Emergency Towing: Risk Assessment

Canadian Marine Shipping Risk Forum
Salish Sea Transboundary Working Group (SSTWG)

March 3rd, 2022

Transport Canada Transports Canada

Canada

Presentation Overview

- **Purpose:** provide an overview of the initiative and proposed risk assessment process

  - Short-Term Measures
  - National Strategy Development
  - Marine Navigational Risk Assessment

Figure 1. *CCG leased emergency tow vessel: Atlantic Eagle.*

What is Emergency Towing?

- **Emergency towing is conducted to assist disabled vessels:**

- Objective is to prevent incidents, ensure crew safety, and prevent/mitigate spills

- Vessels are often towed on a non-emergency basis in Canada. For example, a vessel that is seaworthy but in need of repairs may be towed from one location to another during calm weather

- For large ocean-going vessels (33 m and longer) specialized towing vessels and crew are needed to provide safe and effective ET services

Examples of large disabled vessels in Canadian waters:

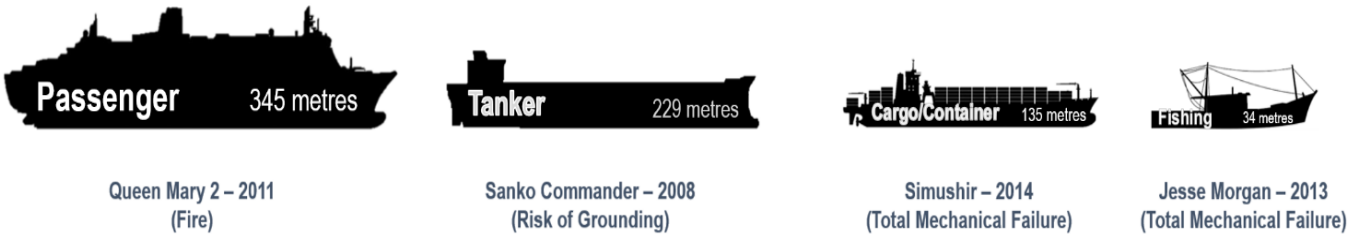


Figure 2. *Examples of large disabled vessels in Canadian waters.*

Short-Term Measures

- **Objective:** Increase emergency tow capacity while the national strategy is being developed

- **Tow kits:** Successfully procured and delivered across the country

- **Emergency Towing Vessels:** On November 5, 2021, the Government of Canada announced a one-year contract extension for the lease of the two emergency towing vessels, the *Atlantic Raven* and the *Atlantic Eagle*.

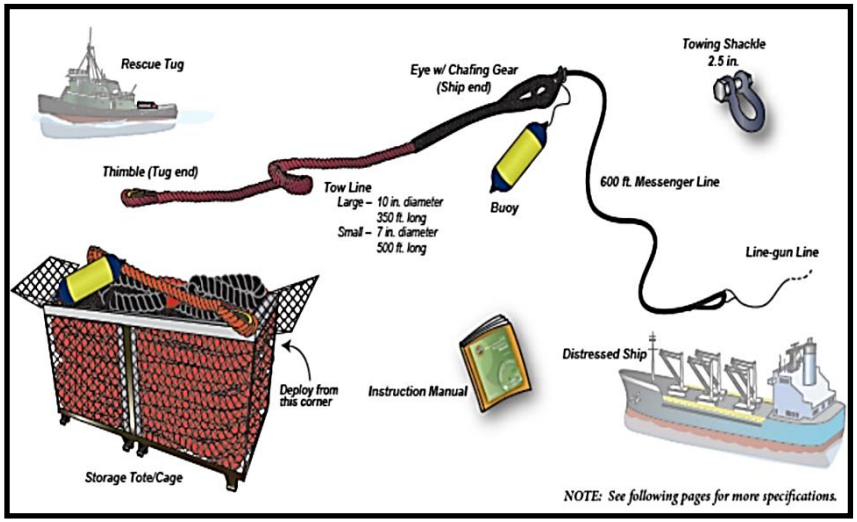


Figure 3. *Example of tow kit.*

National Strategy Development

- **3 Objectives:**
  1. Identify what capacity is required nationally and by region
  2. Determine how ET will be funded and operated
  3. Clarify roles and responsibilities for ET in Canadian waters

- **Risk assessment** is under development
  - One of several inputs to determine ET capacity (cost-benefit analysis, engagement, qualitative analysis and lessons learned from West Coast ETVs)
- **Analysis** of International ET systems/studies (*Summer 2022*)
- **Options paper** for potential governance/funding models (*Spring 2023*)
- **Engagement** on potential governance/funding models (*Spring 2023*)
- **National Strategy** (*Fall 2024)*

Risk Assessment

Risk assessment aims to answer four primary research questions that are national in scope:

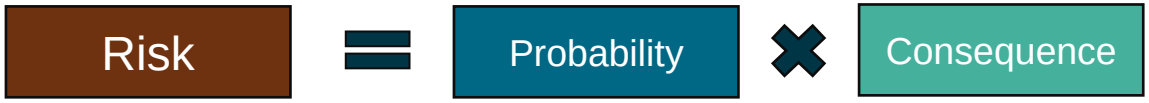
1. Where are large vessels (captured by AIS) currently and in the future more likely to become disabled in Canadian waters?

2. Currently and in the future where and when are large vessels (captured by AIS) more likely to get into accidents in Canadian waters?

3. Where are the areas of highest risk for each accident type?

4. Identify which high-risk areas have existing industry and government towing capacity and where capacity gaps exist.

Risk Assessment: Approach



Probability:

- Using ship accident models to compute expected number ship of accidents.
- Models for: collisions, fire/explosions, groundings (powered and non-powered) hull/machinery damage, and striking's (i.e., allisions).
- Results by accident type, vessel type, vessel size per month and year.

Consequences:

- Still being developed.

Tugs/government vessels of opportunity (additional quantitative study):

- Using an approach similar to Clear Seas (via Nuka consulting) study of "*Availability of Tugs of Opportunity in Canada's Pacific Region*".
- For all of Canada; to identify geographic areas where there might be capacity gaps in terms of towing capacity.

Risk Assessment: Probability (quantitative)

At a high-level, most accident models use yearly averaged accident rate by geographic area, vessel type, and vessel size multiplied by a level of exposure (i.e., vessel traffic metric) to compute expected number of accidents.

Accident rates

Accident data from IHS-Markit from 2005 to 2018 combined with level of exposure (e.g., distance sailed and encounters) data derived from satellite-based AIS data that was analyzed from 2015 to 2018.

For most accident models (fire/explosions, groundings, hull/machinery damage, and striking's), average yearly accident rates are created. They are created per accident type (36 accident rates per):

- Geographic area (4): port, internal waters, 12-24 nm waters, and open sea.
- General vessel type (3): commercial, non-commercial, and others.
- General vessel size (3): <1,000GT, 1,000-10,000GT, and >10,000GT.

For collision model, average yearly accident rates are also created but are not stratified by vessel size (24 accident rates):

- Geographic area (4): port, internal waters, 12-24 nm waters, and open sea.
- General vessel type interaction (6): commercial-to-commercial, commercial-to-non-commercial, commercial-to-others, non-commercial-to-non-commercial, non-commercial-to-others.

Data feeding into the accident rates (accident and level of exposures) were analyzed for Western Europe, North America, and northeastern Asia.

Risk Assessment: Probability (quantitative)

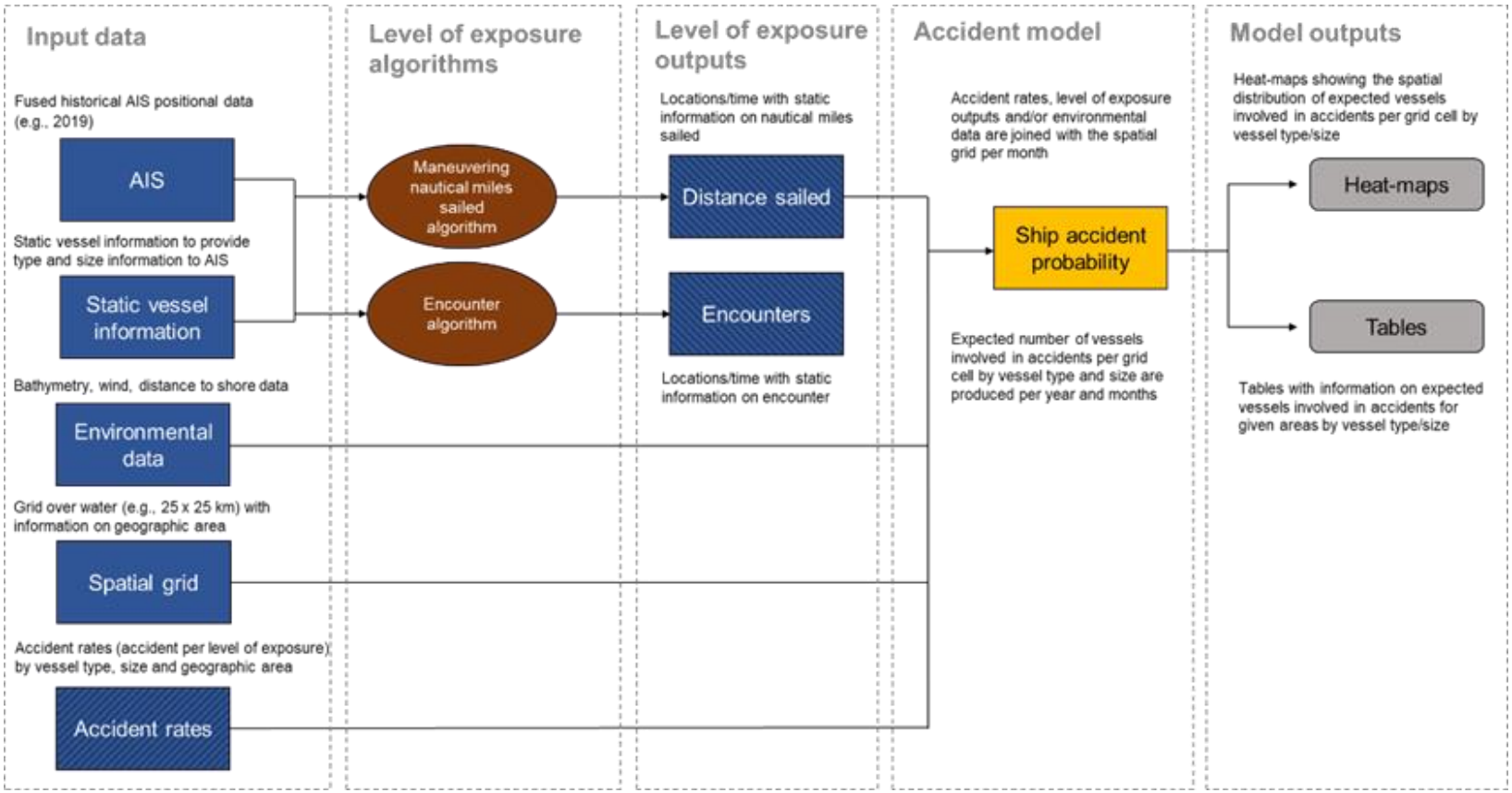


Figure 4. *Generalized example of the ship-accident models workflow.*

Risk Assessment: Stages

Stage 1: Historical context (data analyses)

- Vessel traffic analysis.
- Ship accident analysis (leveraging Clear Seas work).
- Tugs/government vessels of opportunity study

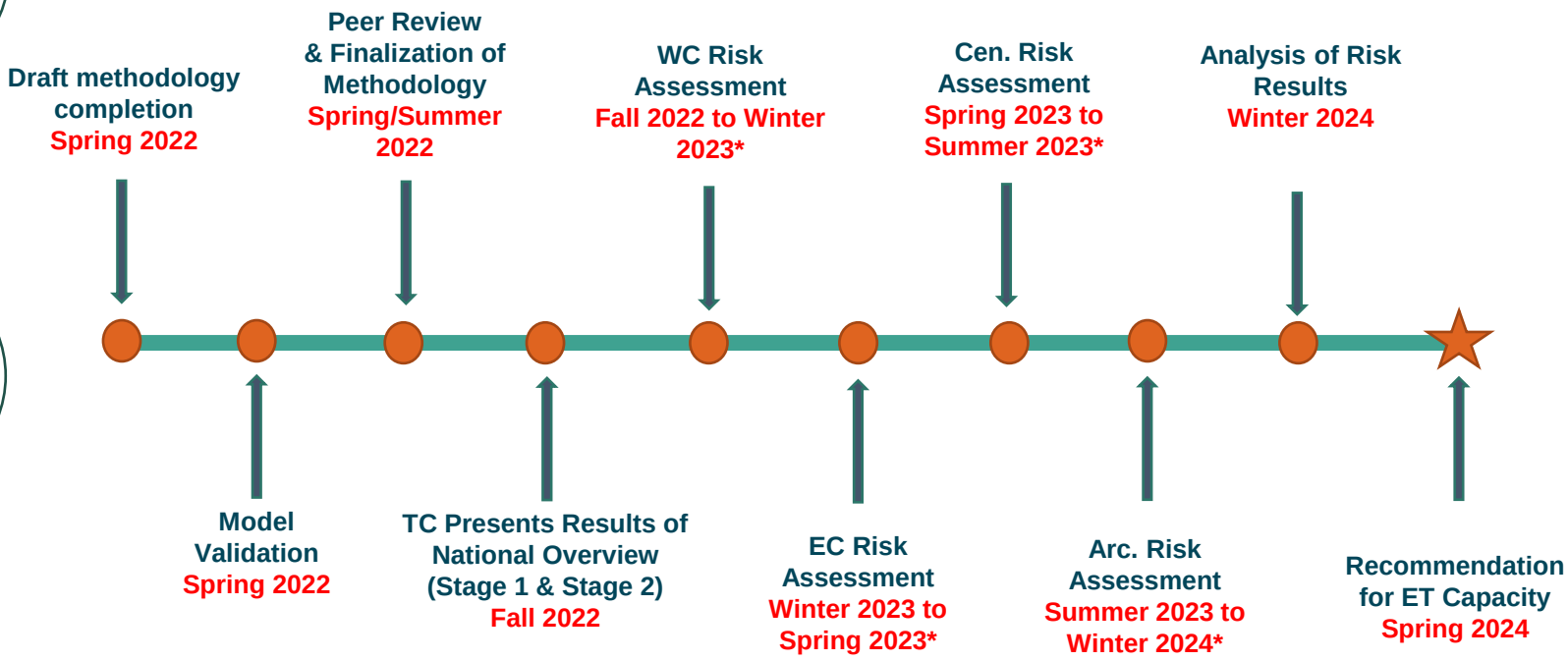
Stage 2: Baseline risk assessment for all of Canada (risk = probability x consequences), using 2019 as the baseline year.

- **Probability** assessment using ship accident models to predict where and when expected ship accidents (collisions, striking's, groundings, fire/explosions, hull/machinery damage) by vessel type and size would occur for a baseline year.
- **Consequences [still being developed]** for different accident types, vessel types, and sizes per month/year.
- Overlay information from the tugs/government of vessels opportunity study to determine locations and times where there is **low towing capacity but high risk**.

Stage 3: Scenario-based risk assessment for each region in Canada (scenario-based risk = scenario-based probability x consequences). Four regional risk assessments.

- Conduct engagement sessions to gather information on shipping-scenarios for each region. Using the information gathered in this session, re-run the ship-accident models to determine scenario-based probabilities for each region.
- Combine the scenario-based probability and consequences to determine scenario-based risks across Canada for different accident types, vessel types, and sizes.
- Overlay information from the tugs/government of vessels opportunity study to determine locations and times where there is low towing capacity but high scenario-based risk.

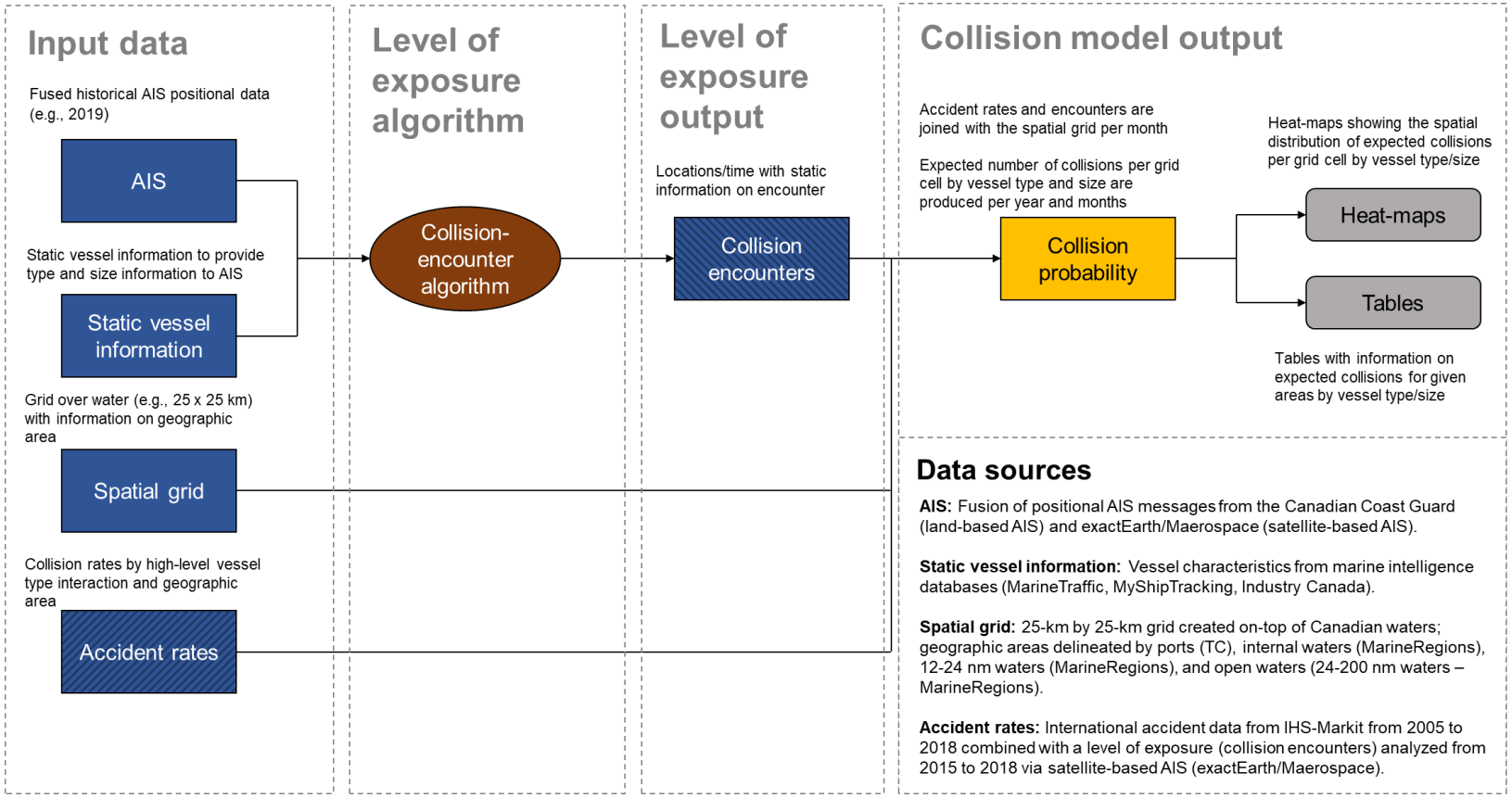
Timeline


Draft methodology completion
Spring 2022
Peer Review & Finalization of Methodology
Spring/Summer 2022
WC Risk Assessment
Fall 2022 to Winter 2023*
Cen. Risk Assessment
Spring 2023 to Summer 2023*
Analysis of Risk Results
Winter 2024
Model Validation
Spring 2022
TC Presents Results of National Overview (Stage 1 & Stage 2)
Fall 2022
EC Risk Assessment
Winter 2023 to Spring 2023*
Arc. Risk Assessment
Summer 2023 to Winter 2024*
Recommendation for ET Capacity
Spring 2024

Thanks for your time.

Questions?

Annex: Collision model workflow



Data sources

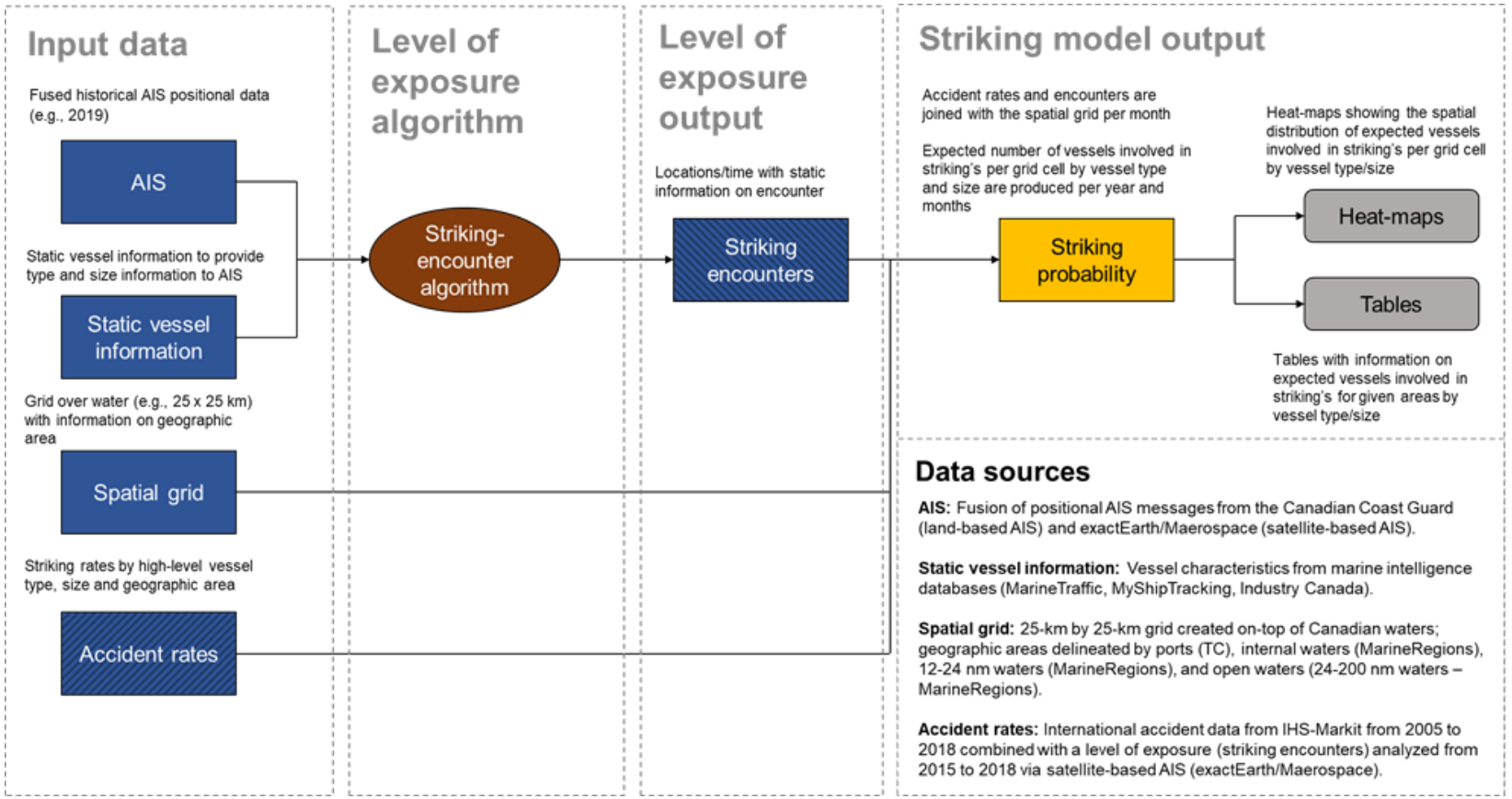
AIS: Fusion of positional AIS messages from the Canadian Coast Guard (land-based AIS) and exactEarth/Maerospace (satellite-based AIS).

Static vessel information: Vessel characteristics from marine intelligence databases (MarineTraffic, MyShipTracking, Industry Canada).

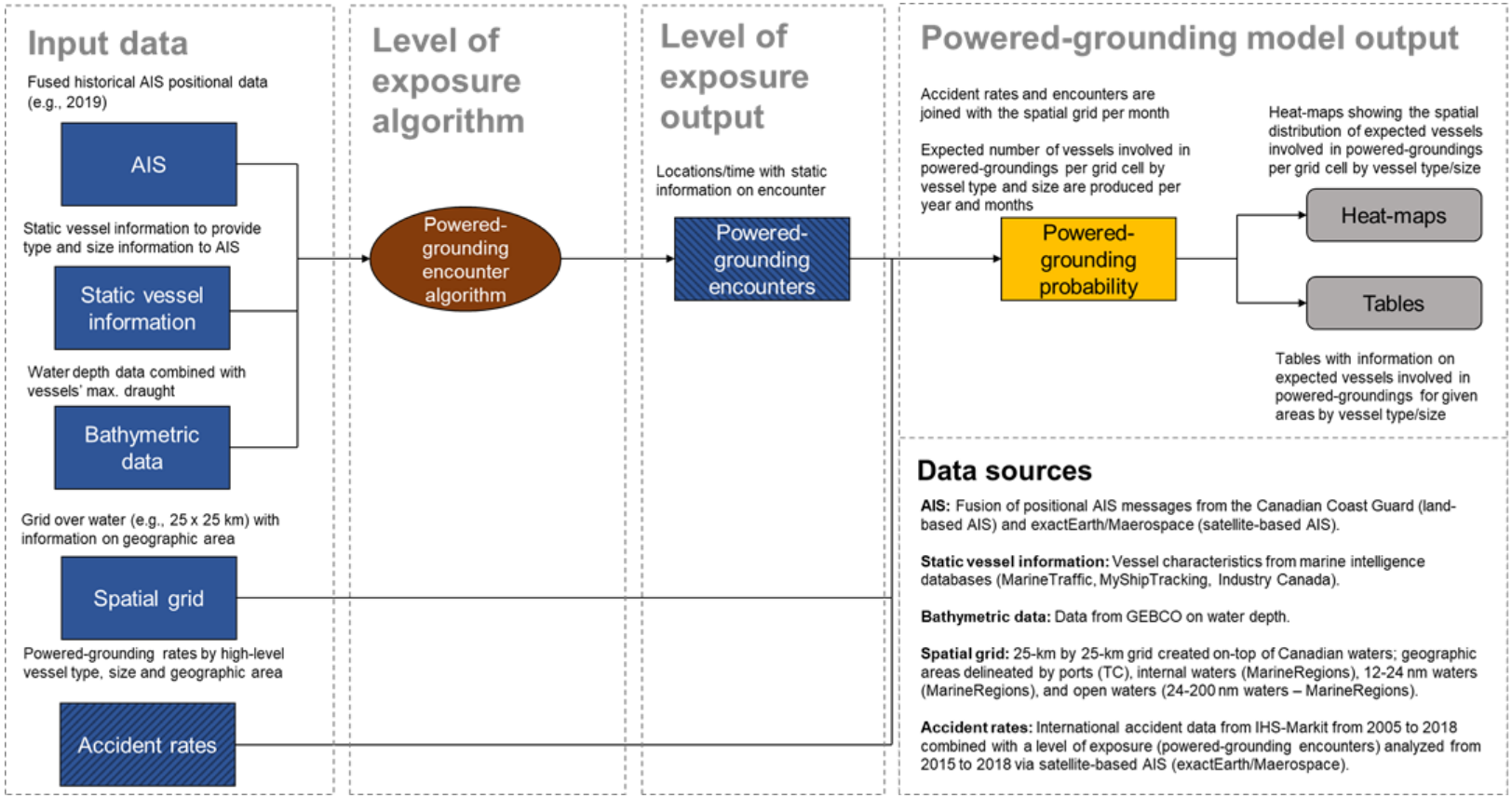
Spatial grid: 25-km by 25-km grid created on-top of Canadian waters; geographic areas delineated by ports (TC), internal waters (MarineRegions), 12-24 nm waters (MarineRegions), and open waters (24-200 nm waters – MarineRegions).

Accident rates: International accident data from IHS-Markit from 2005 to 2018 combined with a level of exposure (collision encounters) analyzed from 2015 to 2018 via satellite-based AIS (exactEarth/Maerospace).

Annex: Striking model workflow

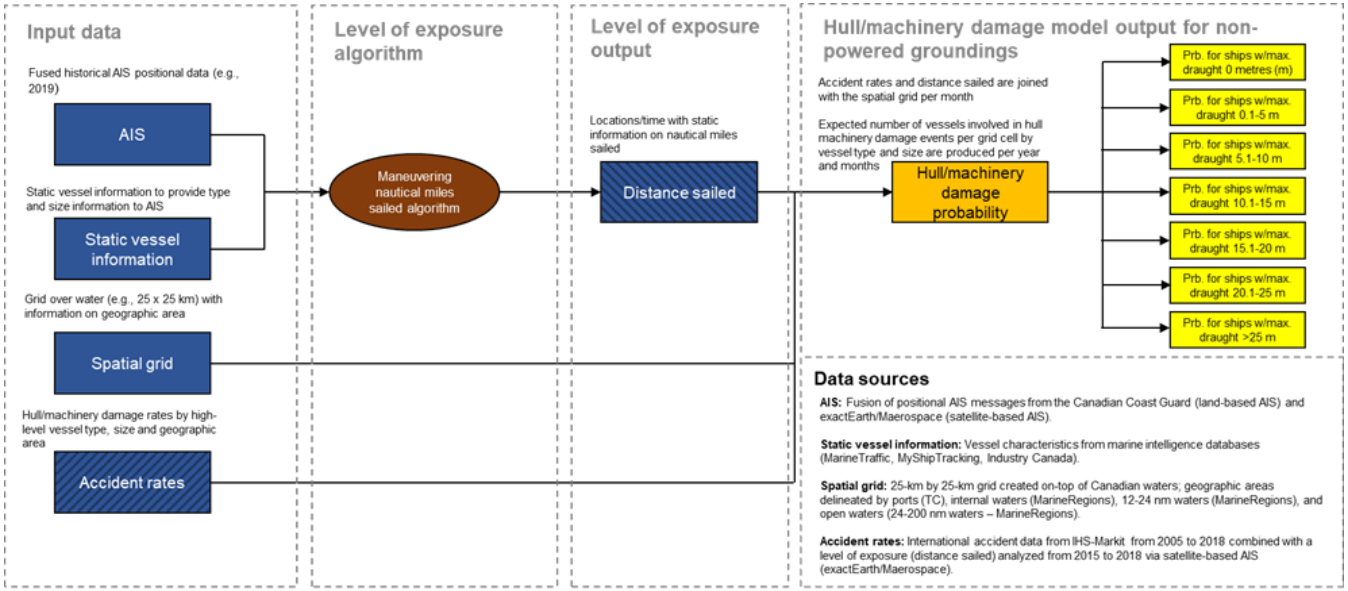


Annex: Powered grounding model workflow

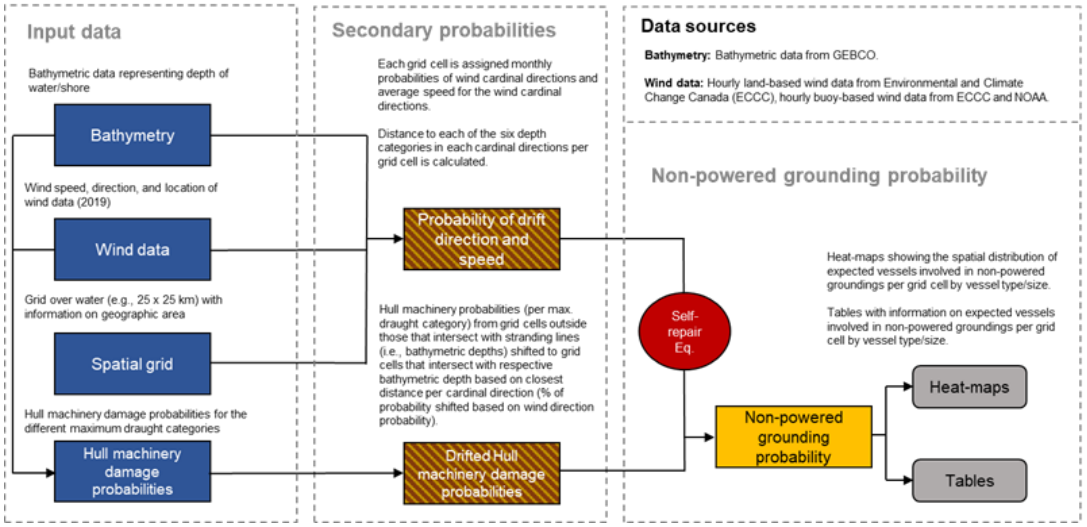


Annex: Non-powered grounding model workflow

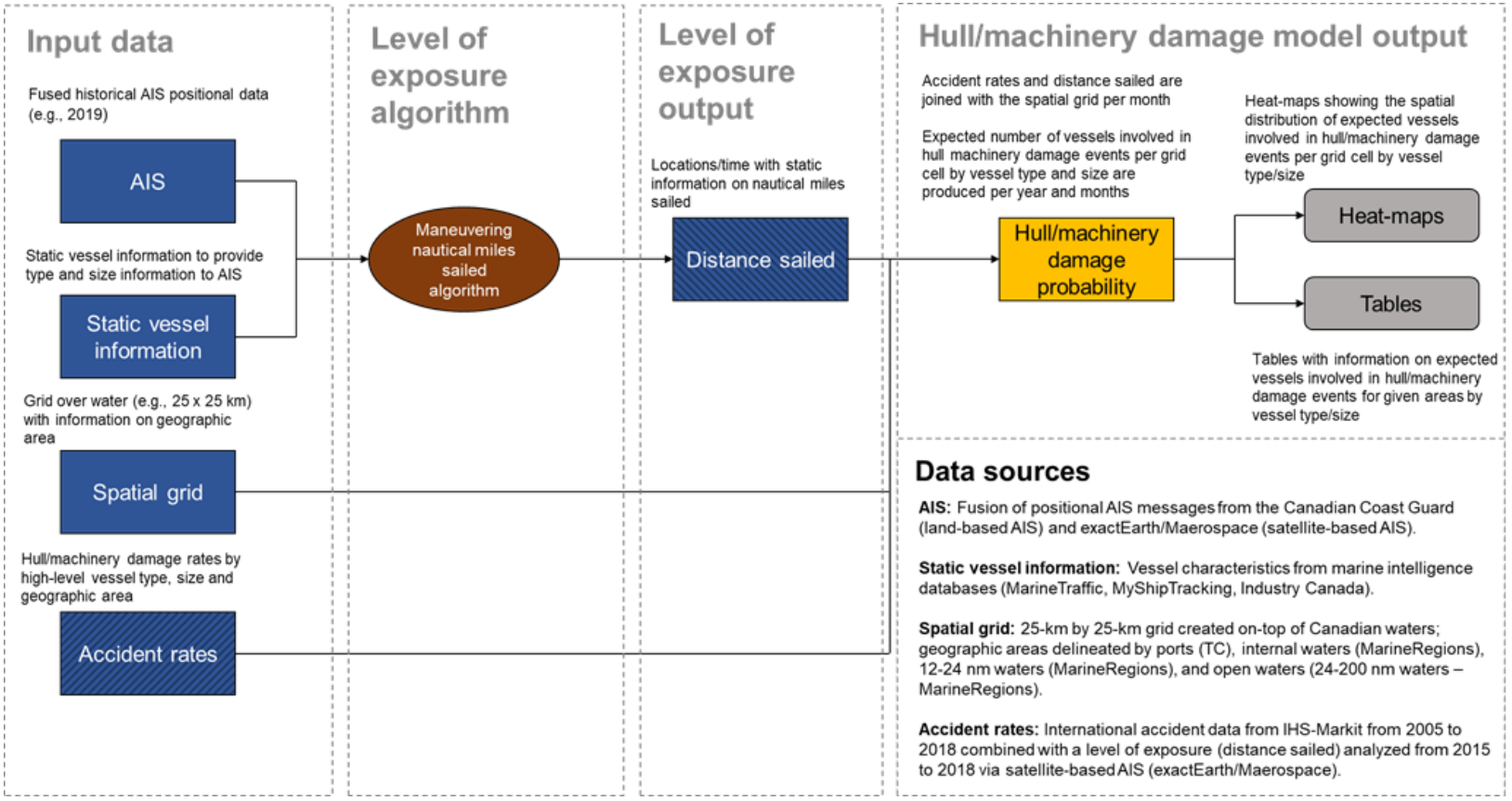
Part 1



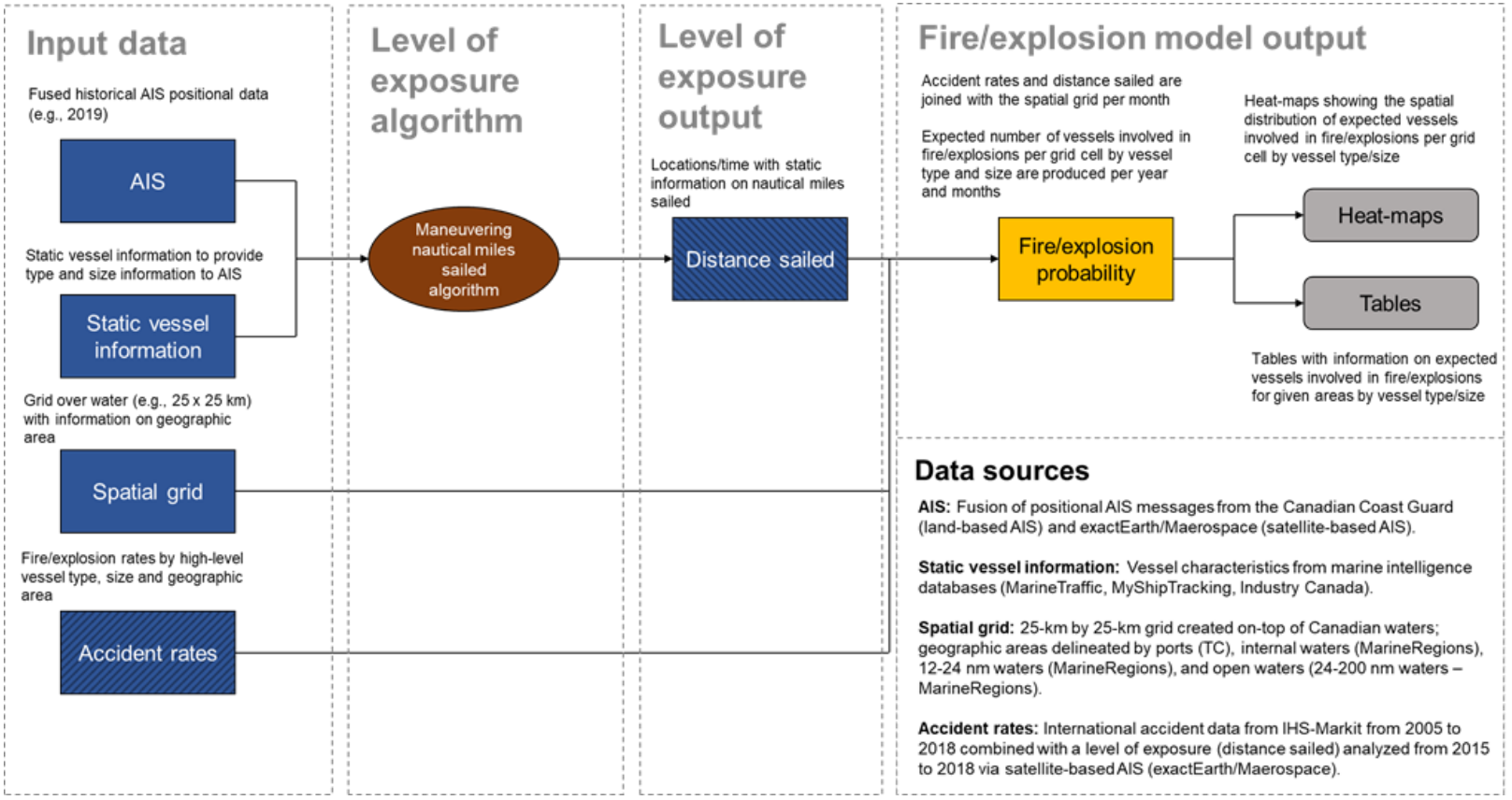
Part 2



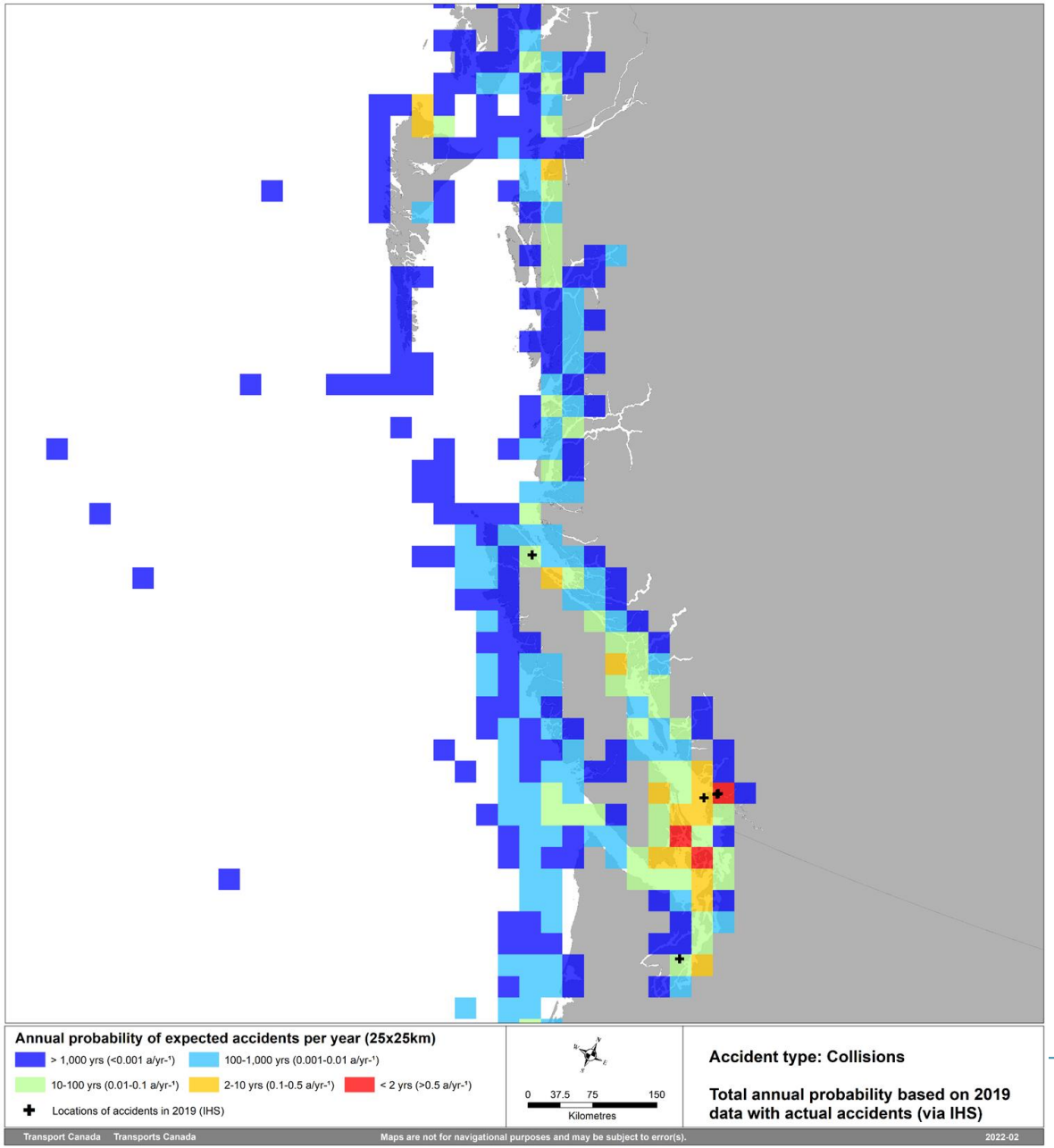
Annex: Hull/machinery damage model workflow



Annex: Fire/explosion model workflow



Annex: Collision model test run



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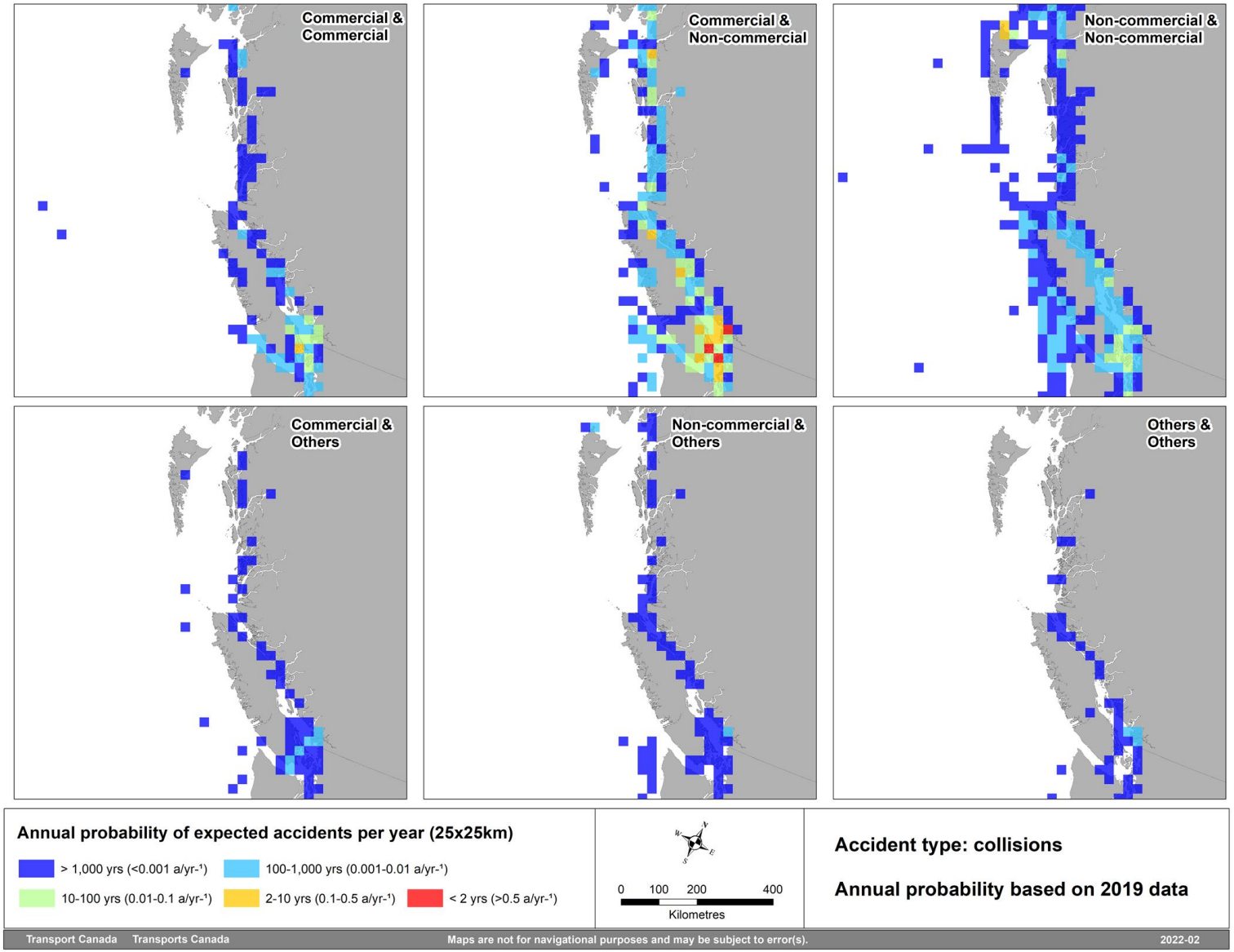

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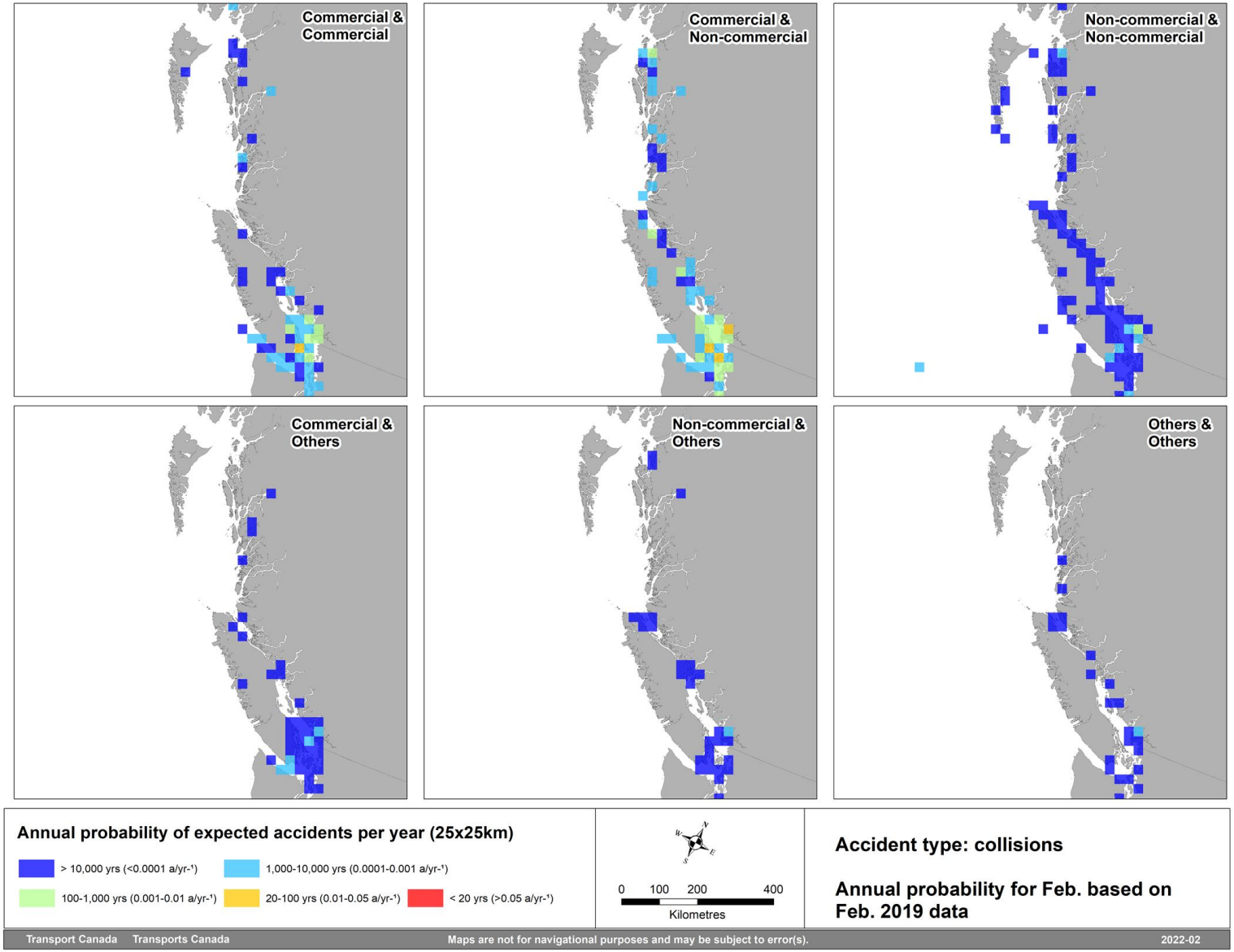

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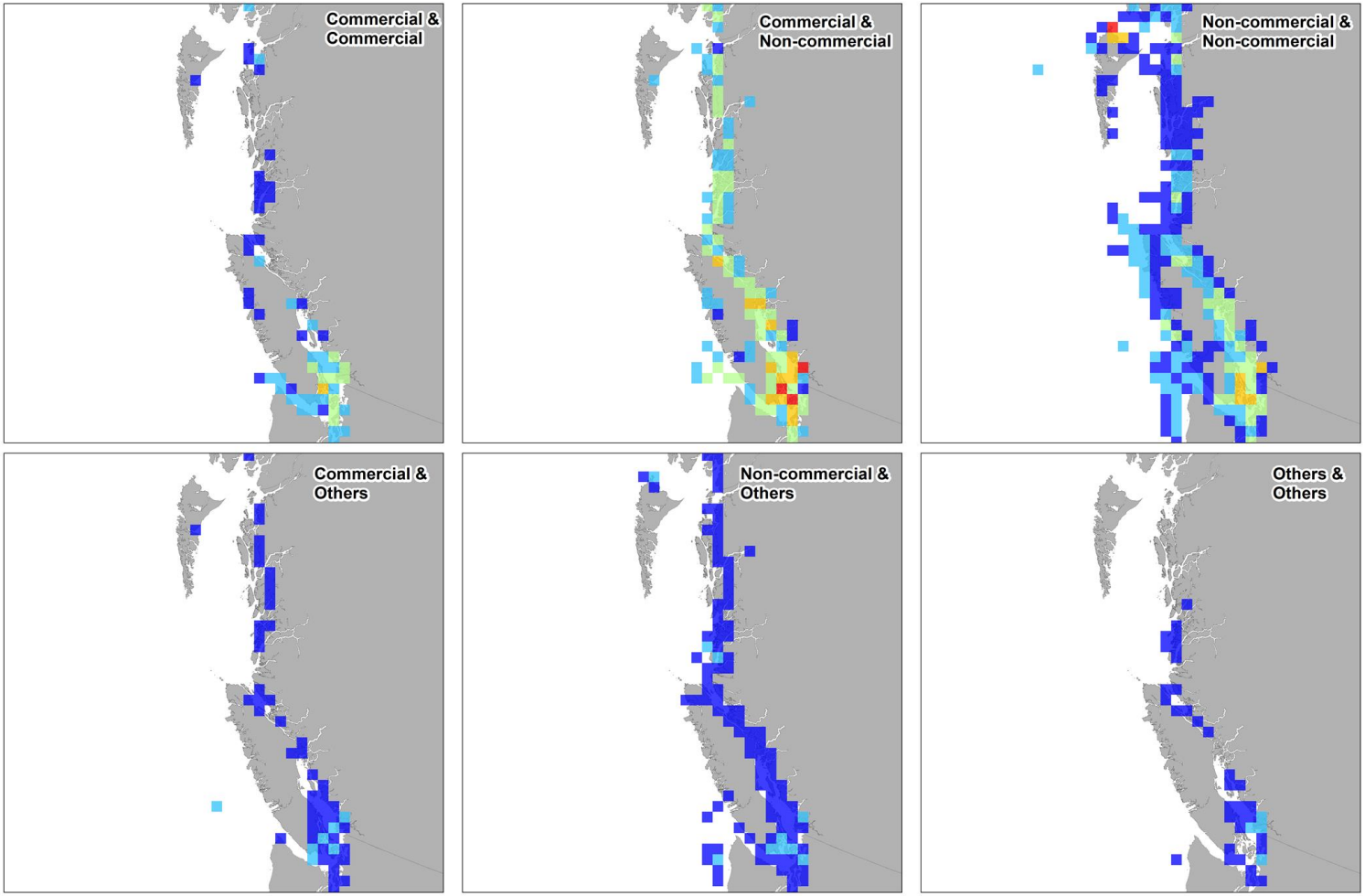

Annex: Collision model test run

Entire model run area Collisions						
Vessel Types	Annual		Feb.		Aug.	
	Expected accidents	Return period	Expected accidents	Return period	Expected accidents	Return period
Commercial & commercial	***5.73E-01***	***1.7***	***3.73E-02***	***26.8***	***6.12E-02***	***16.3***
Commercial & non-commercial	***5.59E+00***	***0.2***	***1.41E-01***	***7.1***	***1.01E+00***	***1.0***
Non-commercial & non-commercial	***1.15E+00***	***0.9***	***6.13E-03***	***163.0***	***3.19E-01***	***3.1***
Commercial & others	***5.45E-02***	***18.3***	***3.58E-03***	***279.4***	***6.14E-03***	***162.8***
Non-commercial & others	***1.69E-02***	***59.3***	***3.95E-04***	***2,531.6***	***3.39E-03***	***294.9***
Others & others	***1.25E-02***	***80.0***	***7.35E-04***	***1,360.5***	***1.28E-03***	***780.6***
Total	**7.397**	**0.1**	**0.190**	**5.3**	**1.397**	**0.7**

West coast prelim. Validation		
IHS collisions 2019:	5.000	
Model error:	+2.397	+47.9%