-1 data. We used ALOS-2 data with observation dates of 15 December 2015 and 14 June 2016 (ascending orbit) and Sentinel-1 data of 18 October 2015 and 1 June 2016 (descending orbit). We set the fault dip and rake angles and the smoothing weights as nonlinear parameters, which were solved using the Particle Swarm Optimization (PSO) (Kennedy and Eberhart, 1995), jointly with a non-negative least squares method for solving for the slip distribution (Fukushima et al., 2013).

In the InSAR analyses, dominant LOS shortening patterns were obtained, consistent with a reverse faulting, were obtained along a known active fault trace (figures). We also confirmed that the unwrapping results of Polcari et al. (2018) can be problematic in the area nearest to the fault, requiring a re-analysis.

The estimated fault dip and rake angles were ~17 and ~66 degrees, respectively, which are significantly different from the values obtained by the previous study (39 and 49 degrees for the dip and rake angles). Notably, the estimated dip angle is significantly shallower than typical values of reverse faulting (30 to 50 degrees), suggesting a special condition such as extremely weak fault. The causative fault of the 2016 earthquake is in a conjugate geometry in relation with a larger structure of the Woodroffe thrust, whose dip angle has been estimated to be less than or equal to 6 degrees (Wex et al., 2017). Our results provide tectonic constraints of the region.

Keywords: InSAR, ALOS-2/PALSAR-2, Sentinel-1, Fault slip distribution, low-angle reverse fault

LOS Displacements in meters
Coseismic + Early Postseismic



: Active Fault Trace
(Source : Global Earthquake Model Data)