

Subduction Zone Observatory Breakout

Breakout started with an introduction by Jeff Freymueller on importance of studying subduction zones both as a location of fundamental earth processes as well as the world's most significant geologic hazards. The specific need that makes such a program compelling are: 1) transformational and high impact science, 2) societal relevance, 3) international partnerships and opportunities, 4) multi-disciplinary science requiring onshore-offshore studies, new technologies, and new high quality/resolution data and thus a source for innovation. Major research challenges in subduction zones include: 1) full deformation spectrum, 2) megathrust processes, 3) tsunami sources, 4) volcanic processes, 5) geochemistry including subduction of volatiles, etc.

Status:

Current subduction zone observation availability, density and resolution vary widely. There is a USGS program: *Integrated Subduction Zone Science*, which is part of the USGS Hazards Mission and is focused on Alaska, Cascadia, and the Caribbean. Components include ground motion prediction, tsunami, EQ early warning, operational EQ forecasting, and volcano hazard. There was a USGS only workshop in April 2015. Recommendations from USGS workshop and backed by the breakout are to create a formal structure for subduction science and resilience, involve collaborators, grow technical capabilities, offshore geodesy, paleoseismology and high-res imaging.

Slow slip questions presented by early career scientists Bartlow and Dimitrova: numerical models showing seismogenic ruptures nucleating at the updip limit of slow slip but some observations don't agree. Slow-slip triggered Eqs? SSE foreshock swarms for prediction? Shallow or even near trench slow-slip events and what is relation with tsunami Eqs? Slip budgets- do SSEs take up whole slip deficit? How much of a subduction zone is really locked, what range of locking fits data, and how do we quantify uncertainty? Potential links between tremor and SS but over what temporal and spatial scales- must monitor tremor and slip!

New topic: How to correctly correct geodetic data for tides, solid earth, GIA, etc? Needs include a denser GPS with farfield reference stations, integration with InSAR, long baseline tide and borehole strain, offshore geodetic, offshore passive seismic. Some questions centered on optimal spacing for GPS with the answer being half-locking depth.

PBO Borehole Strainmeters by Barbour- can use it to assess source characteristics, largest bias comes from source correction (frictional properties?), locations of stations in PBO will show particular improvement for near coast areas.

Q/A- what about including offshore strainmeters? Answer: systematic search for improvements not yet been done just research into using them to refine early warning.

What are the important questions / considerations as we progress towards a future large Subduction Zone Observatory workshop?

- For understand fundamental process of fluid role in SZ processes could consider 3D MT offshore as well as geodetic
- Structural controls on slow-slip as well as understanding the medium that slip takes place in.
- GeoPrisms questions can be used to provide information for this program and haven't been answered yet...so do we restate / redesign? Maybe not worry as we have only just started.
- Observatory is much more than just an bunch of instruments but the people who are also looking at analogues and thus a broader concept
- International interaction could be so very important
- Bridging between high-fidelity images mostly offshore and higher density arrays mostly onshore and need for bridging scales and resolutions
- Targeting different timescales of deformation/motion
- Examine transitions in types of subduction behavior in a larger systems approach (along strike, down dip, and temporally)- similar arguments can out from GeoPrisms workshops
- What about deeper parts of a SZ such as fate of slab, geochemical implications, etc. – need to link with shallow
- Is observatory the right word?

Guidance from NSF: drive this with questions; strongly encouraged to include a broader community of geoscientists early to allow for organic integration

Information from attendees: There was a related workshop held by IRIS in Chile recently as follow-up to Maili EQ and information can be gathered from website. There are more stations along the central and South American subduction zones then currently being accessed by the US subduction zone community and we need to create collaborations both with those in those countries and those already work on those countries.