

Project information

Project title

The studying of the present Ocean acidification state of the Norwegian waters

Year

2011/2012

Project leader

Kai Sørensen, NIVA

Participants

- Kai Sørensen, NIVA (PL)
- Evgeniy Yakushev, NIVA

Collaboration with UNIS for the glacier influence studies.

Flagship

Ocean acidification, Theme: Processes related to the Arctic and the sea ice

Summary of Results

Templefjord (Svalbard) studies

The performed studies in 2011 allowed to estimate the carbonate system (CS) parameters state in the coastal zone affected by the glacier in winter (February) and summer (early September) seasons. The measured carbonate system parameters (parallel measurements of pH using potentiometric(NBS/NIST scale) and spectrophotometric (total scale) techniques, total alkalinity and TIC) will allow to estimate the applicability of the different combinations of the CS parameters for calculating of acidification estimating in the High Arctic. The performed in parallel studies of the hydrophysical structure, oxygen distribution, main nutrient distributions and biological parameters (Chlorophyll a) will give a unique data for the mathematical models elaboration and verification.

Norwegian Sea and Barents Sea coastal studies

The performed studies in summer 2011 of the distributions of the carbonate parameters, nutrients and biological characteristics along the Norwegian coast with a Ferrybox equipped ship (MS Trollfjord) allowed to receive data necessary for estimating of the natural ranges of variability of the parameters studied typical for the Norwegian waters in present.

Studying and modeling of the carbonate system state in the Barents Sea

This work aimed in studying of the role of seasonality of the biogeochemical processes of organic matter (OM) production and decay in the seasonal changes of the carbonate system (pH, pCO₂, aragonite saturation). The observations were performed at a transect Tromsø – Spitsbergen with a Ferrybox equipped Ship-Of-Opportunity (SOOP) cargo vessel MS "Norbjørn" and this data was used for verification. A simplified two dimensional vertical model was used to parameterize the hydrophysical processes of at a Coast Open Arctic section positioned along the observed transect. The biogeochemical processes were parameterized using OxyDep (Yakushev et al., 2011), a simplified biogeochemical model aiming time scales seasonal and larger, that considered inorganic nutrient (NUT), dissolved (DOM) and particular (POM) organic matter and biota (BIO). Dissolved inorganic carbon (DIC) and alkalinity (Alk) were considered as independent model variables. DIC changes were correlated with NUT on the base of the Redfield ratio, Alk was changed in the marine boundary of the modeled transect. The carbonate system equilibration was considered as a fast process and calculated at every time step using the iteration procedure. The carbonate system modeling was described on the base of standard approach (Dickson, 2010). According to the model estimates the summer formation of DOC and POC and their further destruction affected the carbonate system seasonal dynamics. The modeled seasonal variations of pH (~0.2) are close to the observed ones t, i.e. 7.94-7.99 in February and 8.04-8.16 in August (pH(Tot)). Therefore it is possible to conclude that the OM production and decay is the main factor influencing the seasonal variation of the carbonate system parameters in the in the surface waters of the Barents Sea while the role of temperature is supplementary.

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Published Results/Planned Publications

E Yakushev, K.Sørensen Modeling of the role of organic matter production and destruction on the carbonate system seasonal changes in the Barents Sea The 15th Russian Norwegian Symposium at UNIS in Longyearbyen, Svalbard, Norway, 7-8 September 2011 "Climate change and effects on the Barents Sea marine living resources".

Abstracts

E. Yakushev, K. Sørensen (2011). Modeling study of role of organic matter production and destruction on the carbonate system seasonal changes in the Barents Sea European Geosciences Union, General Assembly 2011. Vienna, Austria, 04 – 08 April 2010. Geophysical Research Abstracts.

E. Yakushev, K. Sørensen. On seasonal changes of the carbonate system in the Barents Sea: observations and modeling. *Journal of Marine Biology* (to be submitted 01.12.11)

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Communicated Results

E. Yakushev, K. Sørensen (2011). Modeling of influence of organic matter production and destruction on the carbonate system seasonal changes in Arctic waters. Arctic Frontiers 2011 conference (Tromsø, Norway, January 2011). (Poster presentation).

E. Yakushev, K. Sørensen (2011) Modeling study of role of organic matter production and destruction on the carbonate system seasonal changes in the Barents Sea European Geosciences Union, General Assembly 2011. Vienna, Austria, 04 – 08 April 2010. Geophysical Research Abstracts. (Oral presentation).

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Interdisciplinary Cooperation

In this first phase of the project only collaboration within the acidification flagship has been utilized. The received results can be helpful for planning of expedition studies, analyzing of the archived field data, as well as for elaborating of the interannual and multidecadal variations models. The next phase of the project is planned together with IMR and NP.

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Budget in accordance to results

In which way has the funding from the Fram Centre helped the project?

The funding has help to increase the monitoring of the Barents Sea and supported KLIFs program with more seasonal data (more transects).

Did the Fram Centre funding act as a sufficient boost for completing the project through other sources of funding?

As above the funding has extended the area of coverage of the KLIF program.

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Could results from the project be subject for any commercial utilization

No

If Yes

No, commercial utilization except maybe to improve monitoring techniques.

Conclusions

Continue monitoring observations at a transect Tromsø Longyearbyen covering all the seasons. Continue work on a mathematical model of the carbonate state of the Arctic. Perform studies of the seasonal variability near the glacier (Tempelfjord, Svalbard) aiming to study influence of glacial melting water on the carbonate system parameters

–In February 2012

–In Summer 2012