Regional Online Training Course on the Relationship Between Ocean Environment Variability and Marine Resource Abundance and Oceanographic Sampling

Overview for Oceanographic Survey

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Overview for Oceanographic Survey

- Why we need oceanographic survey?
- What we need to consider for the oceanographic survey?
- The importance of research proposal
- Why understanding the nature of studied phenomena is importance?
- Survey preparation: What we need to consider?

Why oceanographic survey?

https://oceanexplorer.noaa.gov/backmatter/whatisexploration.html

- To increase our understanding of the ocean, so we can more effectively manage, conserve, regulate, and use ocean resources that are vital to our economy and to all of our lives.

Monitoring may be carried out for a variety of reasons

- to discover what there is, find out the situation
- to discover change, determine trends
- to assess impact
- to check predictions and forecasts
- to check compliance with regulations
- to measure performance and effectiveness.

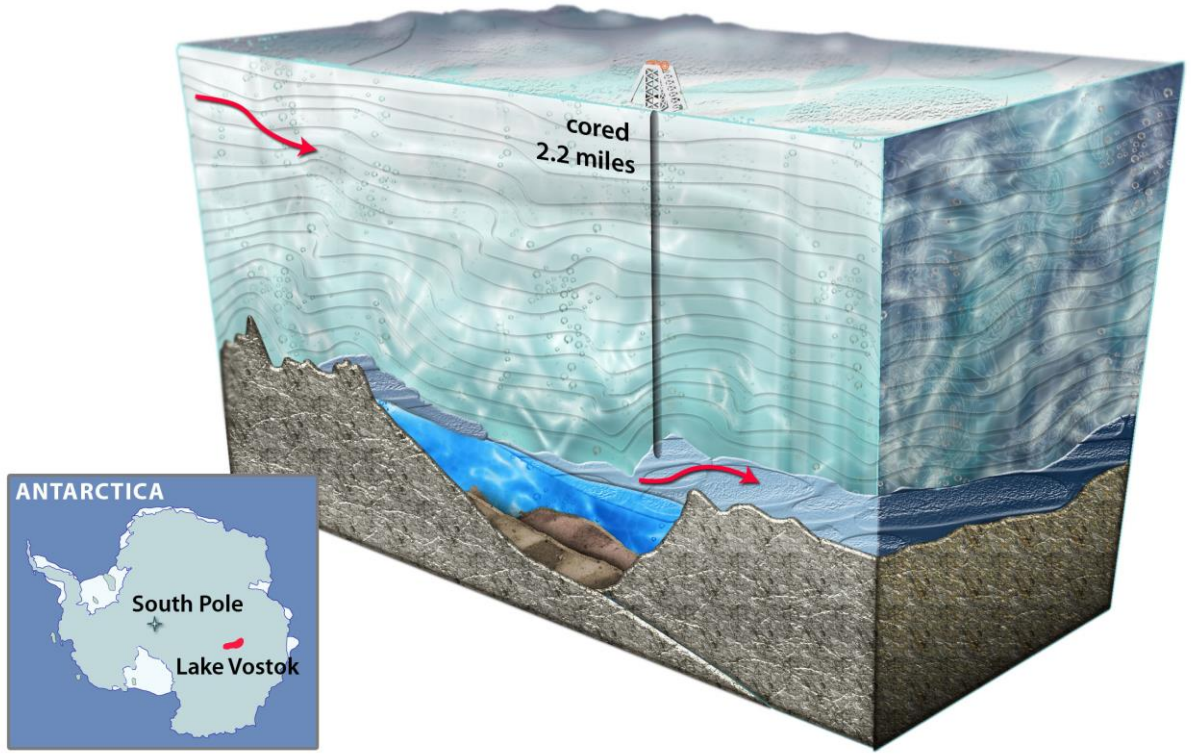
Why we need oceanographic survey?

- This question remind me when I joined the Antarctica expedition with Chinese scientists in 2015.
- Why Antarctica?
  - The continent is surrounded by the South Pole. The area is almost covered by ice all year. It is an area separated from other continents without permanent human habitation. The environment is pure.
  - It is suitable for the studies of "Nature and environment" such as atmospheric, astronomy, physics, marine science, geology and ecology.
  - A perfect place to collect meteorites and study Aurora.
  - Hidden resources such as power sources
  - To investigate the history of the earth’s climate and monitor the results of climate changes

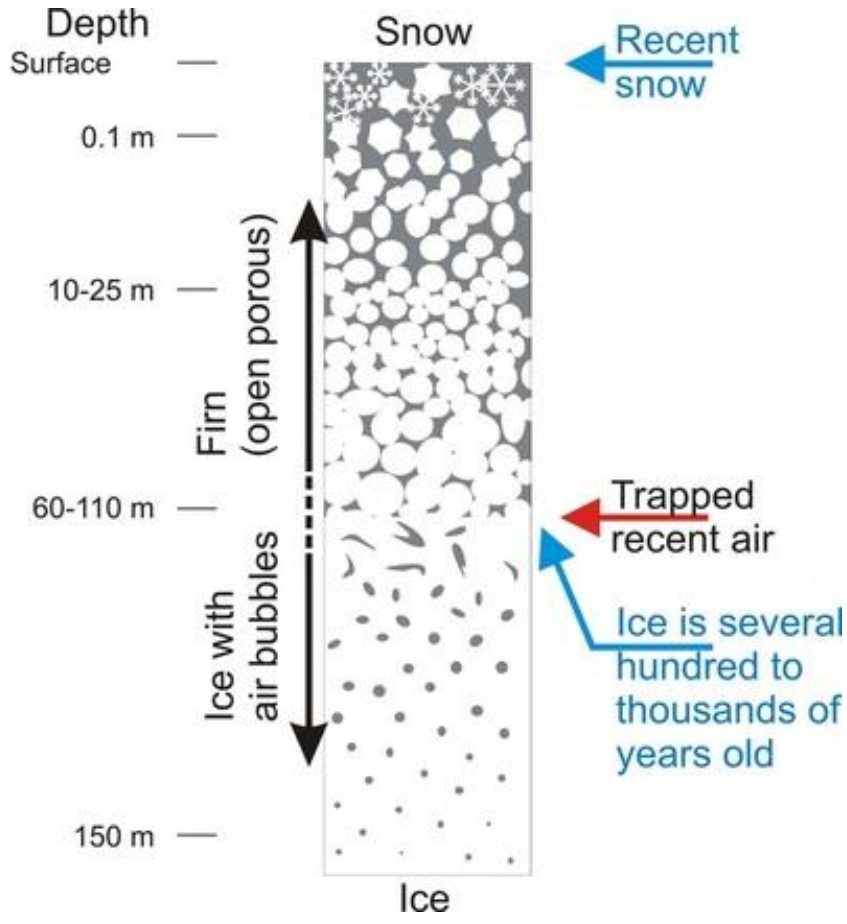
Meteorites found in Antarctica

Meteorite on blue ice found by the ANSMET 2012-2013 recon team (Image: Antarctic Search for Meteorites Program / Katherine Joy)

Ice cores used to investigate the history of the earth's climate



https://www.lakescientist.com/research-summary-sequencing-lifeforms-lake-vostok-ice-cores/



https://mindynicewonger.weebly.com/blog/how-ice-cores-are-dated

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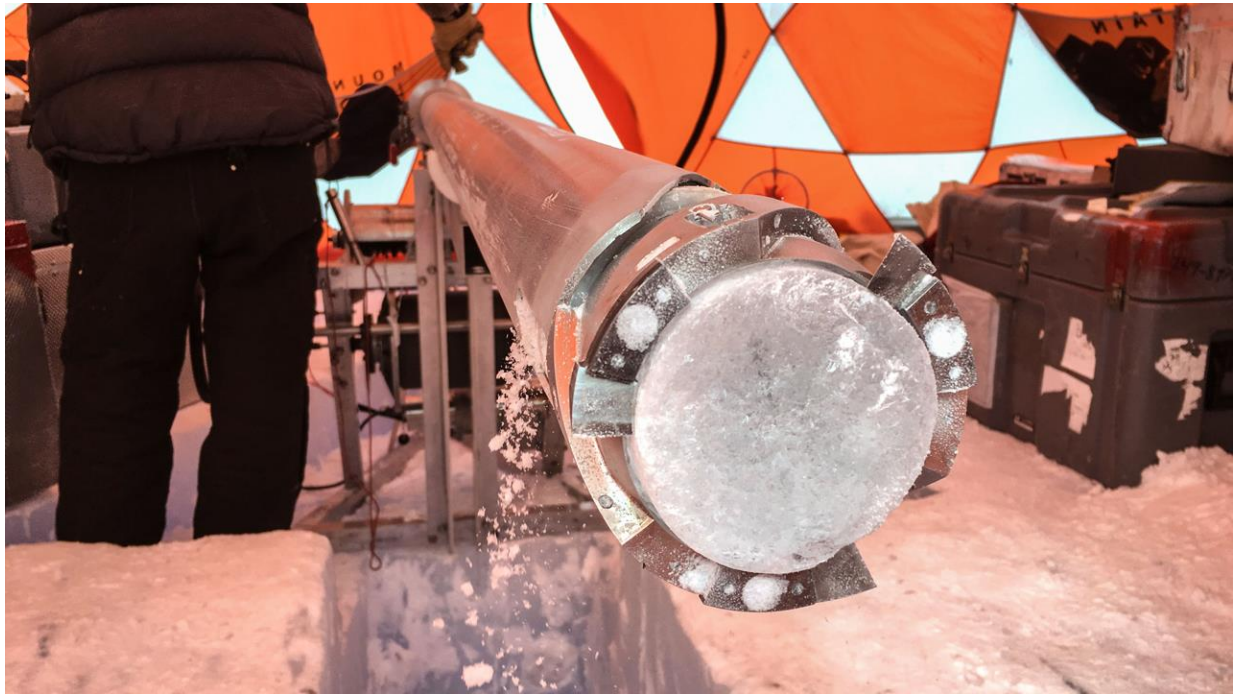
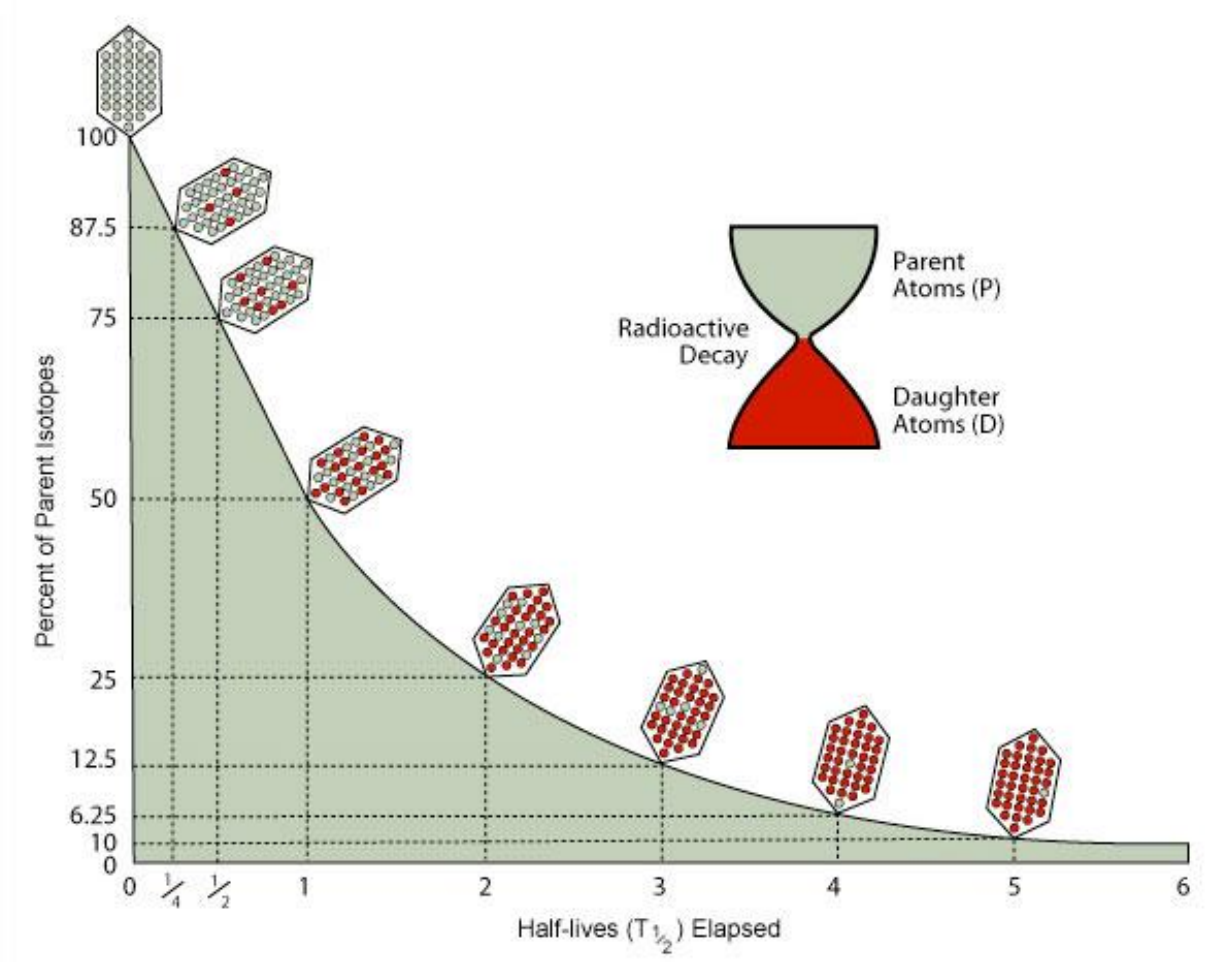


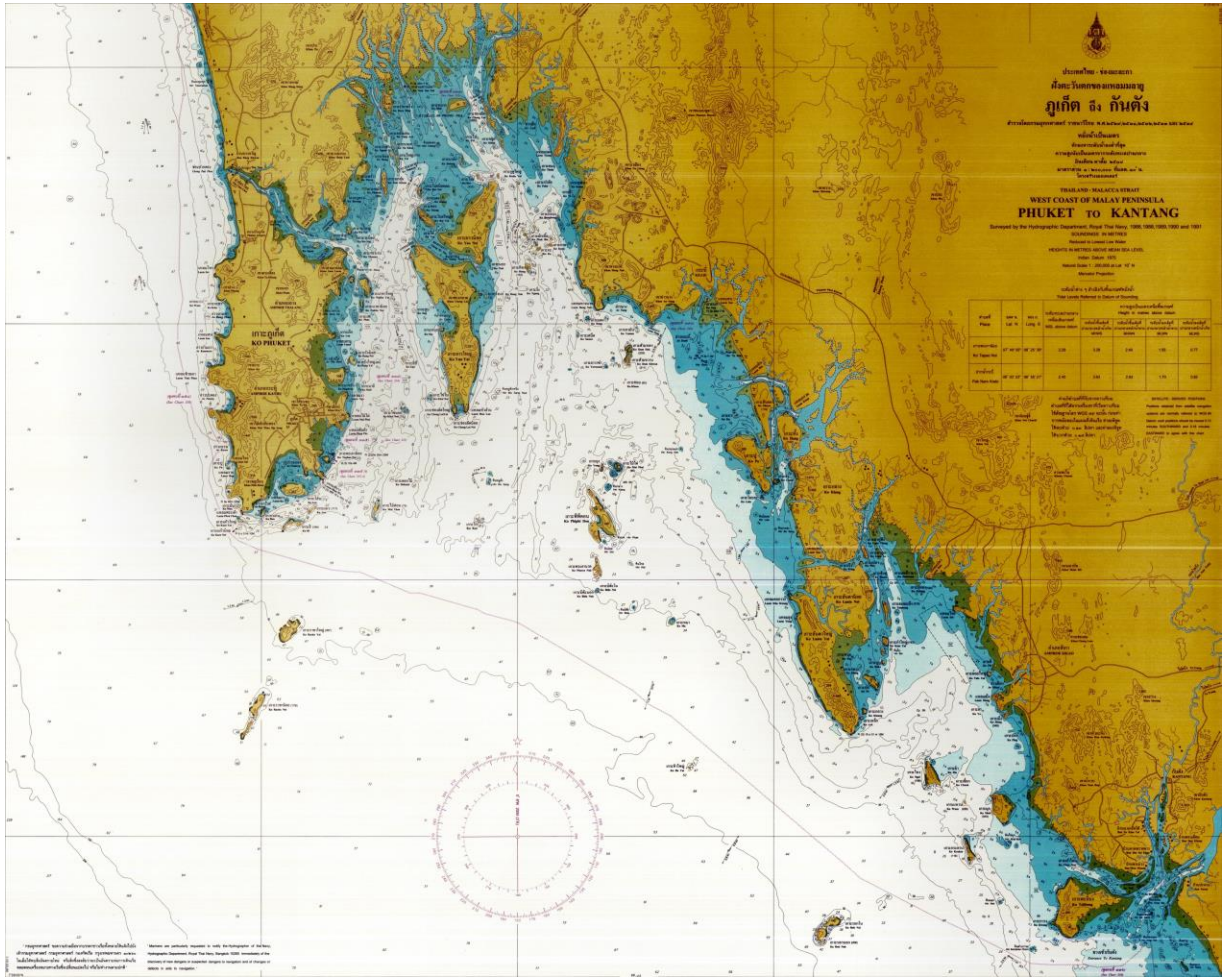
https://www.science.org/content/article/record-shattering-27-million-year-old-ice-core-reveals-start-ice-ages



https://oceanexplorer.noaa.gov/edu/learning/15_seamounts/activities/coral.html

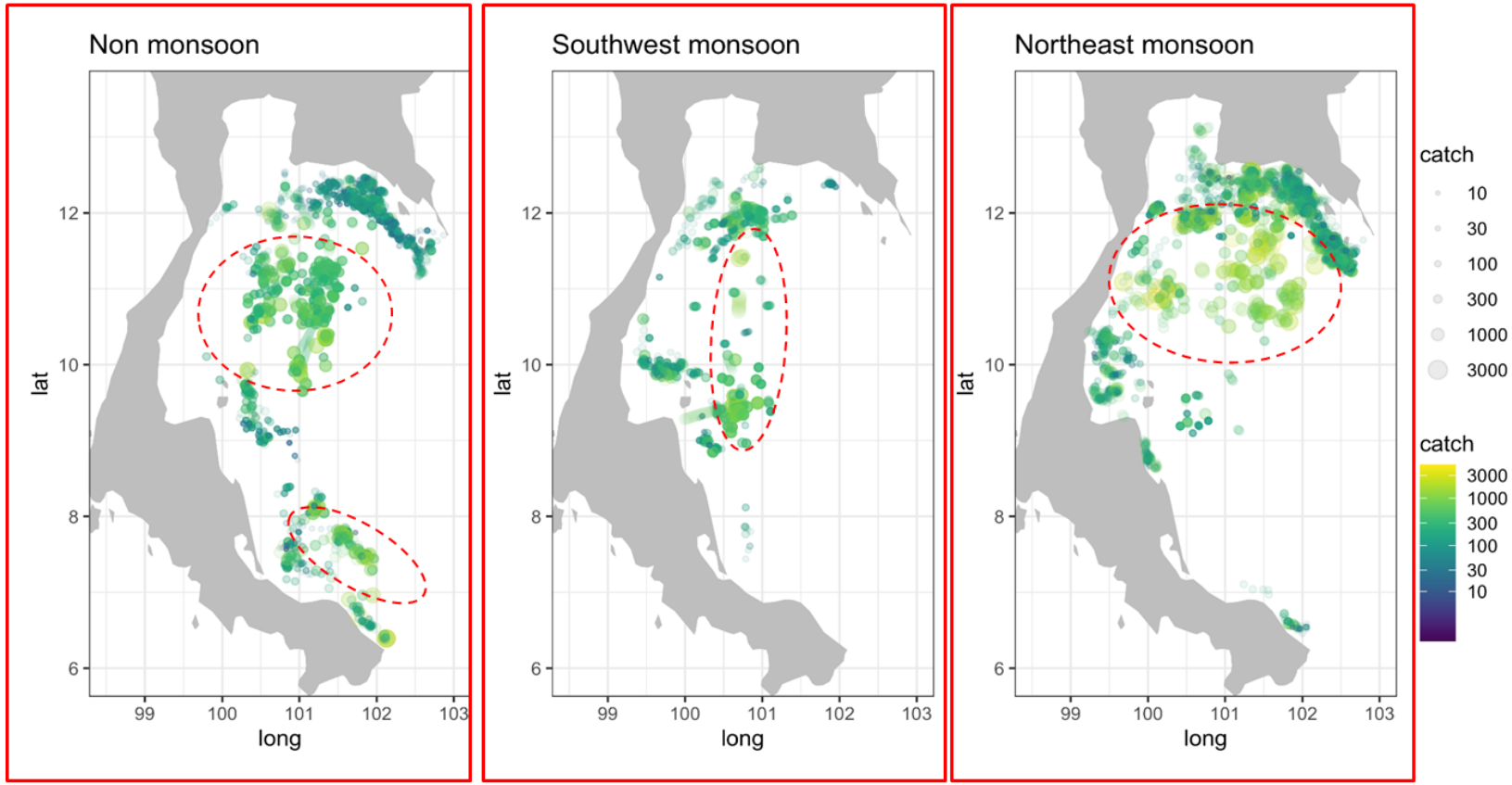
Why oceanographic survey: more specific reasons?

- Bathymetry survey for nautical charts
  - Always need, especially in coastal seas, although satellite data are available for bathymetry mapping.



Why oceanographic survey: more specific reasons?

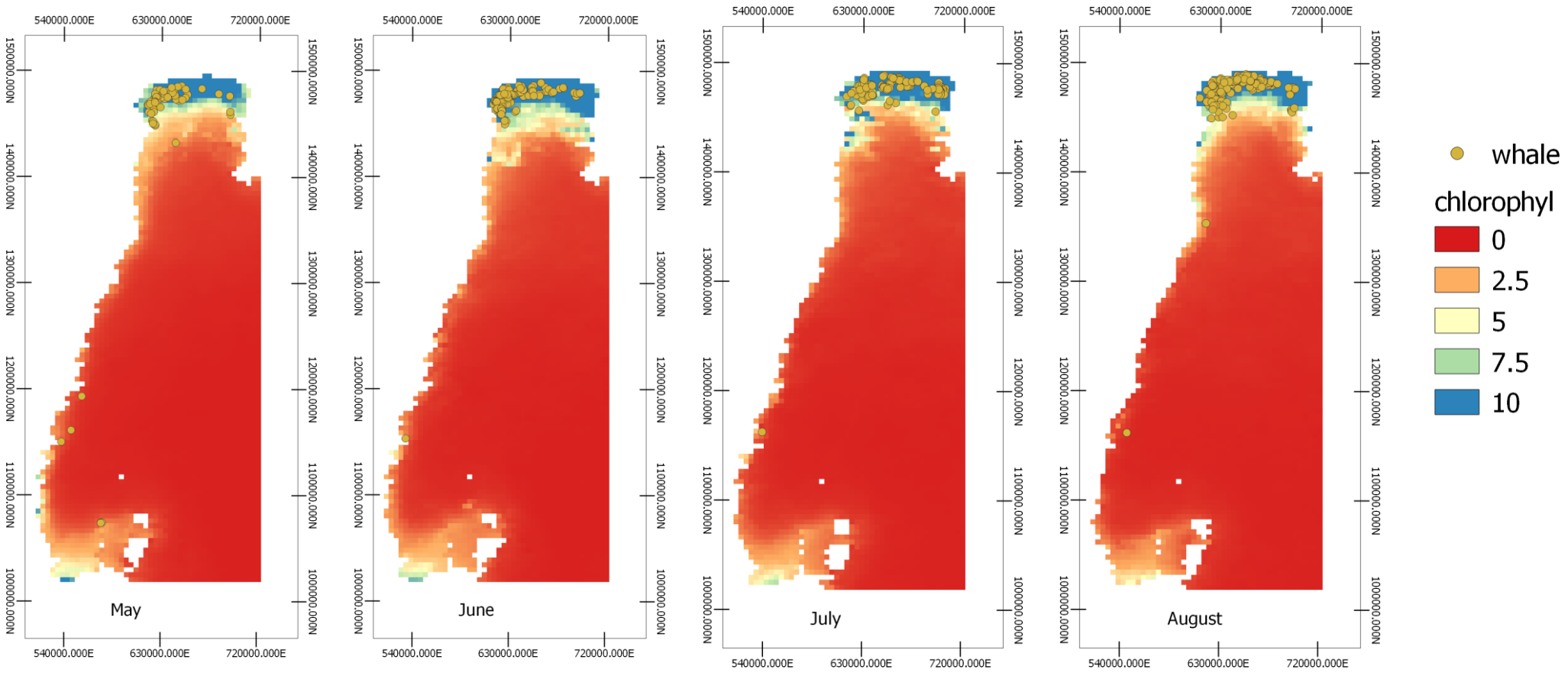
- Fishery resources exploration
  - Where and how much marine productivities?



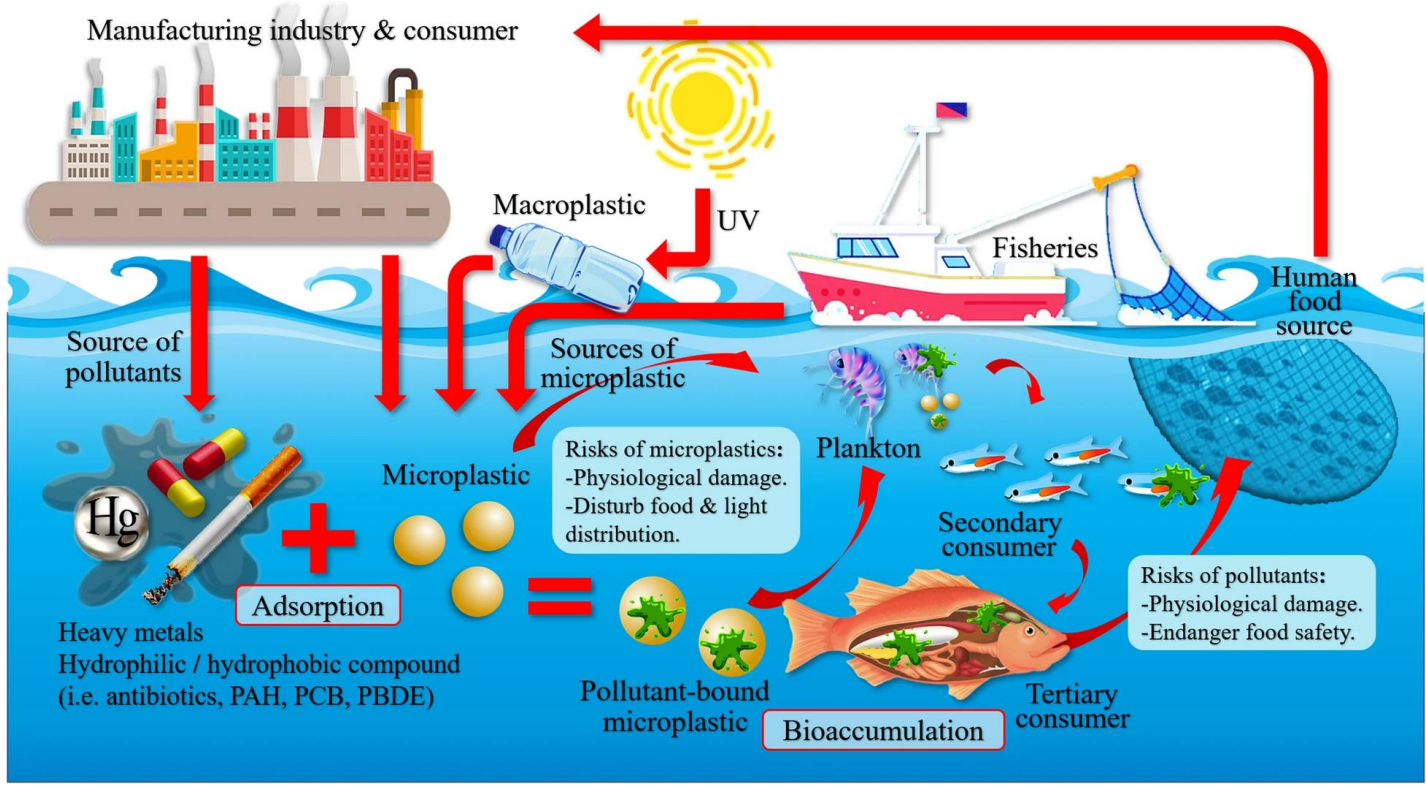
Spatial distribution of anchovies according to VMS data (Katekaew et al., 2021)

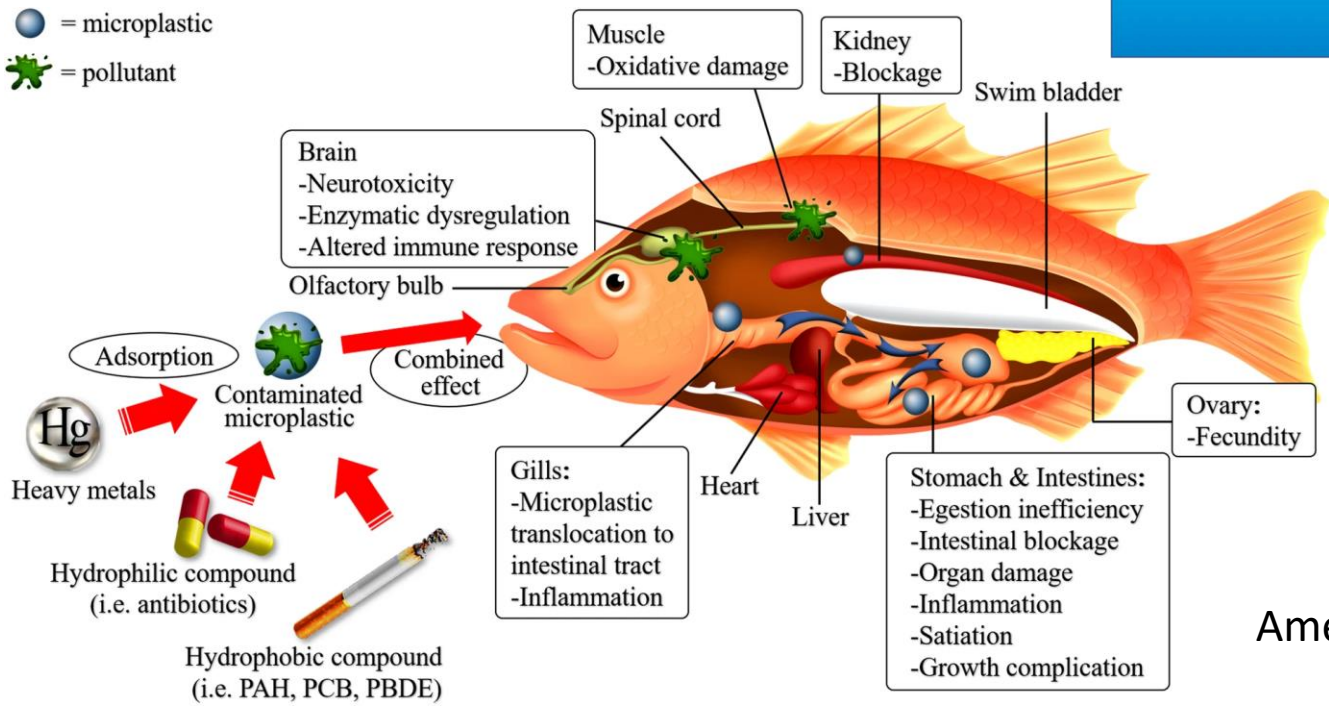
Why oceanographic survey: more specific reasons?

- Ocean environmental investigations
  - Relationship with fishery resources and marine conservative species



Why oceanographic survey: more specific reasons?



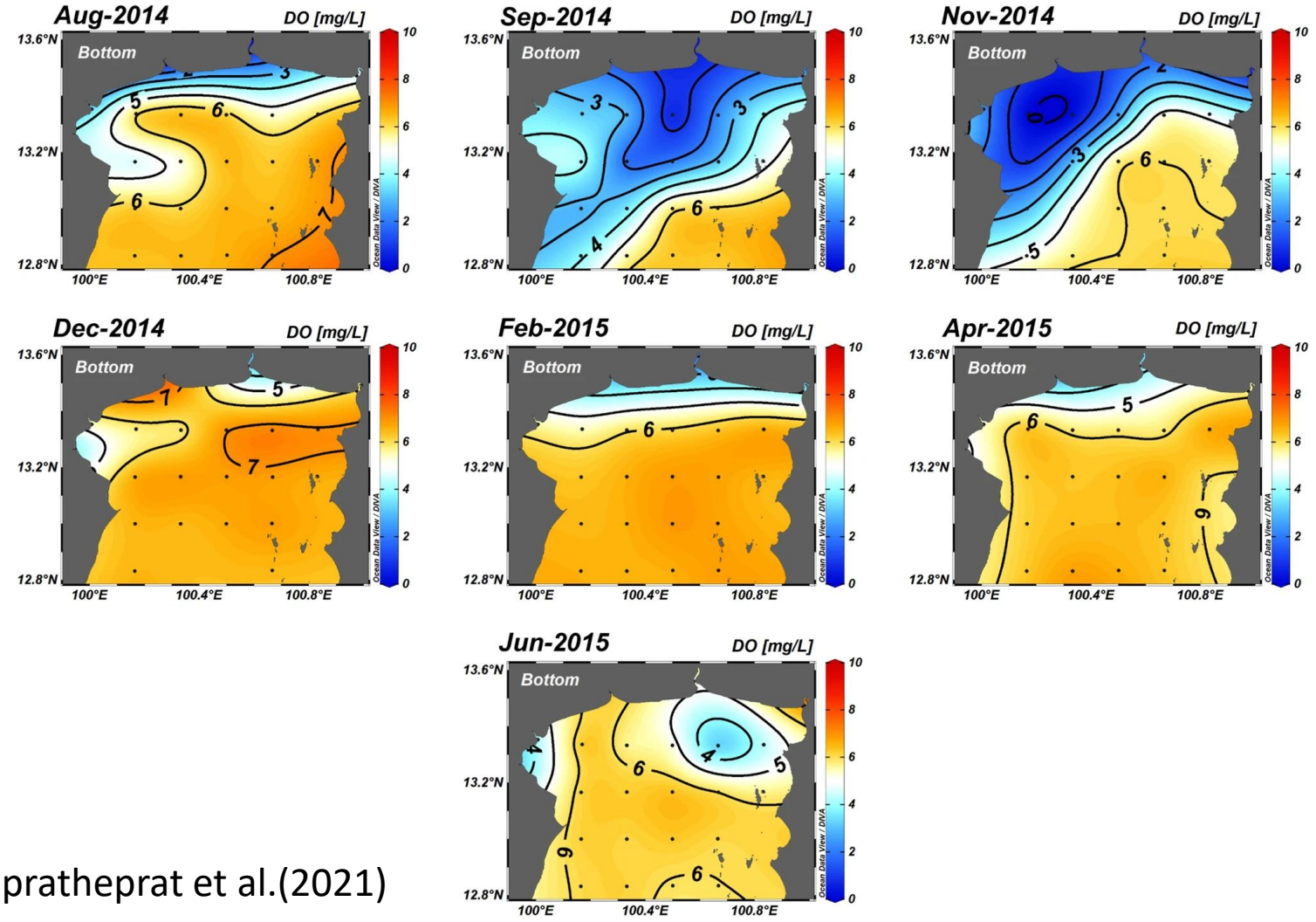


- Ocean environmental investigations
  - Marine pollution monitoring

Amelia et al.(2021)

Why oceanographic survey: more specific reasons?

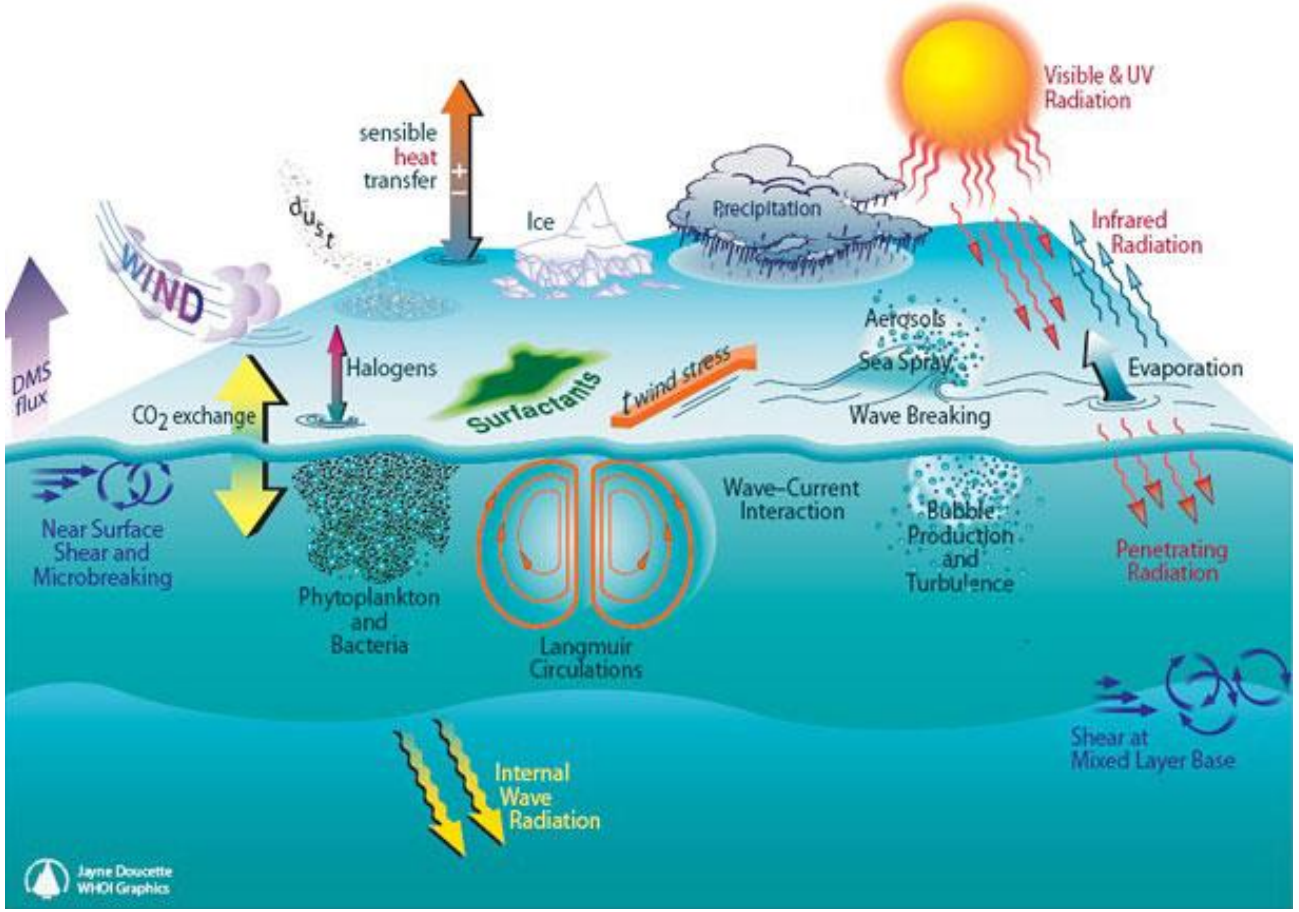
- Ocean environmental investigations
  - Ocean ecosystem related issues – eutrophication, Harmful Algal Bloom (HAB), hypoxia in water column and sediment



Buranapratheprat et al.(2021)

Why oceanographic survey: more specific reasons?

- Air-Sea Interactions
  - Responses of ocean to weather and climate
  - Ocean temperature, water column condition, ocean acidification, sea level rise
  - Influences of climate phenomena, such as El Nino and IOD on ocean environment and ecosystem



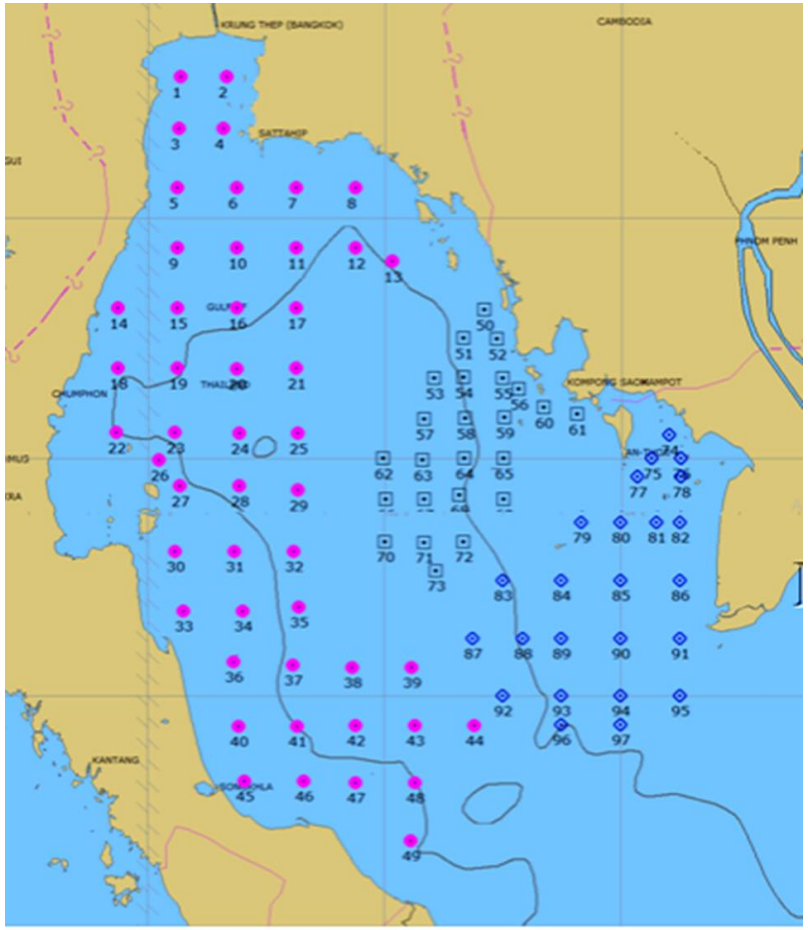
https://www2.whoi.edu/site/casimas/

What do we need to consider for the oceanographic survey?

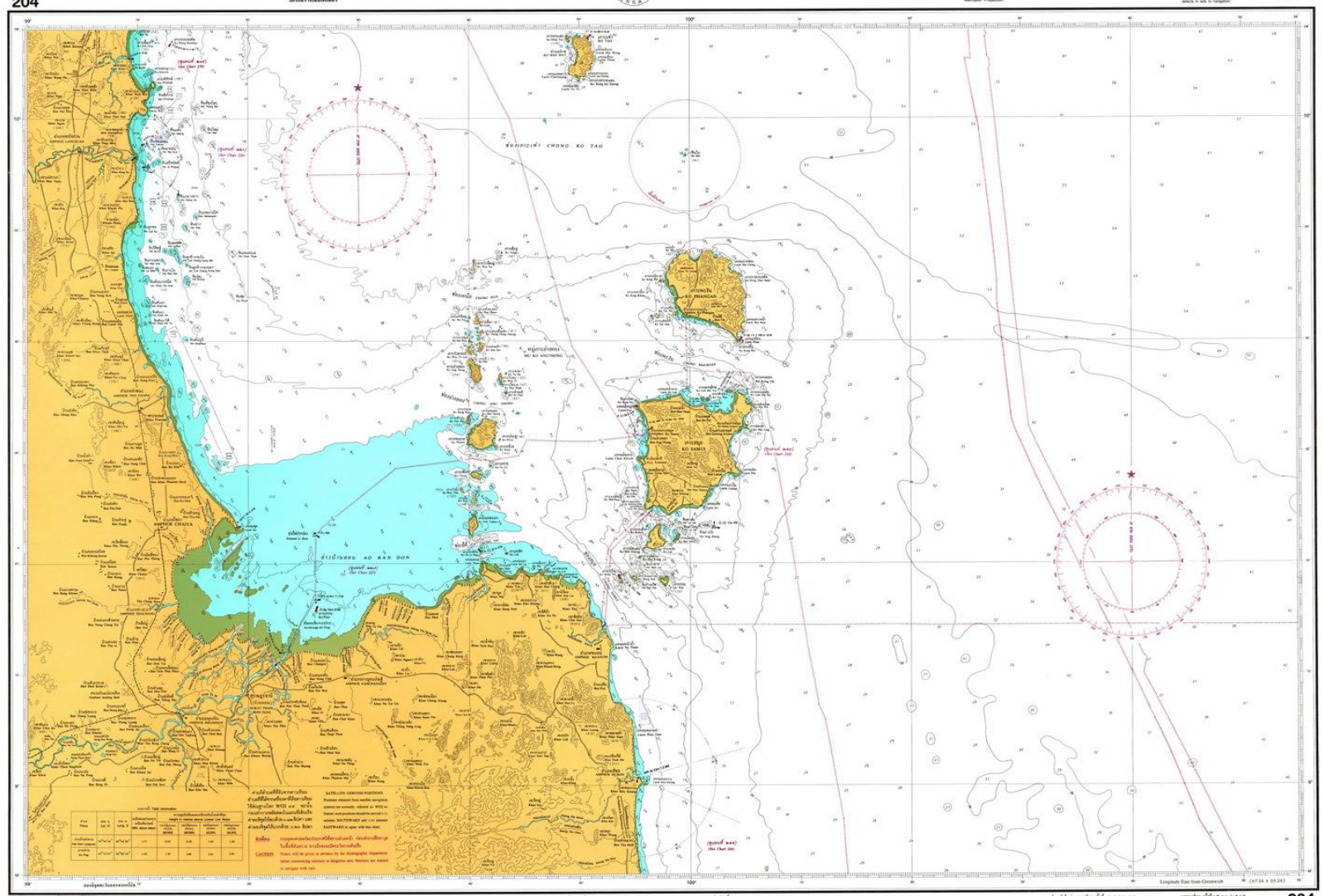
- What do we need to survey for?
  - We cannot do everything in the same survey, so we need to clearly identify the objectives of the survey.
    - Fisheries
    - Pollution
    - Navigation
    - Circulation
    - Etc.
  - Some of them can be integrated (with well survey plans); some cannot.

What do we need to consider for the oceanographic survey?

- Spatial variations in the natures of ocean environments.
  - Horizontal spacing
    - Depended on the phenomena interested and ship time. They need balances.
    - Survey points do not have to be the same spacing. They can be dense in the focused areas – for example, a nautical map survey.



A SEAFDEC survey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ประเทศไทย - อ่าวไทย - ฝั่งตะวันตก
แหลมคอกวาง ถึง หลังสวน
THAILAND - GULF OF THAILAND - WEST COAST
LAEM KHO KWANG TO LANG SUAN
SOUNDINGS IN METRES
Reduced to Lowest Low Water
HEIGHTS IN METRES ABOVE MEAN SEA LEVEL
Indian Datum 1975
Natural Scale 1: 240,000 at Lat. 10° N
Mercator Projection
CHONG KO TAO
KO PHANGAN
KO SAMUI
AO BAN DON
AMPHOE CHAYA
SATELLITE DERIVED POSITIONS
CAUTION
Longitude East from Greenwich
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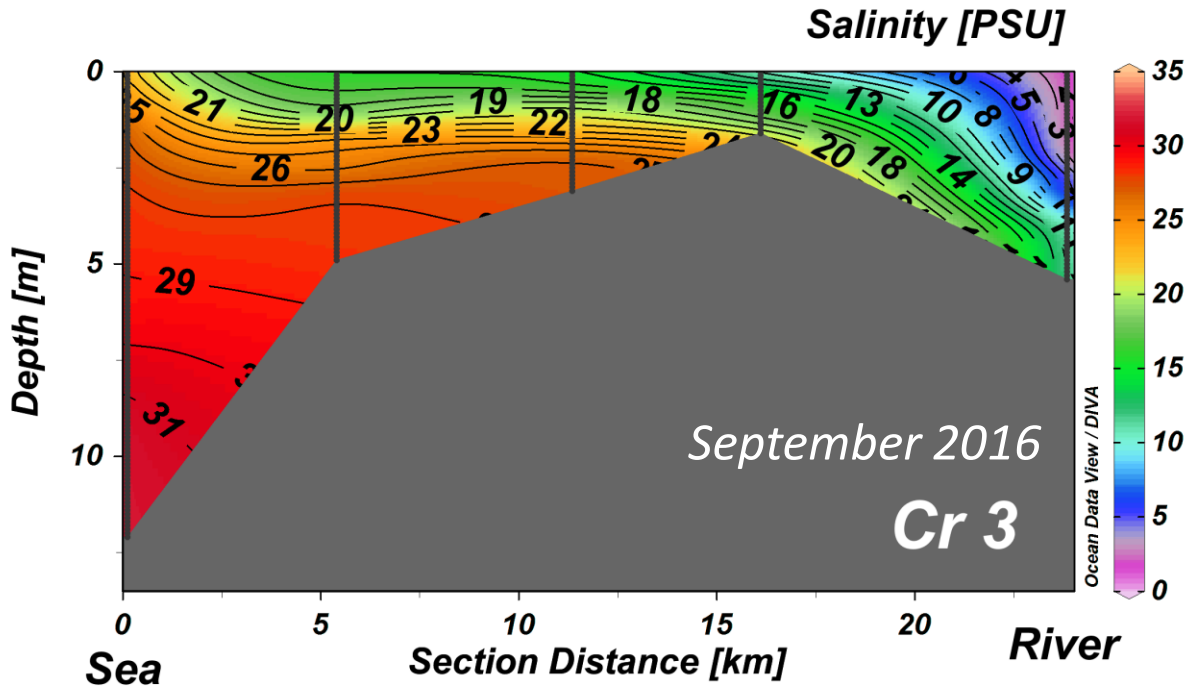
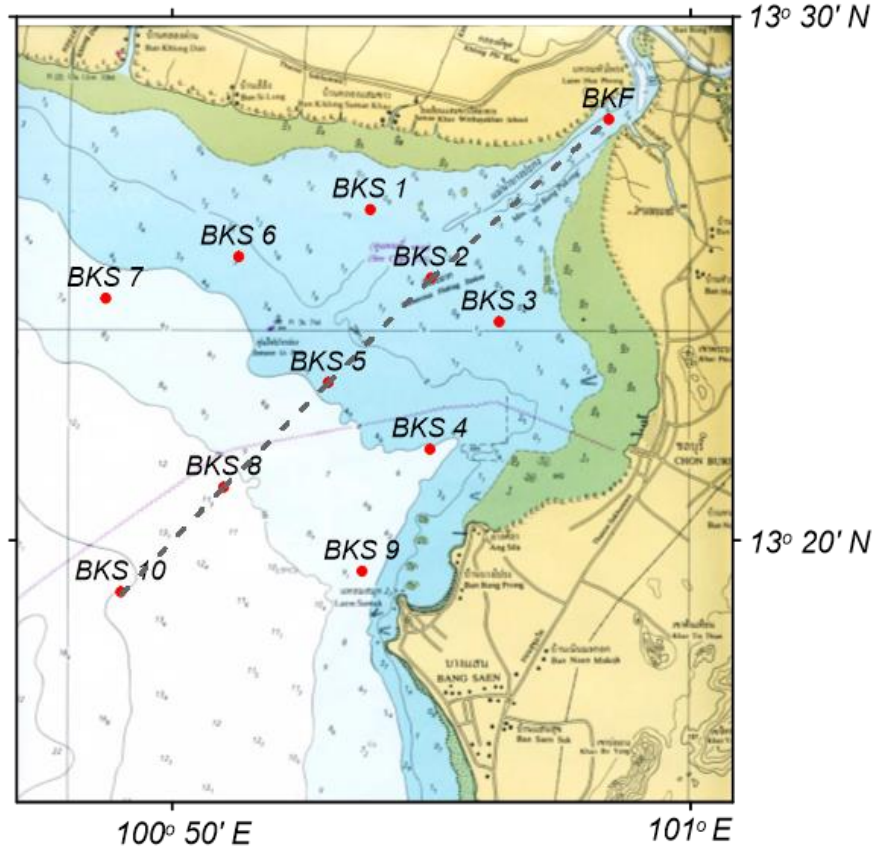
What do we need to consider for the oceanographic survey?

- Vertical spacing
  - Depended on water depth and water column condition – water column mixing or stratification

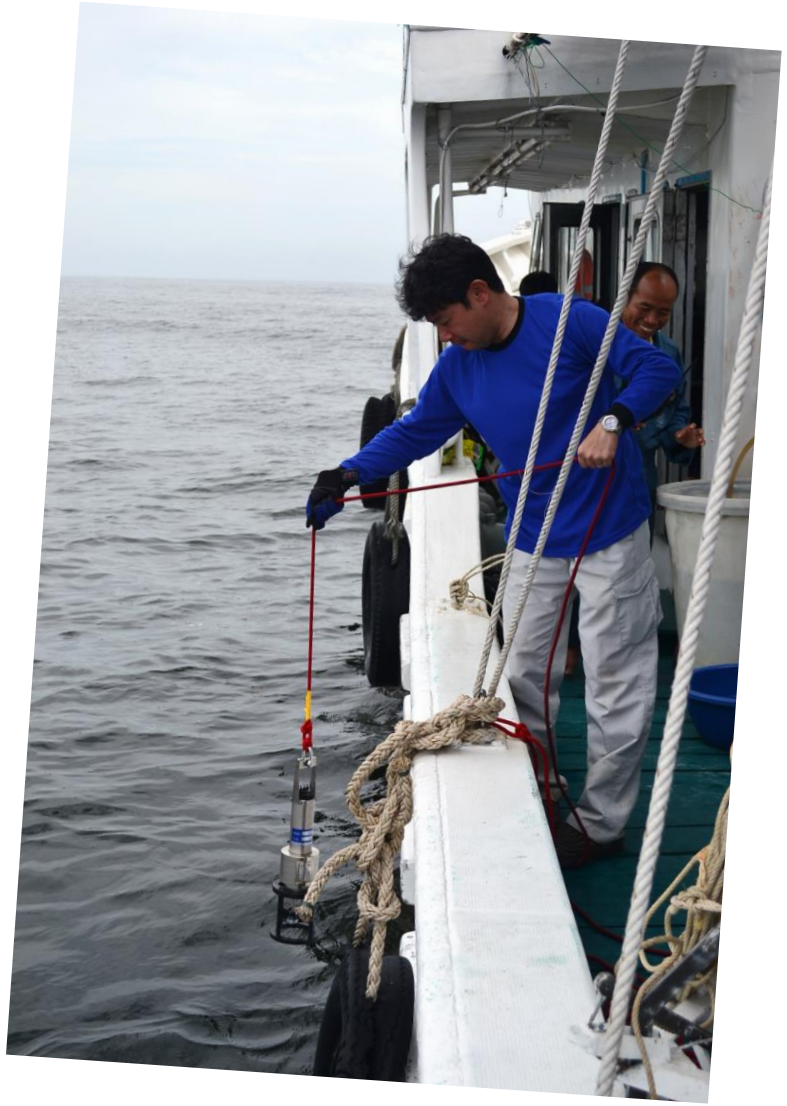


Buranapratheprat et al.(2017)



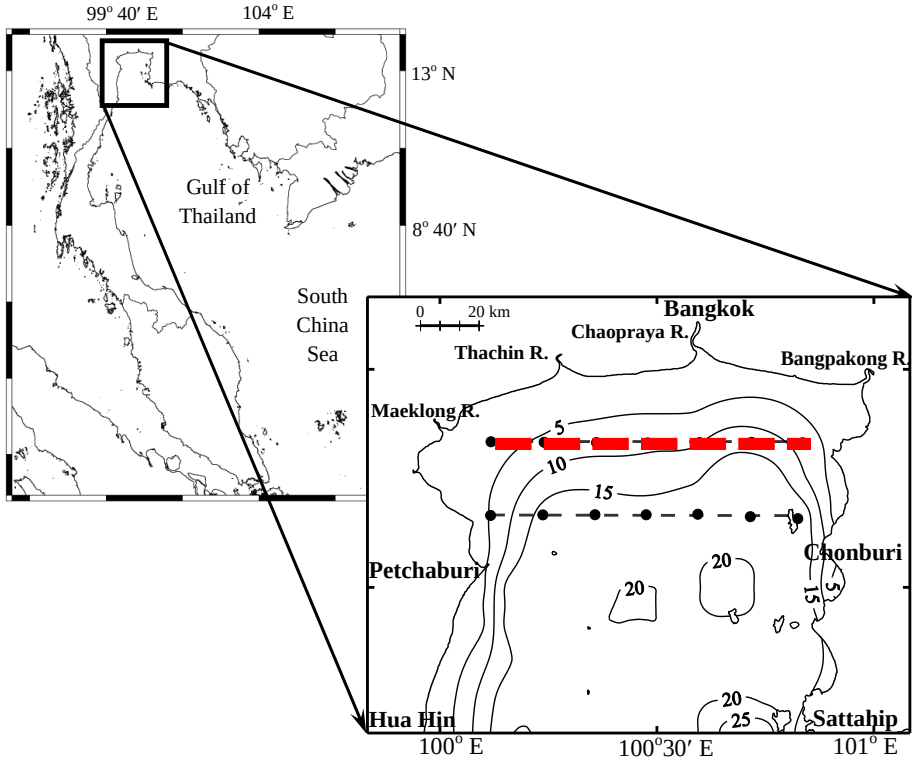
What do we need to consider for the oceanographic survey?

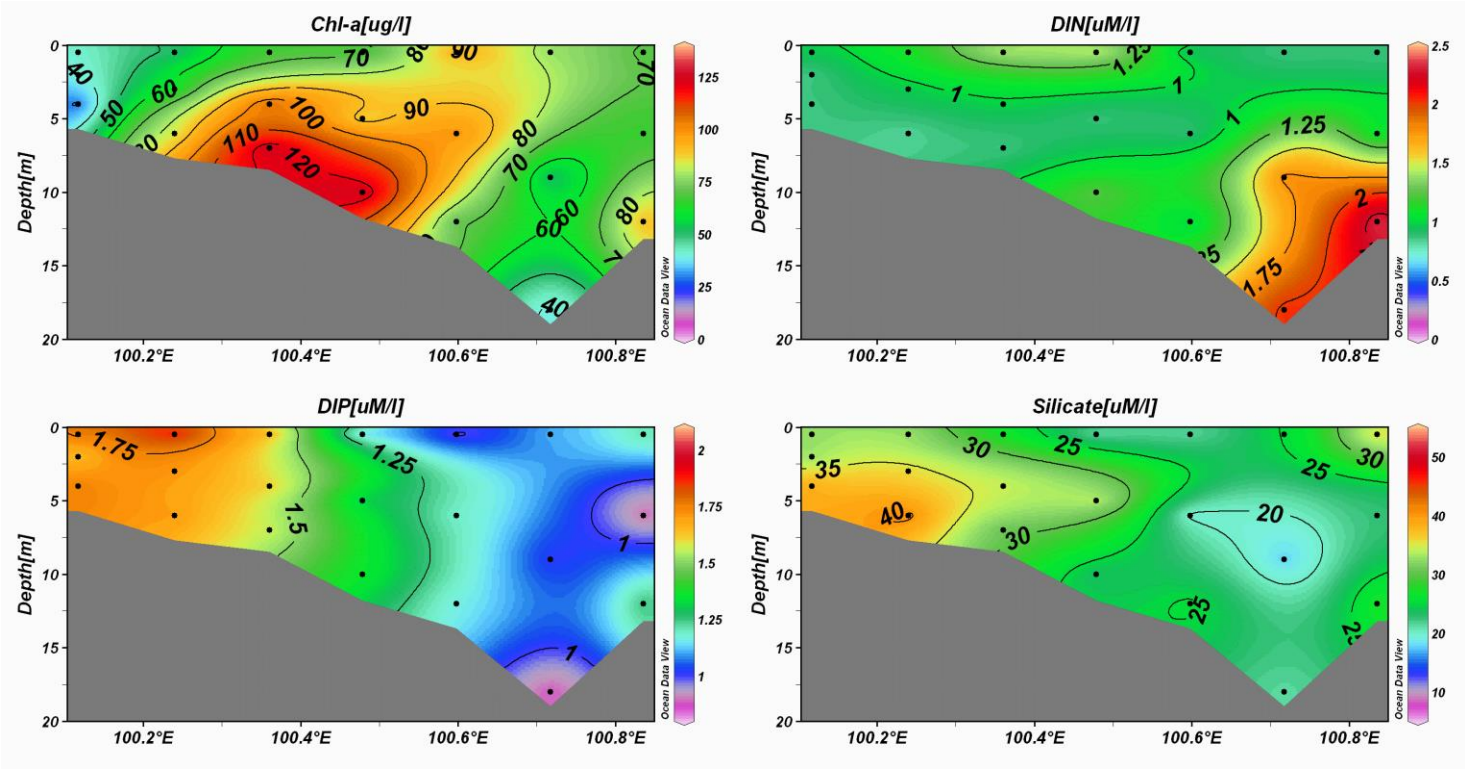
- Vertical spacing
  - Incase of using sensors such as CTD, we need to consider the frequency of measurement.
  - It should be high enough to detect the phenomena we are interested.
  - We may lose the information of profile details if the frequency of measurement is too low.



What do we need to consider for the oceanographic survey?

- Vertical spacing
  - In case of collecting water samples for further analysis in the laboratory
  - You may not think about this much when you use CTD for profiling, but when you need to collect water samples for analysis in laboratory, you may think about this a lot.



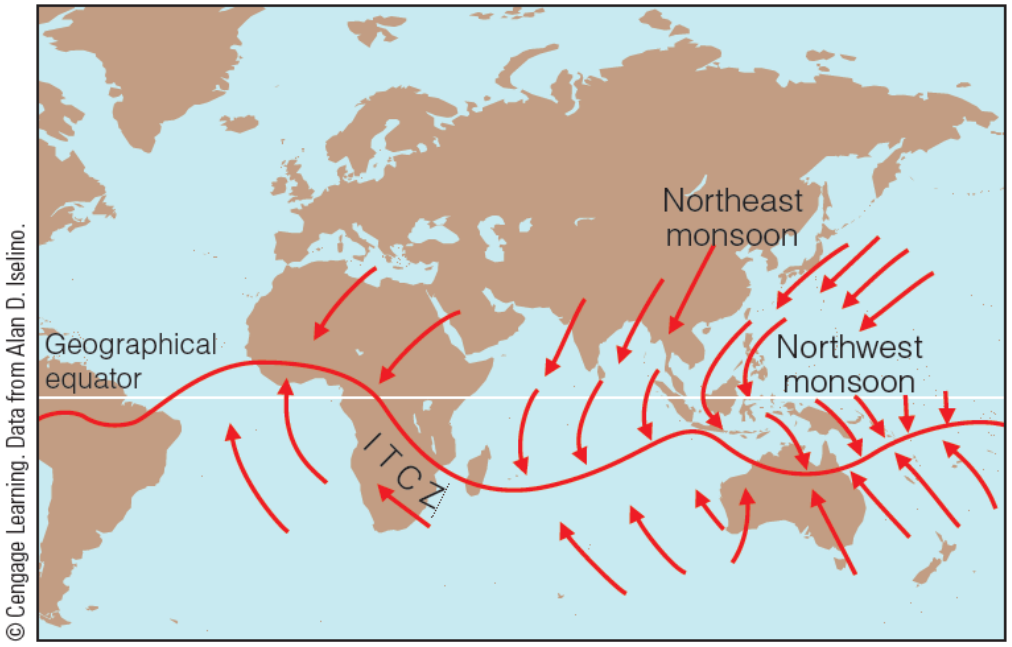


What do we need to consider for the oceanographic survey?

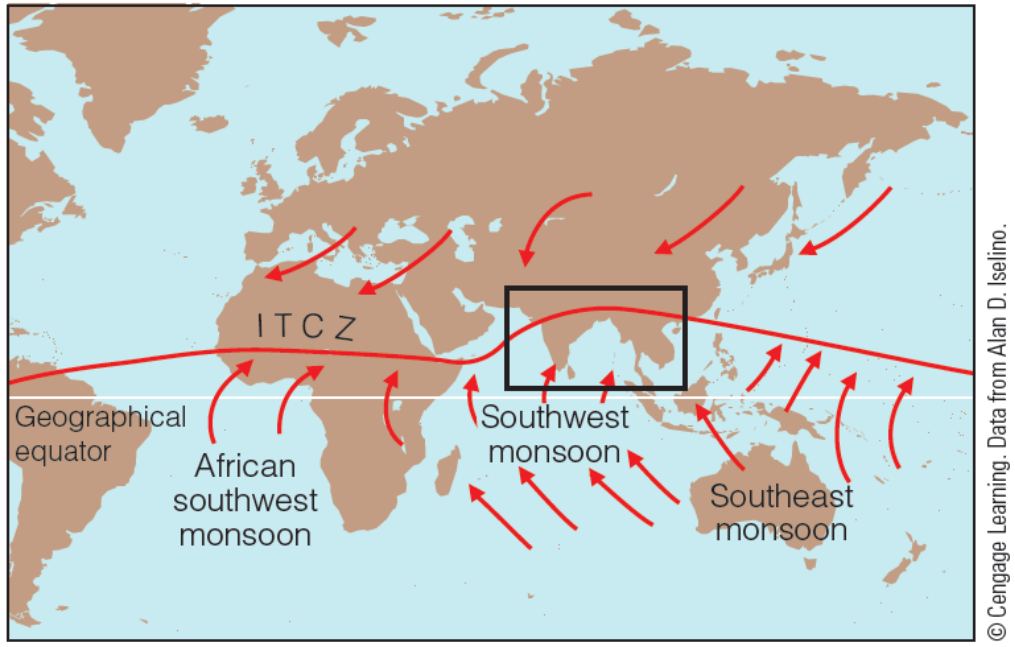
- Temporal variations
  - Seasonal variations
    - We live in SEA, an area that is influenced by monsoons, so surveys have to take them into account.
    - At least collecting must be done in 2 seasons, either in the interchanges or in the middle of the monsoon seasons.
    - Must be aware of safety because during the middle of the monsoon season there may be strong winds and thunderstorms.
    - Whenever possible, surveys should be conducted in all 4 periods to cover all phases of environmental change in a year.

What do we need to consider for the oceanographic survey?

- Seasonal changes may be divided by the characteristics of monsoonal wind patterns or precipitations.



a January

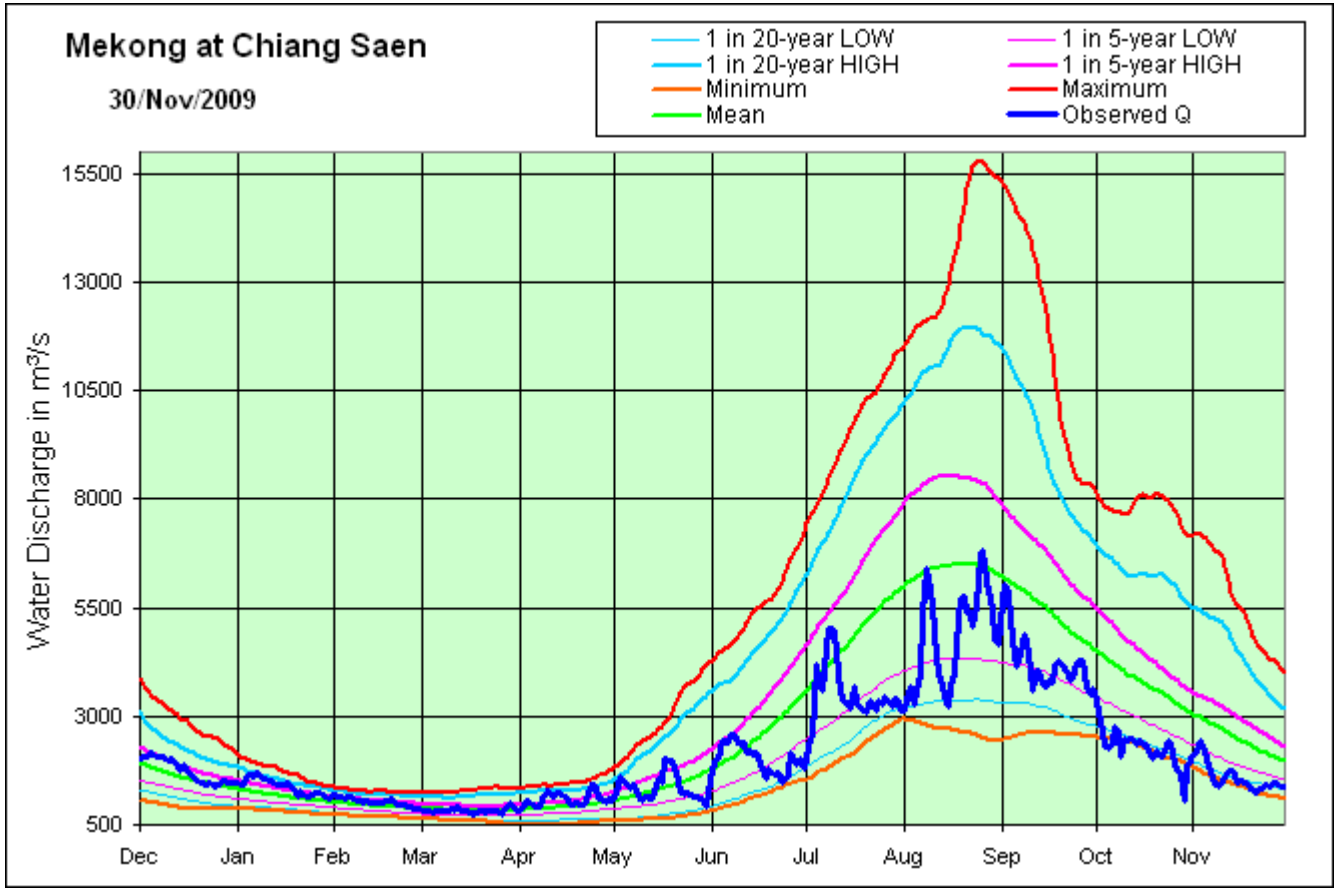


b July

a During the monsoon circulations of January a and July b, surface winds are deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

What do we need to consider for the oceanographic survey?

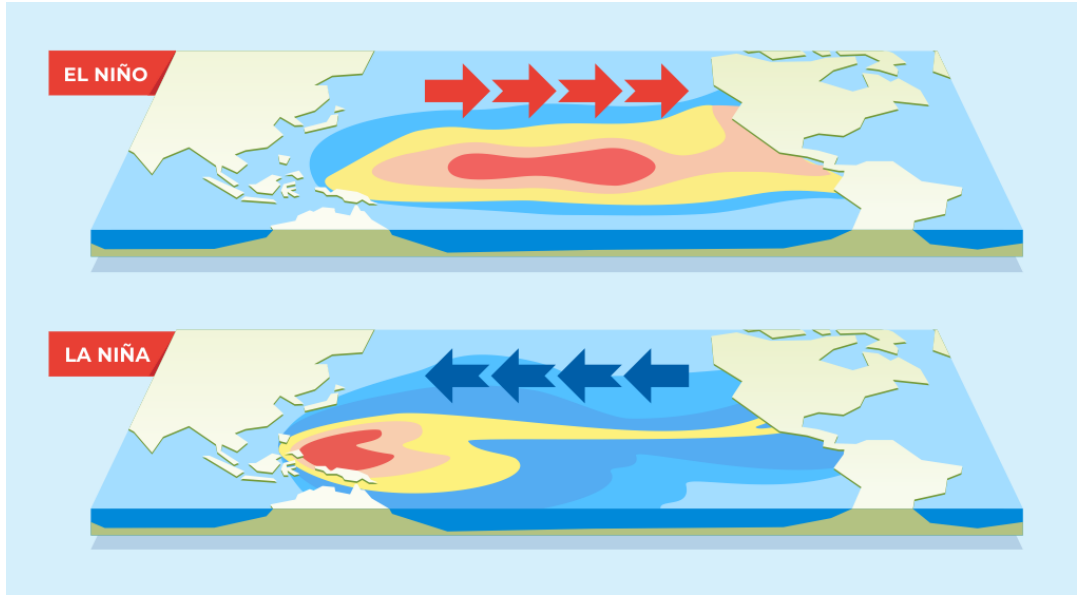
- Seasonal changes may be divided by the characteristics of monsoonal wind patterns or precipitations.



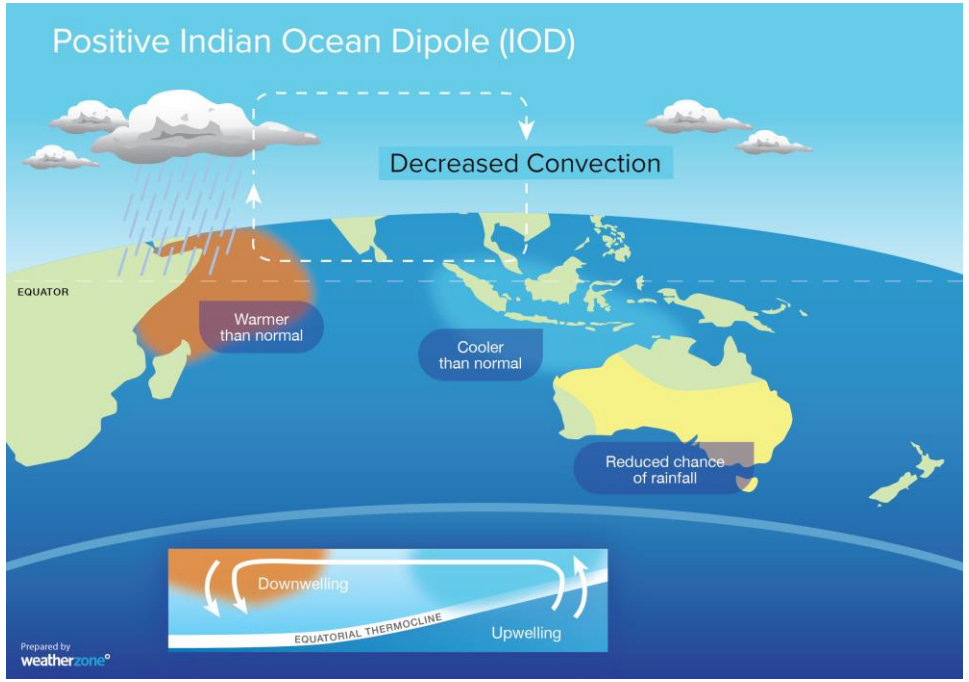
http://archive.iwlearn.net/mrcmekong.org/programmes/wup/Monitor-stations/Chiang-saen.htm

What do we need to consider for the oceanographic survey?

- Temporal variations
  - Annual variations
    - If the interannual variations from, such as, El Nino, IOD or climate changes are focused.



https://thecolumn.ahacentre.org/insight/vol-66-getting-to-know-el-nino-la-nina/



https://www.civilsdaily.com/news/indian-ocean-dipole-iod/

The importance of research proposal

- Much monitoring is undertaken without adequate justification or planning. This results in extravagant and expensive masses of data being collected, never to be used.
- Why we need research proposal?
  - Identify key research questions. What are outputs and outcomes?
  - Clearly define the objectives and the assumptions to achieve the research goals.
  - Visualize the images, such as maps and graphs, and tables that will be presented in the reports or publications.
  - All of these will be used to determine the method of study, including scientific surveys (survey methodologies).

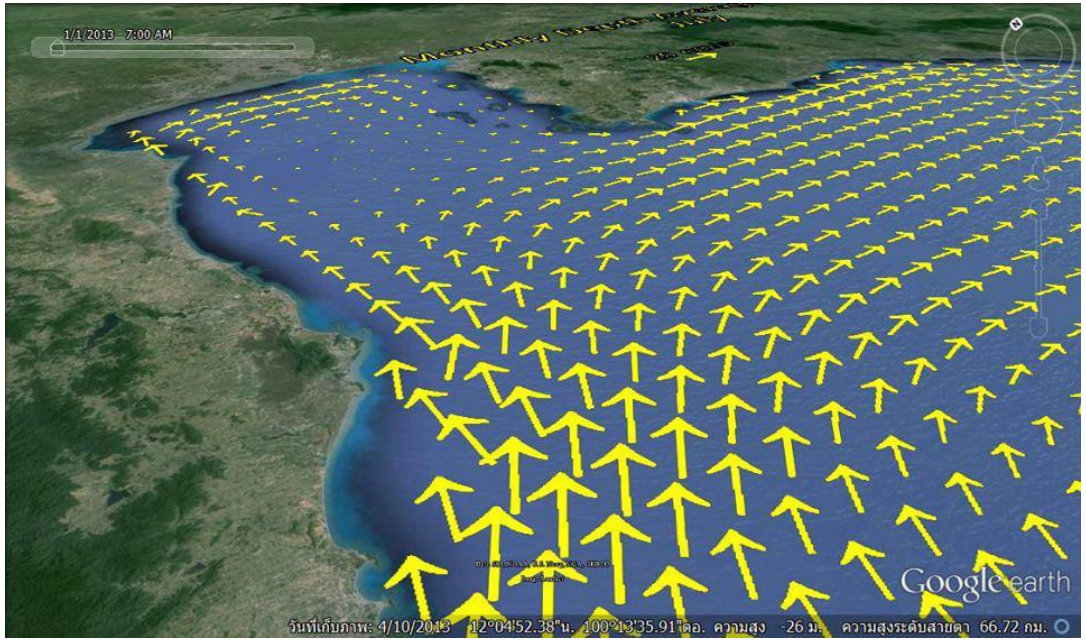
Research questions in oceanographic surveys

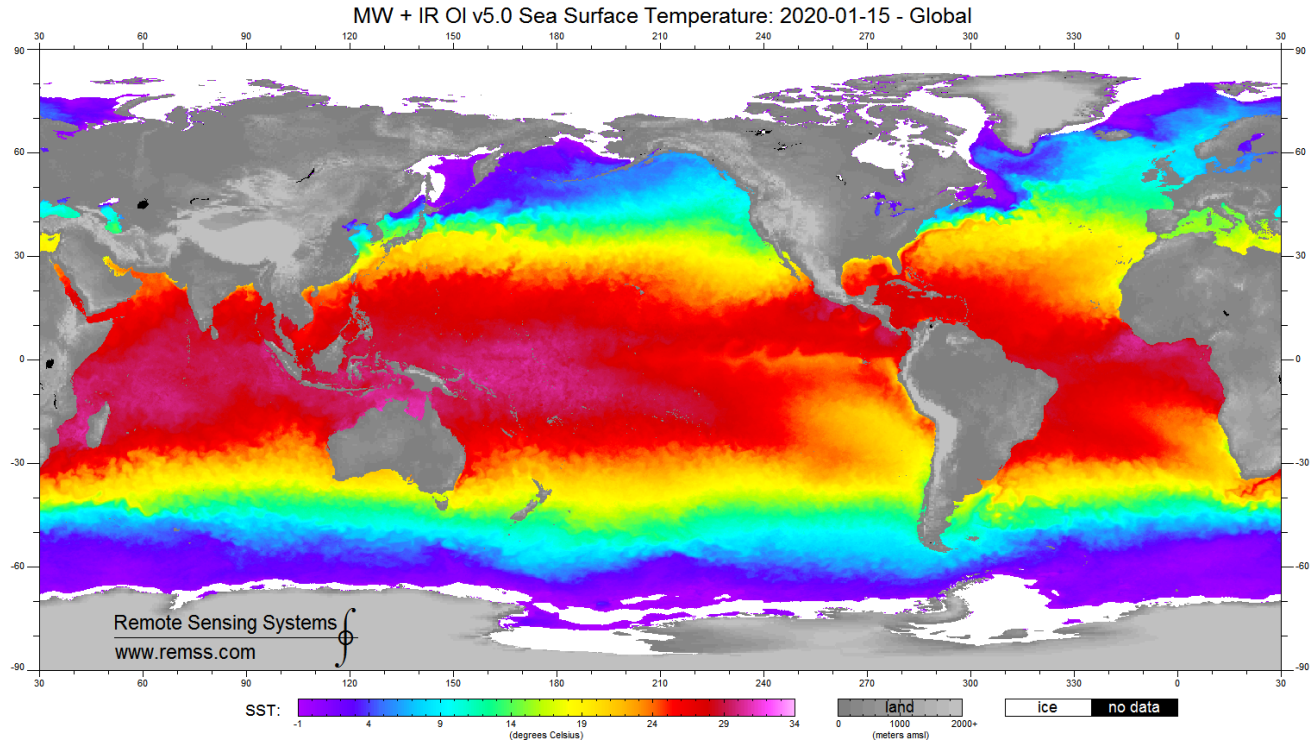
https://cca-reports.ca/wp-content/uploads/2018/10/oceansworkshopreport_web_en.pdf

- What are the processes affecting sea ice change in the Arctic? What is the time horizon for a seasonally ice-free Arctic Ocean? What will be the climatic, biogeochemical, ecological, socioeconomic, cultural, and geopolitical impacts of the seasonal disappearance of sea ice?
- What is the effect of climate change on biogeochemical cycles (carbon, nutrients, essential elements, contaminants) in the Arctic Ocean, and what are the feedbacks and connections to the global ocean?
- How will ocean-ice-atmosphere interactions in the Arctic Ocean and surrounding seas be affected by and affect climate change, and how will the productivity, biodiversity, and services of Arctic benthic, pelagic, and sea ice ecosystems respond?
- How do the ocean, land, and continental sea floor interact in the Arctic? How will interactions evolve under climate change? What regions are at risk of being affected by erosion, flooding, infrastructure destabilization, permafrost thawing, or gas hydrate sublimation?

How to achieve the research goals?

- Without field survey – computer modeling, data analysis from oceanographic database or satellite data
- Data from these sources also need data from field surveys to verify their reliability.





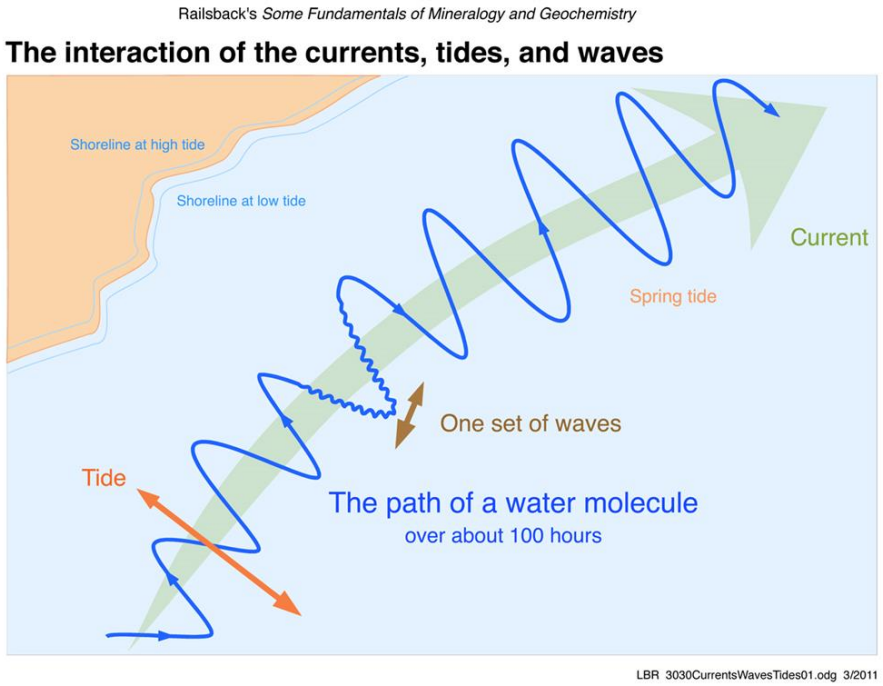
https://images.remss.com/sst/sst_data_daily.html

How to achieve the research goals?

- With field survey - what to study, need to understand more about standard methodologies
- Such as water quality measurement
  - What methods are used to collect samples?
  - How the samples are stored?
  - What instruments are used to measure the data?
  - What is the sensitivity of the instrument? Does it meet the needs of analyzing the phenomenon you want to study?

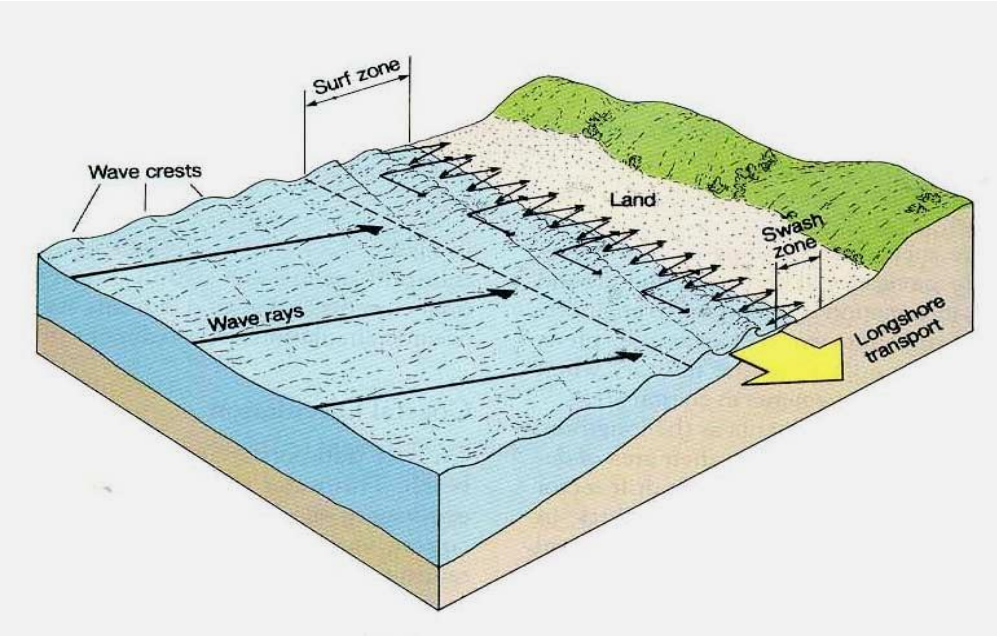
Understanding the nature of the phenomenon being studied is very important.

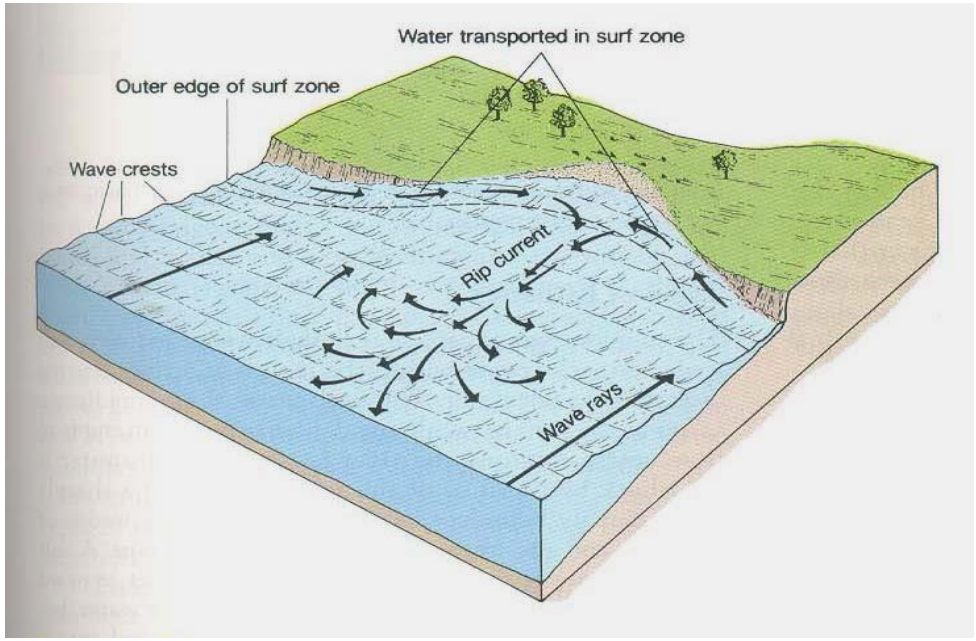
- Must have a good understanding of Oceanographic Phenomena
- Such as the nature of sea currents, need to know instantaneous or residual current, and know which ones can be used to answer questions of interest in studying



Understanding the nature of the phenomenon being studied is very important.

- An example: to study coastal erosion, but measure coastal currents instead of wave action, which is a key factor in coastal changes.
- The studies of longshore and rip currents. Beach profiles, wind and waves should be measured in parallel. Remember to understand the mechanism of occurrence and change of these two types of currents.





Survey preparation

- Planning - Survey Maps and GPS
- Instruments
- Logsheet
- Research team - division of work and work plans
- Each survey has a time limit. The division of labor duties is therefore very important.
- For effective work to be completed according to the planned schedule
  - a brief is required before who does what.
  - What is the order of work? How long does each step take?
  - Shiptime - how much time to travel to the survey point and how much time to work must be clear

An effective survey should determine the following criteria.

- No more than the minimum number of simple measurements or observations should be made.
- Monitoring should be carried out with the minimum frequency.
- The products of monitoring (data) must be subjected to meaningful processing, analysis and interpretation.
- Consider the safety and risks in the work. When a problem arises, there should be a response plan.

Thank you