

2) How does deformation across the subduction plate boundary evolve in space and time, through the seismic cycle and beyond?

Subquestions

1. What is the time history of surface displacements throughout the seismic cycle and what are the contributions from mantle flow, upper and lower plate deformation, and the plate boundary fault?
2. What does interseismic deformation tell us about slip budget and slip behavior of the plate interface (lock, creep, slow slip, etc)? Why are there variations in slip budgets geographically? A global compilation of slip deficit? – Close connection with Group 1 (what controls great earthquakes)
3. How does the stress field evolve in earthquake cycles? Does this affect seismicity rates, location, and mechanisms, and permanent plate deformation?
4. What is the role of non-megathrust faults, such as upper plate faults, lower plate bending faults, and splay faults? How do upper plate faults control slip/strain partitioning and long-term deformation? How do subsea splay faults affect tsunami generation?

These questions are inter-related and represent compelling science.

All these questions require a thematic approach, either with multiple sites or with large along-strike variations on one margin. For example, a long record of geodetic deformation at one site combined with snapshots of margins at different stages the seismic cycle.

For all these questions, significant progress can be made within 5 to 10 years.

Ideal attributes of primary site

Good paleoseismic/paleogeodetic/paleotsunami records, perhaps augmented by historical records of earthquakes, preferably instrumentally recorded great earthquakes

Well defined secondary faults – through seismic imaging, seismic activity, geologic mapping

Active, and representative subduction-zone processes clearly observable at timescale of GeoPRISMS.

Clearly observable (high rate) signal of upper plate deformation – geodetically observed deformation history

Potential for offshore geodetics

Strong along-strike variations

Ongoing or planned amphibious seismological-geodetic experiments

Cabled subsea monitoring networks

High-res seafloor bathymetry

Thematic site attributes

Subduction zones at different stages of great-earthquake cycle

Sites should address at least one of the subquestions

Complement primary site in terms of plate kinematics, thermal regime, seismogenic behavior, or in any of the attributes needed for the primary site