

Carbonate system time-series in the coastal Arctic

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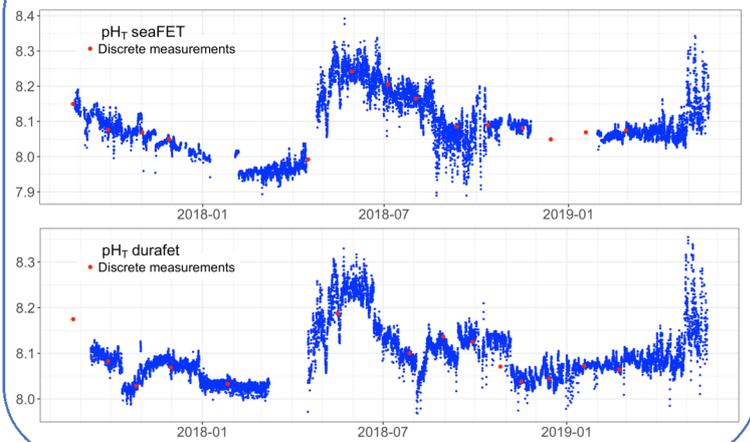
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Introduction

Predictions of the impact of global and climate changes in the oceans requires time-series data to detect internal variability, build realistic scenarios as well as parametrize and validate models. The Arctic ocean is subject to high rates of ocean warming and acidification, which has critical implications for marine organisms, ecosystems, and ecosystem services. Yet, only few measurements of the carbonate system have been performed in the Arctic Ocean and they are spotty both in space and in time. Notably, there is no time-series station measuring the carbonate chemistry in this region, particularly in coastal waters.

We established the first time-series of carbonate system parameters in the coastal Arctic (AWIPEV-CO2). This station, located at Ny-Ålesund (Spitsbergen) at 12 m depth, benefits from a lot of ancillary data from the AWIPEV FerryBox (<http://bit.ly/2Dzqjsg>). Data are available in near-real-time (<https://awipev-co2.obs-vlfr.fr/>).

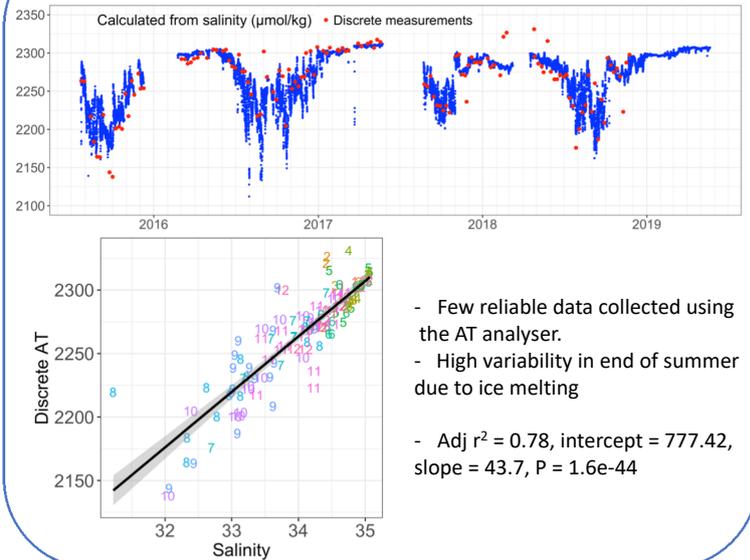
pH



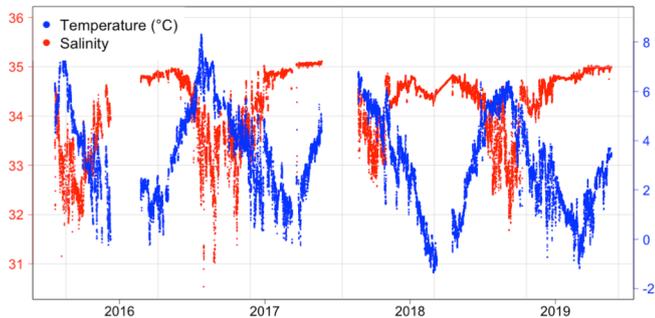
Experimental setup

- Total alkalinity analyser
- $p\text{CO}_2$ analyser
- pH durafet
- Weekly discrete samples (C_T , A_T)
- pH seaFET
- Monthly discrete samples (pH)

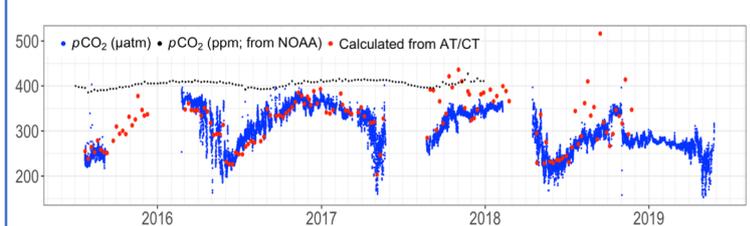
Total alkalinity



Salinity and temperature



CO₂ partial pressure



Challenges and outlook

Autonomous time-series in the Arctic involve a number of challenges related to remoteness and harsh environment. The most serious incident result from icebergs and frozen pumps and tubes. This makes maintenance difficult and leads to discontinuous datasets.

Such time-series data provide information on four key questions:

- (1) What is the seasonal variability (there are very few winter data in the Arctic)?;
- (2) What is the rate of acidification in a high Arctic fjord?;
- (3) What are the combined effects of changes in the carbonate chemistry, temperature and salinity on the calcium carbonate saturation state?;
- (4) What is the annual balance of air-sea-CO₂ fluxes?