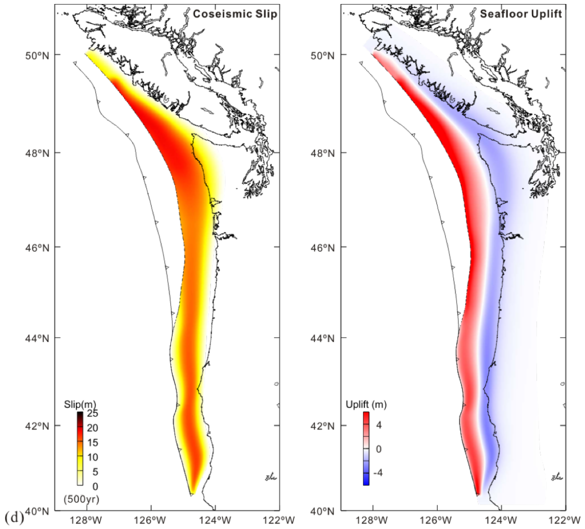
Source models



As part of the preparation of coastal communities for a tsunami we need to generate Source Models for the Cascadia Subduction Zone. The effort on this modelling has been led by Kelin Wang (NRCan) and his student Dawei Gao (UVic SEOS).

Dawei Gao was awarded an AGU award. You can read more about Dawei and his work in an interview here, and you can download his award winning poster in this page (see below). Dawei has now submitted his Masters thesis and will defend on July 26th, 2016. As he advances we will share more information.

Dawei's AGU 2015 poster:

2015AGUposterDGaoV6.pdf

The work on this part of the project is currently funded by the NSERC-CRD award in collaboration with IBM described in the home page of this working group.

The work on source models from this grant is described on the proposal as follows:

> *Developing the earthquake rupture source model is the most critical initial step for the development of tsunami wave models for hazard assessment and real-time warning to mitigate the risk of a local, large tsunami generated by a subduction megathrust earthquake right offshore. However, rupture source modeling remains a poorly developed step in tsunami modeling/forecasting studies. Commonly used models suffer from poor assumptions and simplifications about fault geometry, slip distribution, and margin topography. As part of previous research we compiled information on the tectonics and seismogenic potential of the Explorer segment of the megathrust, developed a 2D thermal model for it to define the thermally controlled seismogenic zone, compiled a geometrical model of the Cascadia megathrust based on previous publications and new information on the depth location of non-volcanic tremor sources, and developed a suite of dislocation models for tsunamigenic rupture of the northern Cascadia megathrust taking into account the shallow geological structure of the subduction system around the deformation front.*
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> *In this project we will expand the source modeling work in several aspects. First, structural information on the shallow part of the northern Cascadia subduction system will be further analyzed and distilled. This involves the synthesis of data from many seismic surveys and amalgamation of models previously developed for the U.S. part of the margin with the Canadian part. Second, 3D elastic finite element models will be developed to model tsunamigenic rupture of the Cascadia megathrust. Source models developed so far are based on numerical integration of point-source dislocation solutions in an elastic half-space, with uniform material properties and flat top surface. Although these are some of the best models in terms of representing fault geometry and slip distribution, they do not handle the deep sea and continental slope topography accurately, and they cannot be used to model the scenario of trench-breaching rupture, a rupture scenario responsible for the devastating tsunami generated by the 2011 M=9 Tohoku-oki earthquake in Japan. Because of the complexity of the shallow structure of Cascadia, with a sediment buried trench, rather fine finite element meshes and hence large computing resources, such as IBM hardware, are needed for this modeling. Third, in order to validate models against modern interseismic geodetic observations at Cascadia and other subduction zones, 3D viscoelastic finite element models will be generated. Both the second and third steps will require the use of a 3D spherical-Earth finite element code developed by Dr. Wang's research group [13] [14] [15].*
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> *A suite of new tsunami enhanced source models for the Cascadia subduction zone will be developed in this objective. These models will be evaluated with wave propagation models (e.g. models from Objective 3) and compared with literature and past events.*