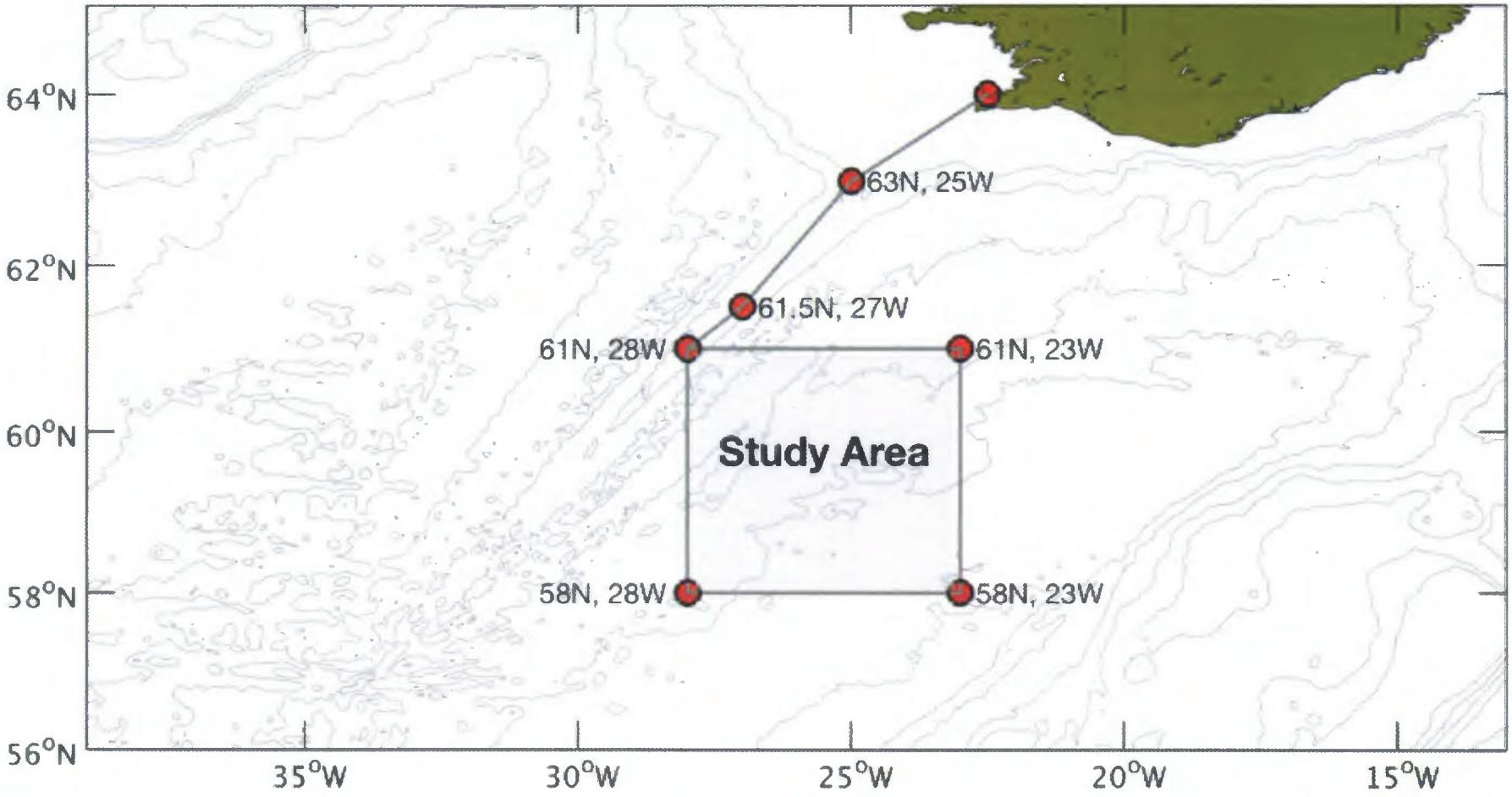
64°N
62°N
60°N
58°N
56°N
35°W
30°W
25°W
20°W
15°W
63N, 25W
61.5N, 27W
61N, 28W
61N, 23W
Study Area
58N, 28W
58N, 23W

# Project description

1. General Information

| | |
|---|---|
| 1.1 Cruise name and/or number: | NISKINE Process Cruise - F2018-097 |

| 1.2 Sponsoring institution(s): | | |
|---|---|---|
| Name | Address | Name of Director |
| Office of Naval Research | Dr. Scott Harper scott.l.harper@navy.mil | Dr. Tom Drake |
| Woods Hole Oceanographic Institution | Kerry Strom 266 Woods Hole Rd. #37 Woods Hole, MA 02543 | Mark Abbot |

| 1.3 Scientist in charge of the project: | |
|---|---|
| Name: | Amy Waterhouse |
| Country: | US |
| Affiliation: | Scripps Institution of Oceanography |
| Address: | 9500 Gilman Drive # 0213 La Jolla, California 92093-0213 US |
| Telephone: | 858-822-4312 |
| Email: | awaterhouse@ucsd.edu |

| 1.4 Entity(ies) /Participant(s) from coastal State involved in the planning of the project: | |
|---|---|
| Name: | See Section 6.2. |
| Country: | |
| Affiliation: | |
| Address: | |
| Telephone: | |
| Fax: | |
| Email: | |
| Website (for CV and photo): | |

2. Description of Project

| 2.1 Nature and objectives of the project: |
|---|
| Refine forecasting of upper-ocean shear set by the interaction of wind-forced high mode near-inertial waves and the mesoscale (10-100 km) upper ocean current patterns. *Note* Amy Waterhouse is the Chief Scientist for Leg 1: 27 April - 22 May 2019, Reykjavik to Reykjavik. For Leg 2, Craig Lee is the Chief Scientist after the port call (Leg 2: ~23 May - 20 June, 2019, Reykjavik to Reykjavik) |

| 2.2 Relevant previous or future research projects: |
|---|
| Better understanding of upper ocean mixing is needed to improve regional forecast models and climate predictions. Shear and strain of the thermocline also affect short to midrange acoustic propagation. |

| 2.3 Previous publications relating to the project: |
|---|
| Our previous work in the region focused on the biology, chemistry and physics of the spring phytoplankton bloom. References include: Martin, P., R.S. Lampitt, M.J. Perry, R. Sanders, C.M. Lee and E. Dâ€™Asaro, 2011: Export and Mesopelagic Particle Flux during a North Atlantic Spring Diatom Bloom. Deep Sea Research, 58(4):338-349, doi:10.1016/j.dsr.2011.01.006. Alkire, M.B., E. Dâ€™Asaro, C.M. Lee, M.J. Perry, A. Gray, I. Cetinic, N. Briggs, E. Kallin, Jan Kaiser and A. Gonzalez-Posada, 2012: Estimates of net community production and export using high-resolution, Lagrangian measurements of O2, NO3-, and POC through the evolution of a spring diatom bloom in the North Atlantic. Deep Sea Research Part 1: Oceanographic Research Papers, doi: 10.1016/j.dsr.2012.01.012. Briggs, N, M.J. Perry, I. Cetinic, C. Lee, A. M. Gray and E. Rehm, 2011: High-resolution observations of aggregate flux during a sub-polar North Atlantic spring bloom. Deep Sea Research Part 1: Oceanographic Research Papers, doi: 10.1016/j.dsr.2011.07.007. Fennel, K., I. Cetinic, E. D'Asaro, C. Lee, and M. J. Perry, 2011: Autonomous data describe North Atlantic spring bloom. EOS Transactions, American Geophysical Union, 92(50), 465, doi:10.1029/2011EO500002. Mahadevan, A., E. Dâ€™Asaro, C.M. Lee and M.J.Perry, 2012: Eddy-driven stratification initiates the North Atlantic Spring Bloom. Science, 337, DOI: 10.1126/science.1218740, 54-58. Cetinic, I., M. J. Perry, N. T. Briggs, E. Kallin, E. A. D'Asaro, and C. M. Lee, 2012: Particulate organic carbon and inherent optical properties during 2008 North Atlantic Bloom Experiment. Journal of Geophysical Research, 117, doi:10.1029/2011JC007771. Cetinic, I., M. J. Perry, E. D'Asaro, N. Briggs, N. Poulton, M. E. Sieracki and C. M. Lee, 2015: A simple optical index shows spatial and temporal heterogeneity in phytoplankton community composition during the 2008 North Atlantic Bloom experiment. Biogeosciences, doi:10.5194/bg-12-1-2015. Alkire, M. B., C.M. Lee, E.A. D'Asaro, M.J. Perry, N. Briggs, I. Cetinic, and A. Gray, 2014: Net community production and export from Seaglider measurements in the North Atlantic after the spring bloom, Journal of Geophysical Research, 119, doi:10.1002/2014JC010105. Omand, M.M., E.A. Dâ€™Asaro, C.M. Lee, M.J. Perry, N. Briggs, I. Cetinic+ and A. Mahadevan, 2015: Eddy-driven subduction exports particulate organic carbon from the spring bloom. Science, DOI: 10.1126/science.1260062. |

3. Geographical Areas

| 3.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude, including coordinates of cruise track/ way points): |
|---|
| Operations will occur within the region bounded by: 1) 63N, 25W 2) 61.5N, 27W 3) 61N, 28W 4) 58N, 28W 5) 58N, 23W 6) 61N, 23W |

| 3.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the location and depth of sampling stations, the tracks of survey lines, and the locations of installations and equipment. |
|---|
| Chart provided - see Section 10.1. |

4. Methods and Means to be Used

| 4.1 Particulars of vessel: | |
|---|---|
| Name: | NEIL ARMSTRONG |
| Type/Class: | Ship |
| Nationality (Flag state): | United States |
| Identification Number (IMO/Lloyds No.): | 9688946 |
| Owner: | United States Navy |
| Operator: | Woods Hole Oceanographic Institution |
| Overall length (meters): | 72.50 |
| Maximum draught (meters): | 4.60 |
| Displacement/Gross tonnage: | 2603.00 |
| Propulsion: | 2 Siemens AC Electric Motors, 2350 HP |
| Cruising: | 11.00 |
| Maximum speed: | 14.00 |
| Call sign: | |
| INMARSAT number and method and capability of communication (including emergency frequencies): | INMARSAT C- (IMN#) 436903967 |
| Name of master: | Captain Kent Sheasley |
| Number of crew: | 20 |
| Number of scientists on board: | 20 |

| 4.2 Other craft in the project, including its use: |
|---|
| none |

| 4.3 Particulars of methods and scientific instruments: | | |
|---|---|---|
| Types of samples and measurements | Methods to be used | Instruments to be used |
| Sensor-based measurements of temperature, salinity, ocean velocity, turbulence, dissolved oxygen, chlorophyll fluorescence, optical backscatter and downwelling irradiance. | Synoptic surveys conducted by towing an instrument behind the ship. Surveys will target oceanographic features (fronts, eddies, filaments) within the operating region defined under 'Geography' and marked on the attached chart. | Triaxus towed, undulating profiler: A box-kite like sensor platform that we tow behind the ship while moving at ~8 its. |
| Sensor-based measurements of temperature, salinity, ocean velocity, turbulence, dissolved oxygen, chlorophyll fluorescence, optical backscatter and downwelling irradiance. | Multi-month surveys by long-endurance autonomous ocean gliders.Gliders will be deployed during the cruise. Some will be recovered during the cruise (thus operating for several weeks), while others will continue to sample for many months after R/V Armstrong departs, to be recovered later by a ship chartered from Iceland. | Seagliders and SGX gliders. Both are small (1.5 m length, 50 kg mass), buoyancy-driven vehicles that glide through the ocean, moving from point to point while collecting profiles from the sea surface to 1000-m depth. Typical dive length is 6 hours, during which the glider traverses 3-5 km horizontally. Gliders can operate for periods of months to a full year. They geolocate using GPS and communicate back to shore using an Iridium satellite modem. |
| Sensor-based measurements of temperature, salinity, ocean velocity, turbulence. | Profiling floats. Floats will be released in a group (number TBD, but could be as many as 20-30) in an upper ocean front, eddy of filament, and allowed to profile while we perform synoptic surveys of the region using Triaxus. Floats would be | EM-APEX floats are a type of Argo profiling float that carries additional sensors for ocean velocity, and, sometimes, ocean turbulence. These float profile over the upper 2000-m of the water column, collecting roughly 200 profiles |

| | | |
|---|---|---|
| | recovered after a 2-5 day period. We will then target another feature and repeat the process. We anticipate 3-5 such surveys over the course of the cruise. | over the lifetime of the float. Data are reported via Iridium modem. |
| Sensor-based measurements of temperature, salinity, ocean velocity, turbulence. | Surface-drifting profilers will be deployed along with the EM-APEX floats to sample upper ocean features. They will be allowed to drift and sample for for 2-5 days, after which they will be recovered. We will then target a new feature and repeat the process. We anticipate 3-5 such surveys over the course of the cruise. | Wirewalker drifters: Surface drifting instruments with a wire that extends hundreds of meters below the sea surface. A profiling instrument, powered by wave action, moves up and down this line, sampling as it goes. Data are stored on board and reported back via Iridium modem. |

| 4.4 Indicate nature and quantity of substances to be released into the marine environment: |
|---|
| yes<br>LI primary batteries |

| 4.5 Indicate whether drilling will be carried out. If yes, please specify: |
|---|
| No |

| 4.6 Indicate whether explosives will be used. If yes, please specify type and trade name, chemical content, depth of trade class and stowage, size, depth of detonation, frequency of detonation, and position in latitude and longitude: |
|---|
| No |

| 4.7 Indicate whether protected species be studied. If yes, please specify: |
|---|
| No |

5. Installations and Equipment

| Details of installations and equipment (including dates of laying, servicing, method and anticipated timeframe for recovery, locations and depth, and measurements): |
|---|
| No |

6. Dates

| 6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms: |
|---|
| Project Start Date: Apr 27, 2019 |
| Project End Date: Jun 20, 2019 |

| 6.2 Coastal State-specific details: | | |
|---|---|---|
| Coastal Area | Estimated Entry Date | Estimated Departure Date |
| **Iceland** | Apr 27, 2019 | Jun 20, 2019 |
| **Explanation of multiple entries:**<br>N/A | | |
| **Research will be performed:** between 12-200 nm | | |
| **Extent to which Iceland will be enabled to participate or to be represented in the research project:**<br>Researchers from Icelandic Institutions, including the Marine and Freshwater Research Institute, the Iceland Met Office and the University of Iceland, are collaborating on this project and will be invited to join the expedition. | | |
| **Name, affiliation and contact information for all participants from Iceland:**<br>Dr. HÃ©Ã°inn Valdimarsson (hedinn.valdimarsson@hafogvatn.is) Dr. Maria Hernandez (mperezhernandez@whoi.edu) Marine and Freshwater Research Institute Dr. Angel Ruiz-Angulo (angel@vedur.is) Iceland Met Office | | |

7. Port Calls

| Port | Arrival Date | End Date | Special Logistical Requirements | Shipping Agent |
|---|---|---|---|---|
| Reykjavik | 5/22/2019 | 5/27/2019 | May need the ability to handle 20' shipping containers and manipulate heavy equipment. | TBD |
| Reykjavik | 6/20/2019 | 6/20/2019 | May need the ability to handle 20' shipping | TBD |

| | | | | |
|---|---|---|---|---|
| | | | containers and manipulate heavy equipment. | |

8. Participation of the representative of the coastal State

| 8.1 Modalities of the participation of the representative of the coastal State in the research project: |
|---|
| See Section 6.2. |

| 8.2 Proposed dates and ports for embarkation/disembarkation: |
|---|
| See Section 6.2. |

9. Access to Data, Samples and Research Results

| 9.1 Expected dates of submission to coastal State of preliminary report, which should include the expected dates of submission of the data and research results: |
|---|
| No more than 60 days from the end date of the research as provided in Section 6.1. |

| 9.2 Anticipated dates of submission to the coastal State of the final report: |
|---|
| No more than 2 years from the end date of the research as provided in Section 6.1. |

| 9.3 Proposed means for access by coastal State to data (including format) and samples: |
|---|
| Data will be provided through official channels at no cost to the coastal State(s). Samples will be provided upon request. |

| 9.4 Proposed means to provide coastal State with assessment of data, samples and research results: |
|---|
| Assessment of data, samples and research results will be provided at no cost to the coastal State(s). |

| 9.5 Proposed means to provide assistance in assessment or interpretation of data, samples and research results: |
|---|
| Assistance in further assessment or interpretation will be provided upon request. |

| 9.6 Proposed means of making results internationally available: |
|---|
| The project funds the creation of a data server that will be used to disseminate reports and data as appropriate and in agreement with data sharing agreements between the US and Iceland and as approved by the funding agency. Results will be published in the open scientific literature. |

10. List of Supporting Documentation

| 10.1 List of attachments, such as additional forms required by the coastal State, etc.: | | | |
|---|---|---|---|
| Attachment Type | Description | Attachment | Submission Date |
| Proposed Cruise Track | Chart showing operating area defined in MSR request text. | 1206562500_IcelandMap.png | Oct 30, 2018 |