

EARTHSCOPE SEMINAR

PAPER SUMMARY

MARCH 19, 2007

PRESENTER: JOHN D. WEST

PAPER TITLE: ROTATION AND PLATE LOCKING AT THE SOUTHERN CASCADIA SUBDUCTION ZONE

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Overview

The authors of this paper use a simultaneous inversion of GPS and tilt meter data to model the rotation of western Oregon relative to continental North America and the plate locking of the southern Cascadia subduction thrust fault. They find that western Oregon and southwestern Washington are rotating clockwise around a pole located on the Olympic-Wallowa lineament (OWL) near the Washington/Oregon border, and that plate locking occurs offshore and increases to the north.

Data

- horizontal vectors from 50 GPS sites in northwest Oregon
- 21 published vectors from southern Oregon
- 4 tilt rates from sites near the Oregon coast
- total of 146 observations (4 tilt plus 2 components for each GPS site)

Methods

- adjust GPS data to North America reference frame
- simultaneously invert for plate locking and rotation
- inversion nodes every 10 km depth and 100 km strike along fault
- solve for minimum misfit

Results

- relatively low misfit for rotation without plate locking; most of the data can be explained by the rotation of western Oregon
- rotation clockwise about a pole along the OWL near the Oregon/Washington border
- double locking zone, offshore shallow and inshore at 30-40 km fault depth
- locking increases to the north

Implications

- block boundary is along the OWL
- Oregon rotation is driven by Basin and Range extension rather than Juan de Fuca plate subduction or Sierra-block movement.
- authors discount the inshore locking zone as an artifact of the model
- moment analysis of plate locking does not match historic earthquake record

Additional Thoughts

- Why doesn't moment analysis match earthquake record/predictions?
- If Basin and Range extension drives western Oregon rotation, what drives Basin and Range extension?