Geophysical Research Abstracts
Vol. 13, EGU2011-13843, 2011
EGU General Assembly 2011

GPS Networks Bringing Interior Western U. S. Deformation into Focus

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Active Basin and Range (BR) extension produces spectacular fault-generated topography spread over ∼800 km in the interior western US. However, present-day deformation rates are relatively low east of the San Andreas fault system and Cascadia subduction zone and ± 1 mm/yr precision in GPS velocity is needed to pinpoint the major faults that accommodate extension. Campaign and continuous GPS data are now capable of providing this precision with sufficient station density to define where present-day motions are being accommodated.

The great majority of geologically young faults appear to slip at rates less than 1 mm/yr but rates are measurably higher near the western and eastern edges of the BR. There is a marked transition in NE California from strike-slip faulting at rates of ∼ 4 mm/yr across the northern Walker Lane zone to pure extension north of about Mt. Lassen. This distinct boundary is apparently related to the prevalence of strike-slip tractions on the San Andreas plate boundary south of the Mendocino triple junction (MTJ) to tensile stresses caused by Cascadia slab retreat north of the MTJ. A horizontal extension rate of 3 mm/yr is observed across the north-striking Hat Creek and related normal faults immediately north of Lassen, but this extension decreases to no more than 1 mm/yr in the Klamath Basin, about 150 km to the north. Extension rates could be as high as ∼1 mm/yr across the Surprise Valley fault (near the California-Nevada border) and the Steens Mountain-Pueblo Mountains fault (SE Oregon). But elsewhere in Oregon, Idaho and Montana, extension rates are < 1 mm/yr and only on the eastern edge of the BR, across the Wasatch and related faults in central Utah do rates reach 3 mm/yr.