Rotation and plate locking at the southern Cascadia subduction zone


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Motivation:
Pacific Northwest Tectonics

Adapted from Wang et al., 2003
Data: GPS and tilt

Observed and calculated Oregon GPS velocities.

Ellipses show measurement uncertainty ($3\sigma$)

McCaffrey et al. 2000
Method

Simultaneous inversion for Oregon Block rotation and plate locking along the Juan de Fuca subduction zone
Results: Rotation

Clockwise rotation with pole on OWL (Olympic-Wallowa Lineament) near Oregon-Washington border

McCaffrey et al. 2000
2003 Wang et al. also showed block rotation for western Oregon, and found a rotation pole (OC-NA) very close to the one found by McCaffrey (M).
Results: Plate Locking

- Two bands of locking: off-shore and in-shore
- Locking increases to the north
- Authors think in-shore locking band may be artifact of model

McCaffrey et al. 2000
Implications/Conclusions

- Block boundary is along the OWL
- Rotation of Oregon block is primarily due to Basin and Range Extension rather than western edge forces
- Moment analysis of plate locking does not match well with historic or predicted earthquakes
Additional Thoughts

- Why doesn’t the moment analysis match the geologic earthquake record?
- If rotation is being driven by Basin and Range extension, what is driving Basin and Range extension?
- How significant are further constraints on tilt? More data = better model?
Locked Zone

Figure from Wang et al.

Wang et al. 2003