Estimation of Slip Rate of the Beichuan Fault by Two Dimensional Viscoelastic Modeling and Lithospheric Block Modeling Using GPS Data and Geologic Uplift Rates Following 2008 Wenchuan Earthquake

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The Tibetan plateau is the highest and the largest plateau in the world and is bounded by the Kunlun-Altyn Tagh-Nan Shan mountains in the north, the Karakoram mountains in the west and the Himalayas in the south. In the east it is bounded by the Longmen Shan mountain which separates it from the Sichuan basin. This region, marking eastern margin of the Tibetan plateau, experienced an earthquake of magnitude 7.9 on May 12, 2008 along the Beichuan fault. We modeled the interseismic slip rates along this fault from GPS data as well as the vertical uplift rates from geologic data using a two-dimensional viscoelastic modeling as well as by lithospheric block modeling. In two dimensional model, it was assumed that an elastic layer, representing the lithosphere, is lying over a viscoelastic halfspace representing the asthenosphere. The best-fit model data is obtained for an elastic thickness of 40-60 km and a fault dip of 500 with T/Tr = 4 where T is the recurrence interval and Tr is the characteristic relaxation time of the asthenosphere. From the modeled data we can conclude that the dip slip component is 5-12 mm/year, strike slip component is 2-8 mm/year and the total slip rate is 5.5 -15 mm/ year. In the elastic block modeling it was assumed that the fault bounded lithospheric blocks behave as undeformed tectonic segments over large time period. Model results show that the mean dip slip component is approximately 5 -7 mm/year and mean strike slip component is 2-4 mm/year. These model estimates of slip rates are significantly higher than proposed by previous works which indicates that the earthquake potential of the Beichuan fault is much higher than previously suggested.