Distribution of Seismic and Aseismic Slip on the Longitudinal Valley Fault

Abstract

The Longitudinal Valley Fault (LVF) runs parallel to the east coast of Taiwan and accommodates about one third of the 875 km interplate displacement estimated for the 1906 San Francisco earthquake. Due to the elongated component of the LVF, the fault blocks are assumed in the Coulomb change. Deformation of topographic features shows that aseismic creep occurs for a significant fraction of fault slip. The LVF is the site of a large earthquake, the 1895 Kwantung Earthquake. The LVF is a series of high-displacement segments separated by low-displacement segments. Aseismic slip occurs on the LVF at the rate of 1 mm per year. Slip events are observed in the LVF during the 1906 San Francisco earthquake and the 1999 Chi-Chi earthquake. The LVF is a large-scale aseismic zone.

Mw 6.8 2003 Chengkung Earthquake

Modified displacement at depth for the coseismic and postseismic history following the 2003 earthquake. Result are obtained using GPS and strain data.

Interseismic displacement from GPS (horizontal component)

(a) Tectonic snapshot of Taiwan
(modified from Dyer et al., 2005)
(b) Horizontal velocity field
(c) Dislocation Model (Okada, 1985)

Displacement model using an elastic half-space (first-slip approximation) for the coseismic slip has been estimated (Okada, 1985). Two half-spaces have been considered: an upper plate with a thickness of 25 km, and a lower plate with a thickness of 5 km.

Postseismic I
Postseismic II

Seasonal variations of creep

After removing the long-term velocity increment and the postseismic creep, the remaining creep still remains in the geodesic data of some GPS stations and at the creepmeter, and it is strongly linked to the seasons.

Slip History at depth

(a) Cumulative slip for 4 periods
(b) Data fitting

Legend

Coseismic
Postseismic
GPS
Strain

c) Detailed slip history for 4 patches

Patch 1: The fault is in a stress shadow and the aseismic slip is negligible.
Patch 2: The fault is in a stress shadow and the aseismic slip is negligible.
Patch 3: The fault is in a stress shadow and the aseismic slip is negligible.
Patch 4: The fault is in a stress shadow and the aseismic slip is negligible.

Postseismic I
Postseismic II

Legend

Coseismic
Postseismic
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Strain

Calibration results for all measurements

Cumulative slip for 4 periods

Data fitting

Figure showing how well the model fits the data for each set of data on the left side of Figure 1 (Mw 6.2 2003 Chengkung earthquake)