

## Project information

### Keywords

Marine Ecology, Biogeochemistry, Physical Oceanography, Mathematical modeling

### Project title

Ecosystem modeling of the Arctic Ocean around Svalbard

### Year

2017

### Project leader

Pedro Duarte

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

78°N 13°W, 72°N 11°E, 83°N 36°E and 88°N 15°E.

### Participants

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### Flagship

Arctic Ocean

### Funding Source

Fram Center

## Summary of Results

As mentioned in the previous report the most recent challenges we faced were to: (i) implement and test time-varying sea-ice boundary conditions; (ii) update the CICE version in the coupled ROMS-EcoDynamo-CICE system from version 5.1.2 to the columnar version that allows to compute vertically resolved biogeochemistry in the ice; (iii) get biogeochemical boundary conditions.

The first task implied significant additions to the CICE code that were made and documented in the repositories: <https://source.uit.no/pmsduarte8/CICE> and <https://source.uit.no/apn/metroms>. The former repository documents all updates done in the CICE code and the former all the changes done in the coupled system. In the Wiki of this last one, there a page describing all technicalities related with the software updates in CICE: [https://source.uit.no/apn/metroms/wikis/CICE\\_time-varying\\_boundaries](https://source.uit.no/apn/metroms/wikis/CICE_time-varying_boundaries). Apart from software development the project leader also produced a template for the boundary files. These boundary files are now being calculated from

runs with the pan-Arctic 4km model developed within the project “Mesoscale modeling of ice, ocean and ecology of the Arctic Ocean (ModOIE)”.

The second task implied significant changes in the build-compile and run scripts of the coupled system. Furthermore, several additions had to be done to different sub-routines and modules of the columnar CICE version. These changes are also documented in the first two repositories mentioned above and, therefore, accessible to all project partners and also to the colleagues involved in the ModOIE Fram center project. In short we now have a new coupled system with a more recent CICE version.

The third task will be handled with the help of colleagues from the Nansen Environmental and Remote Sensing Center (Annette Samuelson) that will provide us the necessary data from the TOPAZ model forecasting system. In line with the participation of the PL in a sea-ice biogeochemical modeling inter-comparison organized by the network “Biogeochemical Exchange Processes at the Sea-ice Interface (BEPsII)”, already mentioned in the previous report, more simulations are being prepared with the standalone CICE model. These simulations will help to better parameterize the CICE model in the coupled system.

For the Management

A retreating sea ice cover will produce potentially important changes in associated ecosystems and corresponding services. Therefore, a deep understanding of ecosystem processes is crucial for the implementation of models allowing accurate prediction of future trends so that appropriate measures may be taken. This work will add to the tools already available at the involved institutions, improving their understanding of the Marginal Ice Zone and the Arctic Ocean. Efforts are being done to conciliate the modeling work developed here with that developed in other Fram Center projects to make sure that the model physical background and setup is exactly the same, avoiding any compatibility issues in the future.

Published Results/Planned Publications

A paper about the coupling methodology ROMS-EcoDynamo is in prep.

Communicated Results

Results were communicated in previous years as described in previous reports but not yet in 2017. However, an Abstract was submitted to the Polar2018 conference.

Interdisciplinary Cooperation

This project benefits from inter-disciplinary cooperation. In fact, the modeling work done so far includes ice physicists and marine biologists. Therefore, the main disciplines involved in the project are Ice and Ocean Physics and Marine Biology and Ecology. Furthermore, contacts were established with colleagues at the University of Alaska Fairbanks regarding biogeochemical modeling that, hopefully, may boost some important collaboration in the near future. Also, contacts were established with the CICE modeling team at the Los Alamos National Laboratory (USA) and the Finnish Environmental Institute.

Budget in accordance to results

Funding from the Fram Centre is fundamental to pay for the project expenses, with emphasis on labor and technical assistance. In spite of the great help of the funding from the Fram Centre, we are struggling with a shortage of man-

power due to unexpected technical problems in using ROMS+CICE. However, we expect to deliver the planned work.

Could results from the project be subject for any commercial utilization

No

Conclusions

Considering the shortcomings described in the last reports it was not possible to have a usable model version before the project end. However, we are optimistic about this goal that we expect to reach within the next months. We will do our best to get the job done as fast as possible. The flagship leadership will continue to be informed about our progresses.