



Applying Weather, Water, Ice, and Climate Data to Inform Navigational Decisions in the Arctic

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ESPG 
Environment, Society
and Policy Group


uOttawa

Vessel operators rely on **WWIC**
information to make safe
navigational decisions.

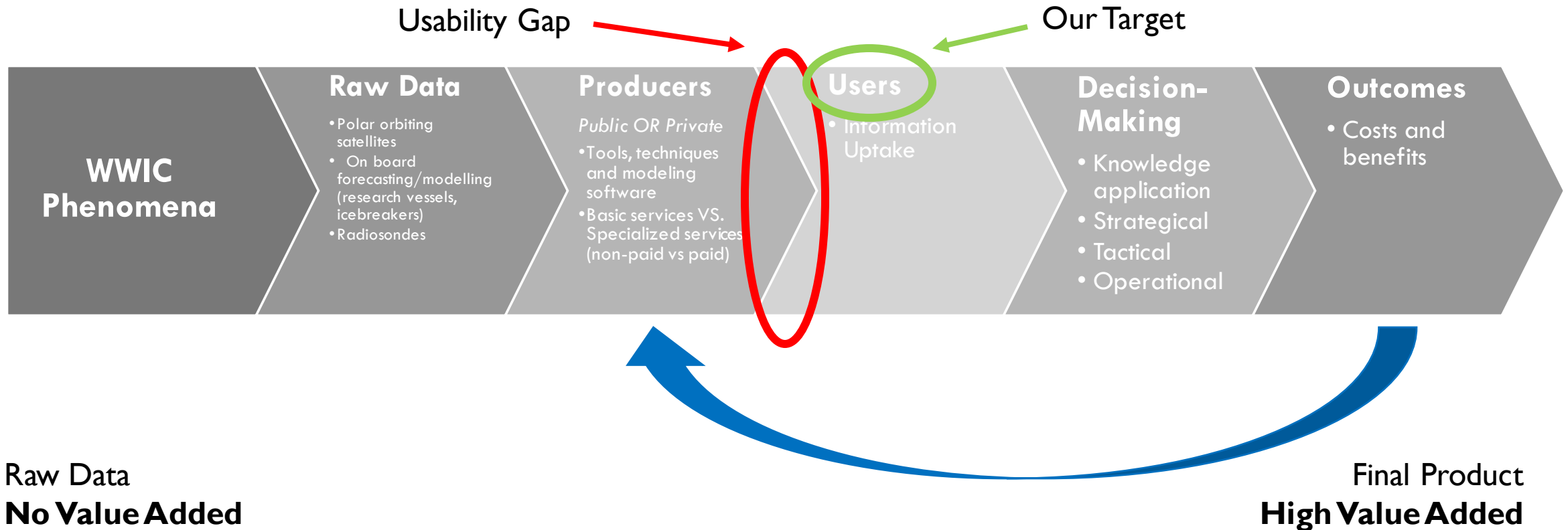
Usability ✓

Accessibility ✓

Accuracy ✓



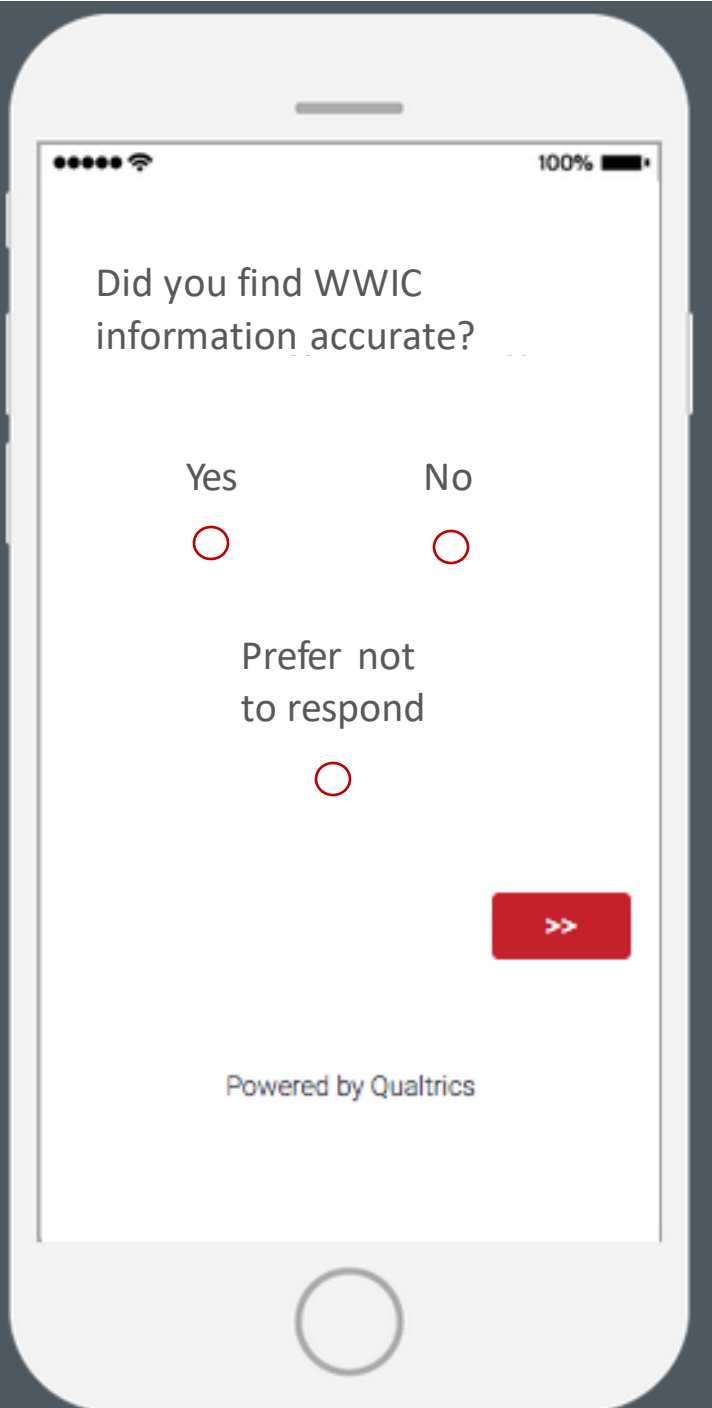
WWIC Information Value-Chain



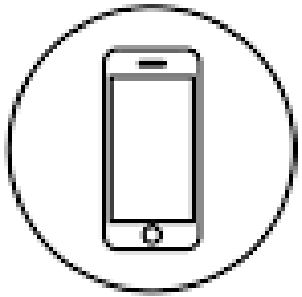
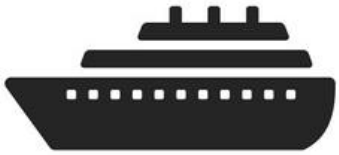
Research Questions

- **What WWIC information** are vessel operators using?
- Is current WWIC information meeting user needs (i.e. is it **useable, accessible, and accurate**)?
- How and where **can WWIC services be improved** for safer navigation?
- Are there **differences between vessel types** (e.g. pleasure craft vs. non-pleasure craft)?

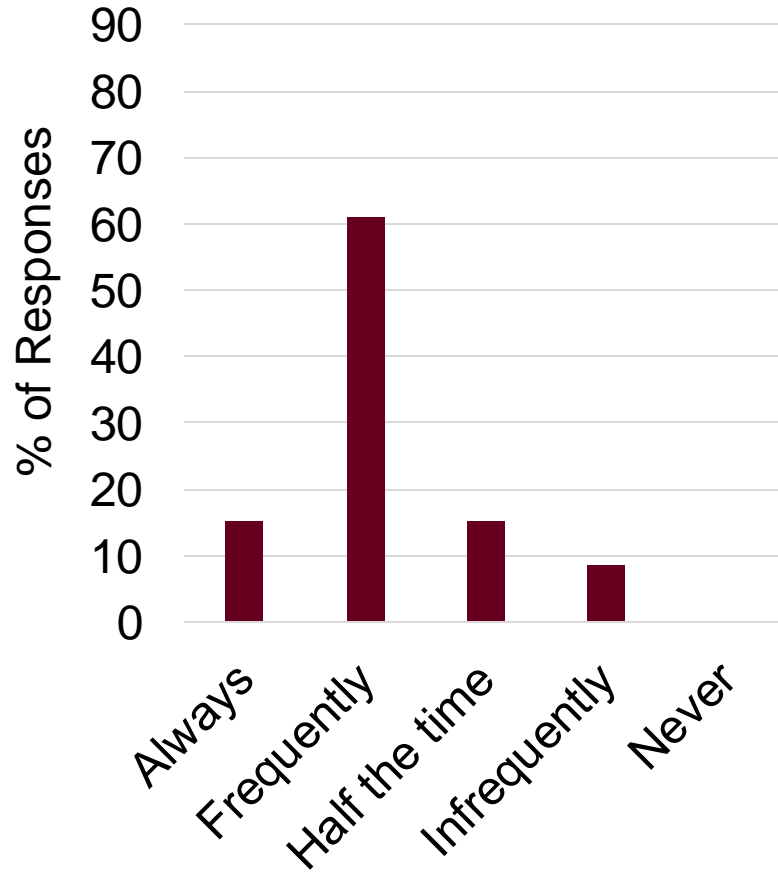




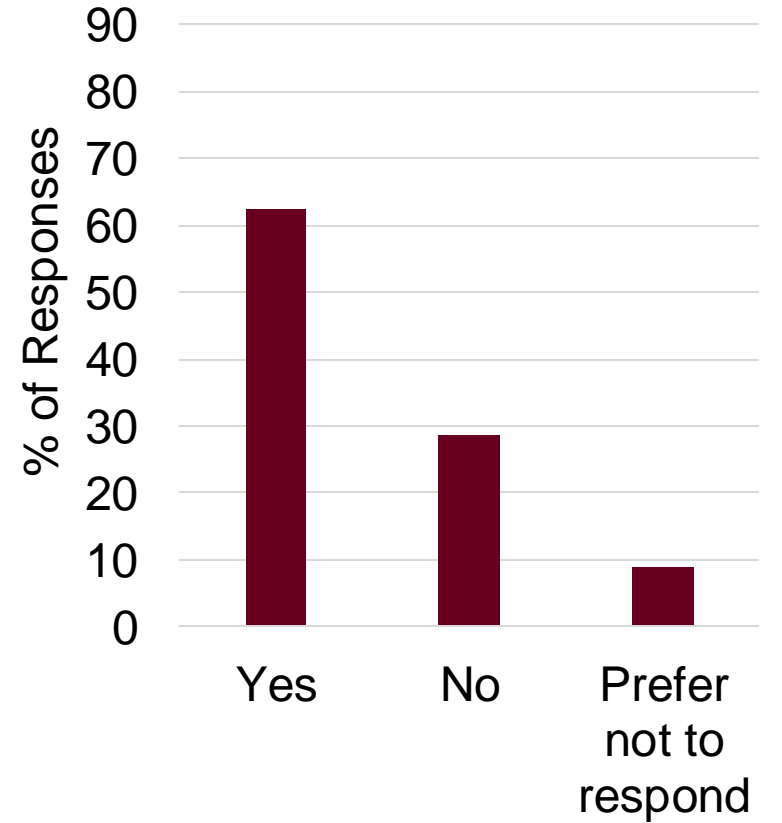
- Mixed-methods survey using Qualtrics
- 56 responses total
- Responses from **all targeted vessel types** except fishing vessels
 - High response rate from **pleasure craft operators** (40%)
- Most participants were **ship captains or skippers** (57%)
- **Range of experience** (from less than 1 year to more than 30 years)
 - Pleasure craft operators were least experienced (61% less than 1 year)



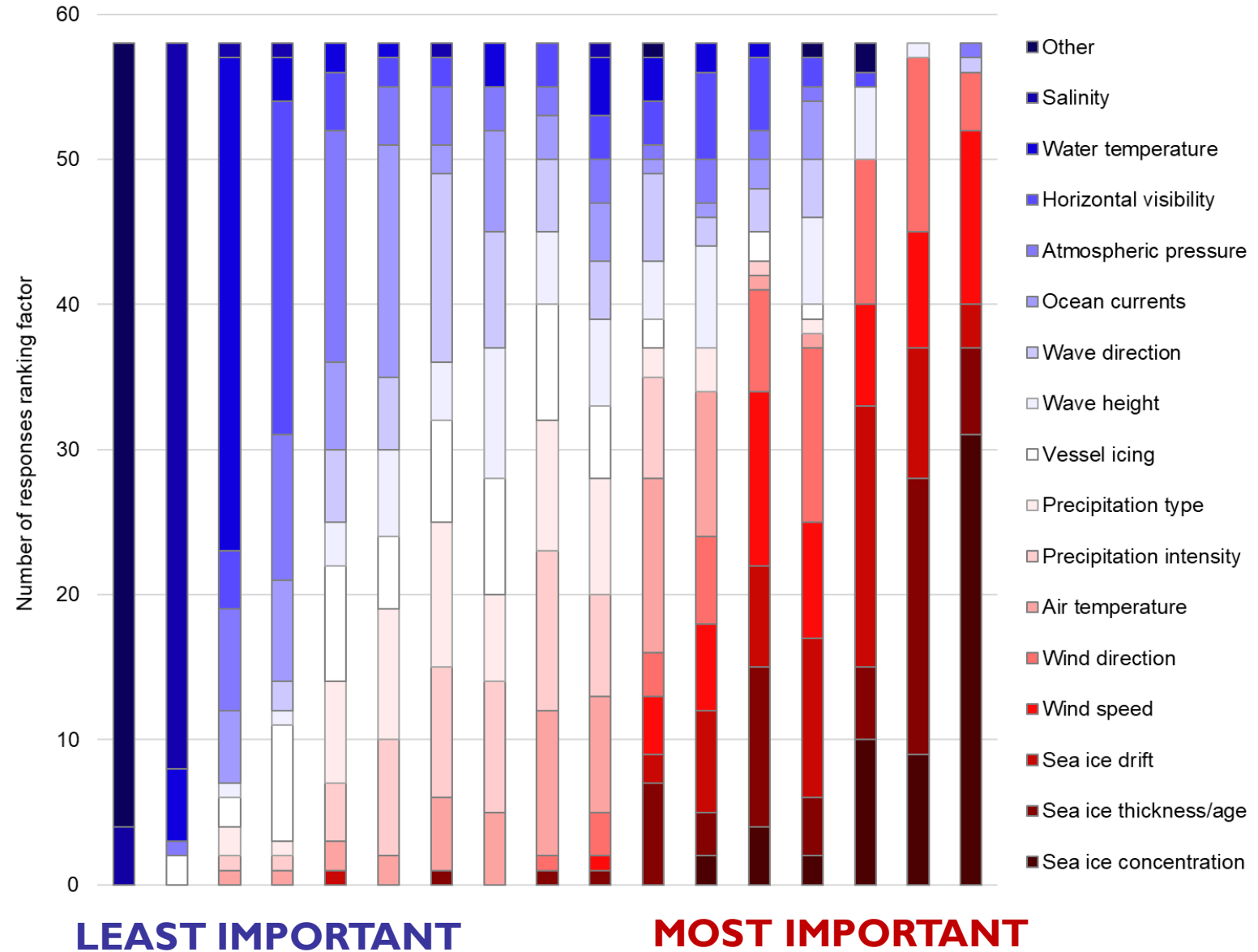
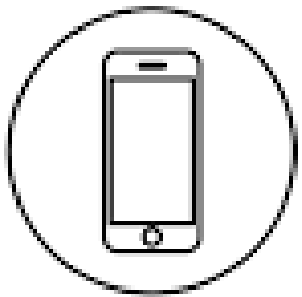
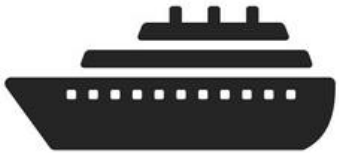
“As a WWIC user, my needs are being met...”



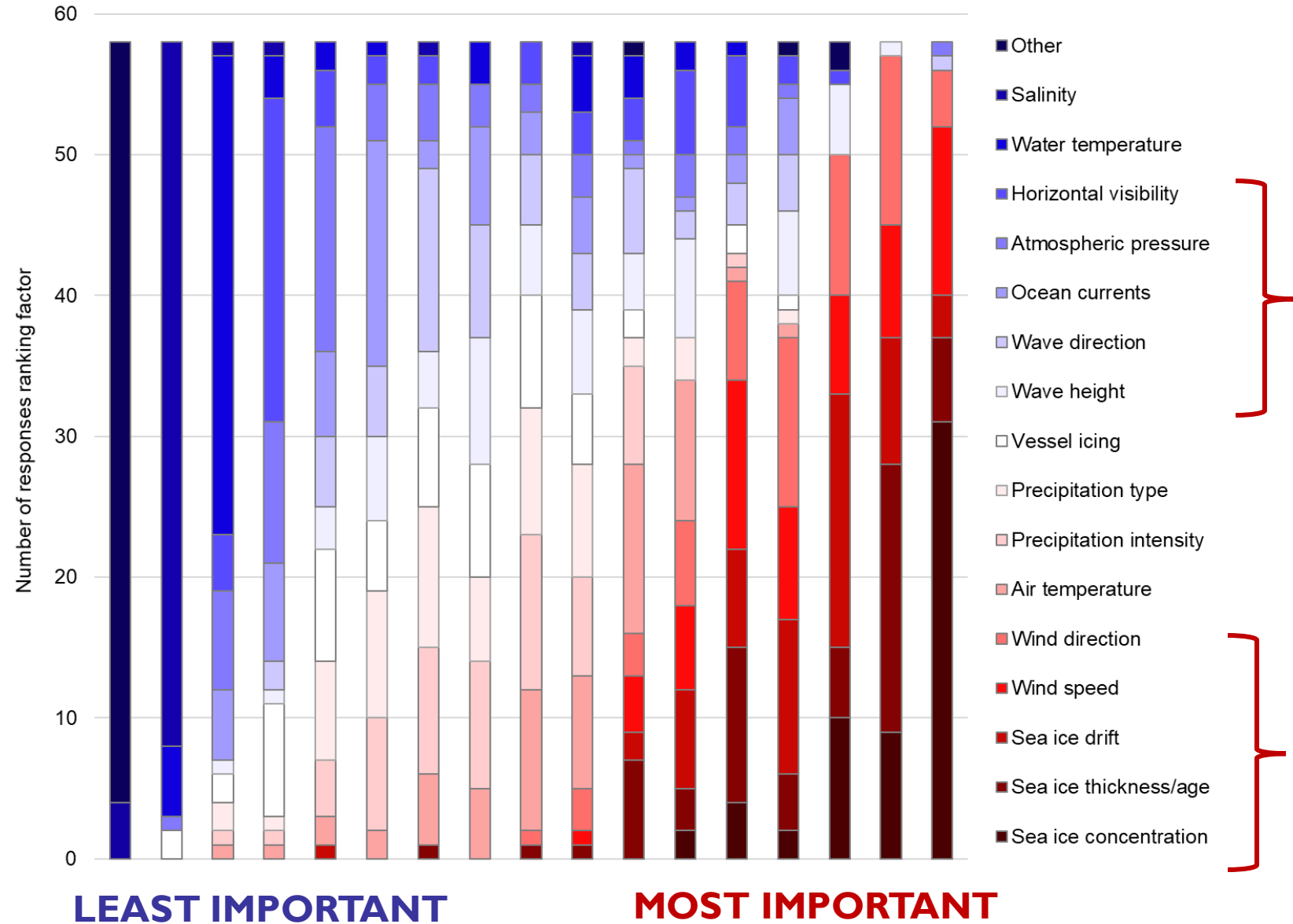
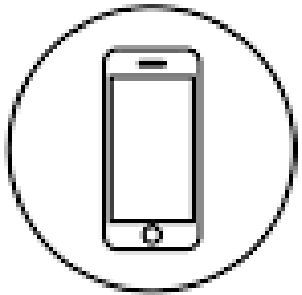
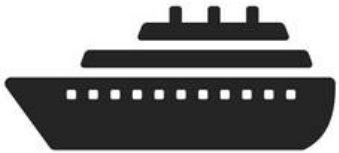
“Could your voyages benefit from additional WWIC services?”



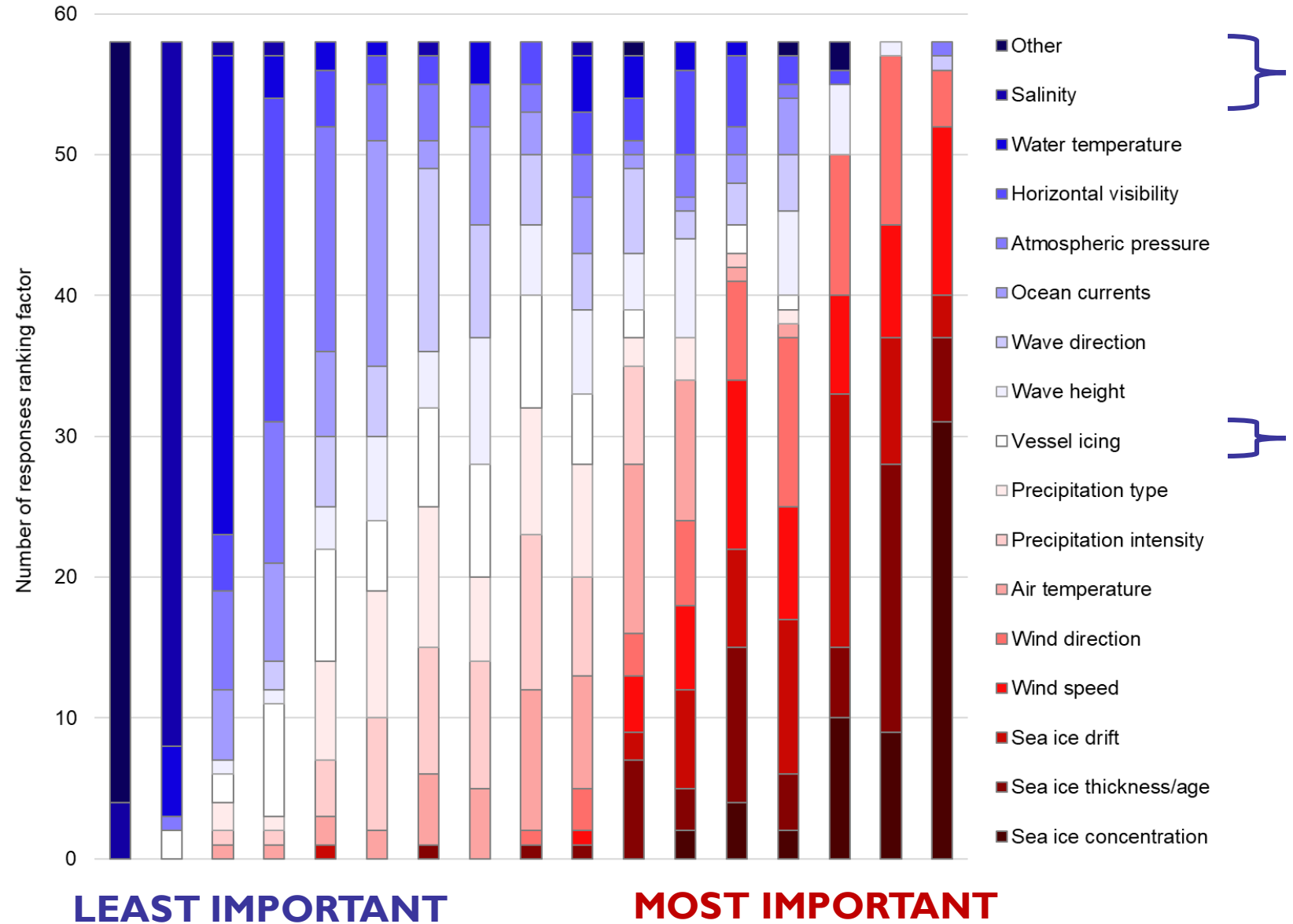
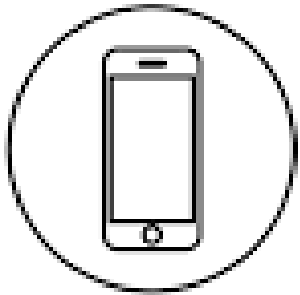
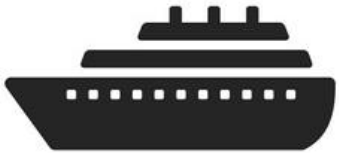
“Please rank these factors by importance for making navigation decisions for safe travel.”



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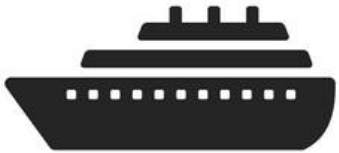
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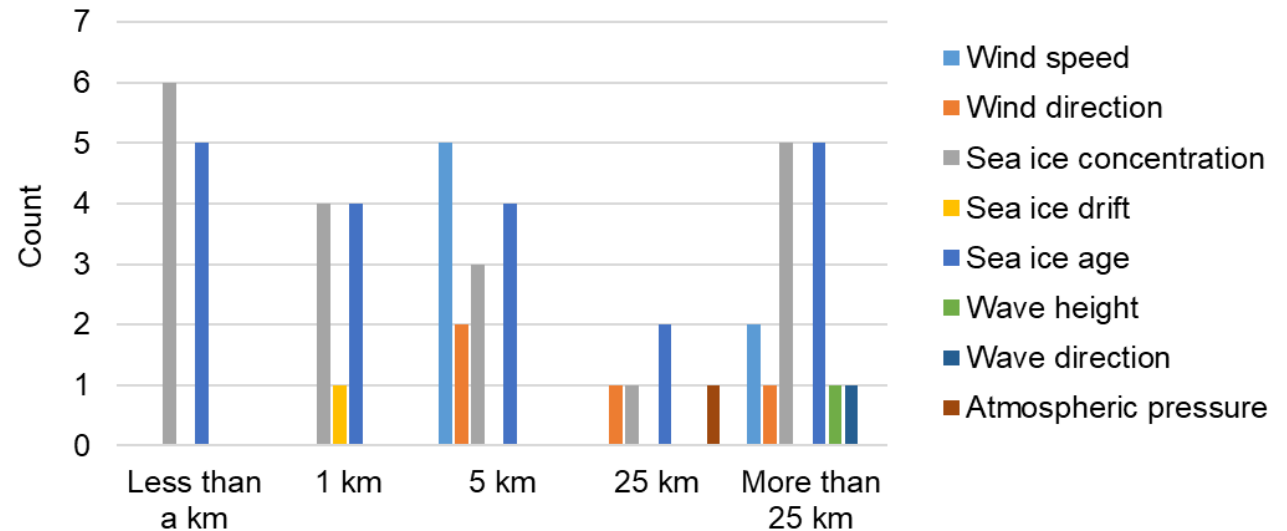
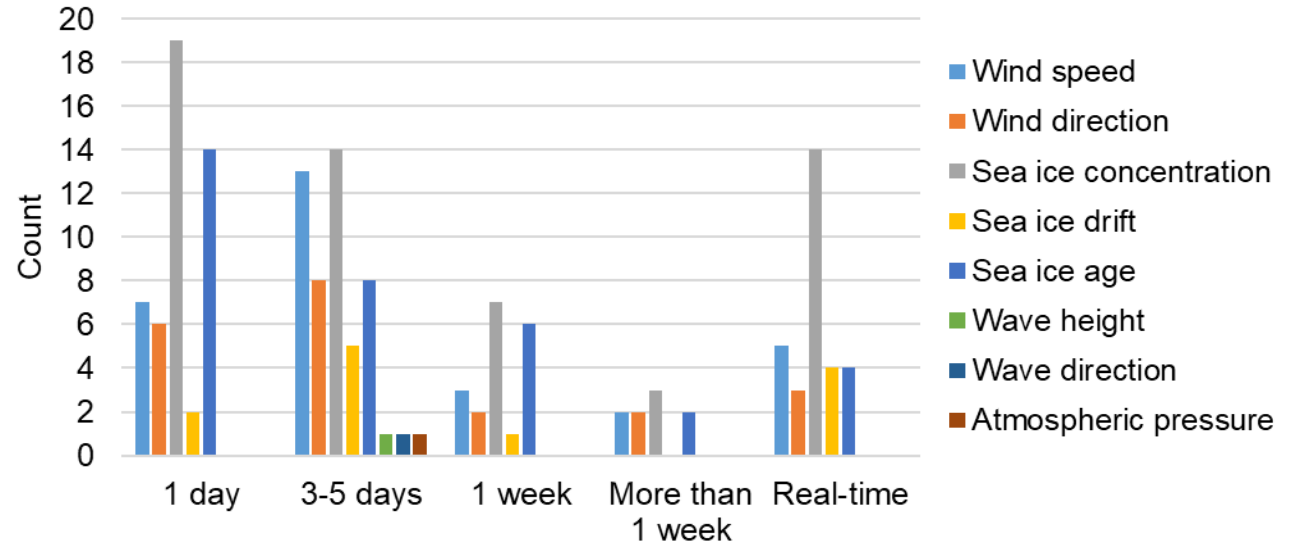
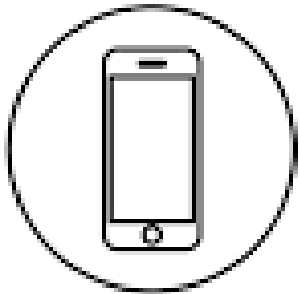
What time scale and spatial resolution information is needed for factors ranked most important



TIME SCALE

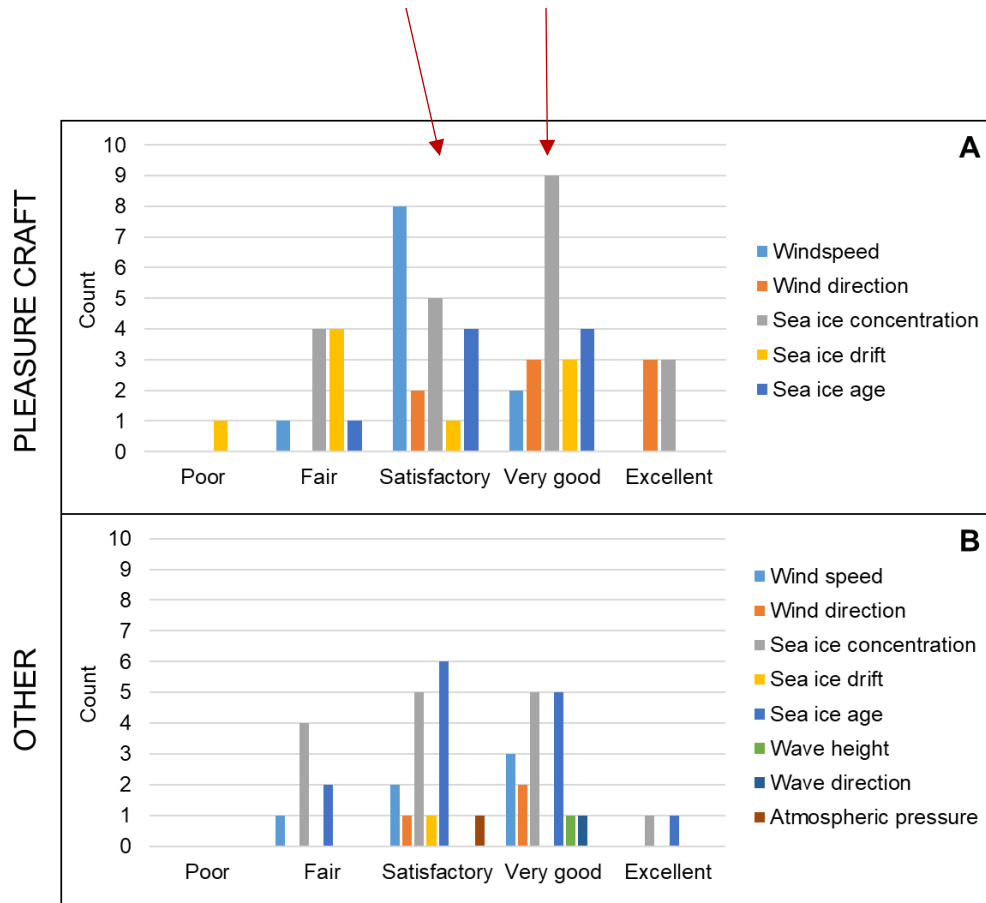


SPATIAL RESOLUTION



Accuracy

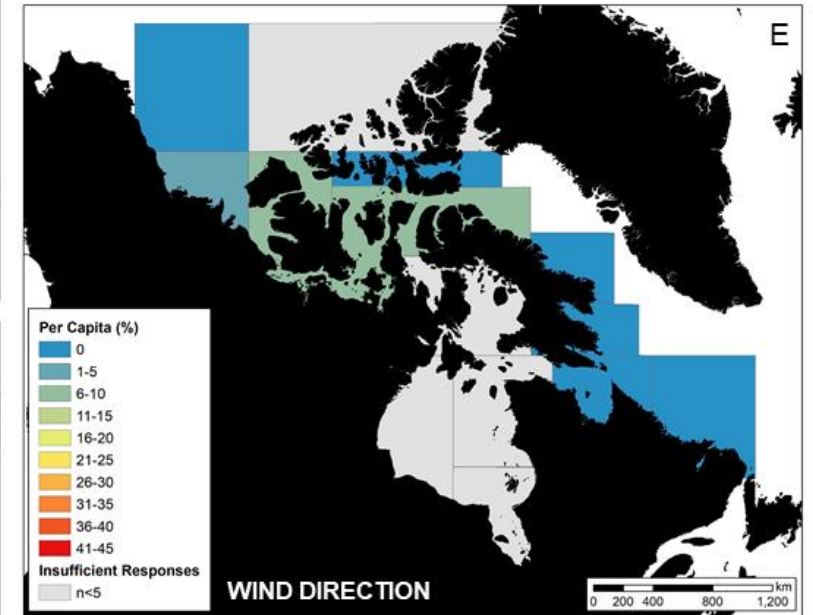
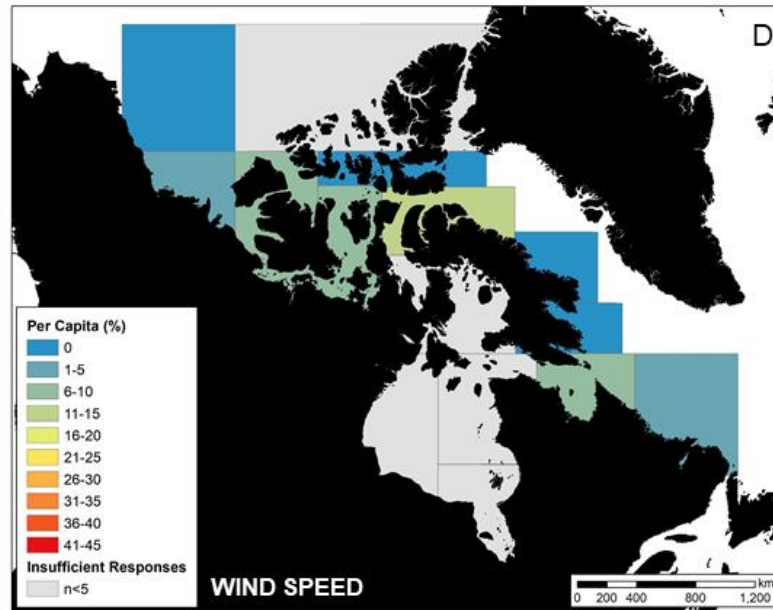
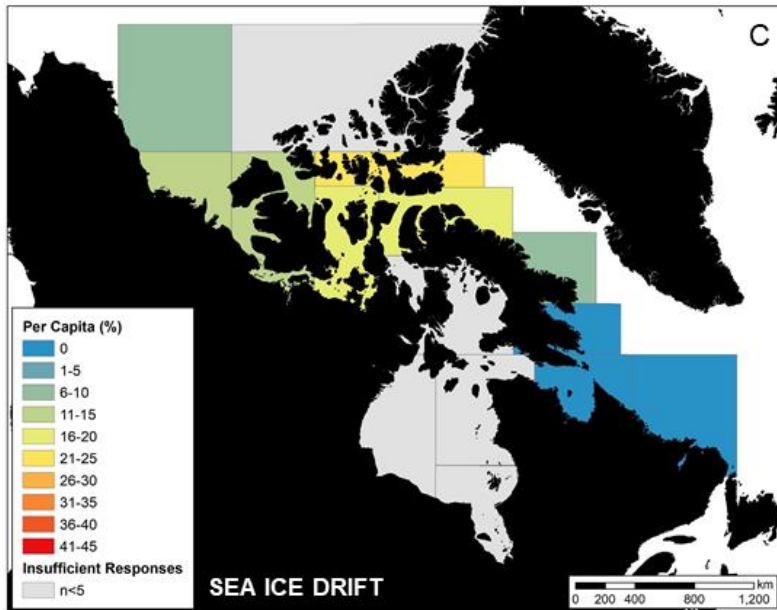
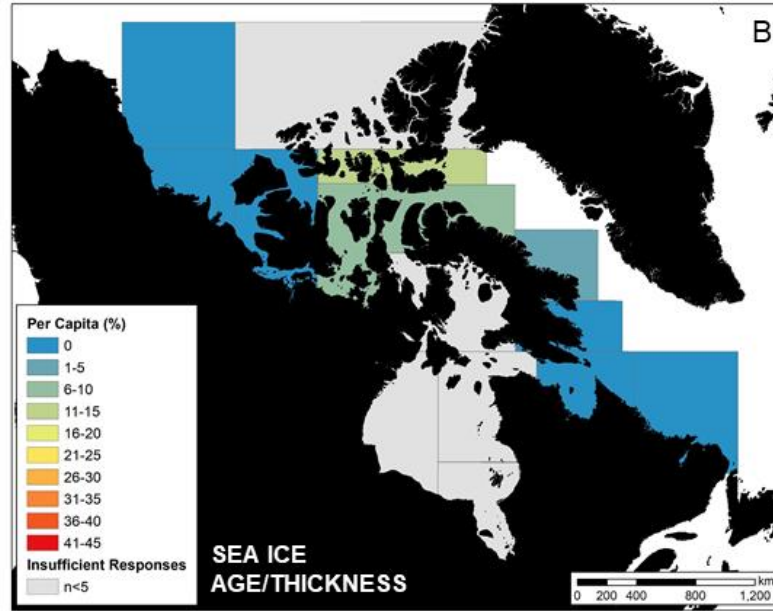
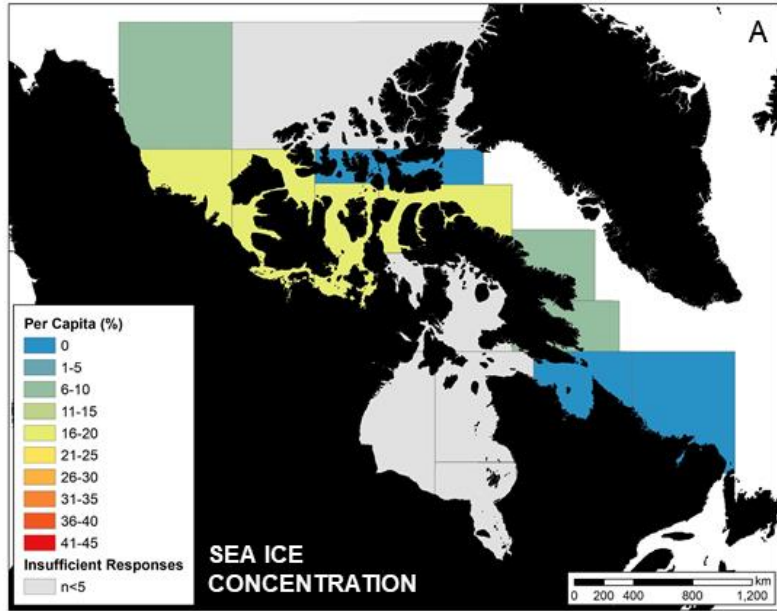
Most users felt accuracy was “satisfactory” or “very good” but suggested some improvements



How could accuracy be improved?	
Improvement	Number of Participants
More frequent / real-time observations <ul style="list-style-type: none"> Real-time reporting from vessels / air crafts 	19
Technological improvements <ul style="list-style-type: none"> Better satellite coverage Increase satellite passing frequency Improve sensor capability 	6
More accurate / detailed ice charts	5
Understand local factors / consider local events	5
Integrate ground truthing of satellite based data	2
Low-pressure systems undermine forecast reliability	2
GRIB underestimates wind speed in Arctic	2
Improve modelling of sea ice concentration	1
Lack of detail on maps	1
Poor communication / difficult to obtain information	1
Charts are drawn using information taken at different times <ul style="list-style-type: none"> Visual, radar, satellite observations 	1
Offer extended internships in the Arctic for ice experts to gain experience	1
Report age of base data used for interpretation	1
Less conservatism	1
Compile data from different sources	1

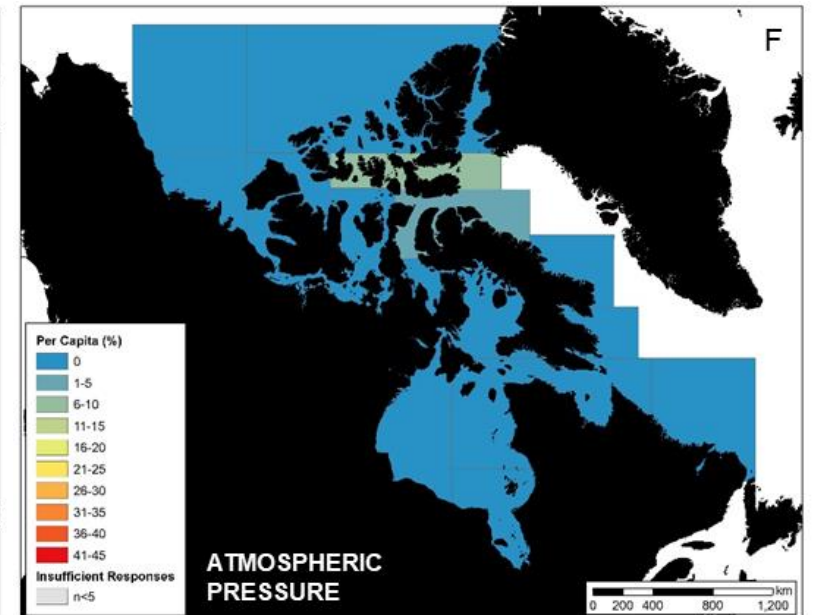
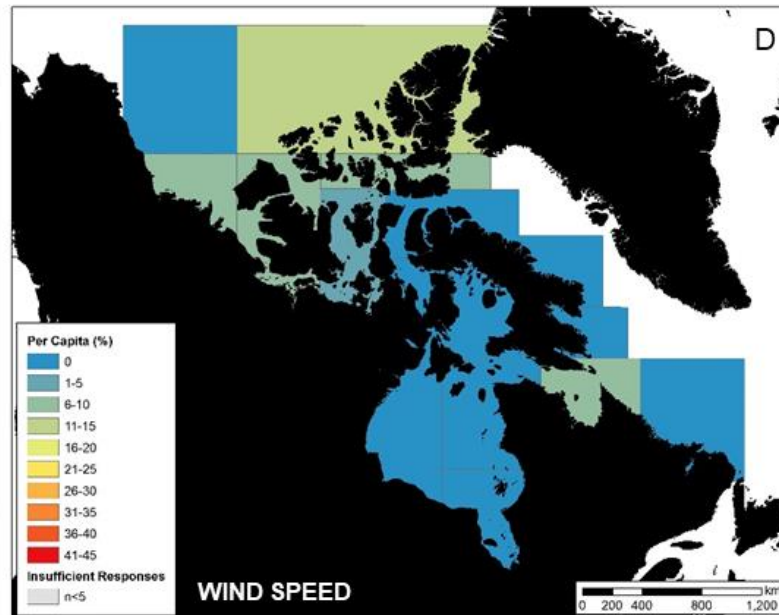
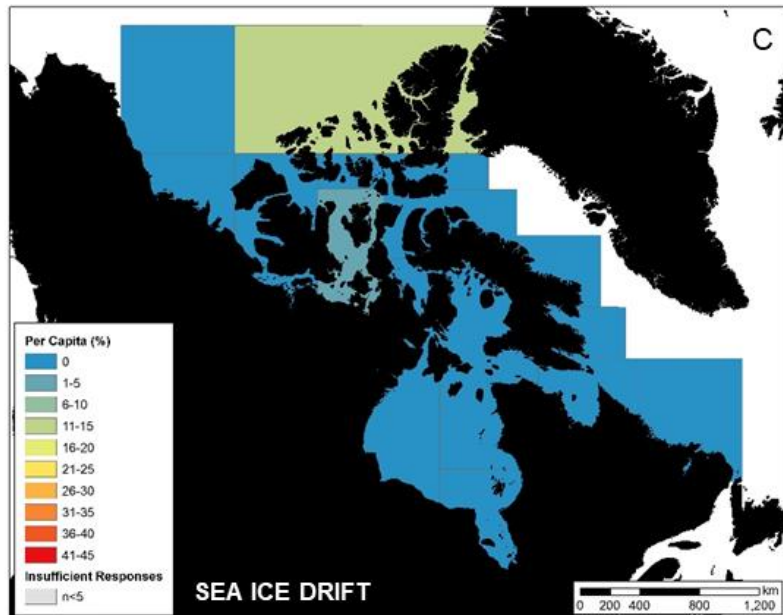
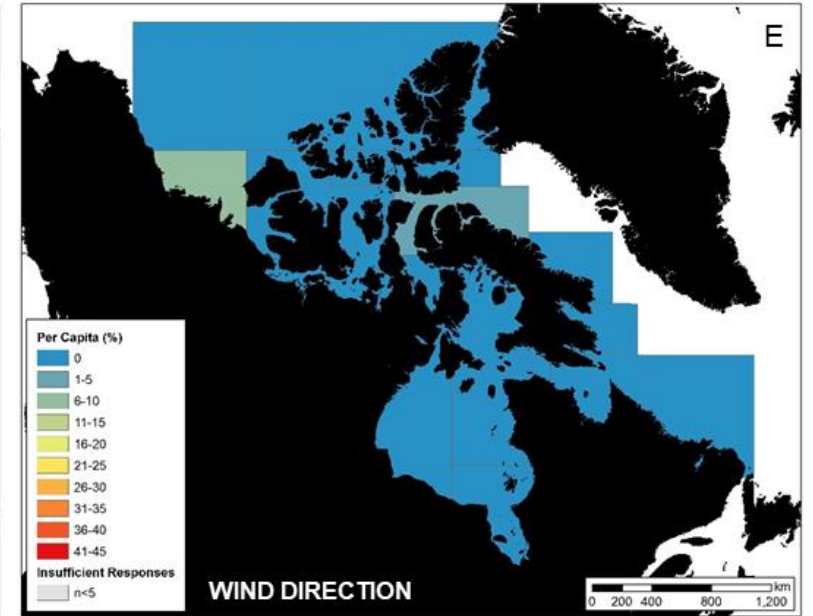
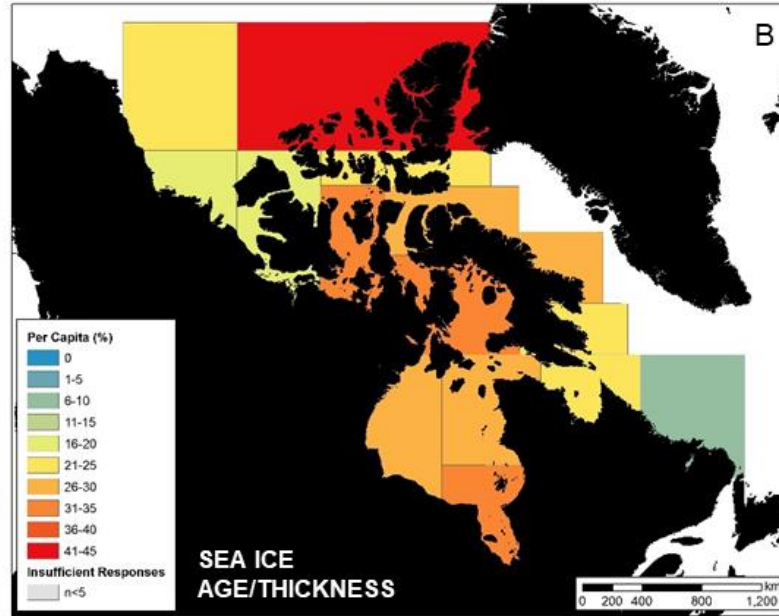
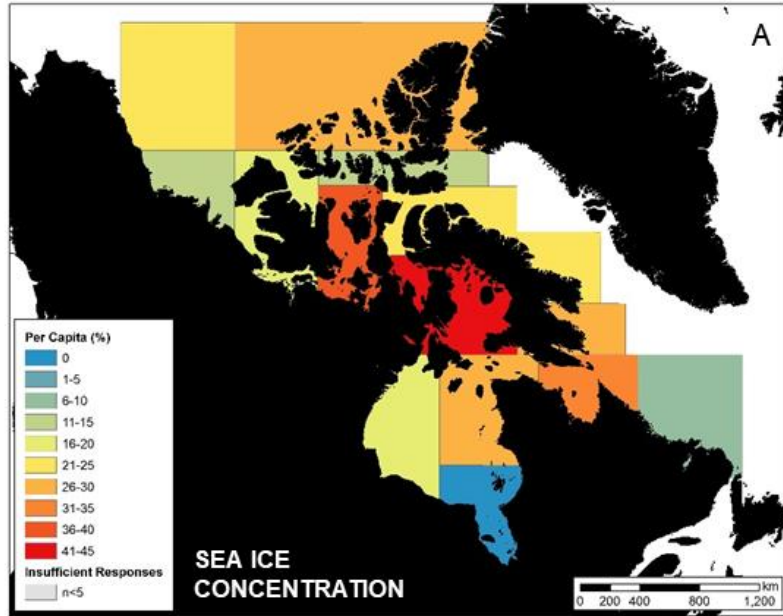
Where were services inaccurate?

PLEASURE CRAFT



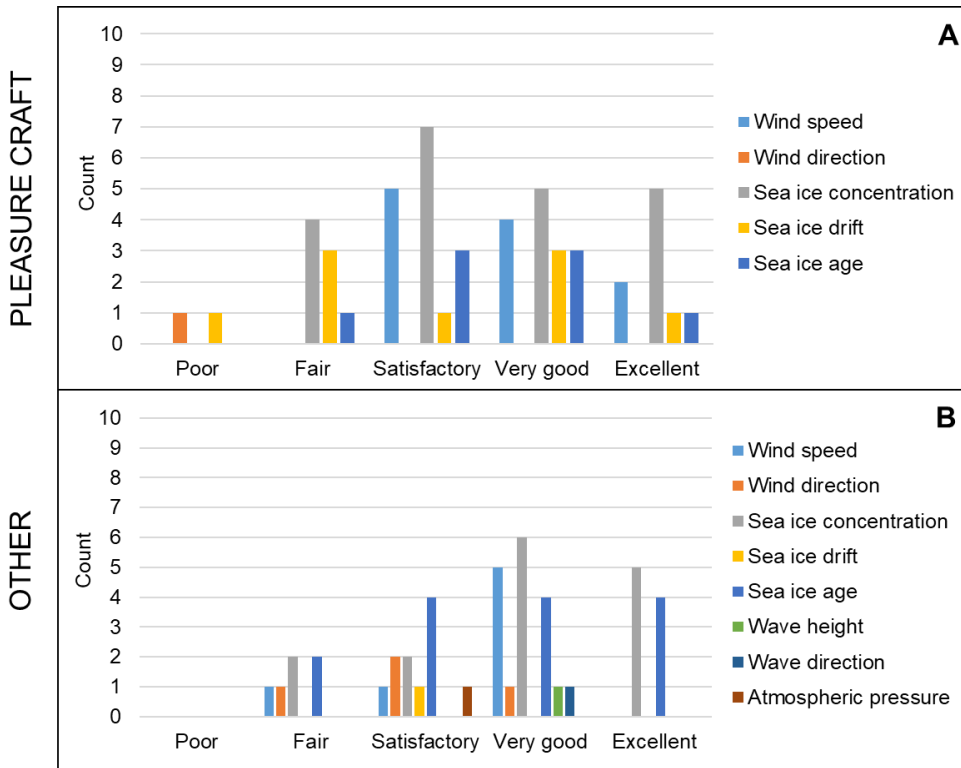
Where were services inaccurate?

NON-PLEASURE CRAFT



Usability

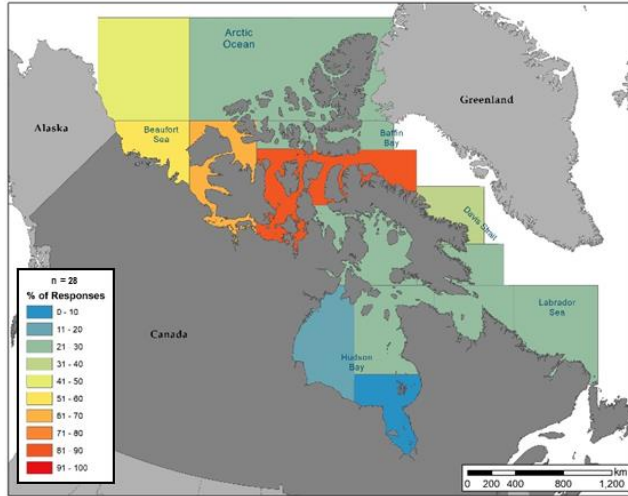
Most users were happy with the usability of current WWIC services, but suggested some improvements.



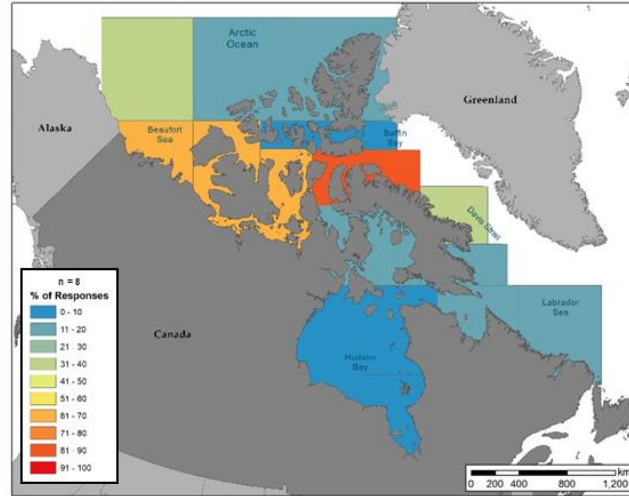
How could usability be improved?	
Improvement	Number of Participants
More frequent updates	7
Downloadable ice charts	1
Improve visual presentation	1
Simpler diagrams	1
Updates earlier and later in the season	1
Updates in more sub-regions	1
Have information for specific locations users are located within	1
Introduce a software app	1
Learning process for Egg Code	1
Include Environment Canada Extended Forecasts on NAVTEX	1

Accessibility

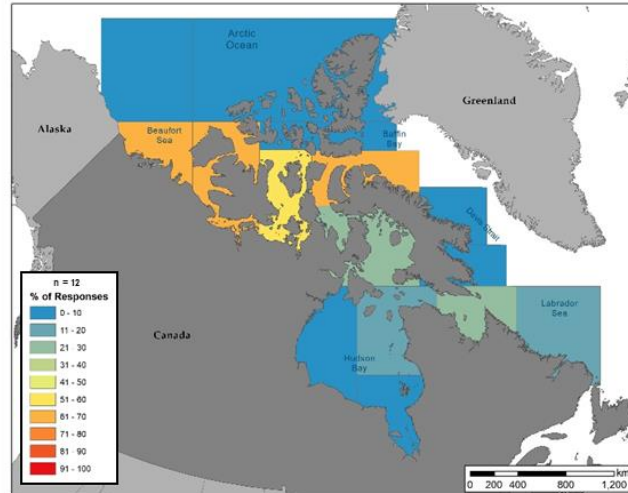
Sea ice concentration



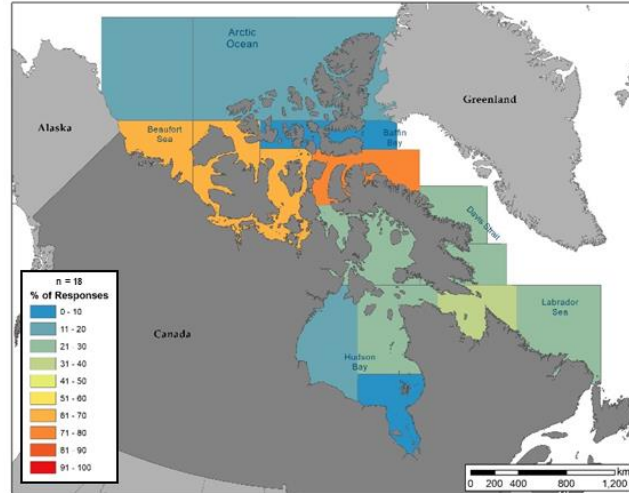
Sea ice drift



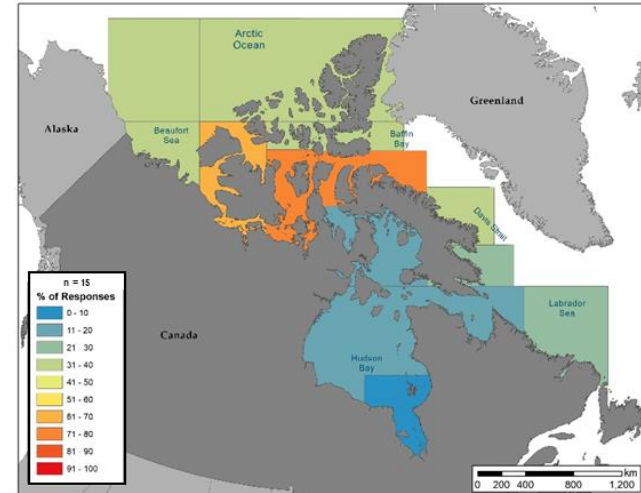
Wind direction



Wind speed



Sea ice age/thickness

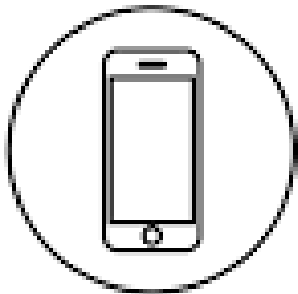
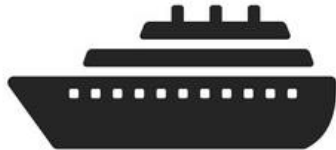


“Were there issues with internet?”

40% of participants said
YES

37% of participants said
SOMETIMES

Accessibility



How could accessibility be improved?	
Improvement	Number of Participants
Faster connectivity speed	20
Receive information via other methods for those without internet <ul style="list-style-type: none"> - Text format with no non-essential graphics (1) - Simple files (small size, text only, compressed) (4) - Pre-organized via Sailmail (2) - SSB Radio (1) - Reduced size ice charts (1) - Satellite phone (1) 	13
More reliable / better satellite coverage	12
Dependant on vessel equipment and capacity	9
No internet connection <ul style="list-style-type: none"> - Relied upon shore-based updates (3) 	5
Improved signal strength	4
Lower cost options	3
Increased bandwidth to vessels	2
Starlink: potential to improve deliverability	2
Provide more information via automatic email responder	2
Use of low-band connection via Iridium	2
GoC subscribe to HEOSAT via Space Norway	2
Long-term forecasts available for those without/infrequent internet connectivity	2
SSB Airmail connections not always possible	1
Improve access / communication	1
Ham radio Wi-Fi	1
Install cell towers to 'hotspot'	1

Summary & Future Work

- Users are satisfied with the current services, but could benefit from additional WWIC information
- Information is needed on a shorter time-scale (same day), with more frequent updates, especially for sea ice
- NWP is the area where operators perceived information to be most inaccurate
- Internet connectivity is a problem, especially for pleasure craft operators



Summary & Future Work

- Descriptive statistics to be completed spring 2023
- 2-page results summary and manuscript writing
- Survey results will be shared with service providers



SSHRC  CRSH

ArcticNet
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Questions? Email me at jhollowa@uottawa.ca!