University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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BSc (University of Victoria, 2010)

"Tidal Sedimentology and Geomorphology in the Central Salish Sea Straits, British Columbia and Washington State"

School of Earth and Ocean Sciences

Friday, December 8th, 2017
9:00 A.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. James Vaughn Barrie, School of Earth and Ocean Sciences, University of Victoria (Co-Supervisor)
Dr. Vera Pospelova, School of Earth and Ocean Sciences, UVic (Co-Supervisor)
Dr. Philip R. Hill, School of Earth and Ocean Sciences (Member)
Dr. Ian J. Walker, Department of Geography, UVic (Outside Member)

External Examiner:
Dr. Alex Cardoso Bastos, Departamento de Oceanografia e Ecologia, Universidade Federal do Espirito Santo

Chair of Oral Examination:
Dr. Andrew Rowe, Department of Mechanical Engineering, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Intra-archipelago waterways, including tidal strait networks, present a complex set of barriers to, and conduits for sediment transport between marine basins. Tidal straits may also be the least well understood tide-dominated sedimentary environment. To address these issues, currents, sediment transport pathways, and seabed sedimentology/geomorphology were studied in the central Salish Sea (Gulf and San Juan Islands region) of British Columbia, Canada and Washington State, USA. A variety of data types were integrated: 3D and 2D tidal models, multibeam bathymetry/backscatter, seabed video, grab samples, cores and seismic reflection. This dissertation included the first regional sediment transport modelling study of the central Salish Sea. Lagrangian particle dispersal simulations were driven by 2D tidal hydrodynamics (~59-days). It was found that flood-tide dominance through narrow intra-archipelago connecting straits resulted in the transfer of sediment into the inland Strait of Georgia, an apparent sediment sink. The formative/maintenance processes at a variety of seabed landforms, including a banner bank with giant dunes, were explained with modelled tides and sediment transport. Deglacial history and modern lateral sedimentological and morphological transitions were also considered. Based on this modern environment case study, adjustments to the tidal strait facies model were identified. In addition, erosion and deposition patterns across the banner bank (dune complex) were monitored with 8-repeat multibeam sonar surveys (~10 years). With this data, spatially variable bathymetric change detection techniques were explored: a cell-by-cell probabilistic depth uncertainty-based threshold (*t*-test), and coherent clusters of change pixels identified with the local Moran's *Ii* spatial autocorrelation statistic. Uncertainty about volumetric change is a considerable challenge in seabed change research — compared to terrestrial studies.