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Hydrothermal alternation and geothermal gradient control the creeping behavior of the Philippine fault on the Leyte segment

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The Philippine Fault is a 1,200 km long sinistral fault that is resultant from the partitioning of the oblique convergence between the Philippine Sea Plate and Eurasia Plate. Aseismic creep along the Philippine fault on Leyte island has been inferred from campaign GPS analysis. However, a Mw 6.5 earthquake event occurred on 6 July 2017 and ruptured the creeping segment on the Leyte near the Tongonan geothermal field, which is a crucial topic to characterize the along-strike and down-dip spatial distribution of seismic and aseismic creeping segments. In this study, we use Small Baseline Subset (SBAS) time series analysis approach to estimate the interseismic slip rate across the Philippine fault on Leyte island with 2007-2011 ALOS-1 PALSAR ascending and descending data. The LOS mean velocity field clearly shows discontinuity across the fault, which is evidence for shallow fault creeping. The discontinuity of LOS velocity across the fault at the northernmost and the middle part of Leyte is about 10 mm/yr based on ascending data. However, this phenomenon does not happen in the southern part of Leyte Island, this might indicate that the creeping phenomenon varies along the fault. Thus we try to figure out the along-strike variation of creeping behavior with integration of geodetic data, geothermal structures based on the magnetotelluric resistivity survey, relocated background seismicity to characterize what is the main geological factor controlling this phenomenon. In order to know the locking depth and slip deficit rate diverting along the Leyte segment, we try to do the inversion by both ascending and descending InSAR data with geodetic data, which help to better understand the seismogenic characteristics and seismic potential of this area.