Sensitivity models

A simple sensitivity analysis using slip on a single reverse fault in two dimensions provides qualitative guidance to the constraints on the preferred rupture parameters (Figure DR2). The dip of the reverse fault affects the width and depth of the subsided area and the width of the uplifted area, whereas the maximum amplitude of the uplifted area is less sensitive to the dip. Conversely, the maximum amplitude of uplift changes almost linearly with the slip magnitude, but the effect of slip magnitude on subsidence is much smaller and the wavelengths of uplift and subsidence are not affected. Changes in the depth to the bottom of the fault are manifested in the width of the uplifted area, whereas the maximum amplitude of the uplift or the width and amplitude of the subsidence are not affected. Changes in the depth of the top part of the fault affect the frontal uplift slope. A shallow fault top creates a steep and abrupt change from uplift to subsidence, whereas a deep fault top creates a gradual change.

Applications of this sensitivity analysis to our models suggest that the fault dip in our models is probably not well constrained because it depends on subsidence data north of the Seattle Fault, which consists of only 3 points. The width of the uplifted area and the uplift gradient at the front of the uplift are relatively well constrained by observations, as is the maximum uplift magnitude, hence, we expect the slip magnitude and depth of top and bottom of the faults to be relatively well constrained.

Data repository figure captions

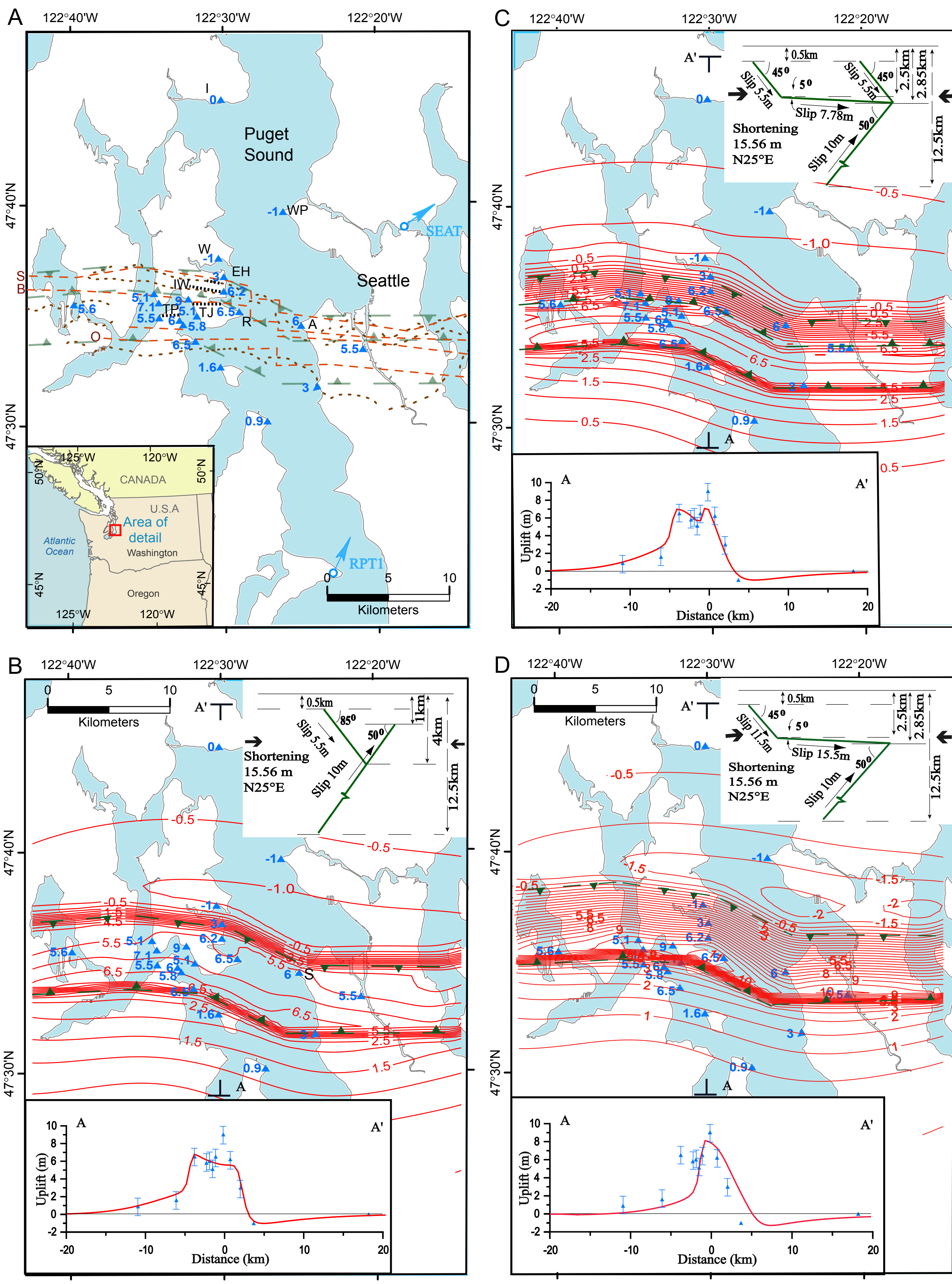
Figure DR1 – (a) Same as Figure 1c, but with a shortening direction of N54°E. (b) Same as Figure 1b, but with horizontal shortening at shallow levels divided equally between the primary fault and the antithetic fault.

Figure DR2 – Effects of fault dip, slip, and depth of top and bottom ends of rupture on surface elevation changes for a single thrust fault. The effects were calculated using 2-D elastic models with an original dip of 50°, a slip of 5 m, and rupture extending from depths of 1 to 12.5 km below the surface.

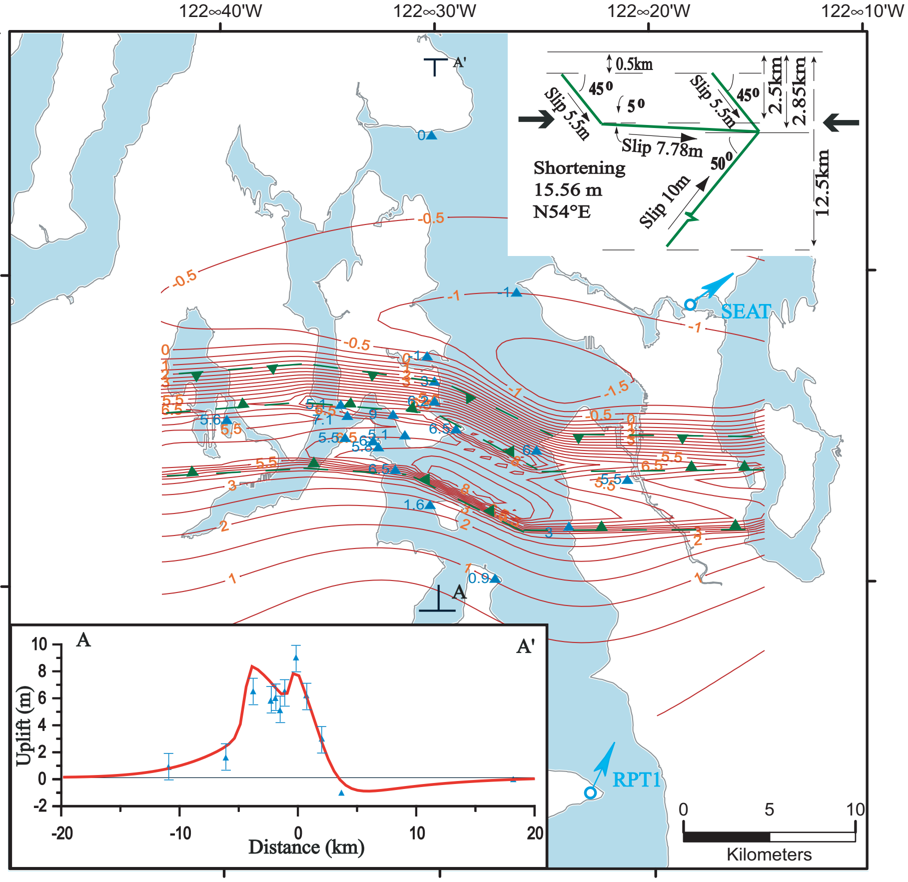
TABLE DR1. MEASURED SHORELINE ELEVATION CHANGES

Longitude	Latitude	Elevation change (m)
-122.66491	47.59138	5.60
-122.57619	47.60119	5.10
-122.57217	47.59365	7.10
-122.56915	47.58309	5.50
-122.55005	47.58007	6.00
-122.54578	47.57605	5.80
-122.53548	47.56500	6.50
-122.53925	47.59666	9.00
-122.52869	47.58510	5.10

-122.49878	47.54464	1.60
-122.50909	47.62431	-1.00
-122.49954	47.61300	3.00
-122.49878	47.60269	6.20
-122.48421	47.58611	6.50
-122.42865	47.65999	-1.00
-122.41583	47.57429	6.00
-122.40050	47.53006	3.00
-122.45378	47.50430	0.90
-122.34998	47.55758	5.50
-122.50580	47.74358	0.00


A
122°40'W
122°30'W
122°20'W
47°40'N
47°30'N
Puget Sound
Seattle
SEAT
RPT1
Kilometers
CANADA
U.S.A
Area of detail
Washington
Oregon
Atlantic Ocean
B
122°40'W
122°30'W
122°20'W
Shortening 15.56 m N25°E
Slip 5.5m
Slip 10m
Uplift (m)
Distance (km)
C
Shortening 15.56 m N25°E
Slip 5.5m
Slip 7.78m
Slip 10m
D
Shortening 15.56 m N25°E
Slip 11.5m
Slip 15.5m
Slip 10m

A



B

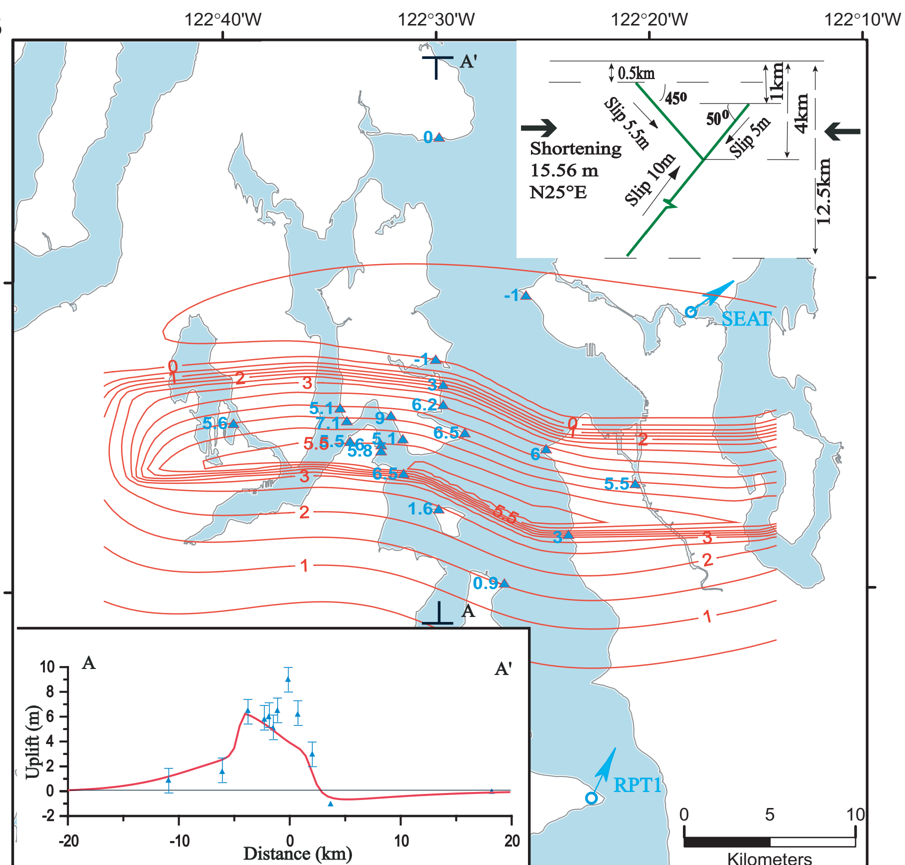
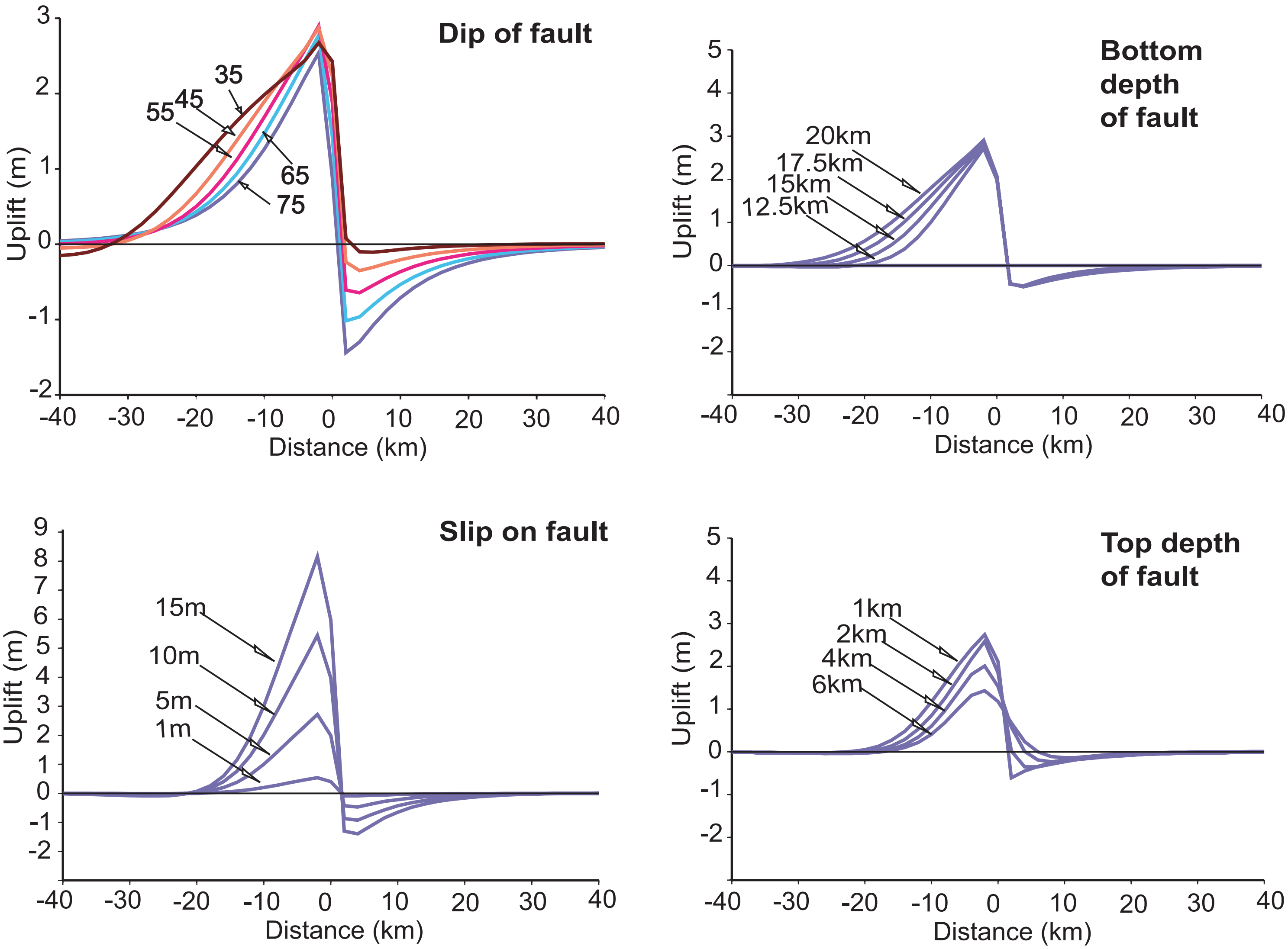


Figure DR1



Repository Figure A2