Vessel Encounter Module Updates and Follow Up

Modeling Team
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Today’s outline

1. Background
2. Movement Module Update
3. Encounter Module Update
4. Next Steps
5. Questions and Comments
Today’s discussion topics

- Current status of our work on the Vessel Movement Module
- Current status of our work on the Vessel Encounter Module
- Next steps for Model Development
Legislative background

- ESHB 1578 was passed in 2019 to reduce the risk of oil spills, and protect Southern Resident Killer Whales

- Ecology’s Spills Program tasked to undertake or assist with multiple policy initiatives in the bill, including the development of an oil spill risk model
Modeling Approach

Vessel Movement Module
- Vessels move in the system according to their empirical distribution

Encounter Module
- Measures and evaluates relationship of each vessel to the shore and other vessels

Accident Module
- Evaluates situations for their potential to lead to accidents

Oil Outflow Module
- Estimates the size of oil spills that result from accidents
Vessel Movement Module

Purpose:

- Simulate vessel activity and potential changes in traffic volume with AIS driven model
Vessel Movement Module Review

Each vessel moves on unique tracks

Tracks are created from AIS

Non AIS vessels TBD

Simulation output:

- Sets of simulated AIS messages
- Output resembles the observed AIS messages
- Has the flexibility to change traffic volumes by vessel type, origin, destination, etc.
Near Term:
- Add additional months of data to test set
- Add Ferries
- Continued testing of simulation algorithm

Longer Term:
- Non-AIS based vessels (tribal fishing, sport fishing, whale watching)
- Towing Vessels
- Dependent vessels (pilot boats, escort and assist tugs)
- Module Description Document
Vessel Encounter Module

Purpose:

- To identify if a vessel or obstacle is nearby enough to represent the possibility of a collision or a powered grounding
Role of the Encounter Module

**Identify locations and potentialities of collisions**
- A collision requires at least two vessels
- Excludes from accident calculation areas and moments where collisions can’t occur

**Identify locations and potentialities of powered groundings**
- A powered grounding requires a shoreline or underwater hazard
- Excludes from accident calculation areas and moments where groundings can’t occur
Technical Discussion Review – Comparing Ship Domains

**Quaternions Ship Domain (QSD)** (Wang 2010)

**Pentagonal Ship Domain** (Bakdi 2019)
Areas for Further Discussion

**Tugs Towing Astern**
- Length of tow/length of barge

**Grounding Encounters**
- Representing the possibility of a collision or a powered grounding
Ship Domains for Tugs and Tows

Vessel characteristics include tow length and barge length
- Towing Astern:
  - Length of Tow: .13 nautical miles
  - + or -.05 nm

- Pushing Ahead
  - Identified subset of vessels
An Approach for Powered Groundings

Defining powered grounding
• Grounding due to navigational error or mechanical issue while vessel is under power

Defining a “grounding candidate”
• The simultaneous presence of a vessel and an underwater hazard in a finite area

How nearby is nearby enough
• No consensus on proximity measure and threshold

Fewer models available in the literature
• Ship domain and CPA based approaches
Selecting an Encounter Model for Powered Groundings

**Model requirement**
- Appropriate for critical turns

**Critical turn models**
- Calculate straight line extending along vessel heading
- Of varying lengths, of varying shapes
Selecting an Encounter Model for Powered Groundings

**Model requirements**
- Appropriate for lateral proximity

**Lateral proximity models**
- Various ship domains
Combined Approach for Grounding Candidates

**Critical turn detection**
- 20 minute vector cone
  - Fowler and Sorgard (2000)
  - Skinnemoen (2018)

**Lateral proximity detection**
- Existing ship domain model
  - Wang (2010)
  - Bakdi (2019)
Detecting overlap with underwater hazards

Two types of grounding candidates
- Vessel draft exceeds water depth
  - within area of cone
  - within area of ship domain

Data Sources
- Vessel drafts
- Bathymetric data
## Grounding candidate model selection

<table>
<thead>
<tr>
<th>Feature</th>
<th>Pro</th>
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<tbody>
<tr>
<td>Variety of vessels</td>
<td>• Ship domain includes ship length and width</td>
</tr>
<tr>
<td>Sensitive to speed</td>
<td>• 20 minute vector linked to speed</td>
</tr>
<tr>
<td>Okay for simulated data</td>
<td>• Does not require detailed maneuvering data</td>
</tr>
<tr>
<td>Detects turns and lateral proximity</td>
<td>• Combined approach</td>
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<tr>
<td>Computational efficiency</td>
<td>• Relatively simple, well documented and reproducible</td>
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Potential Grounding Candidates

Inbound in Strait of Juan de Fuca

• LPG Tanker
  • Length: 740 feet
  • Beam: 120 feet
  • Draft: 30 feet
Potential Grounding Candidates

Approaching Port Angeles Pilot Station
Potential Grounding Candidates

Approaching Southern Entrance to Rosario
Potential Grounding Candidates

Approaching Southern End
Bellingham Channel
Potential Grounding Candidates

North End Bellingham Channel
Potential Grounding Candidates

Approaching Vendovi Anchorage
Areas for Further Discussion

**Grounding Candidates of Long Duration**
- Narrow channels
- On approach to port

20 minute vector cone for detecting critical turns

Ship Domain for detecting lateral proximity
Encounter Module: Next Steps

Near Term
- Test Encounter Models
- Test Grounding Models

Longer Term
- Validate model results for simulated data and AIS data
First survey for feedback on outreach process
• Sent out to more than webinar 400 registrants
• 17 responses received
Survey Results

**Generally happy with outreach so far**
- Webinars described as very helpful, helpful, or somewhat helpful
- Rated outreach efforts at 7-10 out of 10
- 86% say our outreach process is meeting their expectations

**Not all outreach tools are helpful**
- 44% described eComment as unhelpful
Survey Results

Sample comments
• Please be less scripted in the webinars
• Get greater industry participation and involvement
• Simply equating congestion to vessel encounters will not be sufficient
• How will localized weather conditions be incorporated into the model?
Outreach Adjustments

**Streamline tools**
- Discontinuation of eComment tool, for now

**Reduce scriptedness**
- Alternative platforms for technical discussions

**Produce additional resources**
- Frequently asked questions document
Webinars and Technical Discussions

月中讨论
6月至8月 2020

模型开发
9月至10月 2021

Sep Nov Feb Mar May Aug Sep Oct

- 船只移动模块
- 船只遭遇模块
- 船只事故模块
- 油流出模块
Upcoming events

May 26th, 2021 -- 1 pm to 3 pm
- Vessel Accident Module Webinar
Discussion logistics
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References


