HAROLD KUEHN
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DEPARTMENT OF EARTH SCIENCES

TITLE OF THESIS:	ALONG-TRENCH SEGMENTATION AND DOWNDIP LIMIT OF THE SEISMOGENIC ZONE AT THE EASTERN ALASKA-ALEUTIAN SUBDUCTION ZONE
TIME/DATE:	1:00 pm, Wednesday, January 23, 2019
PLACE:	Room 3107, The Mona Campbell Building, 1459 LeMarchant Street

EXAMINING COMMITTEE:

Dr. Mireille Laigle, Observatoire de la Côte d'Azur, Nice, France (External Examiner)

Dr. Donna Shillington, Lamont-Doherty Earth Observatory at Columbia University, New York (Reader)

Dr. Keith Louden, Department of Oceanography, Dalhousie University (Reader)

Dr. Matthias Delescluse, Laboratoire de Géologie de l'Ecole normale supérieure, Paris, France (Reader)

Dr. Mladen Nedimović, Department of Earth Sciences, Dalhousie University (Supervisor)

DEPARTMENTAL REPRESENTATIVE:	Dr. James Brenan, Department of Earth Sciences, Dalhousie University
CHAIR:	Dr. Marlon Lewis, PhD Defence Panel, Faculty of Graduate Studies

ABSTRACT

Along-trench segmentation and down-dip limit of the seismogenic zone at the eastern Alaska-Aleutian subduction zone

The largest and most destructive earthquakes on Earth nucleate on the seismogenic parts of megathrust faults along subduction zones. Understanding the controls on rupture propagation in along-trench and dip direction is a key factor for estimating size and location of future megathrust earthquakes. Various geologic features and subduction-related processes have been proposed to affect megathrust segmentation along the plate boundary zone, however, inaccessibility due to its deep location makes a detailed investigation challenging. The ALEUT project aims to overcome these difficulties by acquisition of state-of-the-art deep penetrating multichannel seismic reflection data combined with coinciding ocean bottom seismometer refraction data for a large section of the eastern Alaska-Aleutian subduction zone (AASZ). This thesis discusses results based on the ALEUT dataset and provides unique insights into possible morphological controls on along-strike rupture organization of the subduction thrust and new constraints on its seismogenic down-dip limit. Plate interface reflections recorded throughout the survey area were used to construct a 3D model of the interplate interface, on which two major (4-5 km high) crest-like features have been identified. The spatial coincidence of these geometrical highs, interpreted to represent subducted seamounts, with boundaries of the region's instrumentally recorded great earthquake ruptures indicates that the megathrust geometry is likely the primary factor controlling the segmentation of the eastern AASZ. The plate interface reflection package appears to be thin (< 2 km) at shallow depths and thick (5-6 km) at greater depths, with a transitional (2-5 km thick) zone in-between. Using information from all ALEUT reflection profiles, a map of the plate interface reflection package type (thin, transitional, thick) and related slip behavior (seismogenic, conditionally stable, aseismic) was constructed for the eastern AASZ. The obtained results confirm earlier constraints on the maximum down-dip extent of the conditionally stable rupture area derived from aftershock locations and inverse tsunami waveform modelling. Determination of the maximum landward extent of the seismogenic (locked) area coincides well with recent geodetic dislocation models for the eastern part of the study area. However, it also indicates a partially seismogenic behavior of the plate interface in the western part that has previously been characterized as weakly coupled.