RÖST MARINE RESEARCH CENTER

Carbon to Sea Initiative

Iceland Ocean Climate Science Joint Learning Opportunity: Additional Questions & Answers

Introduction

This document provides an updated record of the questions received and answered by the Joint Learning Opportunity (JLO) Management Team at jlo@rostrannsoknir.is. Questions and answers have been edited for clarity and to protect the identity of potential applicants.

Logistical Questions

1. Will the JLO be granting the awards in USD?

We will have the ability to award funds in USD (as well as Icelandic Króna).

2. Would the JLO allow budgeting a little time for an administrative support specialist into the direct costs for the project?

We should be able to work with applicants on this. Please note administrative needs in the "total project budget" section of the proposal and, if selected, we can work through it together in contracting.

3. Should applicants budget for personnel lodging, per diem, and transportation once in Iceland? Will they be responsible for finding accommodations, a vehicle for transportation, etc.?

Yes, applicants should include in budgets the types of expenses above, the award funding can be used for these items.

Applicants will be responsible for their team's travel logistics, including finding and booking accommodation, flights, rental cars, and arranging meals. The Röst / JLO team may be able to provide suggestions as the logistics plan develops further.

4. What is the price of accommodations for the duration of the research? Are there suggestions on where to stay or a suggested cost of living for the region?

Spending on accommodations and food in Iceland can vary greatly and depends heavily on people´s preferences and the size of the team. Generally people should try to stay near the

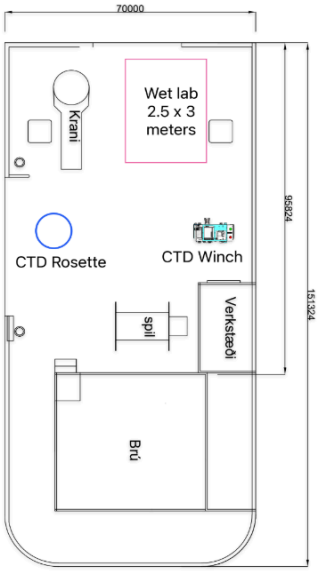
research site, Hvalfjörður, or secondarily Akranes or Mosfellsbær. Expected price ranges from $200-$350 USD per night for a modest cabin that suits 2-4 people. Larger, nicer cabins can go much higher than that (e.g., $1000 USD/night for 4-6).

5. How much space is there to work with on the ship and on the enclosed area on the dock?

The research vessel has limited work space. The working deck space is about 7x9.6 meters (mock up below). There are two enclosed spaces on the dock. One space is the electrical house that should be kept dry and will house the control room and alkalinity sensors. The other is a long utility shack that can be cleaned out and used specifically for JLO applicant equipment.

Editor's Note: An alternate vessel with additional room may be secured for the trial given the rescheduled dates and vessel availability.

Figure 1: Proposed layout of research vessel.



Biological Monitoring Questions

6. For "benthic near-field" monitoring, it says that grab samples of fauna will be collected, preserved and analyzed. Which type of analyses are planned?

The Research Team plans to grab samples for species ID and analysis of community composition, relative abundance, distribution, and faunal life stages. Fauna will be preserved, but analysis plans have not been finalized. Additionally, we have been collecting similar data for a year prior to the field trial, along with eDNA and core samples for geochemical analysis.

7. Is anyone sampling the zooplankton, with nets or otherwise? Is anyone sampling the phytoplankton community (cells, not fluorescence)?

Discrete sampling: Starting two weeks prior to the NaOH addition, biological monitoring will take place from the pier to establish a baseline. This sampling will continue throughout the experiment, with additional measurements taken from the ship, and sampling will continue from the pier for two weeks after the NaOH addition ends. Pier water samples will be taken every other day with a hand lowered Nisken bottle or vertical net tows. On board the ship, samples will be taken at different depths and locations, relative to the NaOH release point, with the Niskin bottles attached to the CTD. Benthic grab samples and a video survey will be done from the pier or a small boat once before, once during, and once after OAE.

- **Chlorophyll a and pheophytin**: Replicate water samples filtered under low light conditions through 25 mm GF/F filters with the filters frozen and stored at −20 °C until the concentrations of Chl a and pheophytin a can be determined using EPA method 445.0 (Arar and Collins 1997).
- **Plankton ID**: Replicate 100 ml samples should be preserved in two ways; (1) with Lugol's solution at room temperature and (2) with cold glutaraldehyde (2 % final concentration) stored in a refrigerator. Analysis with shore-based automated imaging (FlowCam + flow cytometer) and / or traditional microscopic identification.
- **Zooplankton**: Vertical Bongo 153 micron net sampling with replicate samples preserved in formaldehyde at room temperature. Analysis with shore-based automated imaging and / or traditional microscopic identification.
- **Macrofauna (whales, birds, seals, etc.):** Visual monitoring from the pier during the field trial.
- **Photosynthetically active radiation (PAR)**: Quantum light meter (e.g., LI-COR) lowered from the pier or ship.
- **Nutrients:** Replicate water samples filtered and prepared to measure ammonium, nitrate, nitrite, and phosphorus. Analysis done with a photometer on site.
- **Benthic**: Video camera with a light that can be lowered from the pier for a brief survey. Grab samples with samples preserved for identification.

Continuous biological monitoring: Fluorometers will be located on the pier, on the ship CTD, and on the buoy at the NaOH release point.

8. What type of plankton (phytoplankton, zooplankton) is proposed to be processed by the Flowcam? And is there already a flowcam that someone is running?

We are planning to rent a FlowCam with the purpose of sampling phytoplankton samples for enumeration and possibly microscopic ID. However, this is not confirmed yet, and we have not allocated personnel to FlowCam or analysis.

9. Is there room on the boat/in the schedule for some zooplankton net tows, and would it be possible to tow at night?

For plankton tows, we will be using a 150 micron mesh bongo. The size of the boat is still being determined, please include in your proposal what space you may require.

With the alkalinity release rescheduled to September, there will be night hours for possible sampling / studying. Please note however that many boat operators require their vessel to return to home port (e.g. Akranes) in the evening so nighttime use of the main research vessel may be limited or not possible.

10. Where can the baseline data for the phyto/zooplankton community composition be found?

There will be baseline data for the phytoplankton/zooplankton community available by April 1st, 2025. It is currently being processed.

11. Would the changes in carbonate chemistry be available in real-time (or close to) so we could conduct more opportunistic biological sampling at the time in the field?

In terms of carbonate chemistry at the time of release, we will have TA, pH, and pCO2 sensors running continuously, with real-time data read-outs available. This information will be collected directly at the release site, up to 30-50 meters from the release site at the tethered buoy, and via underway sensors on the vessel.

12. Are there plankton nets available already from HAFRO (or Röst) or should I budget this in my proposal?

We own (1) <153 micron mesh bongo net with a 30 cm mouth. If you are in need of more or different mesh sizes, applicants should add this in their estimated budgets. If you are planning on doing bongo tows, please make sure you highlight your need for vessel space in your proposal.

Sensor Deployment Questions

13. Can applicants add additional sensors to the CTD rosette?

We will be using a SBE19 Seacat CTD. Any additional sensor an applicant would like to add will be evaluated for compatibility and any power or data storage requirements. A prerequisite is that it will not interfere with the core research. Please specify in the application what assumptions are being made or requirements are had.

14. Do the pier-based sensor package and tethered platform provide real-time data access (i.e. via a dashboard or similar interface)?

There will be real-time access to data via dashboard integrations. The Research Team is planning to have a control room space on the pier which can be used for additional dashboard setups if needed.

15. What are current sensing intervals for the pier-based sensor package and tethered platforms? Is there a preferred sensing interval?

For sensing intervals, we have not yet determined each interval for each sensor. Our preferred interval would be the highest resolution possible according to both the sensor specs and the sensitivity of the parameter we are capturing. For example, pH on a 60 second interval.

16. Can you please share more information about the diffuser and tethered buoy?

The diffuser will be fixed at 2 meters deep. The diffuser will have a pH sensor monitoring the direct outflow pH continuously. The tethered platform will be located from 30-50 meters away from the diffuser depending on tidal fluctuations. This platform will contain a sonde that measures pH, turbidity, chlorophyll-a, pCO2, in addition to temperature, salinity, and conductivity.

The JLO Management Team's advice is that applicants should summarize their technology's specifications, sensing capabilities and integration requirements to other hardware, floats or buoys in their proposal. The Research Team can work with applicants on optimal deployment zone(s) should their proposal be selected.

Alkalinity Release Questions

17. What concentration of NaOH release is planned and what changes in pH and TA are expected in the near-field?

We are using a 30% concentration of NaOH, diluted with freshwater to a 4.5% solution. The in situ pH for the fjord is typically 8.1-8.2, and below are both models of horizontal and vertical extent of estimated maximum pH values after 96 hours in the near-field zone. Total Alkalinity was not part of the near-field modeling but is in progress as part of the Regional Ocean Model and may become available to awardees at a later time.

Figure 2: Horizontal extent of estimated maximum pH values after 96 hours according to ROMS modeling included in permit application

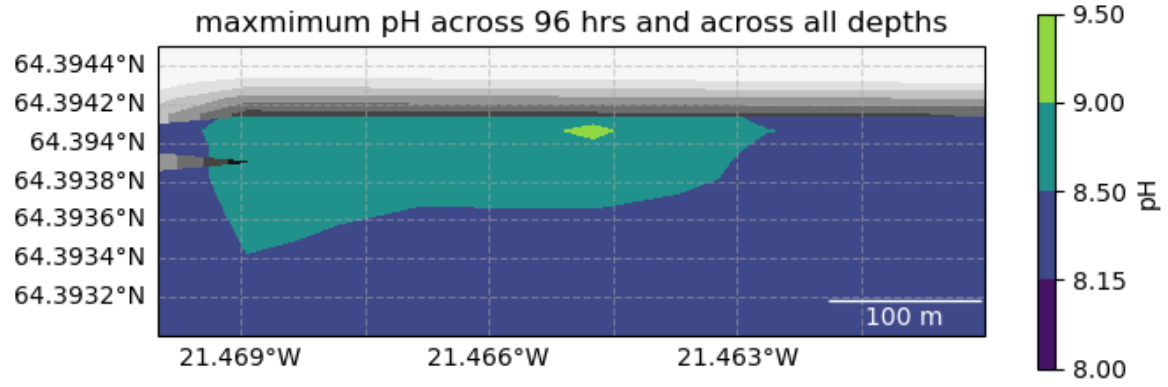
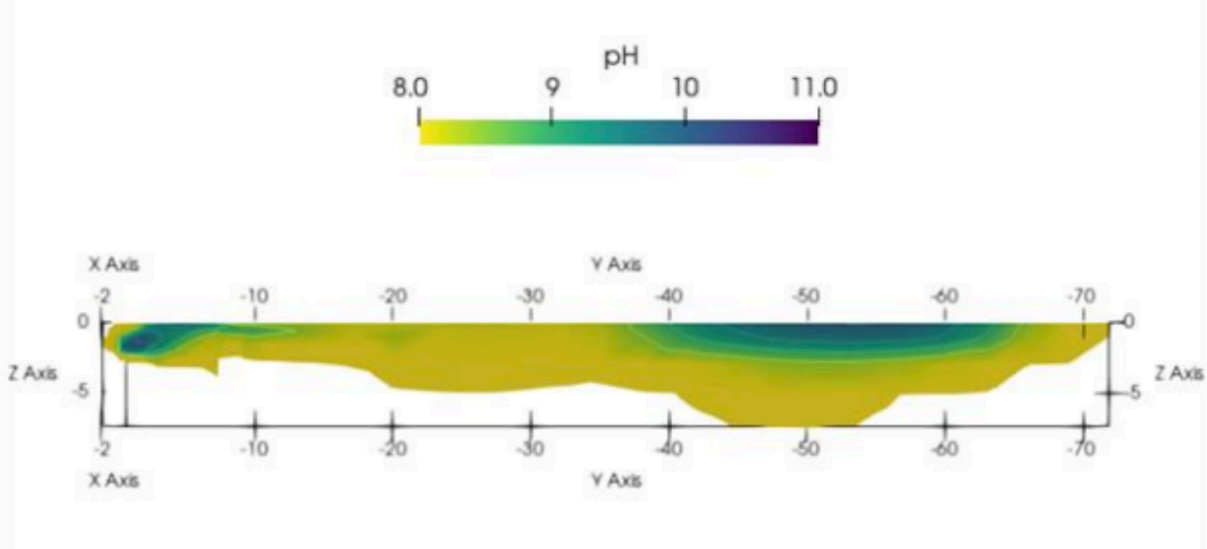


Figure 3: Vertical extent of estimated maximum pH values after 96 hours according to ROMS modeling included in permit application



Editors Note: Regarding the figures above, considering the limitations of the model, the size of the patch and concentration value of pH should be considered directional until additional data is collected via the May dye release study. Additionally the ROMS model was run for the conditions in the fjord in the summer and would need to be rerun for the new trial date of September.

18. Will the pHs reach the levels shown in the figure above?

The figure above was generated in a model that roughly estimated the theoretical maximum pH results from an idealized release. In practice, there is a feedback control planned for the dosing system to try to ensure the pH never exceeds a maximum threshold.

19. How long would subsequent measurements of carb chemistry take place after the release? What is the approx. time period in which the changes post-release would still be evident?

We will conduct vessel-based monitoring for 10 days after the last alkalinity release. A pier-based pCO2 sensor will continue to collect data after the trial. We expect the alkalinity signal to be detectable for up to 50 hours after the final release time.

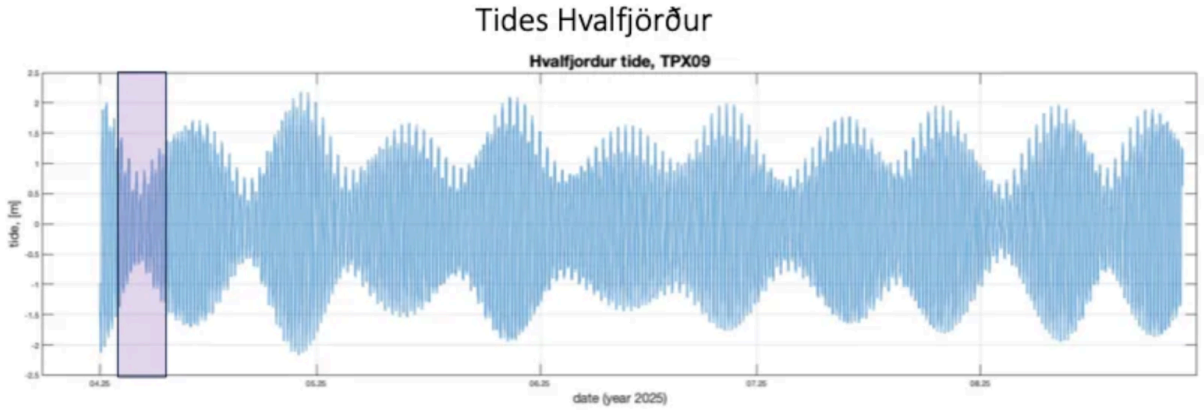
20. What sort of spatial extent would be sampled as part of the carbonate chemistry content?

We don't expect to see detectable alkalinity signals outside of the 50 meter range during the experiment. In addition to the fixed monitoring points at the pier and at the tethered platform, the vessel will take discrete samples in the near and far field (to be determined by dye study and continued modeling) and measure SF_6 and rhodamine to trace the alkalinity plume.

21. Are the tidal dynamics high and the gradients are likely not to be sustained over the sampling period, or is the retention adequate enough to have the gradients across which we can sample?

Hvalfjörður has one of the most extreme tidal cycles in Iceland. The tidal range is from 1.5 meters at neap tide to 3.5 meters during the spring tide. That being said, the tidal current influence around the release site is relatively weak, and the site is fairly well protected from wind-driven mixing. Depending on the tidal signal at the given time, along with weather, weak stratification/gradients remain fairly stable for this fjord. See figure below for tidal variability:

Figure 4: Tidal variability in the fjord



22. What is the maximum expected time for the release of data after the results are ready?

We are currently working on our data management and dissemination plan regarding the data outcomes from the field trial. Of course, any data recorded or measured by sensors can be shared immediately, but will not be quality assured. Analysis of discrete water samples will take weeks to months. If you are referring to your own data / observations they will be subject to the data management and dissemination plan which will be developed jointly with all JLO participants.