UNDERSTANDING THE IMPACT OF COVID-19 ON THE SOUNDSCAPE THROUGH MODELLING AND OBSERVATORY DATA

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APPLIED OCEAN SCIENCES

OCEAN NETWORKS CANADA

1 INTRODUCTION

At frequencies below 400 Hz, the global soundscape is dominated by shipping, marine mammals (at selected frequencies) and large storms.

Thanks to the progress in computational power, it is now possible to model the ship and wind contribution to the soundscape at these frequencies on a global scale in a manageable time. It is essential, in order to improve the accuracy of these models, to validate the results with measured data.

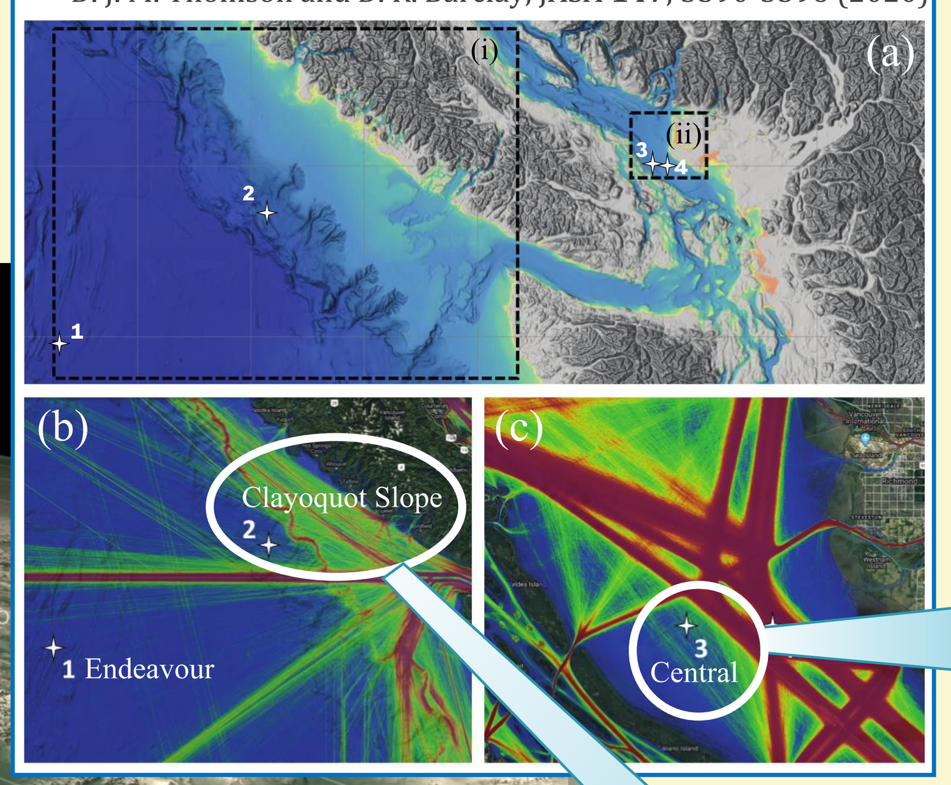
METHODS

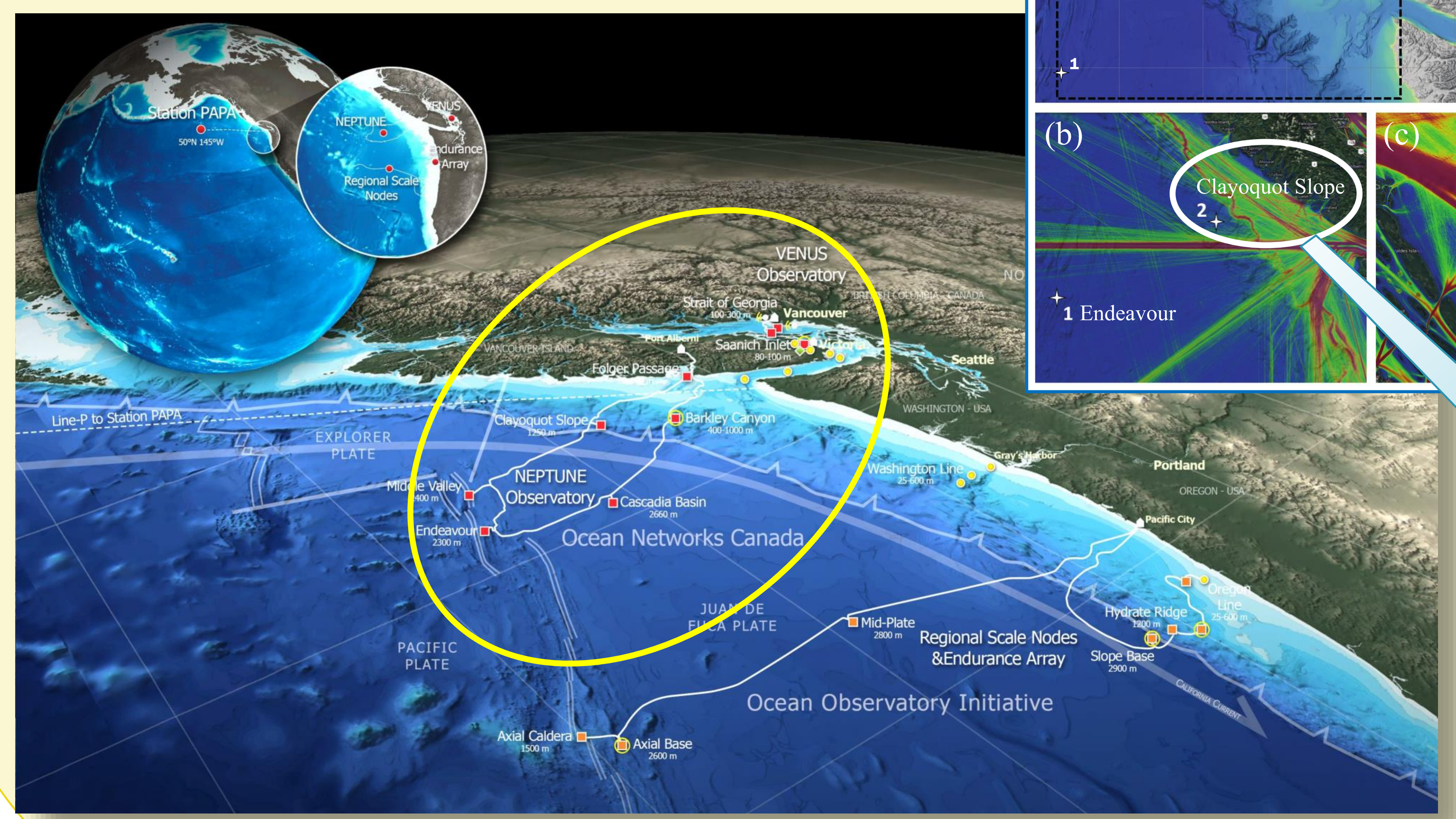
In this study, a **high-speed parabolic-equation model** from Applied Ocean Sciences is used to compute the propagation loss on a four-dimensional, high-resolution grid of receivers where the sources are obtained from **dynamic AIS information on global ship traffic and wind speed**, over the years 2019 and 2020.

For the purpose of validation, this study proposes to compare the model's results with data gathered by Ocean Networks Canada's **hydrophone stations connected to cabled observatories in the Northeast Pacific Ocean** in the same period of time. When necessary, acoustic data are complemented with other data types – *e.g.*, marine traffic/trade statistics, Automatic Identification System (AIS – ONC stations and other datasets) etc.

This poster presents the current status of the study, discussing strengths and challenges of the approach.

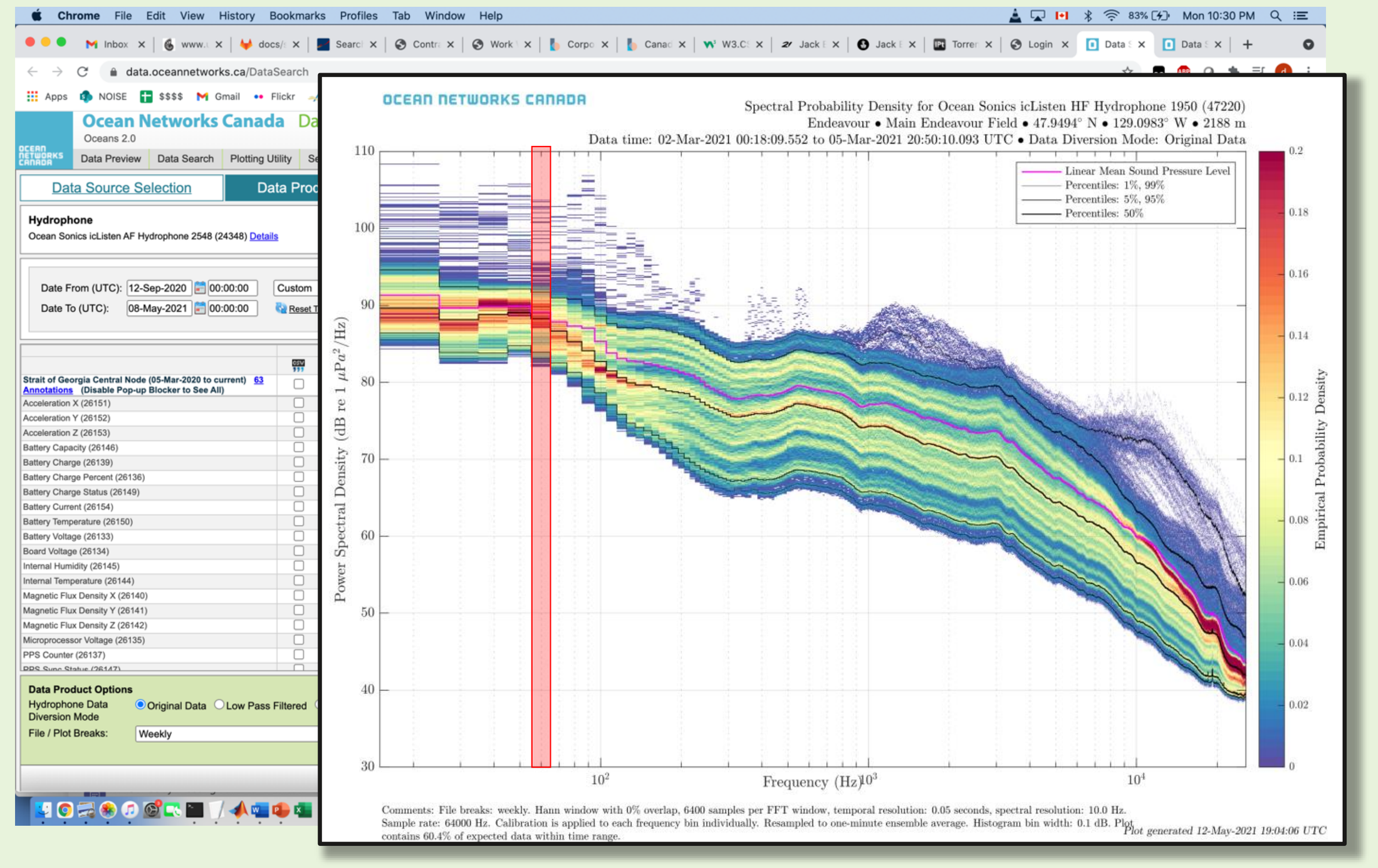
D. J. M. Thomson and D. R. Barclay, JASA **147**, 3390-3396 (2020)

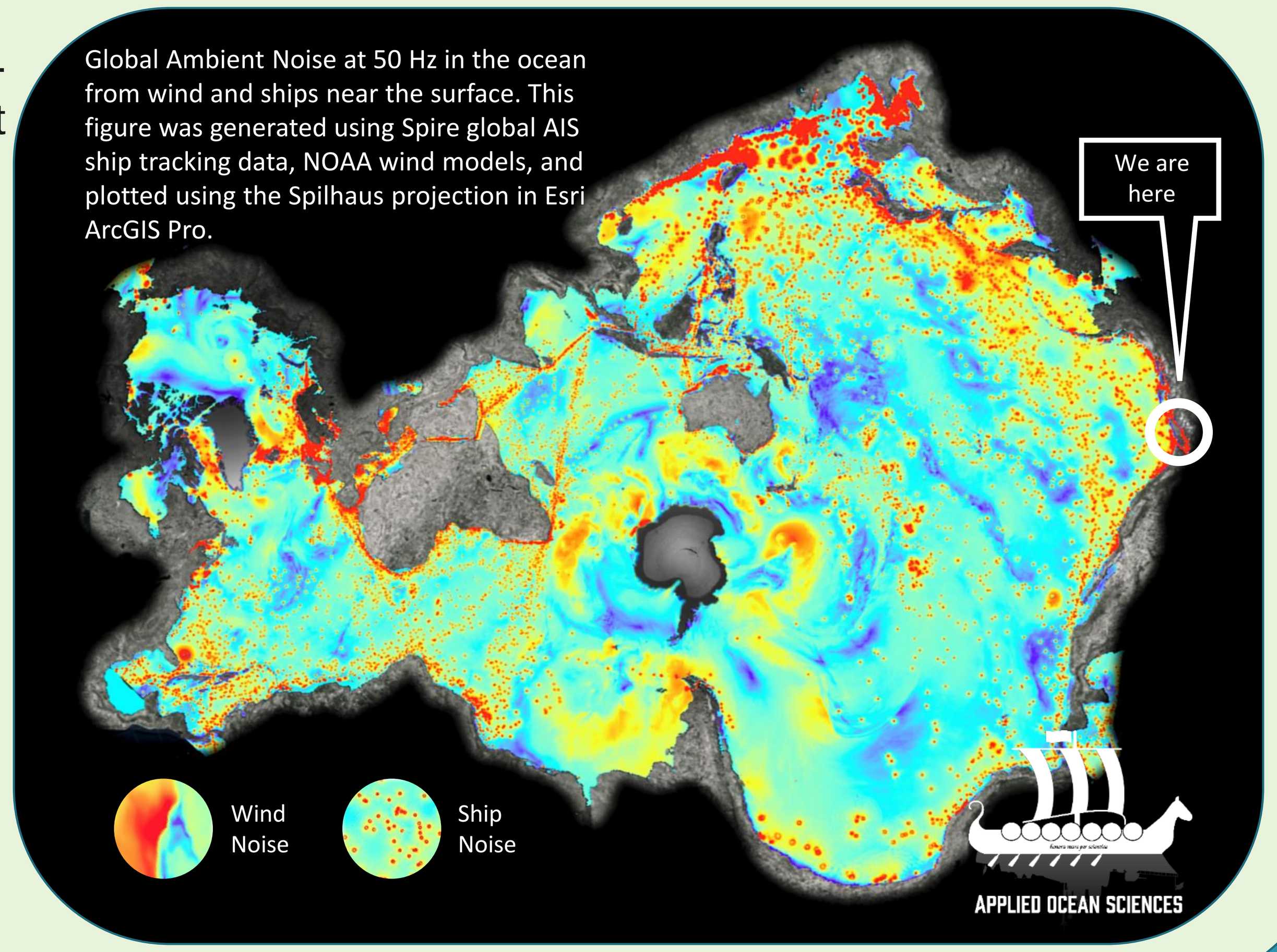




2 DATA

- Measurement: Spectral probability density (SPD) from ONC's data portal (https://data.oceannetworks.ca/home), measured by hydrophones at Clayoquot Slope and Strait of Georgia
- Model: Ship and noise data produced based on AIS global vessel-traffic data (Spire) and wind modelling (NOAA) using a proprietary fast parabolic-equation acoustic-propagation model

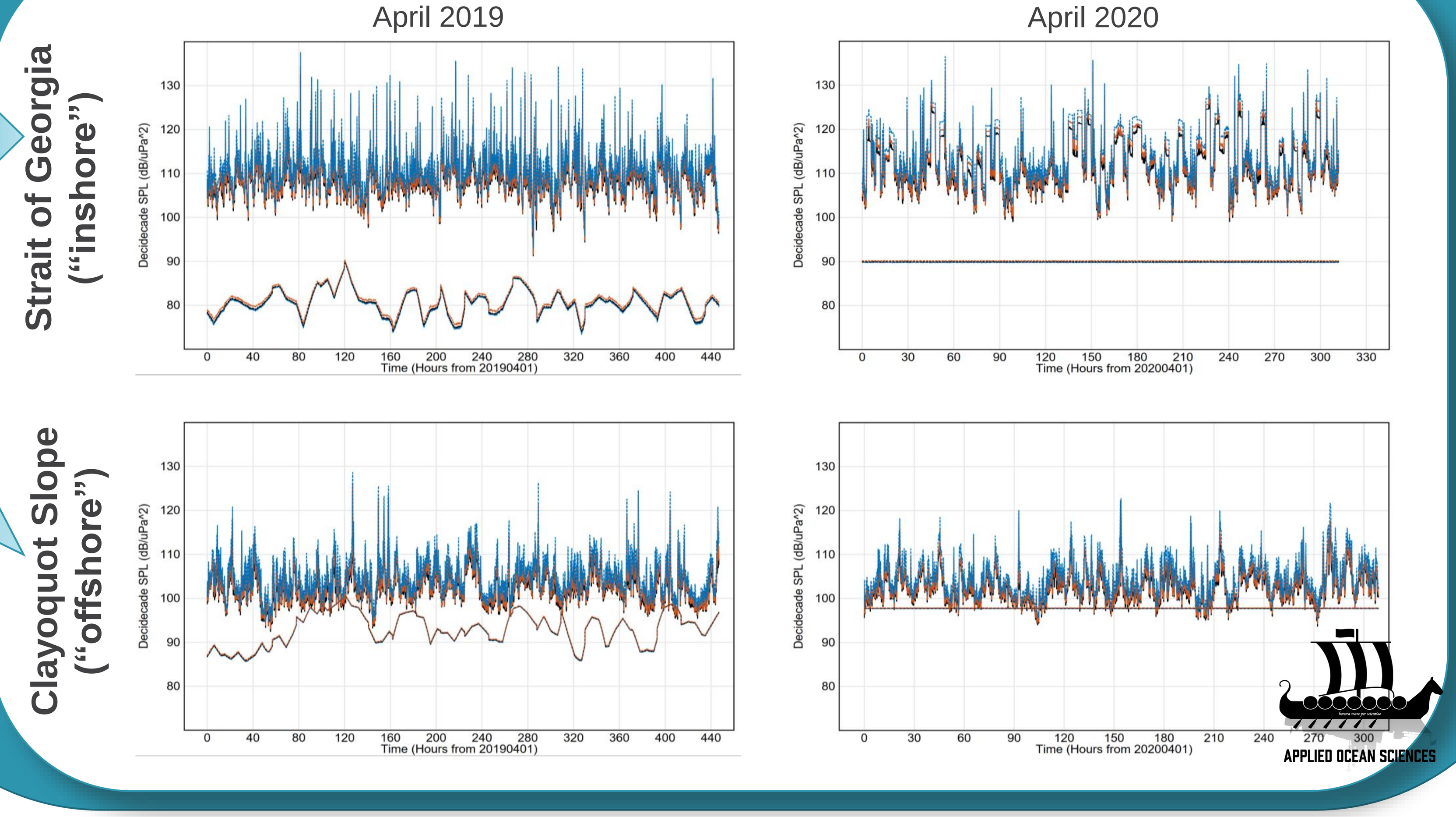




3a RESULTS: MODEL

- Example: April 2019 vs. April 2020, Sound Pressure Level (SPL) in decidecade centered at 63 Hz
- Each peak is the closest point of approach of a ship
- April 2020: Issues retrieving wind data*
- **Inshore:** Reduced traffic (fewer peaks) in 2020. Stationary ships (horizontal stripes): uncertain source level*
- **Offshore:** Wind is a more important component of the soundscape. No apparent difference in traffic (confirmed by AIS data)

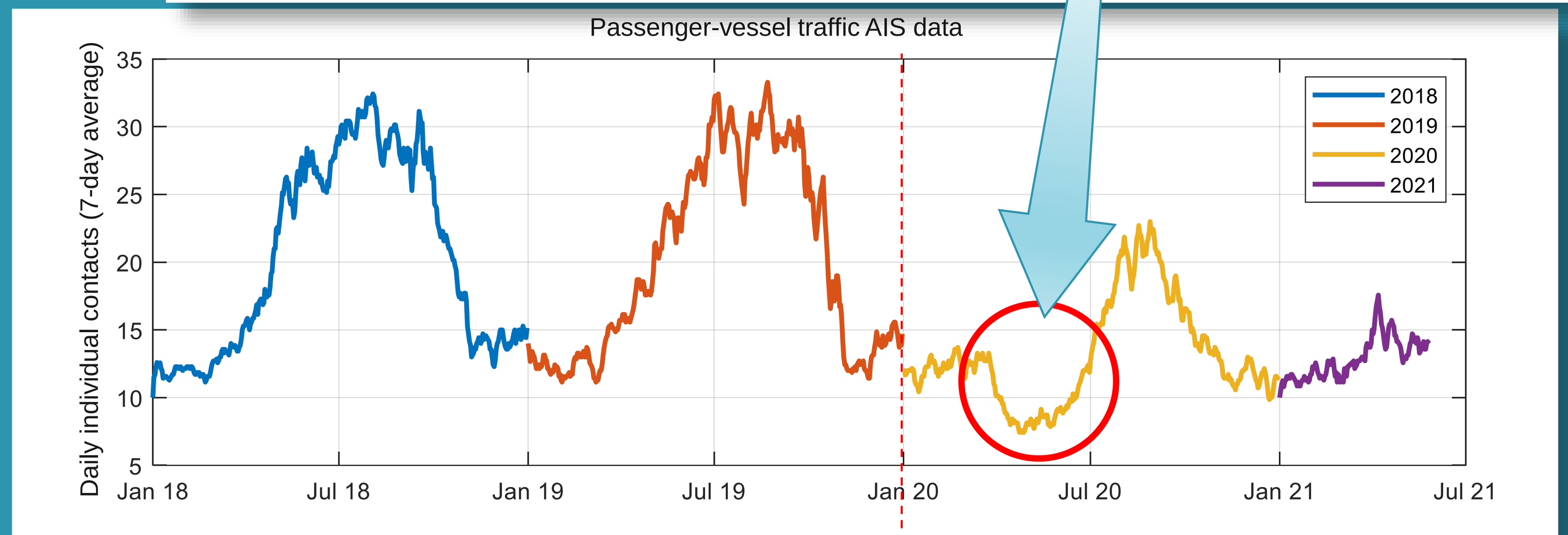
SPL in 56.2 - 70.8 Hz decidecade (nominal center freq. 63 Hz)



3b RESULTS: MEASURED DATA

Example: ONC's Strait of Georgia Central hydrophone data

- Hydrophone swap March 1st 2020 – Potential sensitivity issues*
- Visible minimum ("quieting") in the SPD level in a 5 Hz band around 63 Hz in March-June 2020 (top) corresponding exactly to the suppression of ferry traffic (bottom, AIS data) due to COVID restrictions



4 CONCLUDING REMARKS

Acoustic-model validation – Case study: Understanding the impact of COVID-19 on the soundscape through modelling and observatory data

- **Inshore: Strait of Georgia**
  - Acoustic data: A few dB of reduction in 63 Hz band in April-June 2020
  - AIS data: Reduced passenger-vessel traffic in the same period of time
  - Modelling: In 2020: Uncertain source level for idling ships, wind not properly modelled*
- **Offshore: Clayoquot slope**
  - Acoustic data: No visible quieting
  - AIS data: No visible change in vessel traffic
  - Modelling: Stronger influence of wind; no visible quieting in 2020 (consistent with measured data); wind not properly modelled in 2020*

* OPEN ISSUES

- Cabled hydrophones showing significant drift (sensitivity degradation) – compensation method is required
- Produce decidecade SPL data from hydrophones
- Glitch in wind data retrieval
- Modify ship source level during idle times

LESSONS LEARNED

- Cabled hydrophones showing significant drift (sensitivity degradation): Necessity of method for *in-situ* sensitivity testing for long-term, single-hydrophone installations
- Implement new data product on ONC's data portal: 1-minute, 1-Hz-band sound levels