OCEAN NETWORKS CANADA

THE ONC TSUNAMI PROGRAM: A SUMMARY AND LOOK AHEAD

Tania Insua, PhD, Ocean Analytics Program Manager, February 2018

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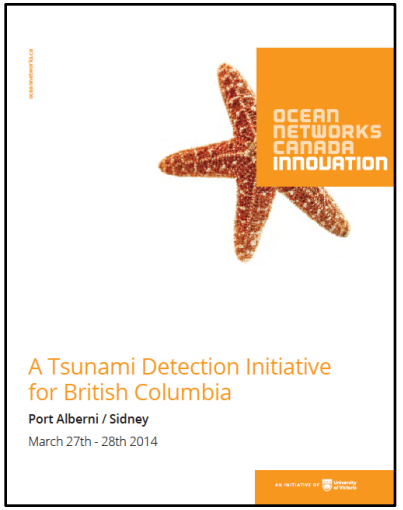
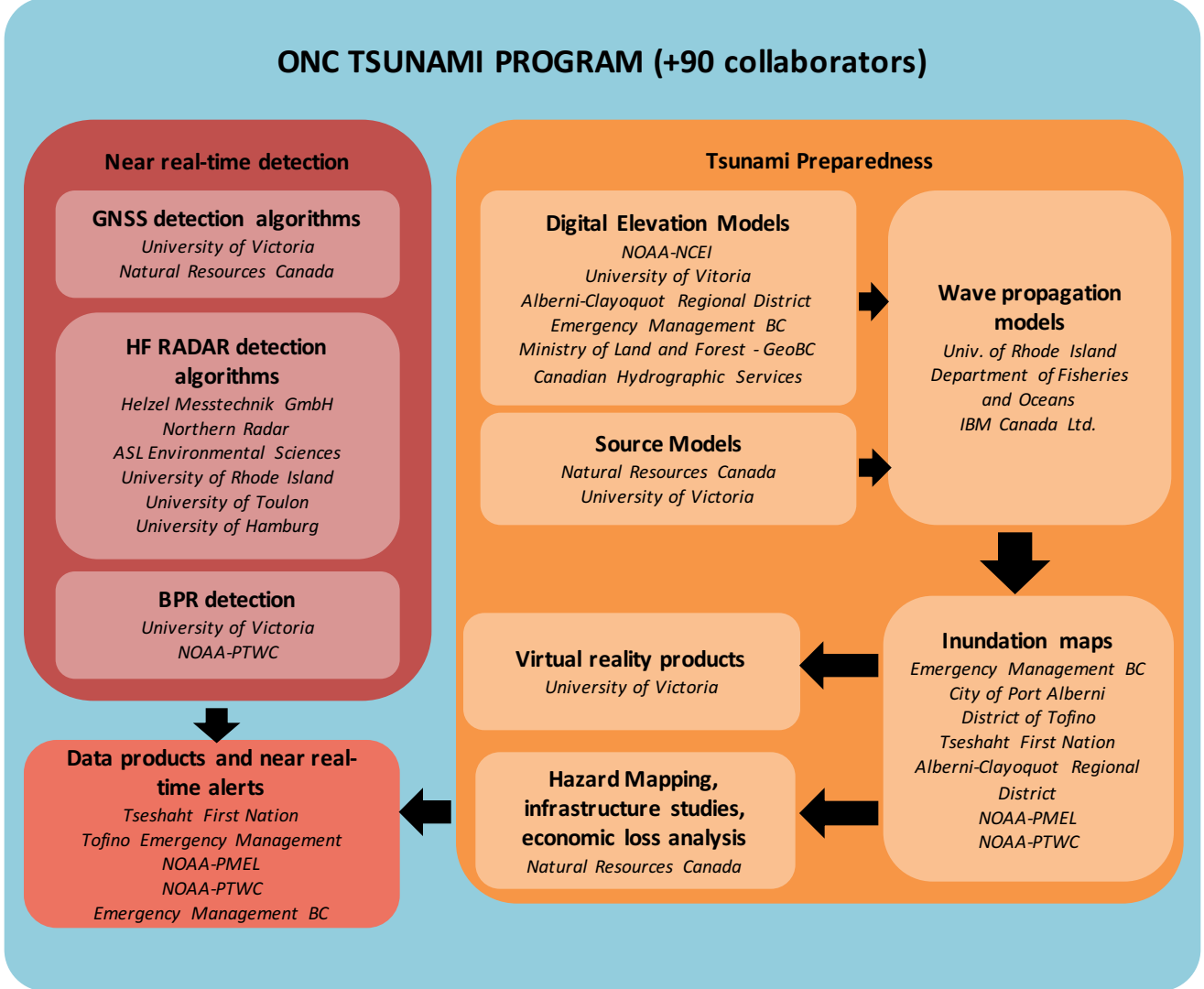
ONC TSUNAMI PROGRAM OVERVIEW

TSUNAMI WORKSHOP, PORT ALBERNI AND SIDNEY, 2014

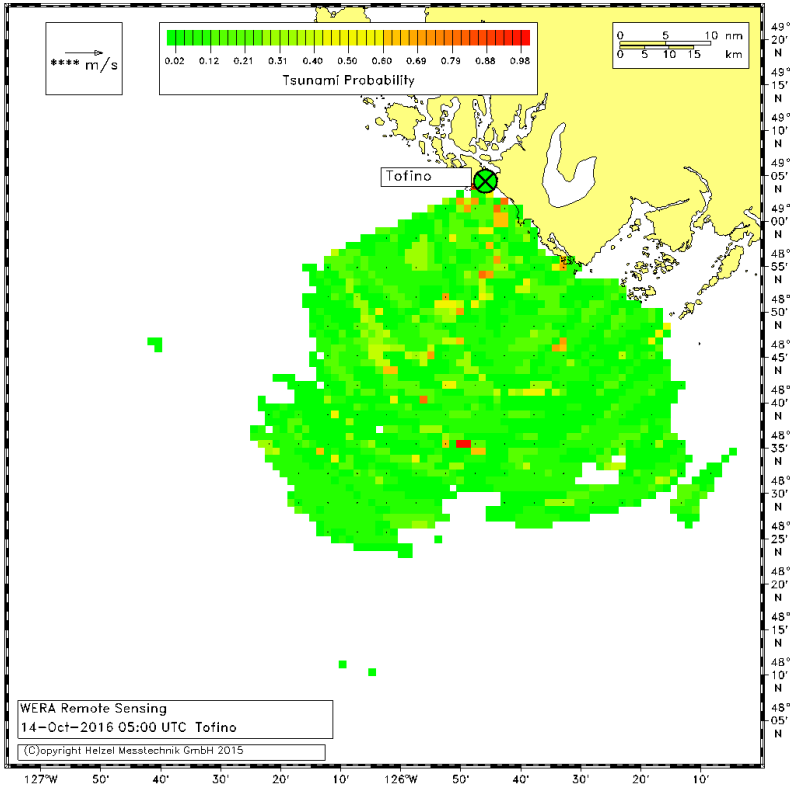
1. Need for broader **real-time** network of **instruments** in particular configurations
2. Need for detailed **bathymetry and topography**
3. Need data for better **source models**
4. Tailored **wave propagation models** for British Columbia
5. Need of **benchmarking**

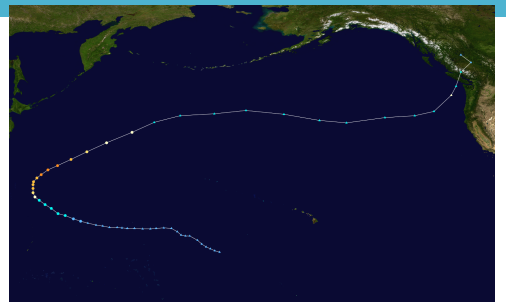


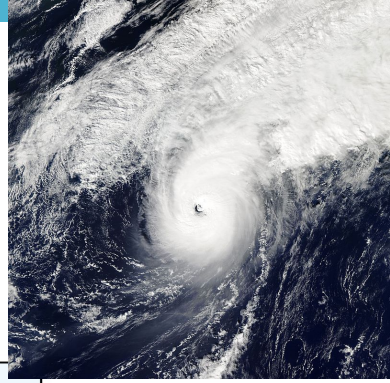

ONC TSUNAMI PROGRAM (+90 collaborators)
Near real-time detection
GNSS detection algorithms
University of Victoria
Natural Resources Canada
HF RADAR detection algorithms
Helzel Messtechnik GmbH
Northern Radar
ASL Environmental Sciences
University of Rhode Island
University of Toulon
University of Hamburg
BPR detection
University of Victoria
NOAA-PTWC
Data products and near real-time alerts
Tseshaht First Nation
Tofino Emergency Management
NOAA-PMEL
NOAA-PTWC
Emergency Management BC
Tsunami Preparedness
Digital Elevation Models
NOAA-NCEI
University of Vitoria
Alberni-Clayoquot Regional District
Emergency Management BC
Ministry of Land and Forest - GeoBC
Canadian Hydrographic Services
Source Models
Natural Resources Canada
University of Victoria
Wave propagation models
Univ. of Rhode Island
Department of Fisheries and Oceans
IBM Canada Ltd.
Inundation maps
Emergency Management BC
City of Port Alberni
District of Tofino
Tseshaht First Nation
Alberni-Clayoquot Regional District
NOAA-PMEL
NOAA-PTWC
Virtual reality products
University of Victoria
Hazard Mapping, infrastructure studies, economic loss analysis
Natural Resources Canada

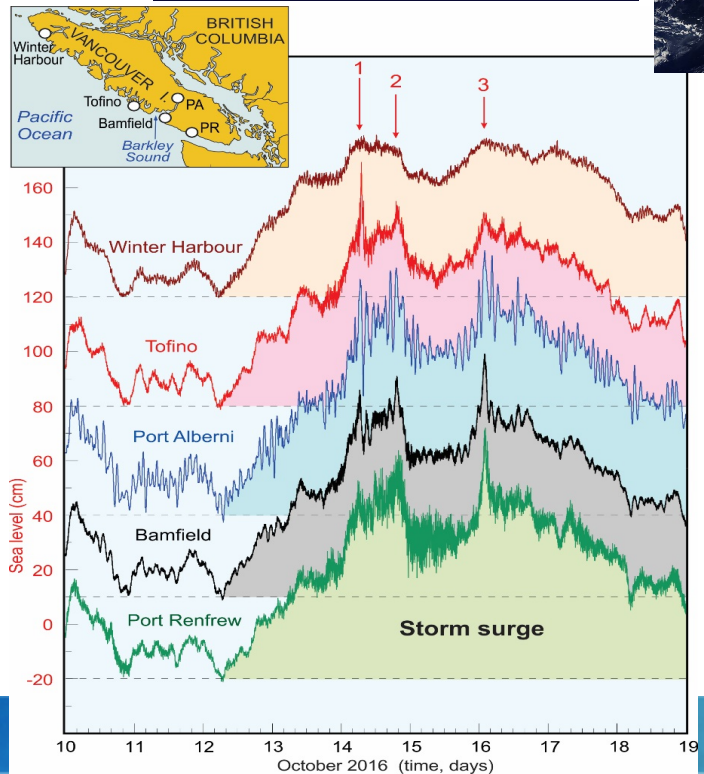
METEO-TSUNAMI, OCTOBER 2016

In collaboration with Helzel and R. Thomson, A. Rabinovich, I. Fine (DFO)









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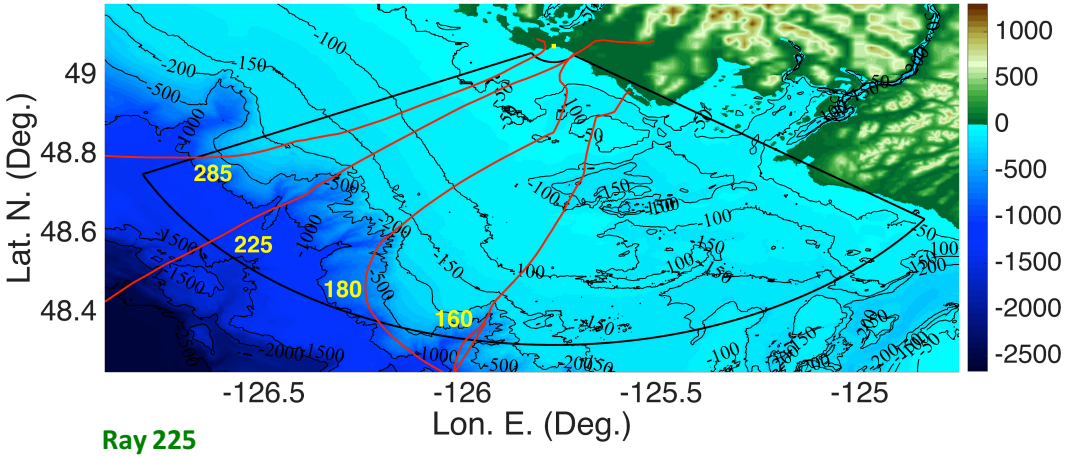
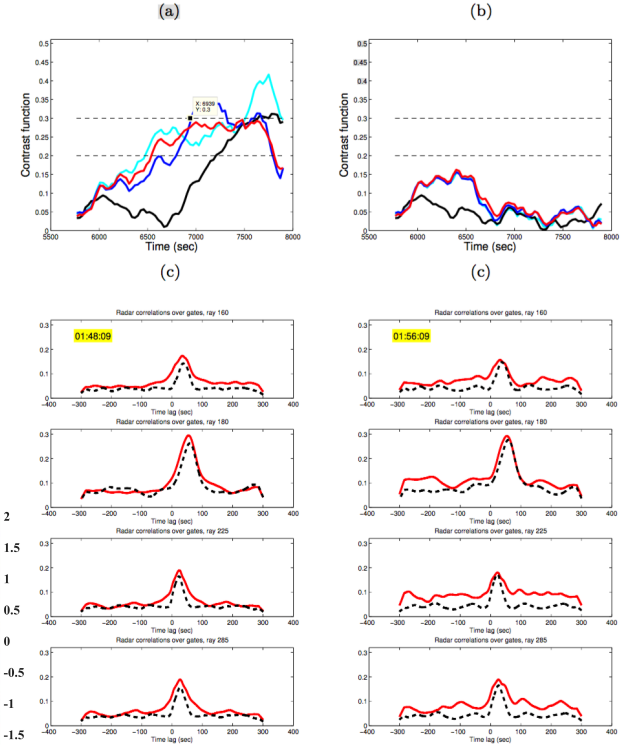
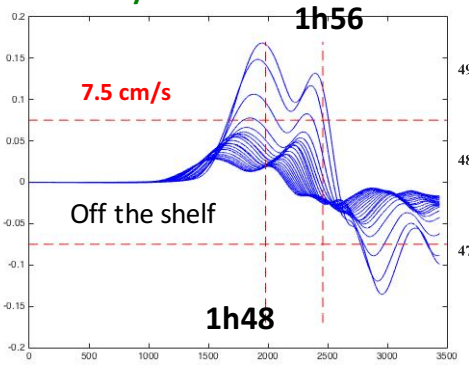
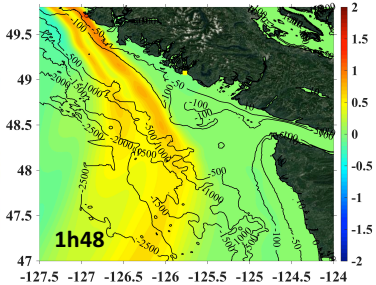
HF WERA RADAR: NEW ALGORITHMS FOR TSUNAMI DETECTION

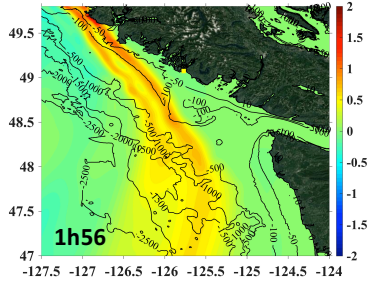




Ray 225







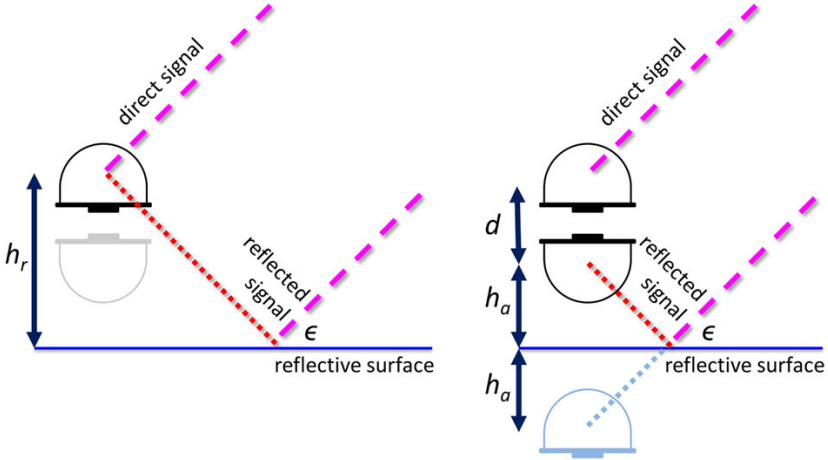
First detection at 1h48

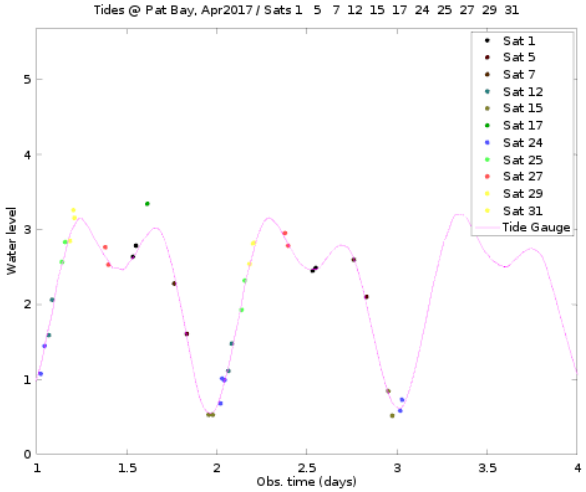
In collaboration with S. Grilli (URI), and C-A Guerin (U.Toulon)

GNSS TSUNAMI WAVE DETECTION

In collaboration with L. Leonard, G. Lintern, J. Henton

- Continuous 1Hz GNSS (NRCan and ONC)
- Latency <10s
- Configuration with 1 or 2 antennas
- GNSS used as tide gauges
- Reflected signals analyzed based on multipath reflection theory





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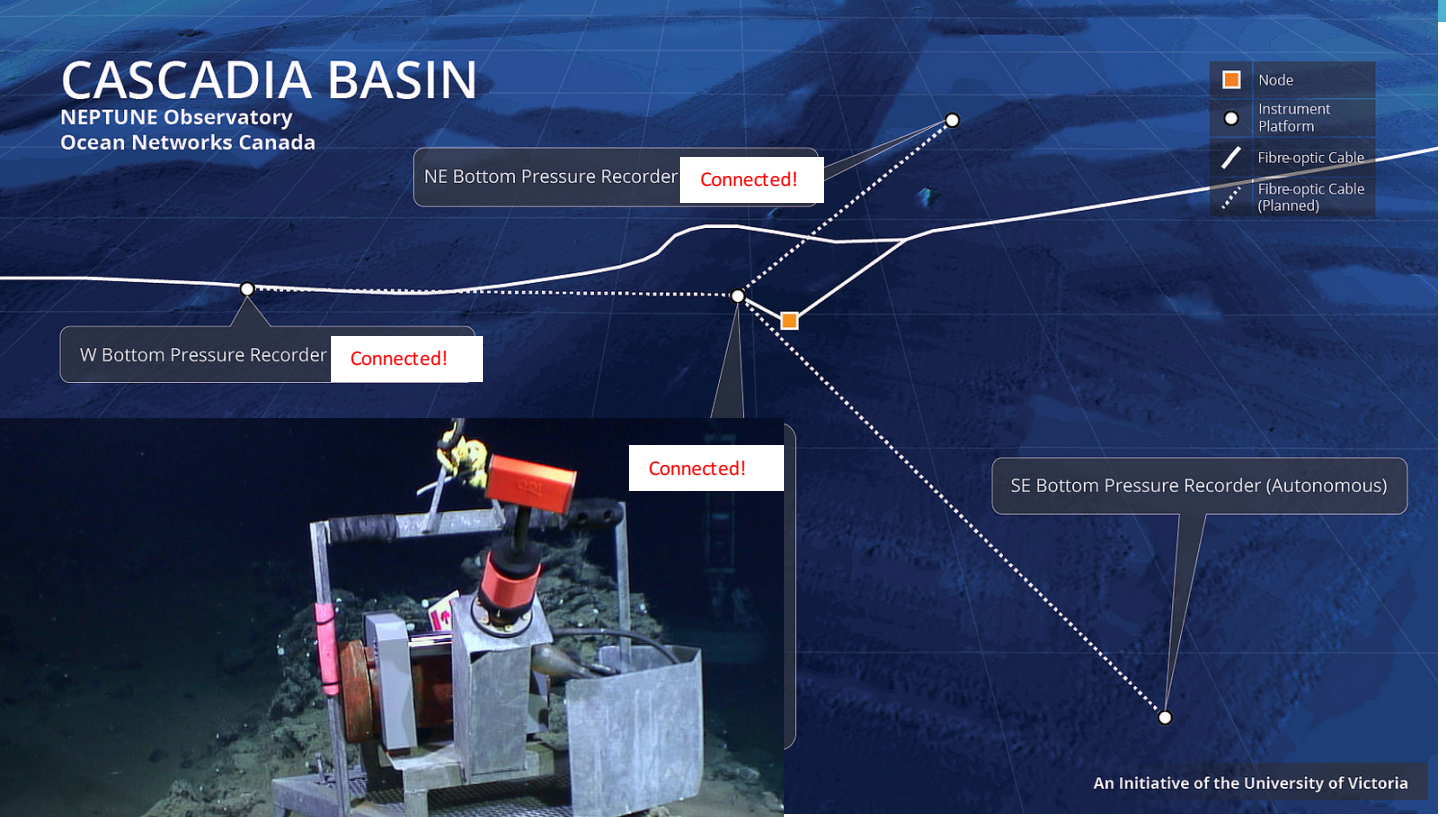

BOTTOM PRESSURE RECORDERS

- New detiding algorithm in Oceans 2.0
- NOAA real-time use
- IBM DSX use
- Data analysis for tsunami events

In collaboration with R. Thomson, A. Rabinovich, I. Fine (DFO)

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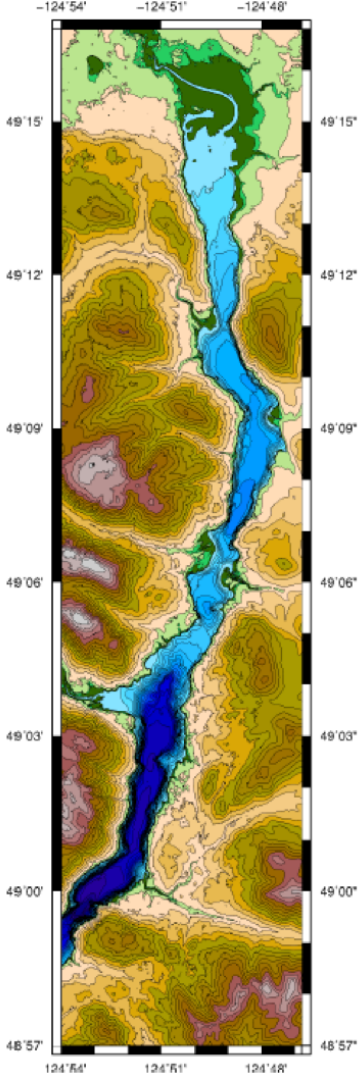
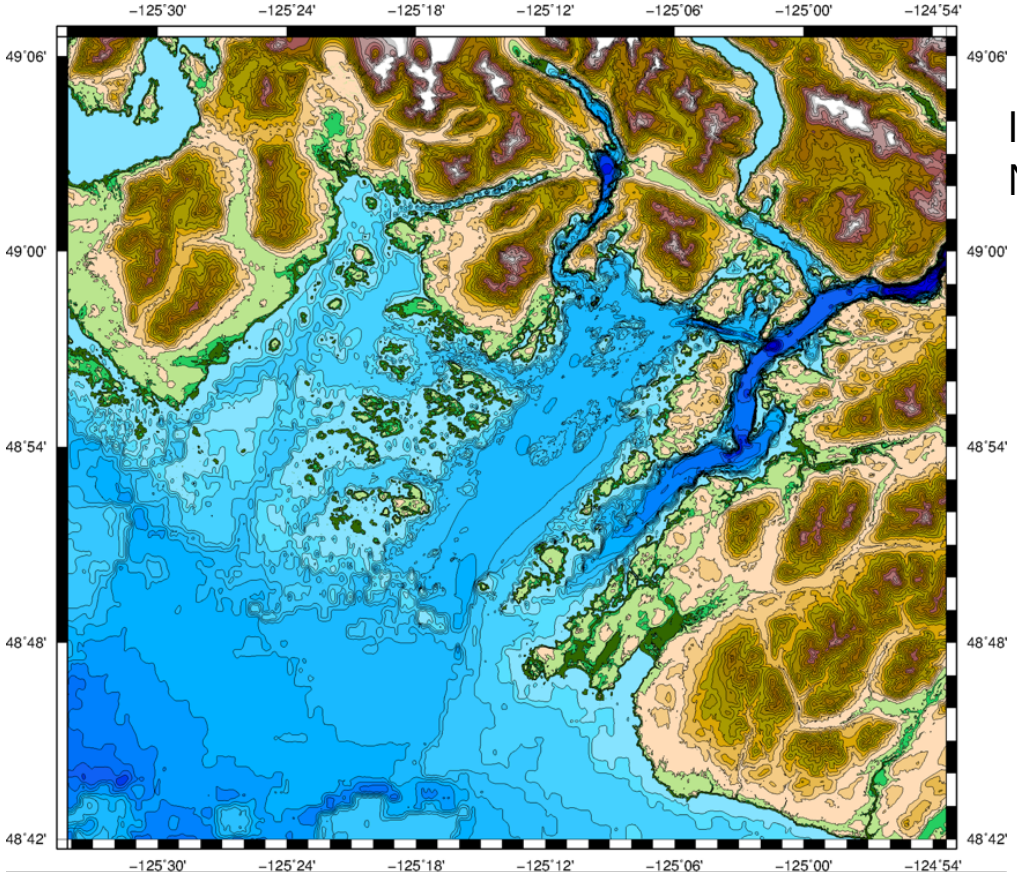
DIGITAL ELEVATION MODELS



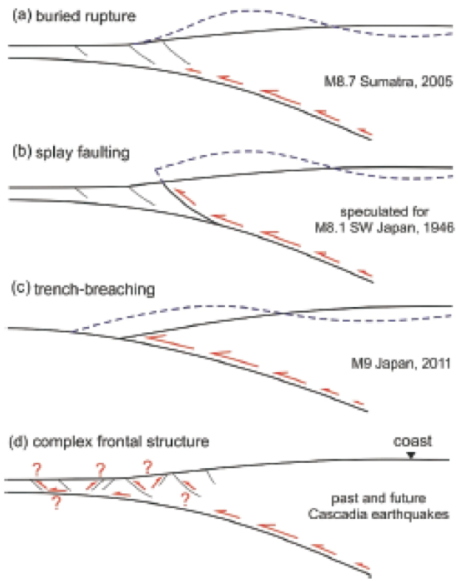


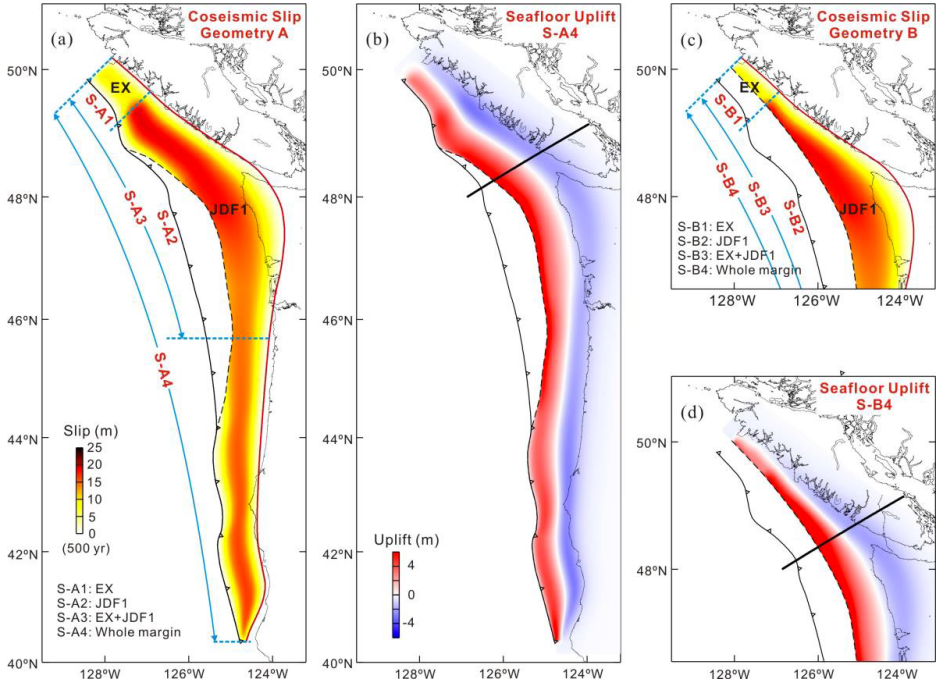
In collaboration with NOAA, GeoBC, ACRD

SOURCE MODELS

In collaboration with Kelin Wang (NRCan)

24 NEW MODELS!





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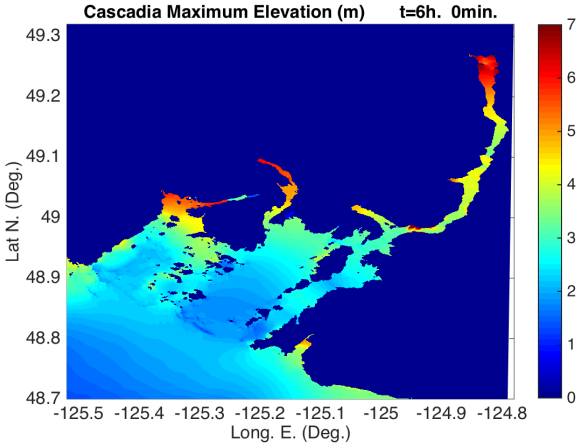
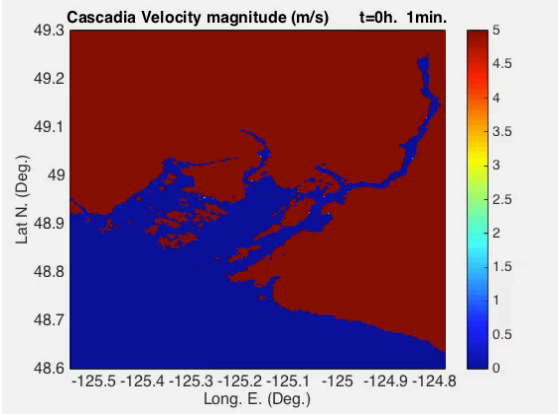
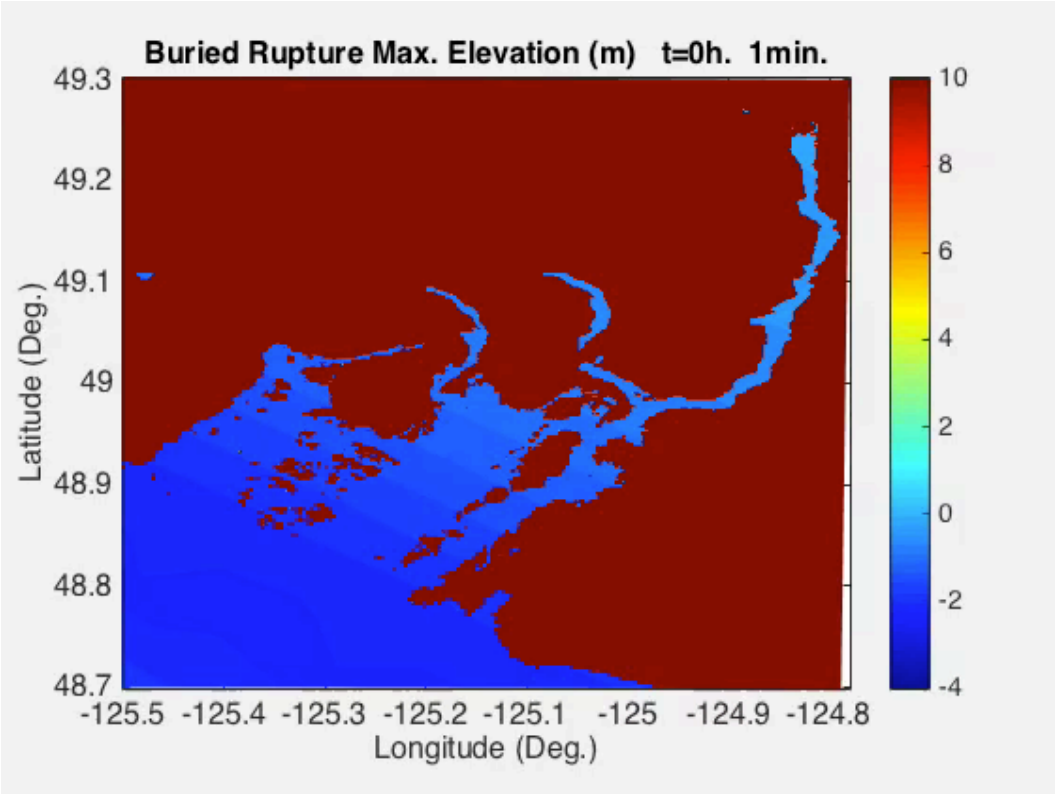
TSUNAMI MODELS

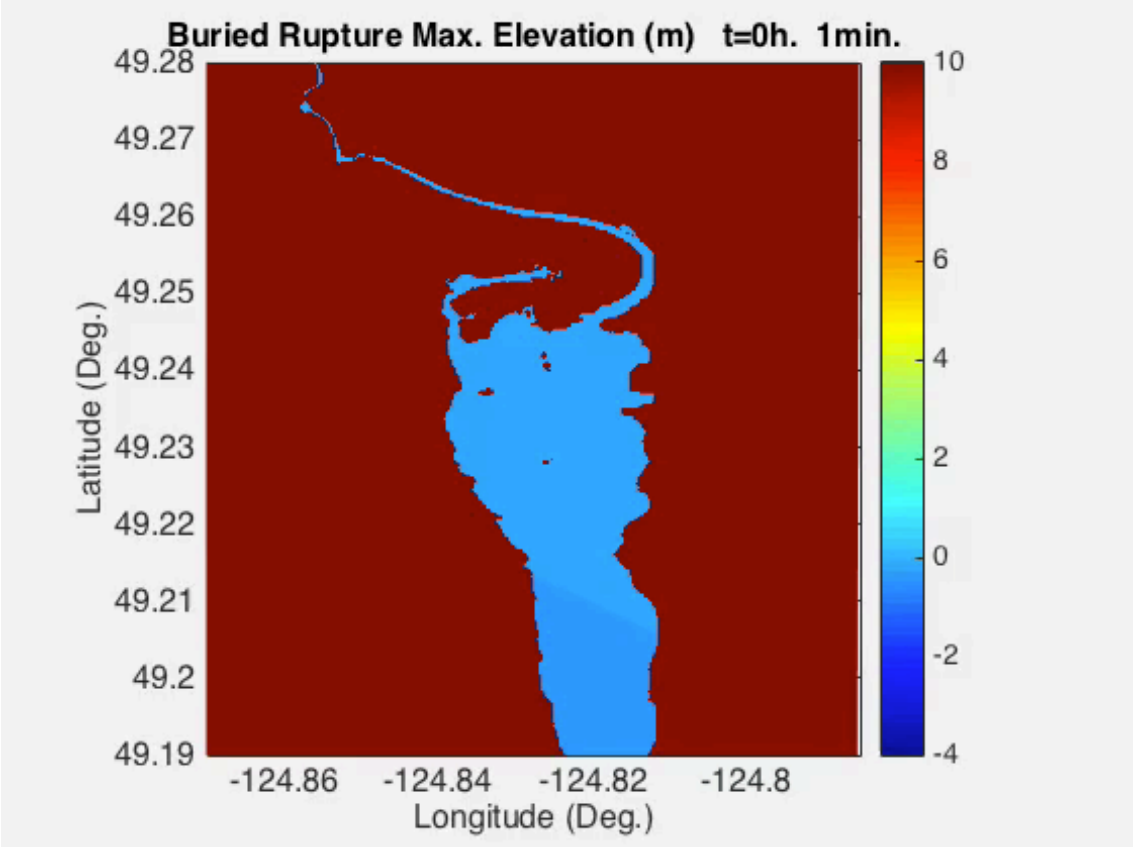
In collaboration with S. Grilli (URI)

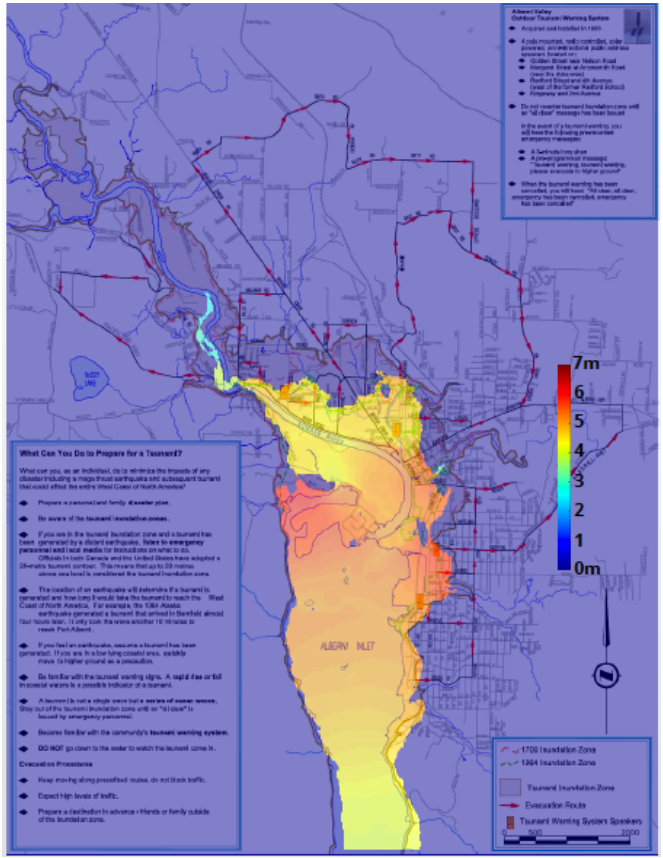






TSUNAMI MODELS





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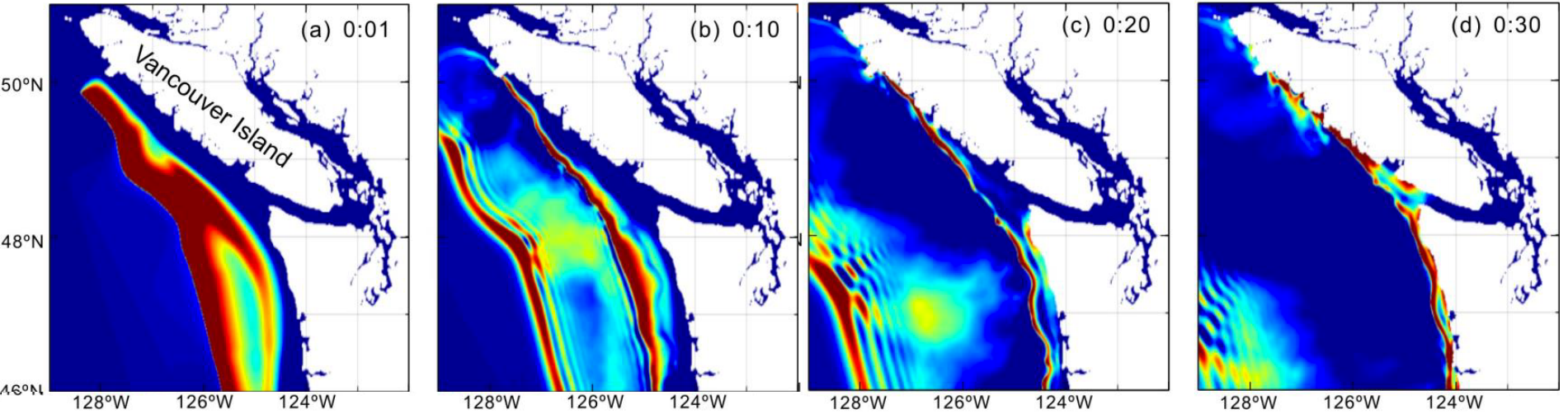
MOST RECENT RESULTS



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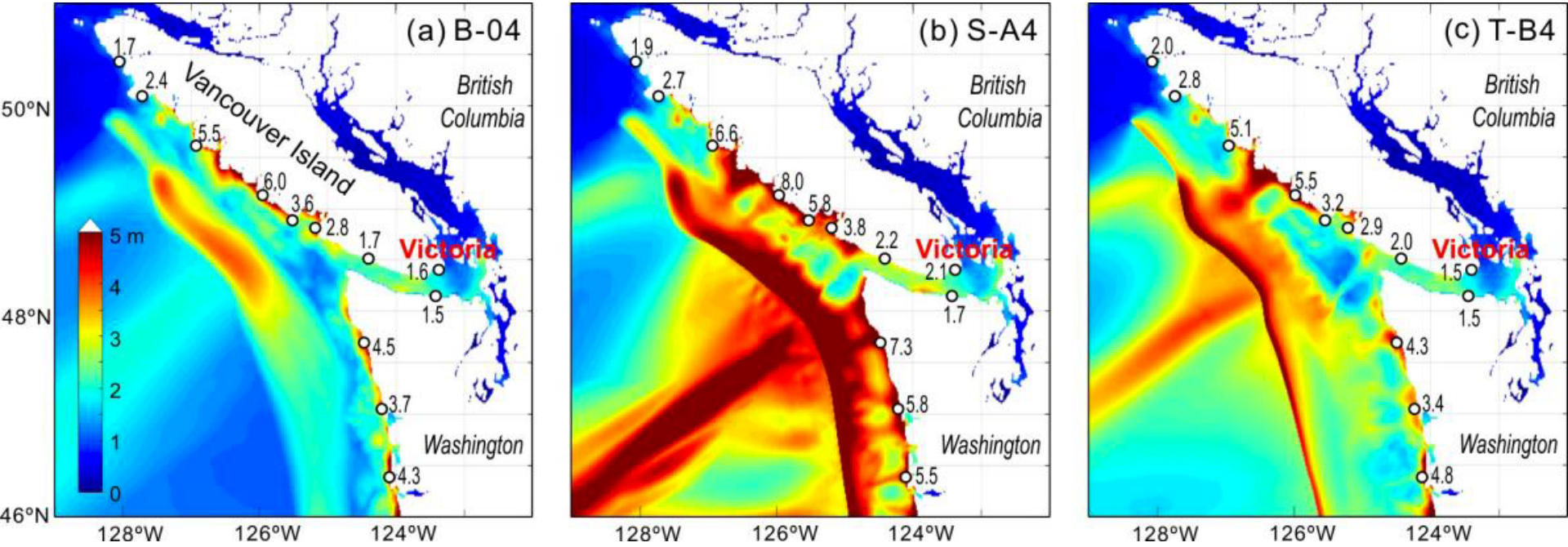

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Volt

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ONC TSUNAMI PROGRAM METRICS

ONC TSUNAMI PROGRAM BY THE NUMBERS SINCE 2014

1. More than **70 direct collaborators** including academics, government scientists, emergency managers and First Nations
2. A total of **20 students strongly involved** (12 active) in the development of the program
3. A total of **6 industry partners** (ASL, Helzel, NHC, Arlington Group, Urthecast, IBM) so far and 2 leads (Airbus and 1Qbit)
4. Continuing studies **2 courses** with a total of **~40 attendees**
5. A total of **3 international workshops** with **~70 attendees**: WERA, DEM and Tsunami
6. A total of **11 peer reviewed publications** so far and 19 contributions and abstracts:
   - 5 peer review journal publications
   - 5 peer reviewed conference articles
   - 1 preliminary patent
   - 2 United Nations presentations and 3 output documents
   - 14 conference posters and presentations

ONC TSUNAMI PROGRAM BY THE NUMBERS SINCE 2014

1. **Media references:** 5 TV interviews, 4 radio interviews, 2 industry magazines and bulletins
2. **Initial budget: $139,000** (student salaries) from IBM
3. **Total value** up to date: **~$0.8M**
   a. $560,000 – Tsunami technology NSERC-CRD
   b. $50,000 – EMBC
   c. $180,000 – Prince Rupert RFP
4. **Engaged community with framework for collaboration** (MOU GeoBC, NOAA)

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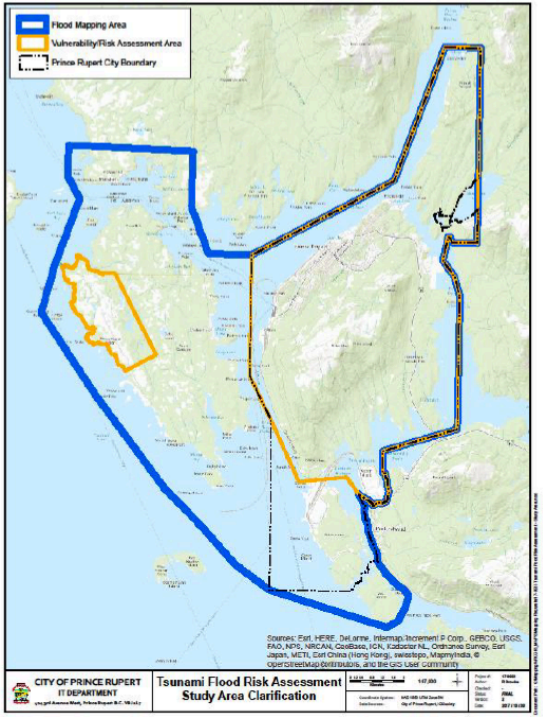
ONC TSUNAMI PROGRAM: THE WAY AHEAD

FUNDING SOURCES

1. **Current:**
   - NSERC – Science grants (students and scientists) $560k
   - Prince Rupert RFP $500k ($180k ONC)
2. **Leads:**
   - CSSP grant for tsunami hazard in Canada – proposal submitted $1.5M ($300k ONC)
   - EMBC
   - Tofino RFP
   - Defence Construction Canada
   - IBM
   - Supercluster initiative with Urthecast

THE PRINCE RUPERT PROJECT

1. **Objective:** Produce tsunami model outputs (inundation, time of arrival, velocities) for the most likely and worst cases in the area of Prince Rupert
2. **Collaborators:**
   - Northwest Hydraulics Consulting
   - Arlington Group
   - UNBC: Dr. Brian Menounos
   - SFU: Dr. John Clague
3. **Budget:** RFP total value $500k, $180k to ONC
4. **Timeline:**
   - Project start: March 2018
   - ONC deliverables: June 2018
   - Project report and start presentations: August 2018
   - Project end: December 2018



TIMELINE

2018

1. **February:**
   a. Ocean Modelling Radar Article
   b. 23rd: Discover Tectoria Demo for VR
   c. 28th: Uvic, Oak Bay, Saanich presentation
2. **March:**
   a. 13th-15th: Radar Presentation at Oceanology International
   b. Tsunami week:
      26th: Presentation for Ministry of Citizens' services
      27th-28th: Port Alberni and ACRD
3. **April:**
   a. Port Alberni results
   b. Natural Hazards source article
   c. 5th : Presentation for Project Management Institute and Professional Engineers
   d. 8th-15th: EGU Radar presentation
4. **May:**
   a. 14th-16th: BC tech summit - VR

2018

1. **June:**
   a. Prince Rupert deliverables
   b. Resolution of CSSP grant
   c. Virtual reality Royal BC museum deliverable?
   d. ASLO presentations: GNSS + VR
2. **July:** Tsunami workshop?
3. **August:**
   a. Prince Rupert project report and presentations
   b. 12th-16th: Siggraph conference VR
4. **September:**
   a. GNSS project closure
   b. DEM workshop with NOAA
5. **October:**
   a. Finish SWOT, market and partnership analysis

2019 - April: Closure Tsunami NSERC-CRD
2021 - June: Closure CSSP grant

FUTURE DEVELOPMENT – OTHER PROJECTS/MARKETS

1. **Tsunami modeling**
   a. Modeling and dynamic tide modelling
   b. Wave structure interaction
   c. Landslide generated tsunami modeling
   d. Economic impact modeling and hazard planning modelling
2. **Virtual reality –** 3 main markets
   a. Emergency operation center of the future
   b. Emergency responders training – Agent Based Modelling
   c. Public education and outreach
3. **Real time alerts**
   a. WARN: based on modeling – pending ~3yr development
   b. WERA detection – second system?
   c. GNSS: Big potential, needs development
   d. Tsunami detector in Juan de Fuca – US-Canada collaboration

MAIN RISKS AND RISK MANAGEMENT STRATEGIES

1. **Human Resources limitations and single points of failure** - Need of 4 profiles to keep developing the tsunami market:
    - *Computational Fluids Dynamics specialist* – soon to be advertised!
    - *Cloud and cluster specialist* - needed also for other programs
    - GIS specialist part time
    - Project manager and admin part time

   Strategy: Hiring modeller soon under Prince Rupert Project
2. **Hardware limitations -** ONC needs to invest in hardware and storage adequate for modeling

   Strategy: Testing new internal servers while expanding to resource allocation for research with Westgrid and industry cloud solution for commercial projects

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QUESTIONS TO THE OBSERVATORY COUNCIL

DISCUSSION

1. What is the council opinion on model outputs data storage? What should be the strategy for ONC?
2. What is the council opinion on the risk evaluation and strategies proposed?
3. What is the council opinion on the future development? What projects/markets should be targeted first by ONC?

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THANK YOU!

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