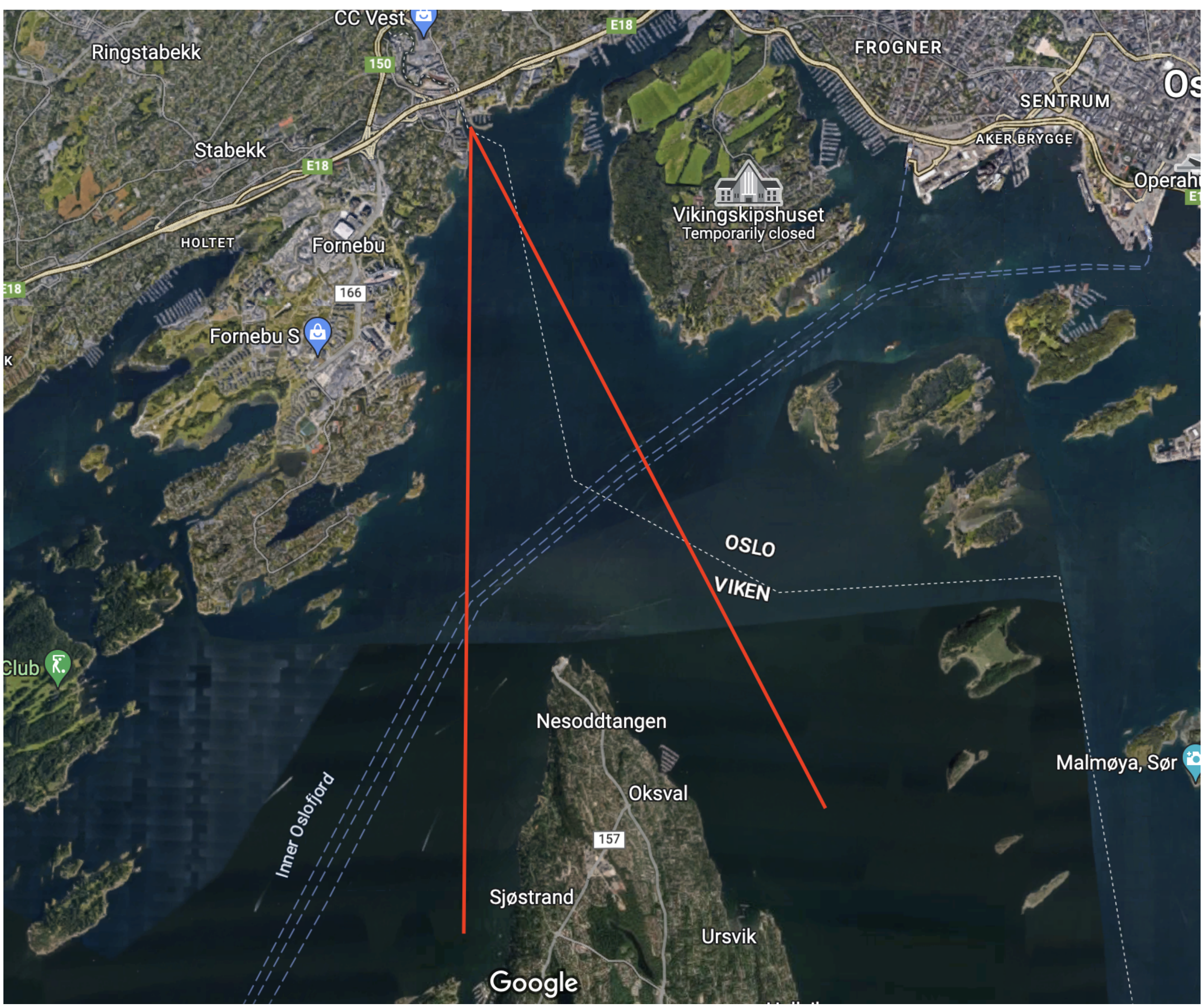
Cruise - instructions

The RV Trygve Braarud will traverse a hydrographic section, starting at the Lysakerelva outlet and sailing either towards Bunnefjorden or Vestfjorden depending on the weather conditions and vessel traffic (that is, one of the approximate red tracks in the figure below).

There will be three main tasks: (i) taking hydrographic (CTD) measurements at several stations along the section, some of **which will be repeated**, (ii) taking weather and air-sea flux measurements at the same stations, and (iii) deploying and tracking drifters with drogues at various depths to provide qualitative information about the drift currents and upper ocean velocity shear.

In-situ measurements will be compared with ocean circulation model results for the same time and positions. A few scripts to get you started on the analysis can be found at https://github.com/kaihc/GEO2320/tree/main/cruise



1. Stations

We aim to have three or four stations along the section. At each station, the following measurements will be made:

- SeaBird CTD profile using the ship-mounted instrument (operated by the crew).
- CastAway CTD profile using a handheld device.
- Secchi disk observation (shortwave light penetration in the upper ocean).
- From the panels on the bridge/in the instrument room (if available), note
  - wind speed and direction (m/s and degrees clockwise from N),
  - relative humidity (%),
  - sea surface temperature (C),
  - air temperature (C),
  - mean sea level pressure (hPa).
- Manual observation of significant wave height (in meters).
- Manual observation of total cloud cover (in oktas).
- Take a note if it's raining.

Self-organize and share tasks among yourselves, and switch tasks after each station so that everyone gets to try everything. At each station, you must decide on **a station name**, and note the **time of arrival** at the station as well as **the position**. **Use decimal degrees for lat/lon. All times must be indicated using UTC and <u>clearly denoted with a trailing "z"</u>**. For example, if the local time is 12:45 CEST, the time should be noted as "10:45z". Take photos, make good notes, learn the names of the crew.

Exercises

1. Plot profiles of the hydrographic data (salinity, temperature and density.
2. Compare a few profiles between the SeaBird and CastAway CTDs.
3. Plot the same quantities (same location and times) using the model data made available from thredds.met.no (https://thredds.met.no/thredds/fjordos.html or https://thredds.met.no/thredds/catalog/fjordos/operational_archive/complete_archive/catalog.html). See also example python code in github cruise repo.
4. Calculate the surface heat fluxes using the COARE 3.5 algorithm using the script made available on github.
5. How is the ocean mixed layer developing? Is it being stabilized or destabilized? Use the estimated heat fluxes and the observed temporal development of the vertical density structure.
6. Discuss the following:
   a. Can you identify different water masses based on the Secchi disk data?
   b. How does the model compare to the measurements?
   c. How do the CTD instruments compare?

d. Do you notice differences between data in the Vestfjorden and Bunnefjorden (there is a sill between these two parts of the fjord)?

Useful links:
https://www.rmbel.info/training/how-to-use-a-secchi-disk/
https://www.eoas.ubc.ca/courses/atsc113/flying/met_concepts/01-met_concepts/01c-cloud_coverage/index.html

2. Drifter experiment

On one station on the outgoing leg, several drifters with drouges at different depths (0m, 3m, 5m, 20m) will be deployed. Some of the drifters are tracked using GPS and the cell phone network, and will be recovered after about 1 hour of free drift. The instantaneous position during the experiment will be not be shared with you because an important task is, on recovery, to try to spot the drifters from the ship deck. If you have sunglasses with polarizing glasses, please bring them.

Exercises

1. Calculate average drift speeds for the various drifters and report them in knots and m/s.
2. Calculate the vertical velocity shear.