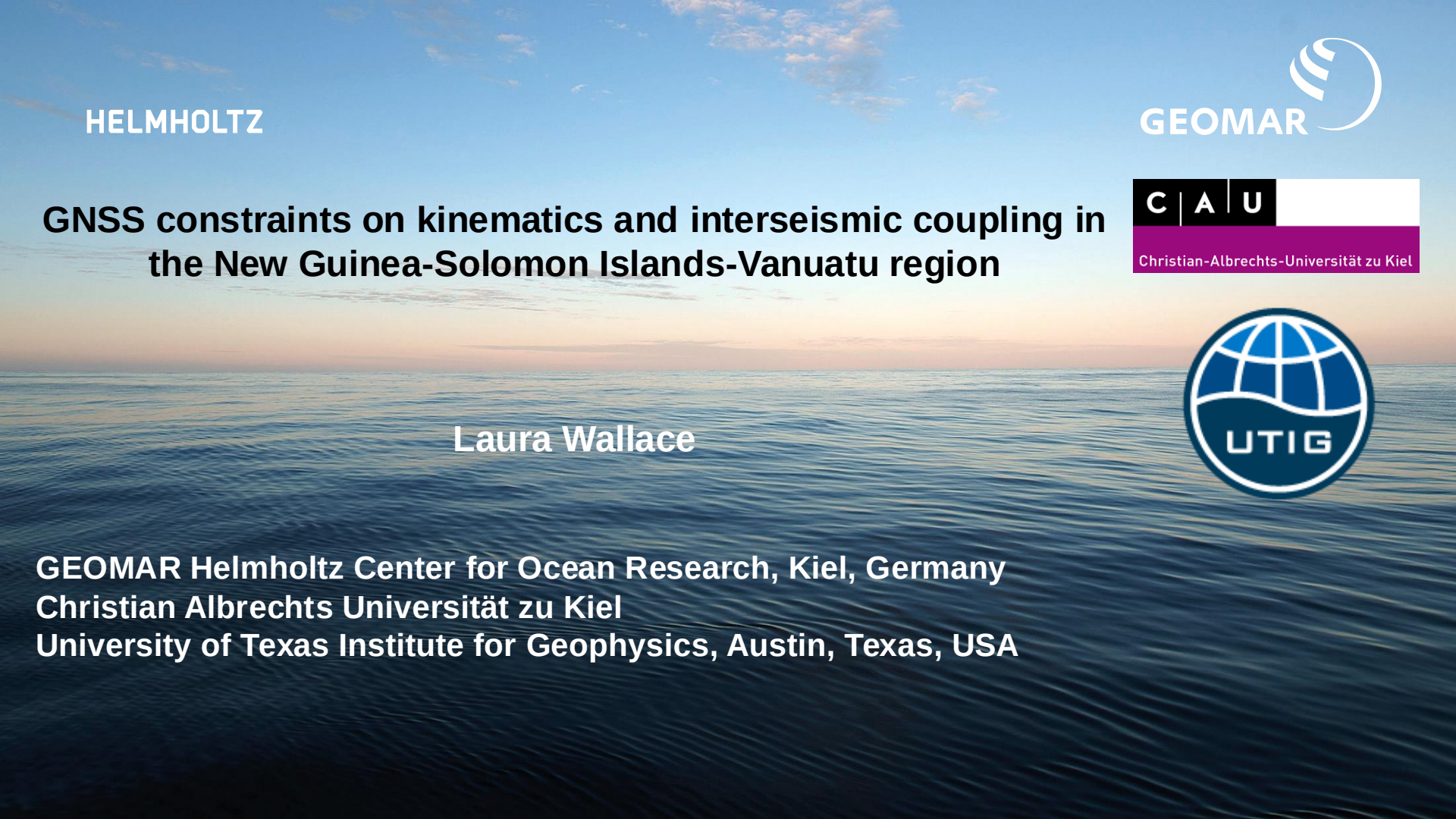

GNSS constraints on kinematics and interseismic coupling in the New Guinea-Solomon Islands-Vanuatu region

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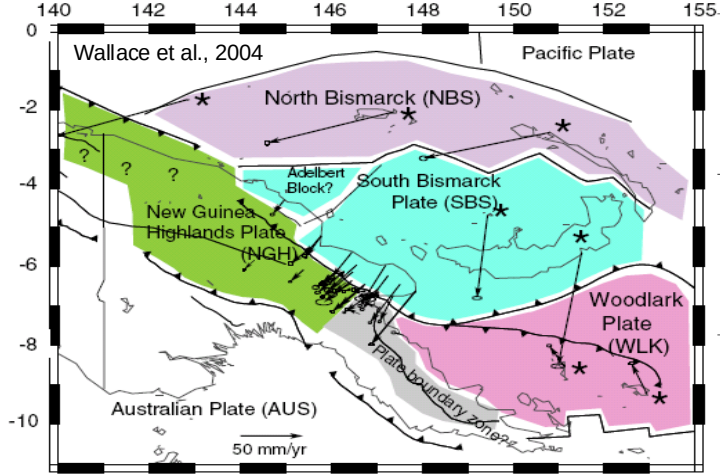
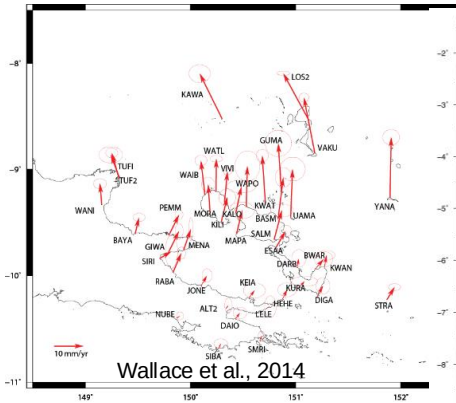
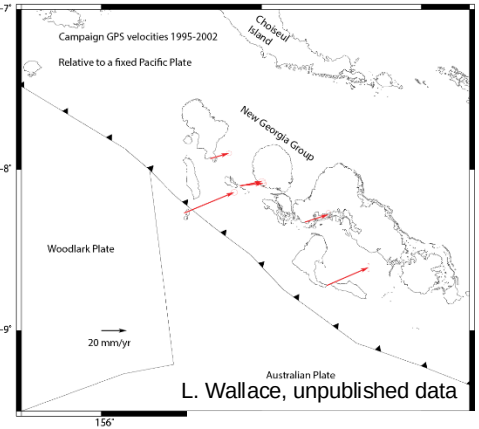
Geodetic constraints in the region: mostly campaign GNSS

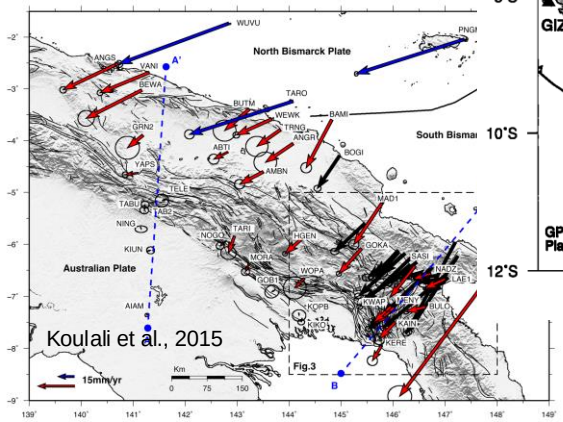
PNG

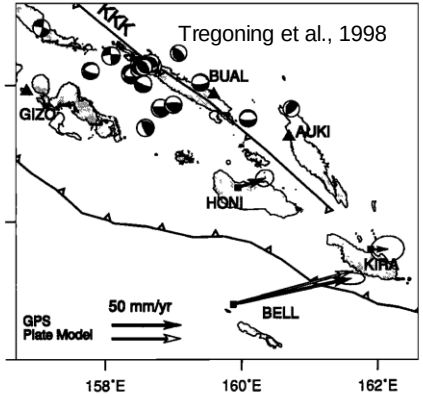




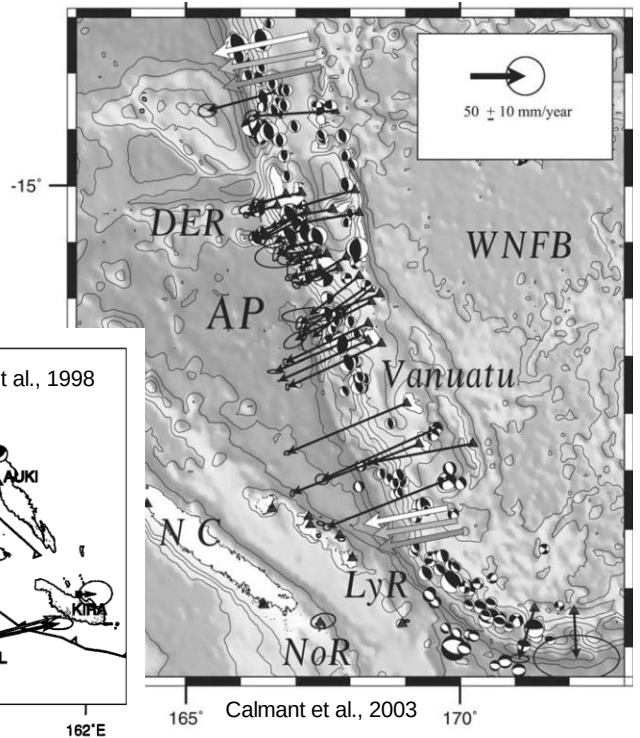
Solomon Islands



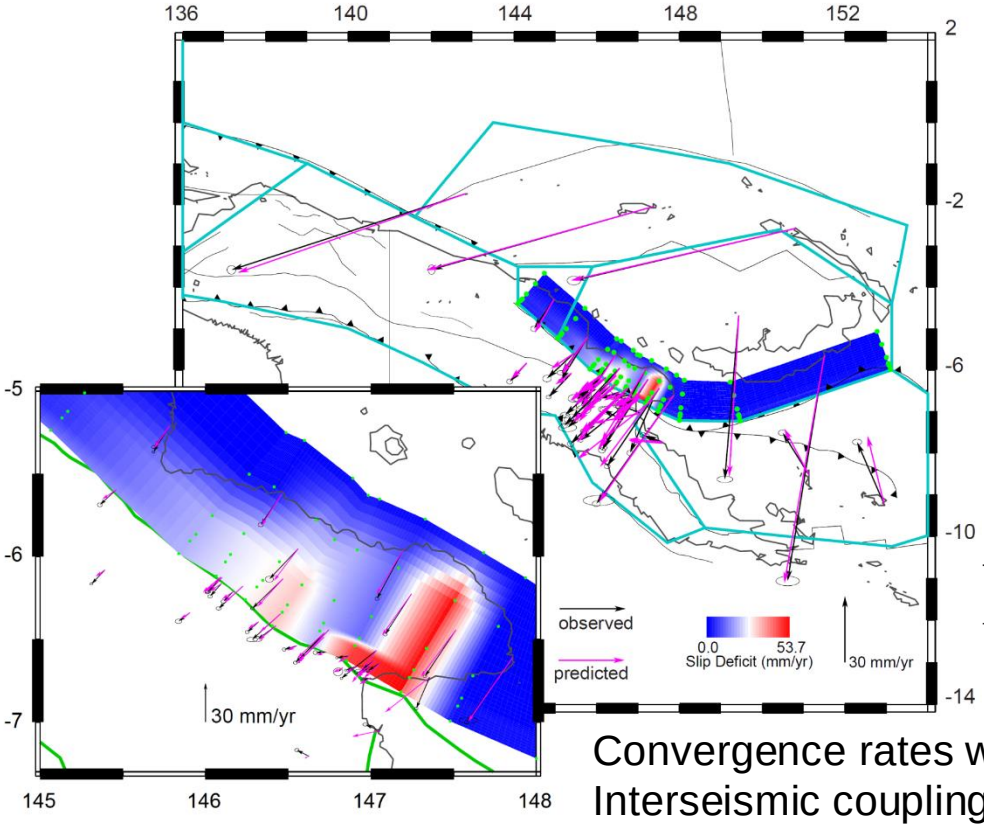


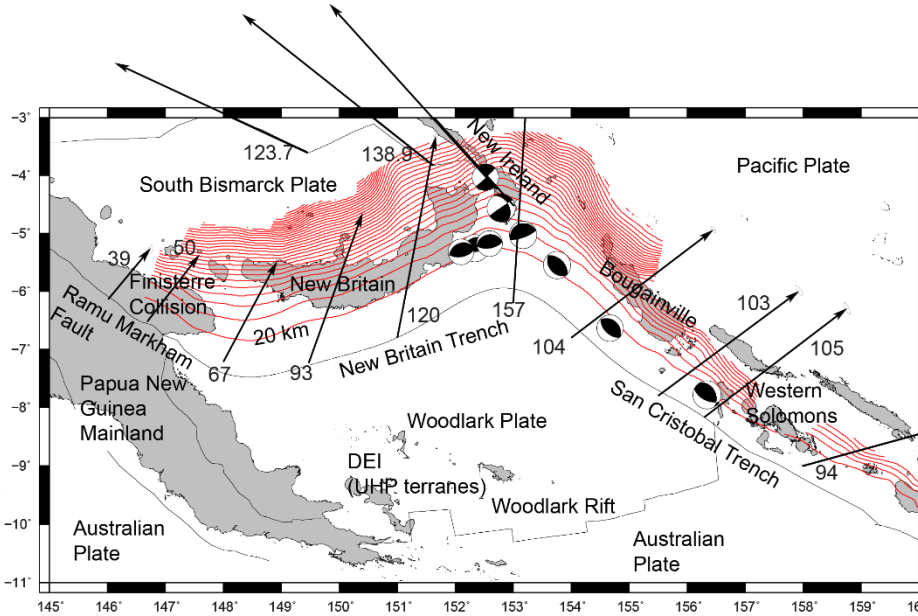


Vanuatu



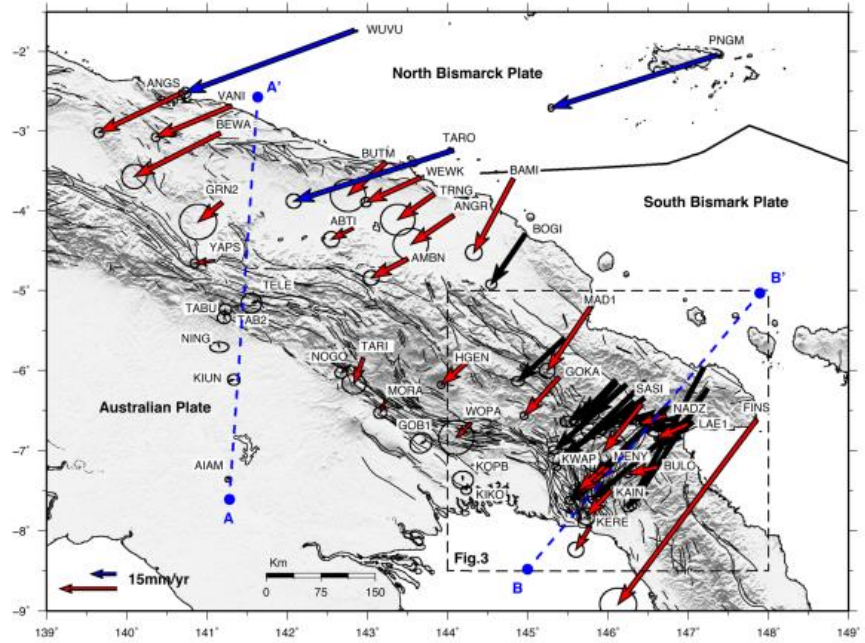
New Britain Trench and Ramu-Markham Fault

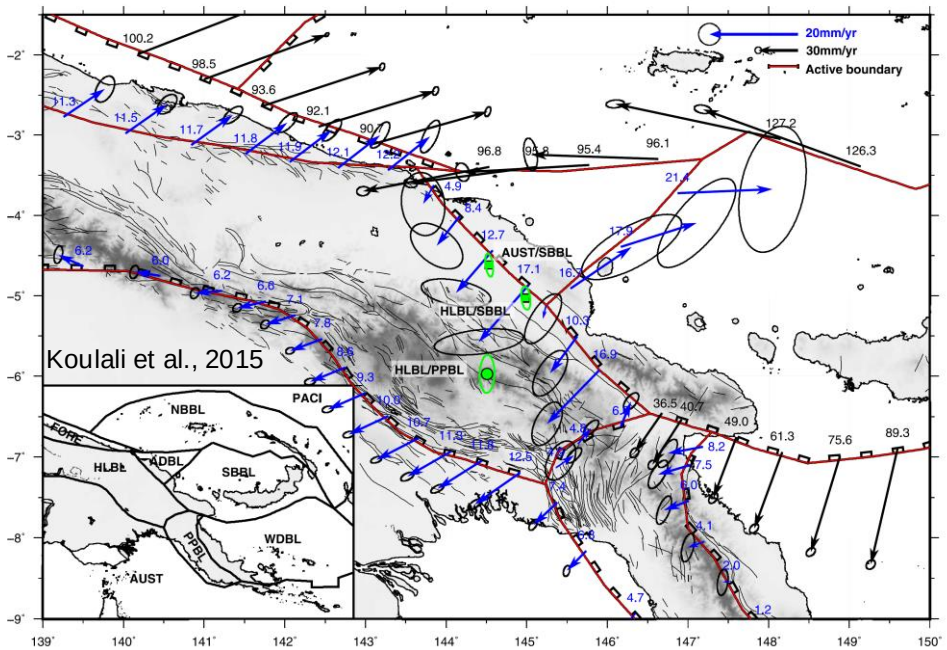




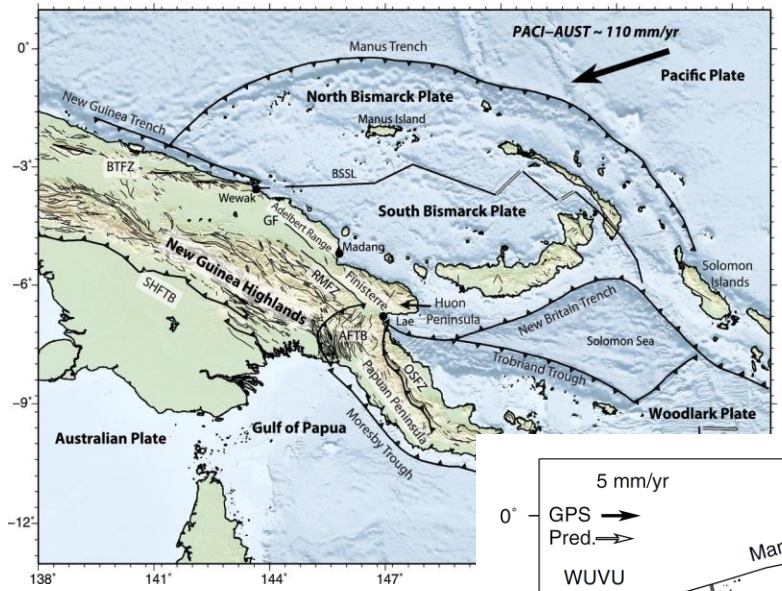
Convergence rates well-constrained by GNSS measurements. Interseismic coupling estimated for Ramu-Markham Fault, but data insufficient to estimate degree of coupling on New Britain Trench

Convergence on New Guinea Trench is highly oblique, and ~9-10 cm/yr

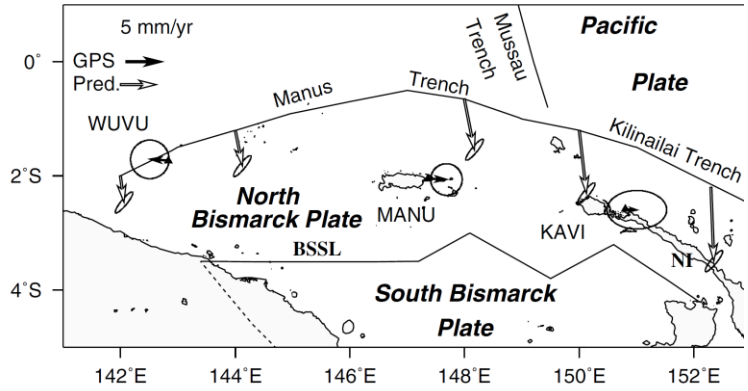


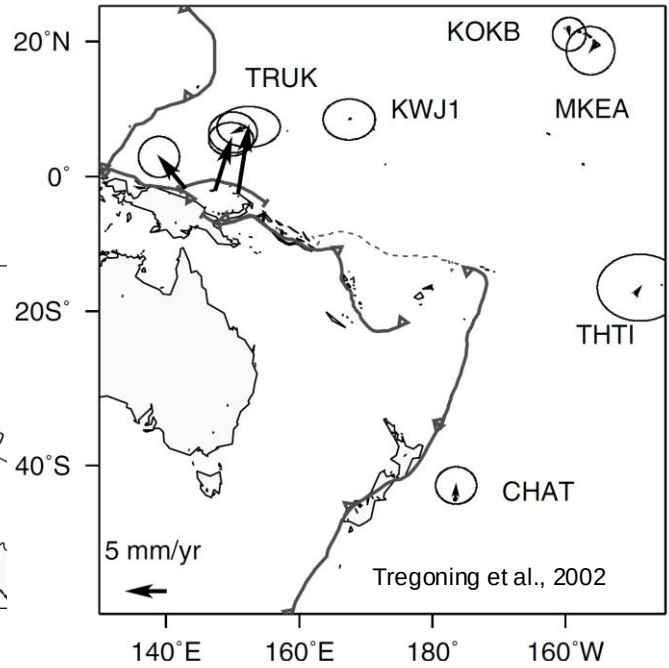


The Manus Trench



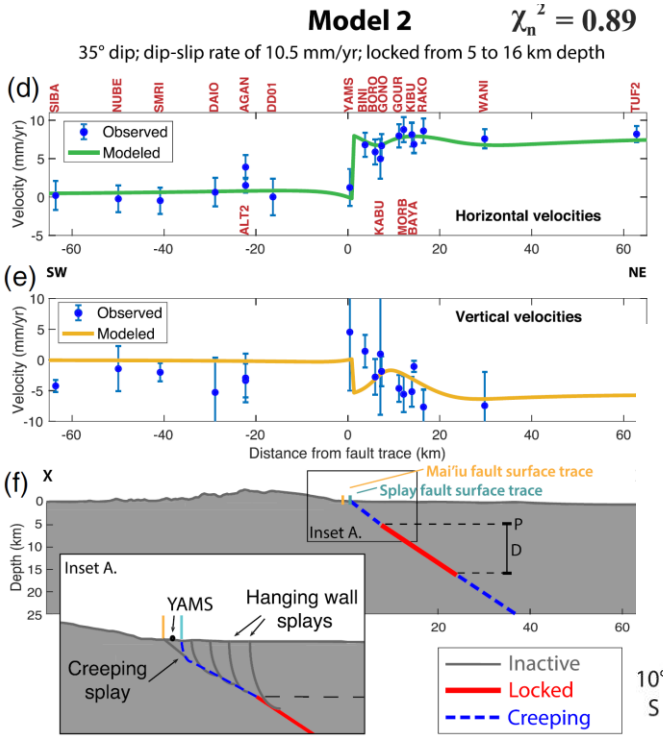
North Bismarck Plate mostly moving with Pacific Plate motion. GNSS measurements of sites in North Bismarck Plate suggest 7-10 mm/yr of convergence on the Manus Trench



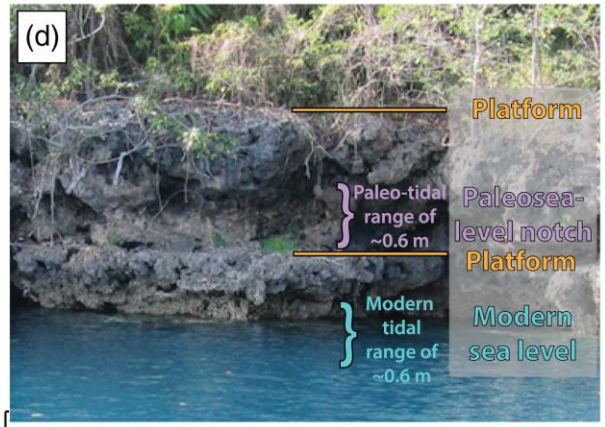


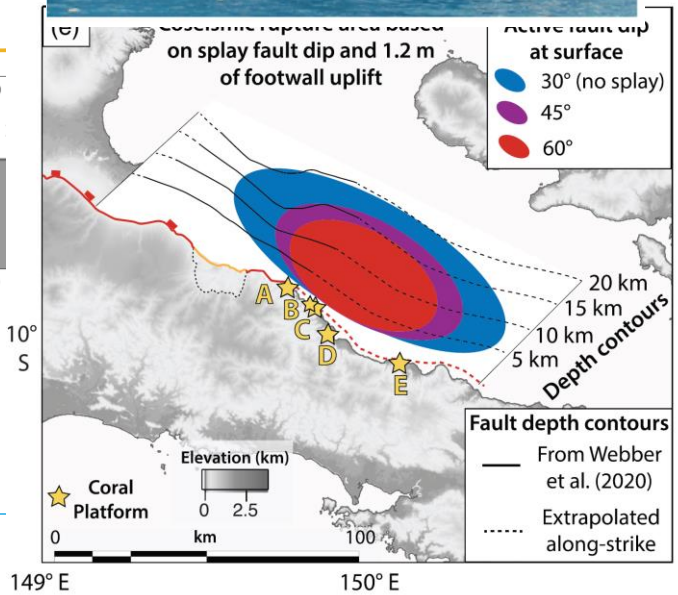
Tregoning et al., 2002

Low-angle normal faults in Woodlark Basin as a potential tsunami source for southeast PNG



Biemiller et al., 2020 (JGR, GRL)

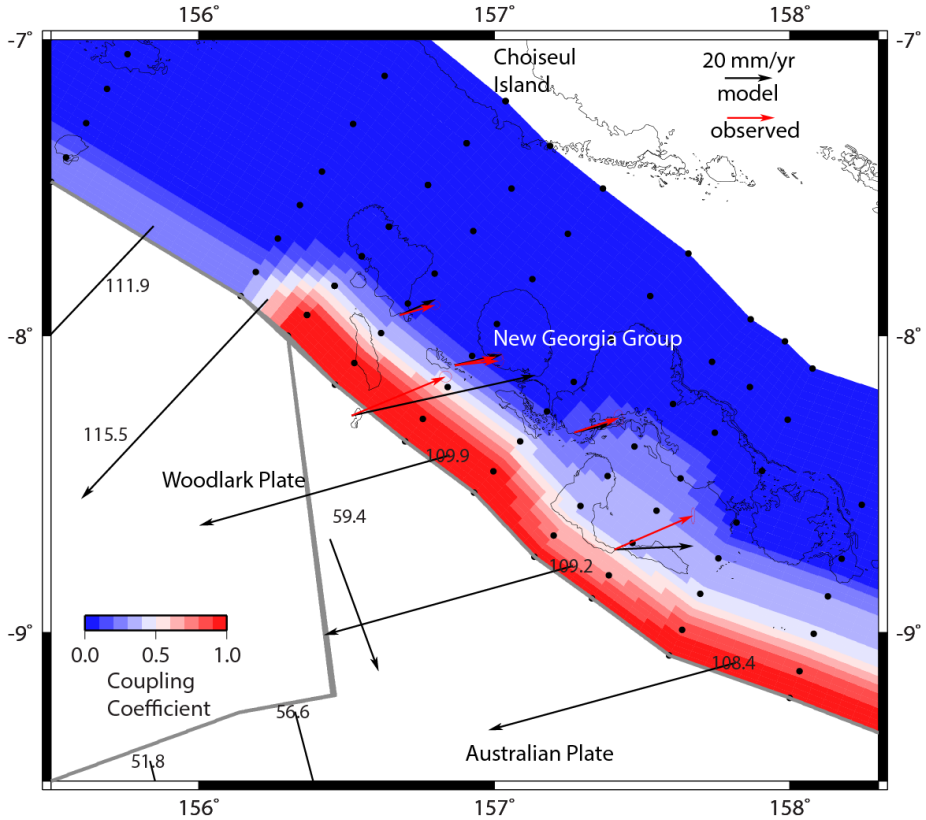




Campaign GNSS data suggests locking of low-angle normal fault in SE PNG. Nearby corals in footwall show abrupt coseismic uplift events

Rupture of these faults could generate tsunami

Elastic block model for western Solomons region



L. Wallace, unpublished data

GNSS in western Solomons and southeast PNG, earthquake slip vectors, transform fault orientations.

Coupling down to 10-20 km

Shallow down-dip limit to coupling and consistent with the fact that very young (<5 Ma) oceanic crust is subducting here

Best fitting rotation poles suggest ~ 1 cm of shortening between the Solomons and the Pacific Plate (e.g., North Solomons Trench), although not well-constrained

Coseismic slip in the 2007 M8.1 earthquake and interseismic coupling prior to the earthquake

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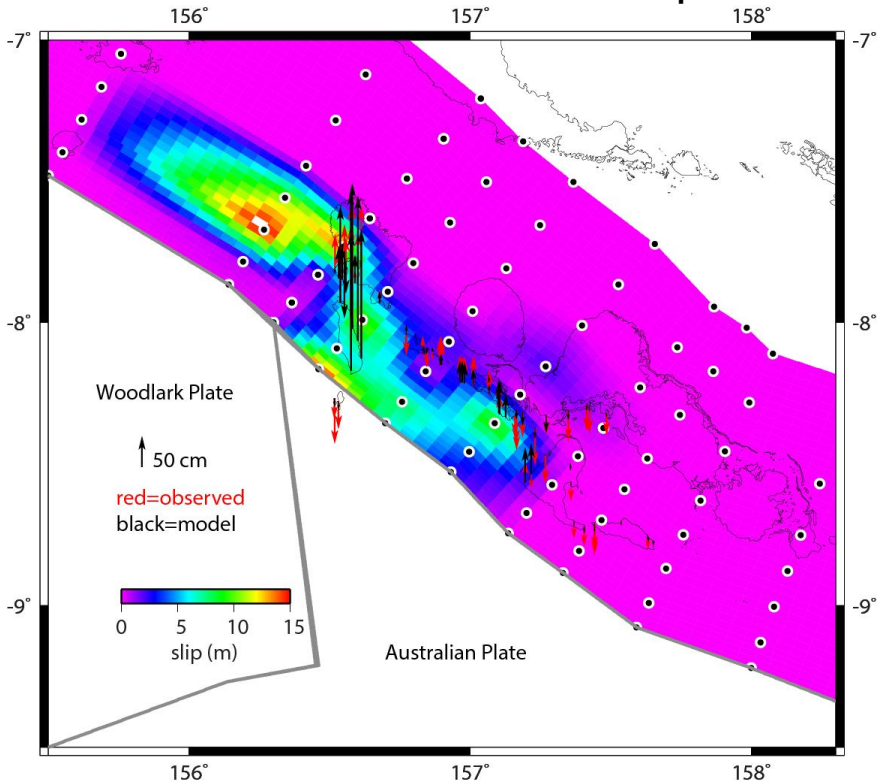

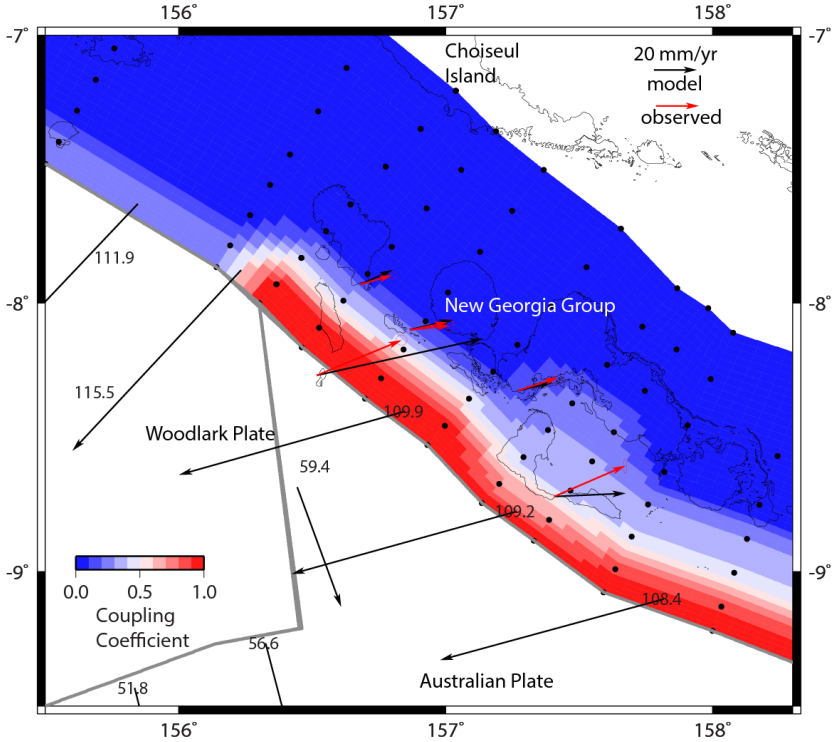

Coseismic slip based on horizontal GNSS displacements and vertical coral displacements

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Comparison with previous slip inversions for the 2007 earthquake

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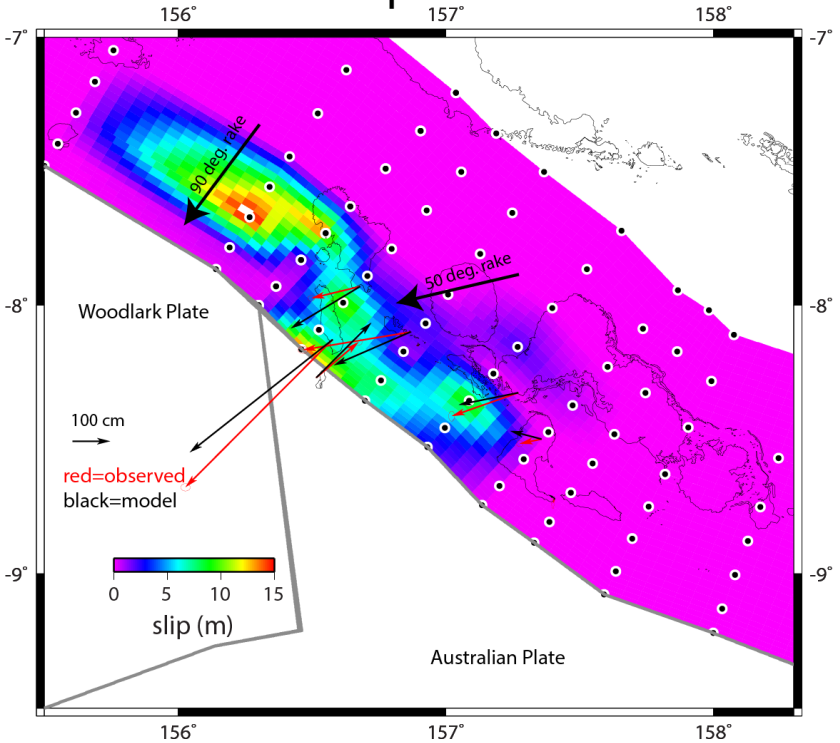
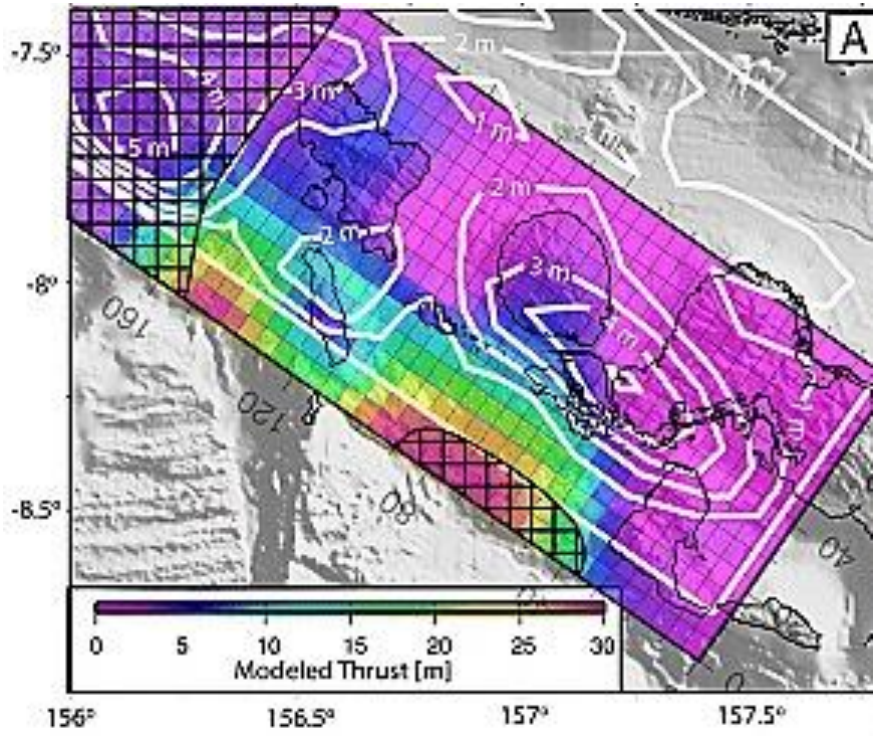
Our inversions from GPS *and* corals require mostly near trench slip (<5-10 km deep) with a maximum slip of 10-15 m





Colored squares (Chen et al., 2009, corals only)
White contours (Furlong et al., 2008, seismology)

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Elastic block model for Vanuatu region constrained by GNSS velocities, transform orientations, seafloor spreading rates, and earthquake slip vectors

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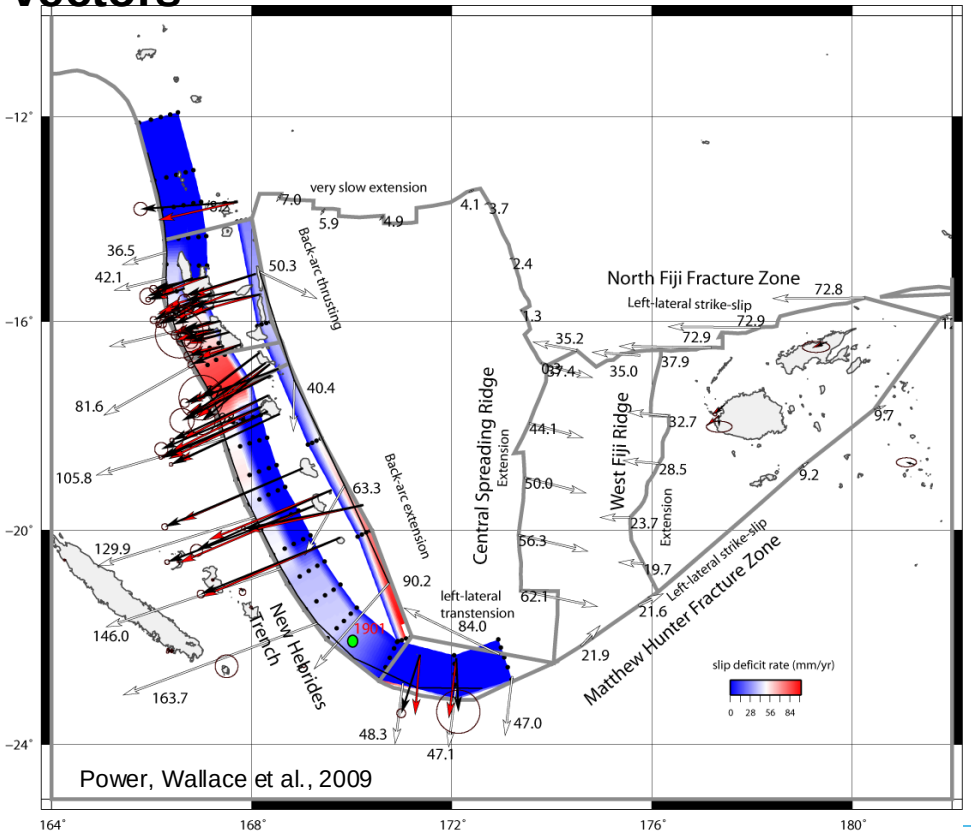

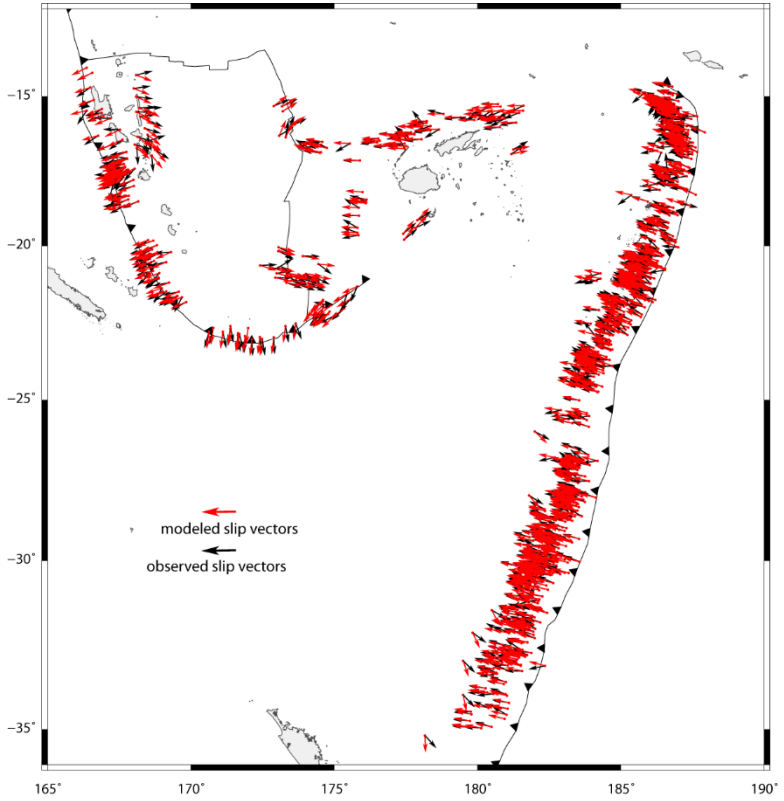

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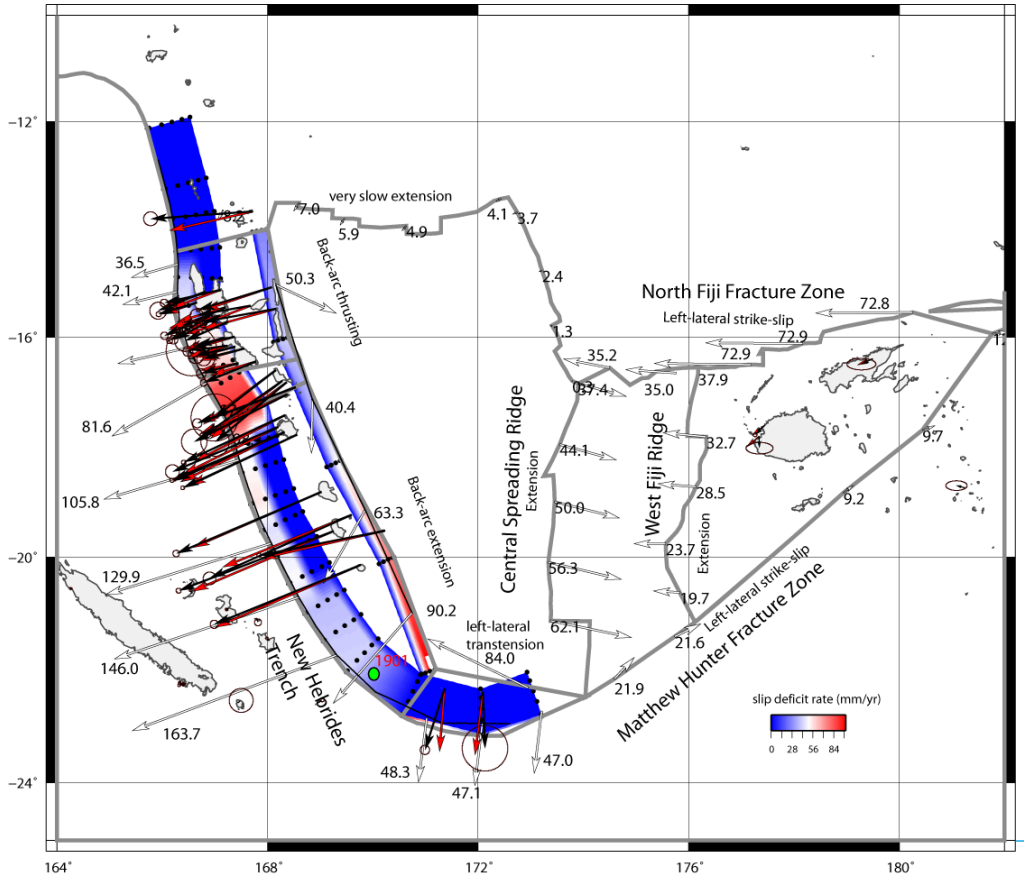
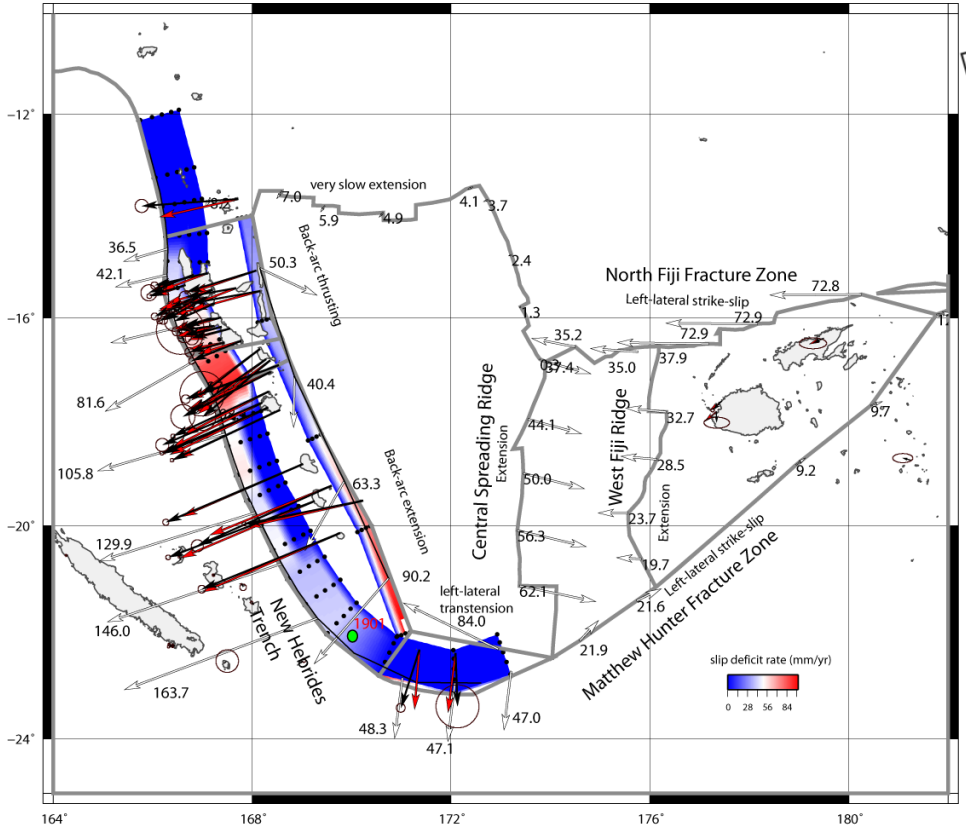
Evidence for deep interseismic coupling in region of Santo



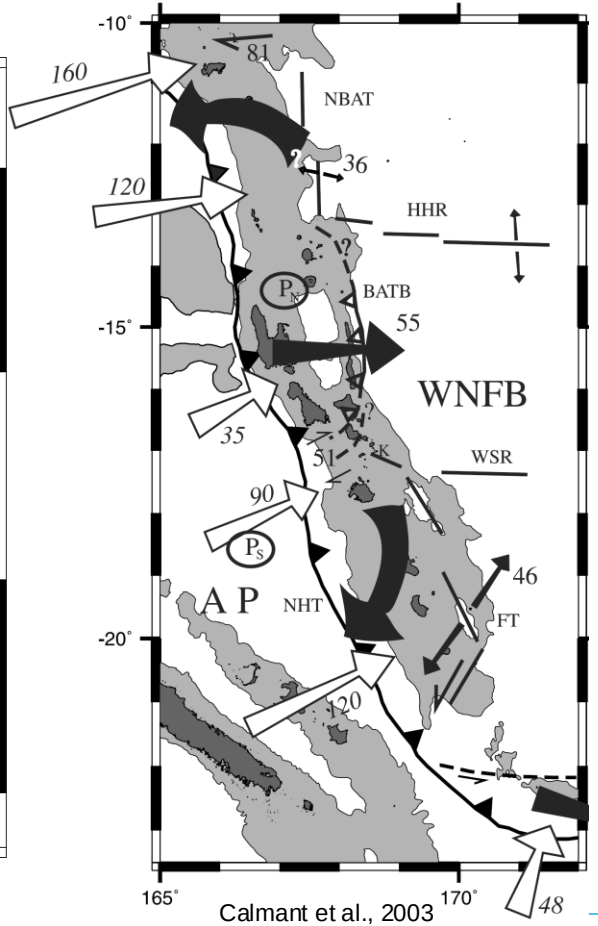
- We must acknowledge uncertainties in this coupling depth due to trade offs between upper plate deformation (on structures in the back-arc) and locking on the plate boundary

- Coupling estimated elsewhere on the subduction zone is very uncertain, due to lack of geodetic constraints (too far form shore-based GNSS).

Convergence rates on the New Hebrides Trench vary along-strike. Rates at northern end highly uncertain



Power, Wallace et al., 2009



Calmant et al., 2003

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What does geodesy help to constrain in the region?

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GNSS velocities provide important information on microplate kinematics and total slip rates on major tectonic boundaries in the region.

Elastic block models used to integrate GNSS observations with other kinematic indicators like earthquake slip vectors, transform orientations, and seafloor spreading rates to develop a holistic view of the tectonic block kinematics and total slip rates. This helps to inform the moment budget we need to to target.

In a few cases, we can estimate the degree of interseismic coupling (or locking) on faults with the elastic block models. This can only be done where networks are dense enough and/or close enough to the fault source (Ramu-Markham Fault, New Hebrides Trench near Santo, New Georgia Group in Solomons). Coupling estimates for other areas are highly uncertain.