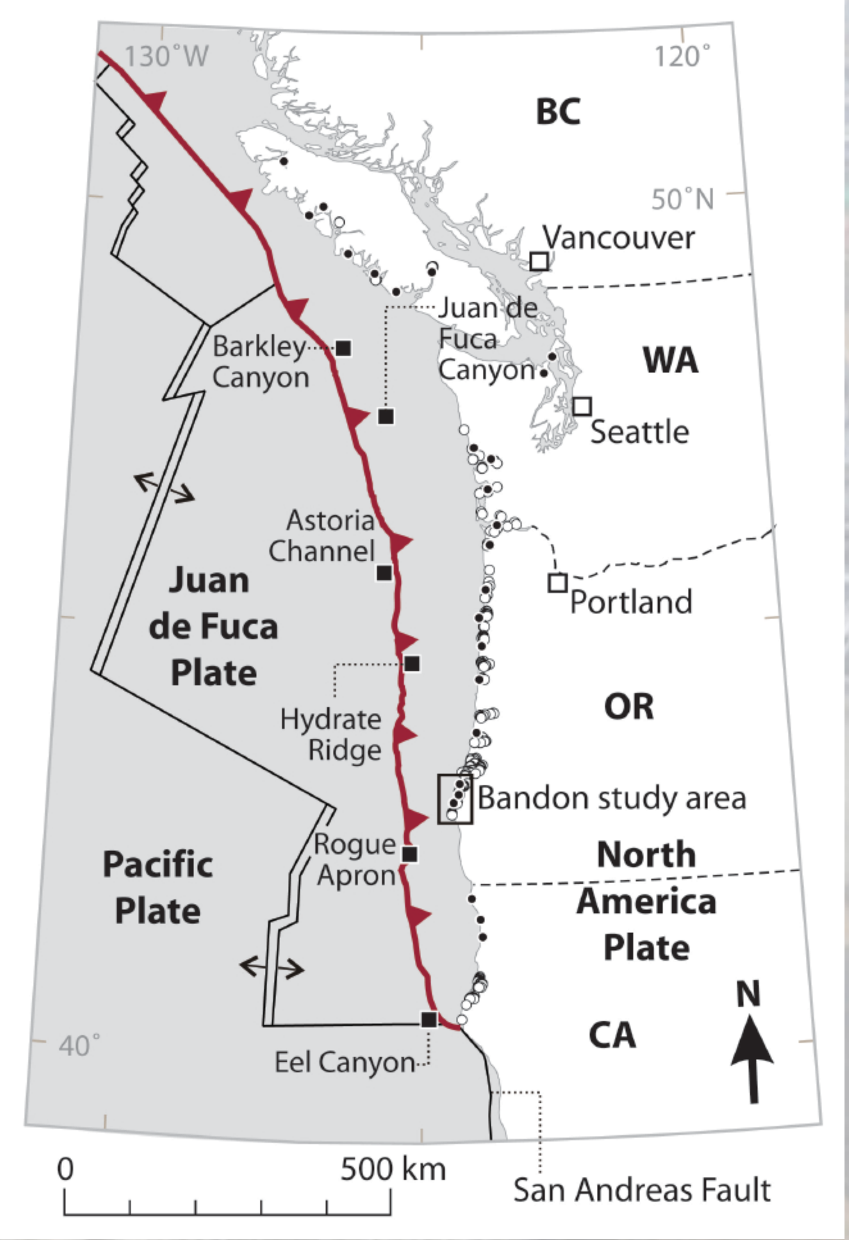
OR Approach based on:

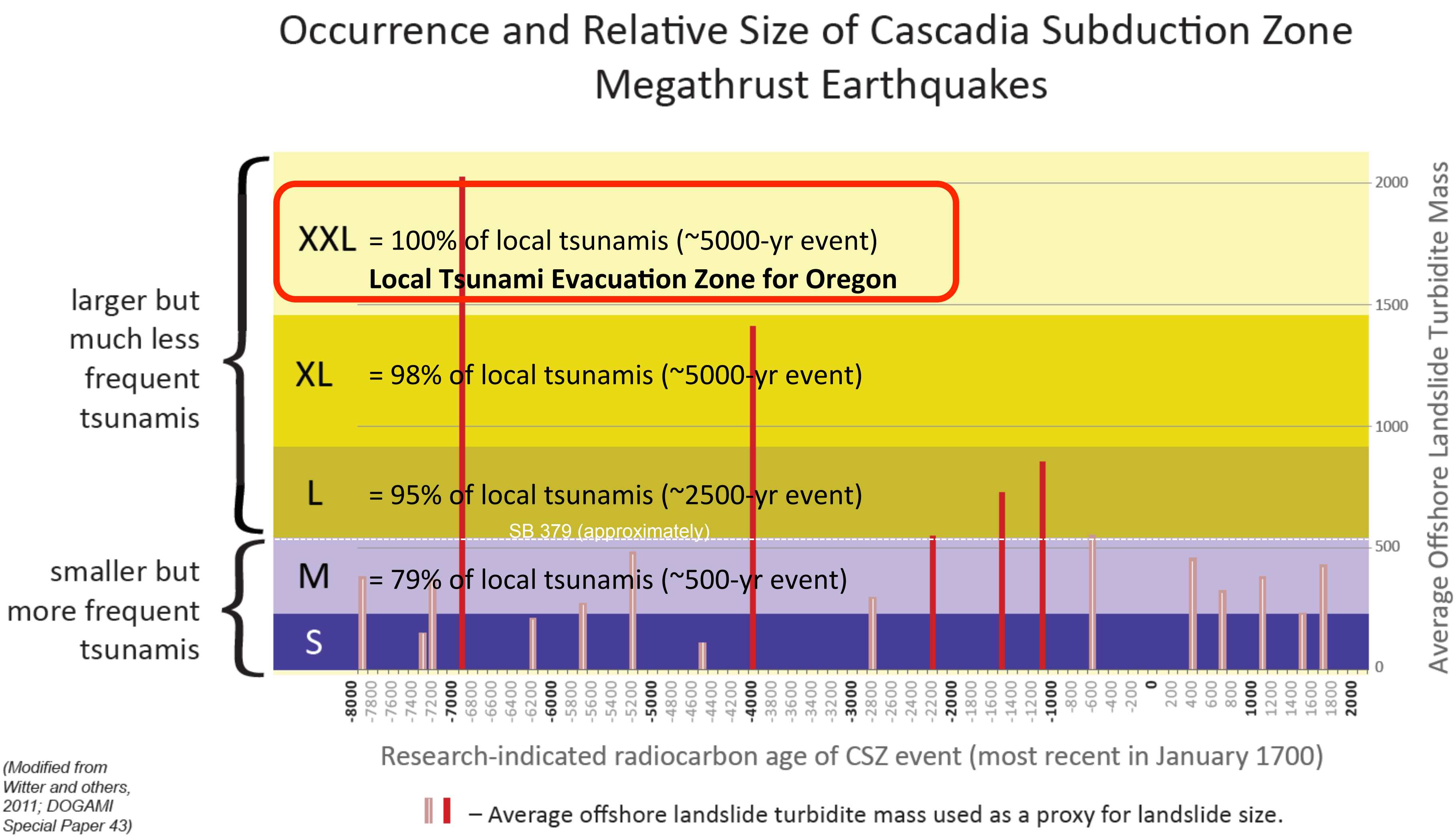
- Knowledge of the structure of the Cascadia megathrust;
- Theoretical understanding of megathrust ruptures;
- Paleoseismic records extending back 10,000 years (i.e. deep sea turbidites);
- Coastal evidence of coseismic subsidence and tsunami inundation

OVERALL GOAL:

Represent as full a range of potential sources (covering all reasonable geologically reasonable model space, erring on the conservative side)



Qualitative Explanation of Cascadia Tsunami Scenarios
shown on published tsunami inundation maps



(Modified from Witter and others, 2011; DOGAMI Special Paper 43)

Summary: Cascadia Tsunami Scenarios

Table 1. Estimated earthquake parameters for tsunami source scenarios used in Oregon tsunami inundation maps (TIM series).

Rupture Scenario (Witter and others, 2011)	Tsunami Inundation Map (TIM Series) Scenario	Length (km)	Width (km)[a]	Slip Deficit Time (years)	Maximum Slip (m)[b]	Average Slip (m)[c]	Moment Magnitude (M_w)[d]
XXL1	XXL	1,000	83	1,200	41	20	9.1
XL1	XL	1,000	83	1,050–1,200	41	20	9.1
L1	L	1,000	83	650–800	27	13	9.0
M1	M	1,000	83	425–525	18	9	8.9
Sm1	S	1,000	83	300	10	5	8.7
AK64	Alaska M9.2 (1964)	650	280	no data	22.1	8.6	9.2
AKmax	Alaska Maximum	600	100	no data	30	no data	9.2

[a] Equivalent fault width calculated from rupture area divided by length; modeled fault width varies with latitude; Cascadia values (Sm1–XXL1) are from Witter and others (2011).

[b] Maximum slip estimates for Cascadia scenarios (Sm1–XXL1) are calculated from the recurrence interval multiplied by a convergence rate in southern Oregon (34 mm yr^{-1} at 42.94°W latitude) and are from Witter and others (2011); estimates for AK64 and AKmax are derived from the maximum subfault slip of Johnson and others (1996) and TPSW (2006), respectively.

[c] Average slip estimate is 0.49 of maximum slip estimate for Cascadia scenarios (XXL1–Sm1) and is from Witter and others (2011); estimates for AK64 and AKmax are from Johnson and others (1996) and TPSW (2006), respectively.

[d] Moment magnitude (M_w) = (log M_0 – 9.1)/1.5 where M_0 = seismic moment assuming rigidity = 4 × 1010 N m^{-2} and is from Witter and others (2011).

Tsunami Runup	Max Shoreline Flow Depth	Inundation distance	Tsunami arrival
4 to >25 m	4 to >25 m	1 to >3 km	15 to 20 min

Needs:

- Short term: assign approximate probabilities to model scenarios already developed in Oregon. Necessary to place the logic tree approach in a better context;

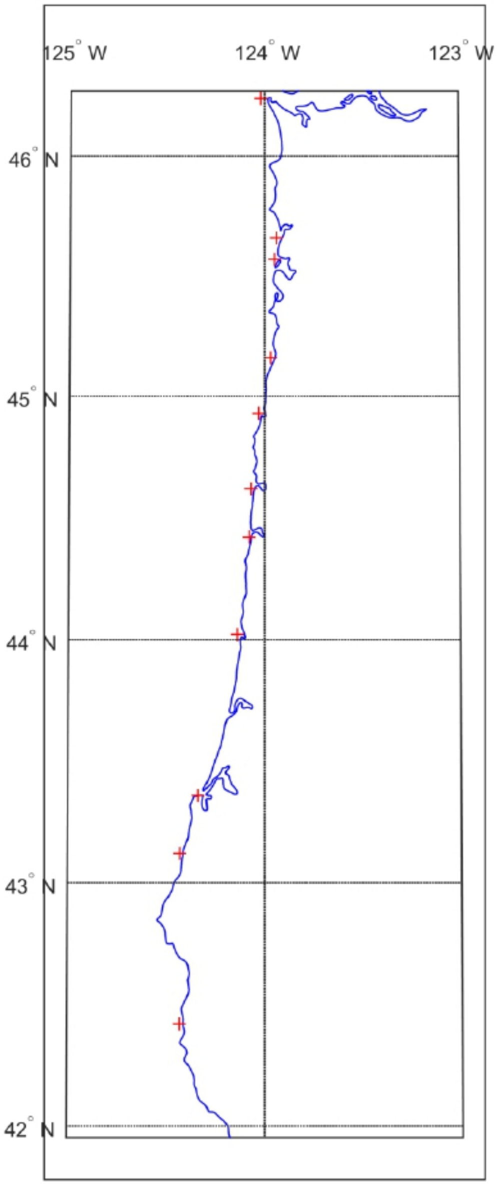
- Longer term: Offer new probabilistic inundations and force levels, especially as an alternative to the ASCE 7;

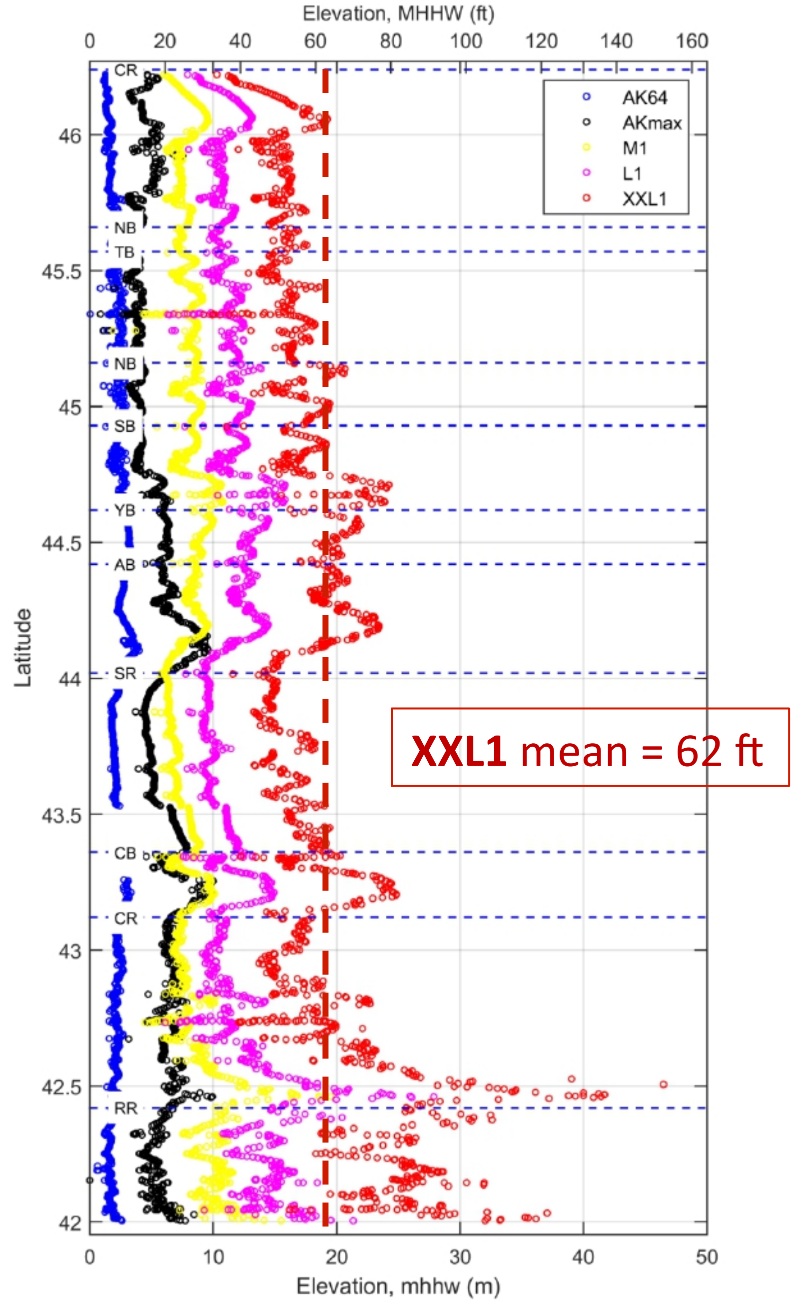
- Refinements to the along coast co-seismic response.

- Better coordination between USGS and state modeling teams.

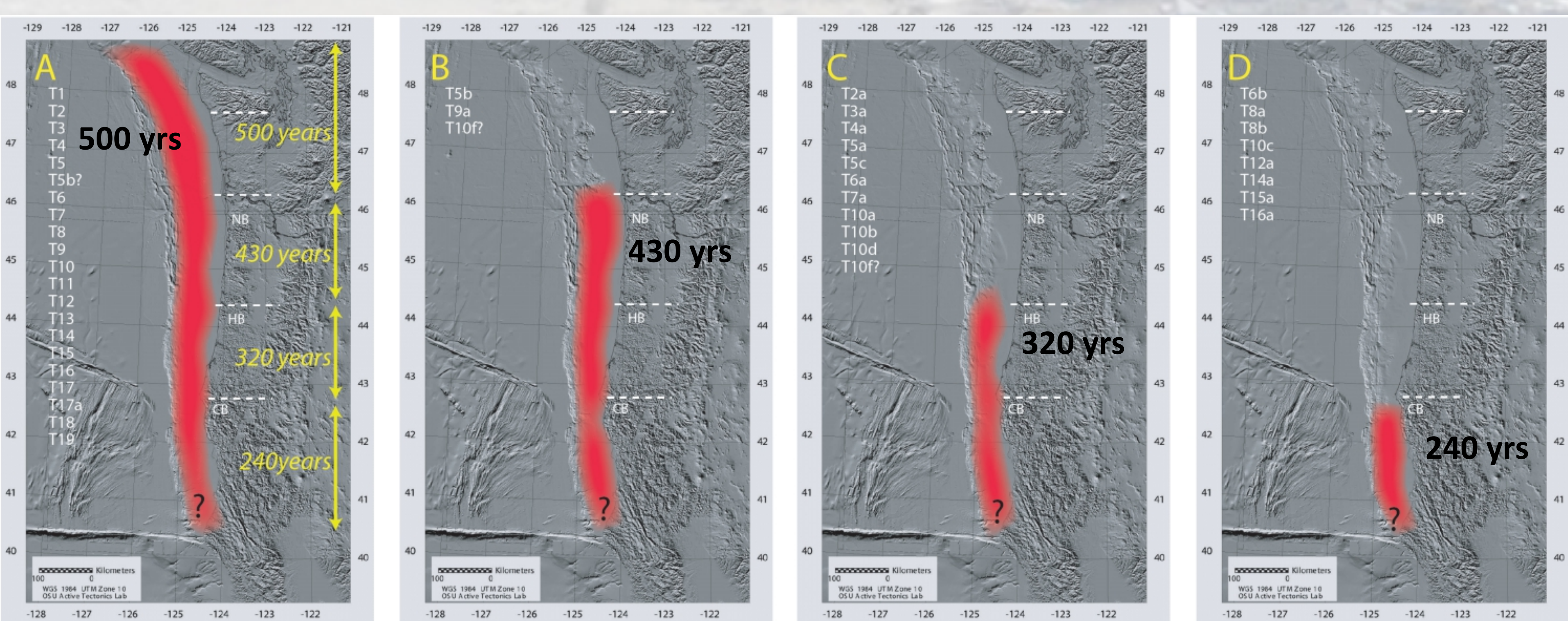
- Submarine landslides?

Open coast


125° W
124° W
123° W
46° N
45° N
44° N
43° N
42° N

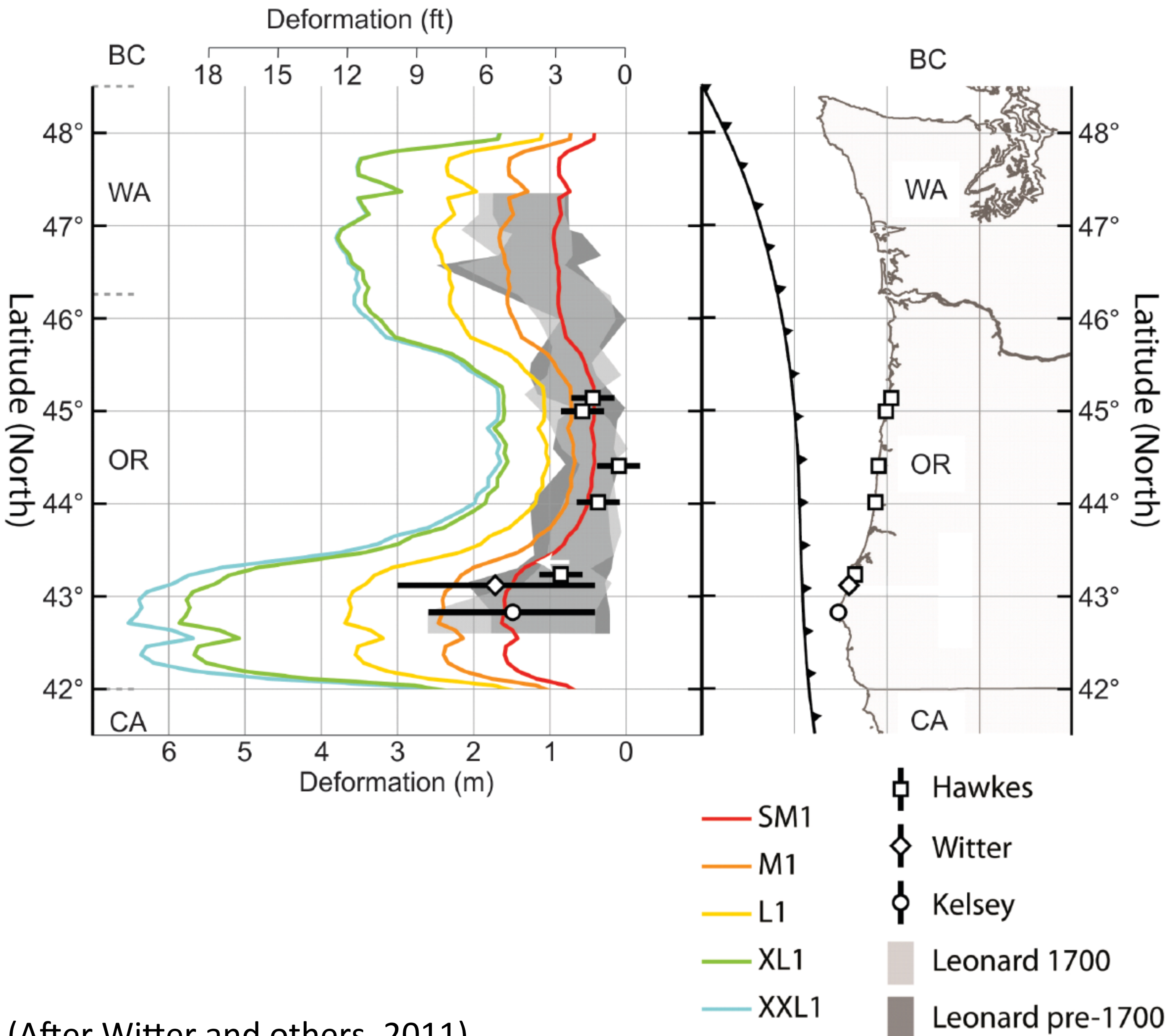

Elevation, MHHW (ft)
0
20
40
60
80
100
120
140
160
AK64
AKmax
M1
L1
XXL1
CR
NB
TB
NB
SB
YB
AB
SR
CB
CR
RR
46
45.5
45
44.5
44
43.5
43
42.5
42
Latitude
0
10
20
30
40
50
Elevation, mhhw (m)
XXL1 mean = 62 ft

Cascadia Turbidite Paleoseismology



Recurrence intervals and rupture extents for Cascadia earthquakes, Goldfinger et al. (2011)

- 19 to 20 full length or nearly full length ruptures
- 2 to 3 ruptures of ~75% of the length of the margin
- 19 shorter ruptures of southern segments



(After Witter and others, 2011)

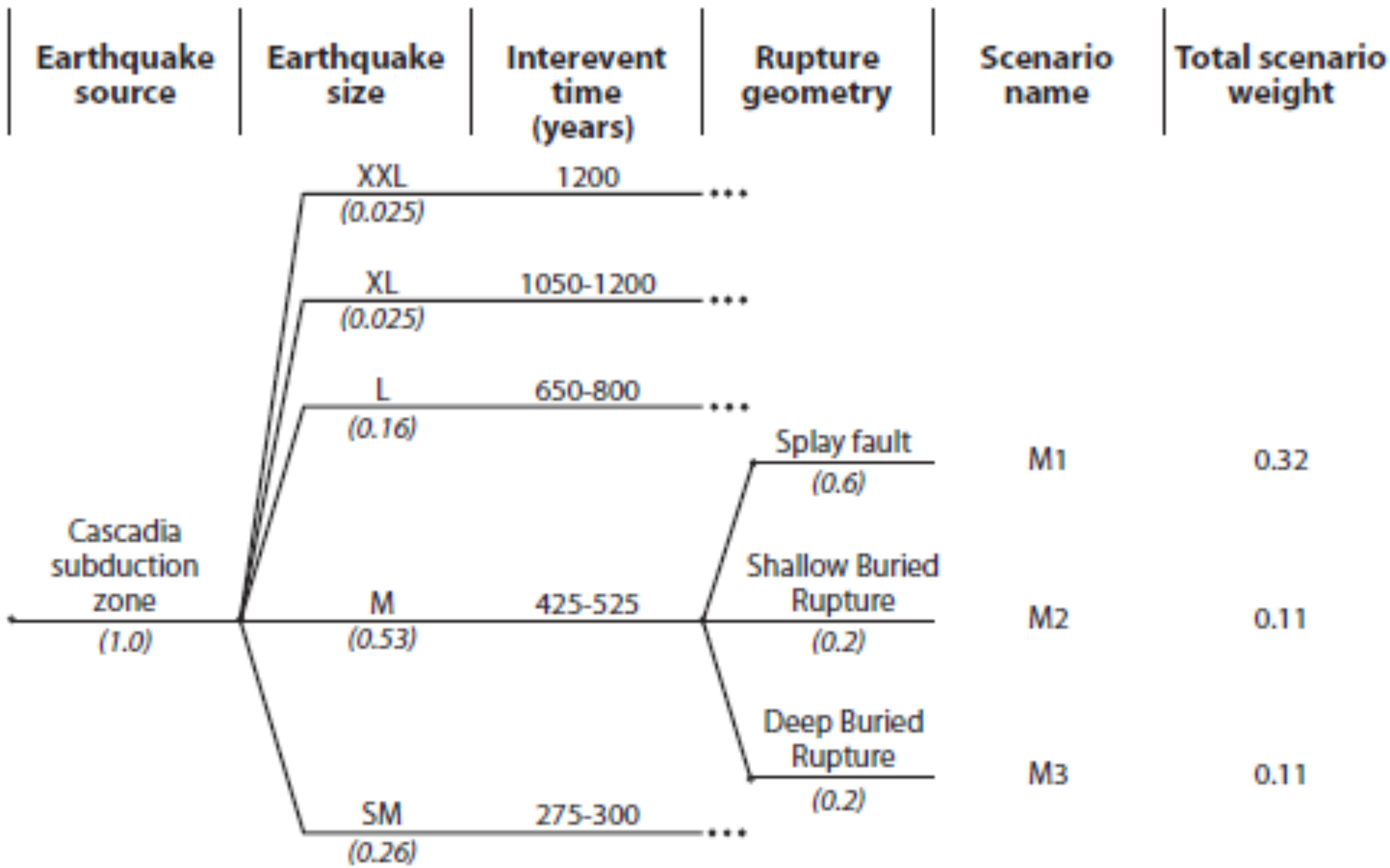


Figure 7. Schematic logic tree used to rank 15 Cascadia earthquake models. See Table 3 for a list of all parameters and weights used in the analysis. Earthquakes sizes are extra extra large (XXL), large (XL), large (L), M, medium (M), and small (SM).