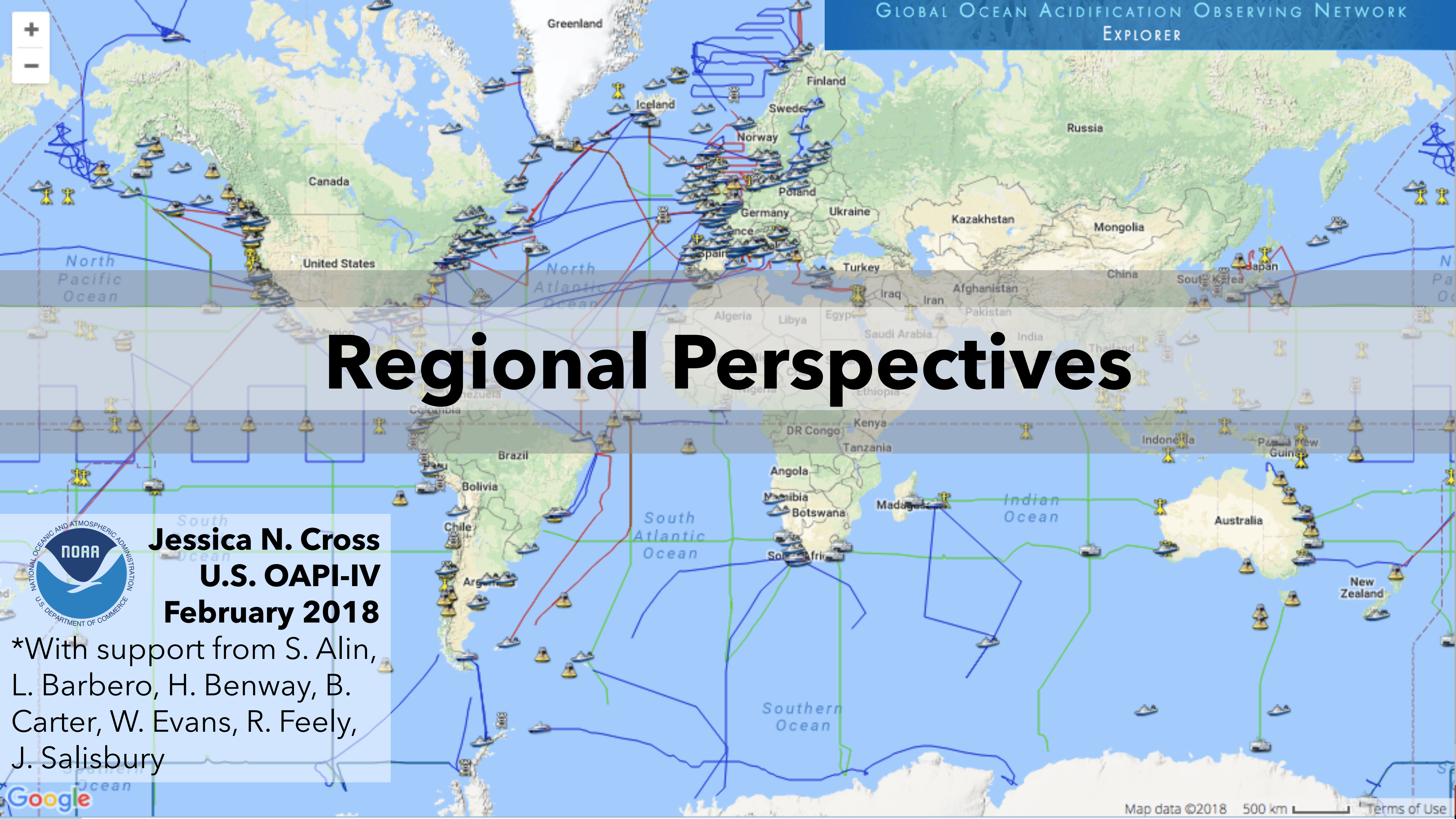
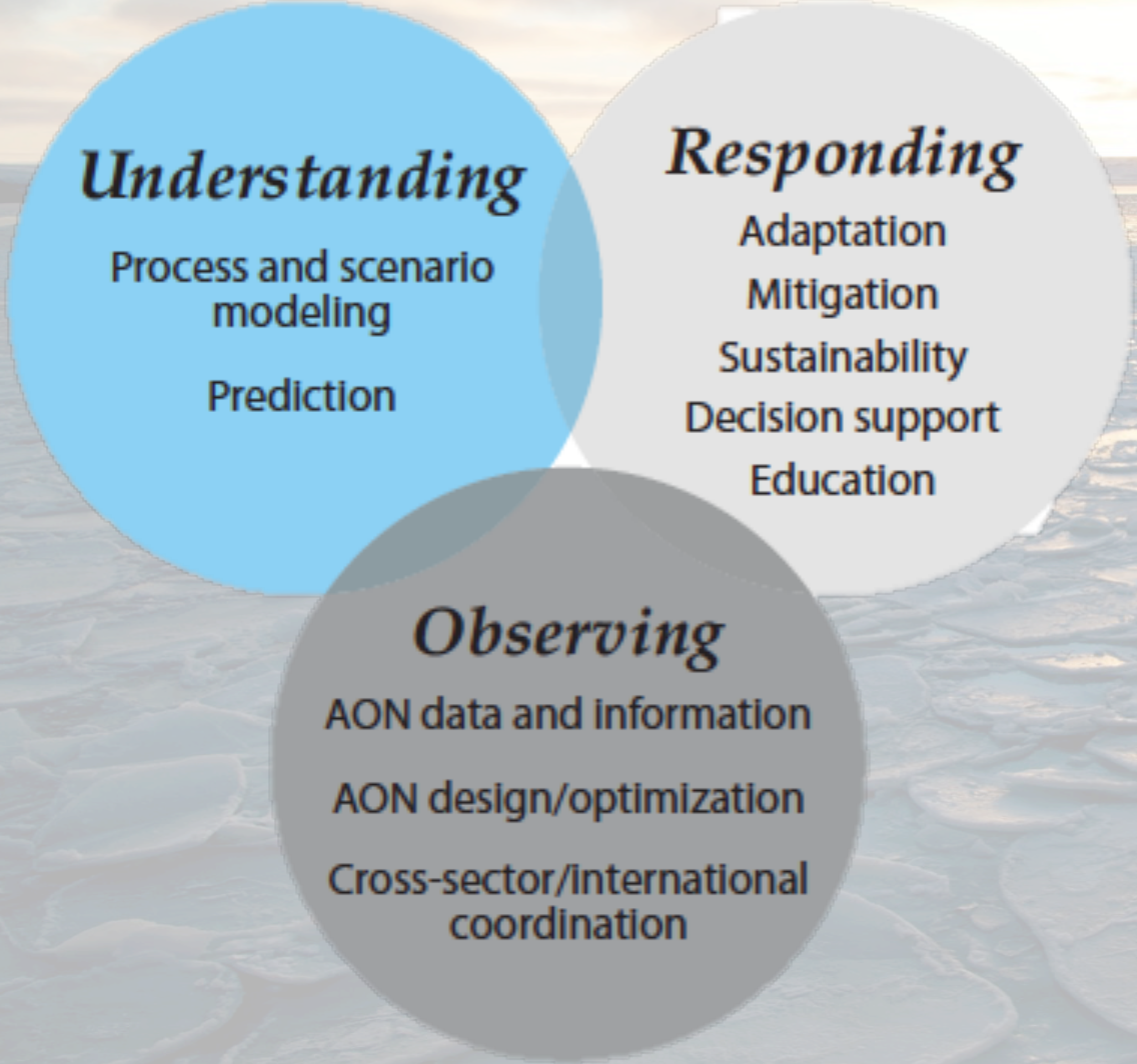



# Regional Perspectives

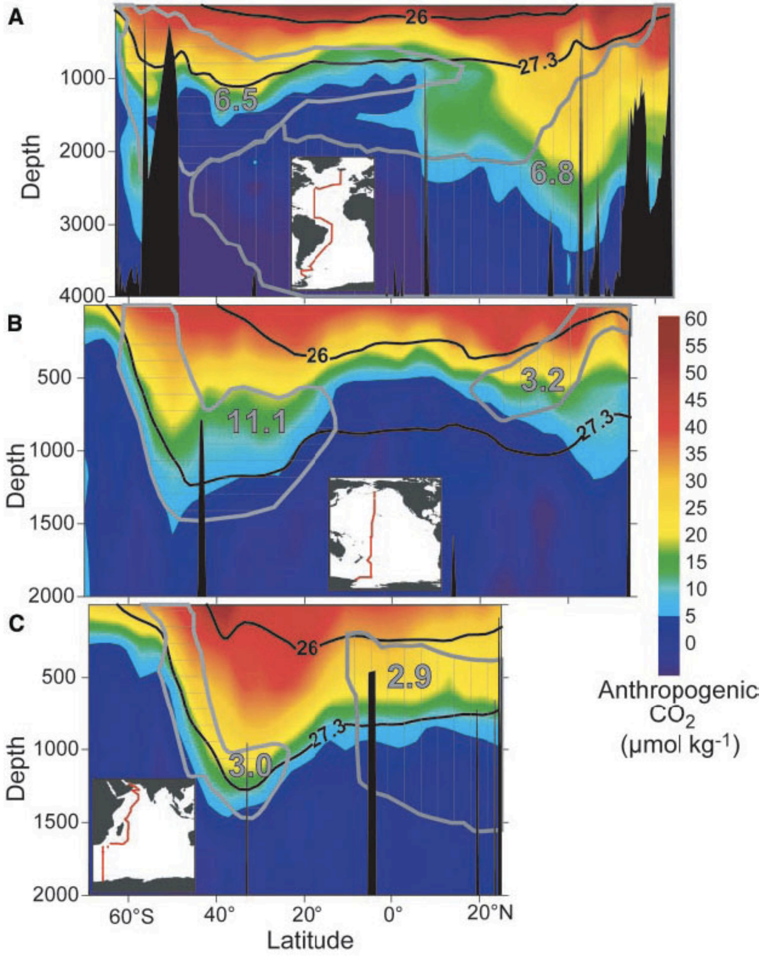
**Jessica N. Cross**
**U.S. OAPI-IV**
**February 2018**
*With support from S. Alin, L. Barbero, H. Benway, B. Carter, W. Evans, R. Feely, J. Salisbury

**_Given infinite time and infinite resources…_**

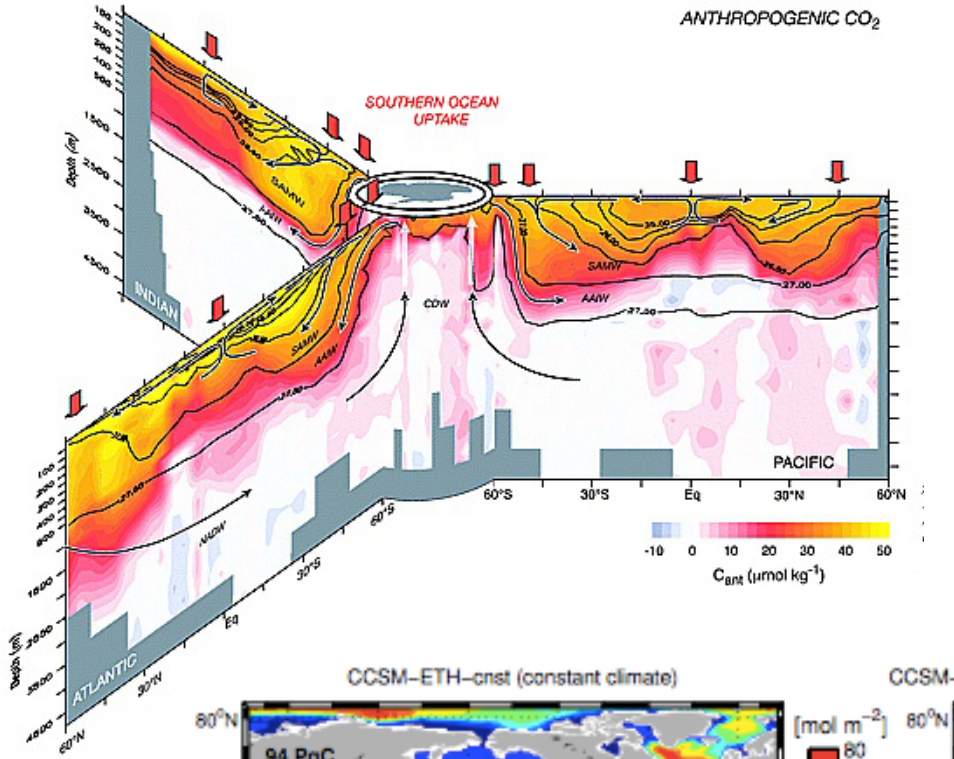



***Observing systems designed for rapid responses to rapid changes***

# Basin-scale anthropogenic CO2 inventories

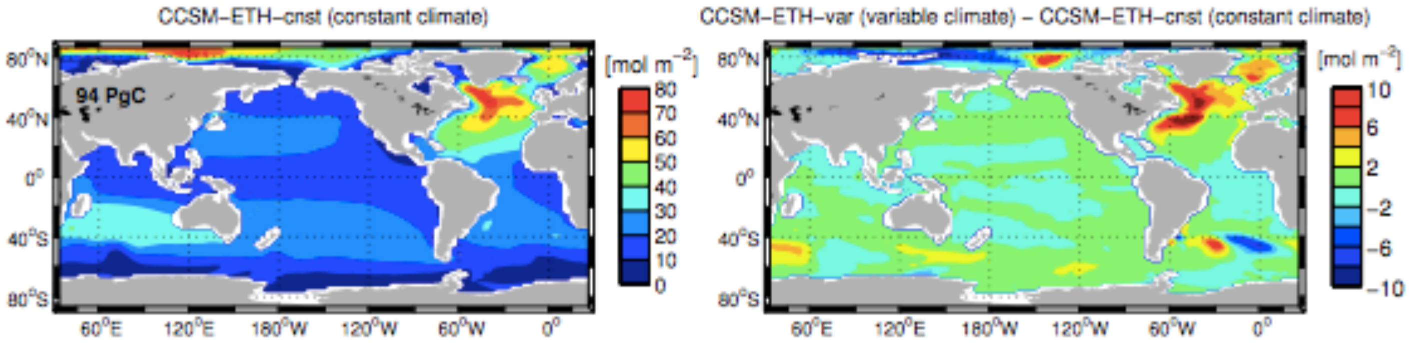



Sabine et al., 2004

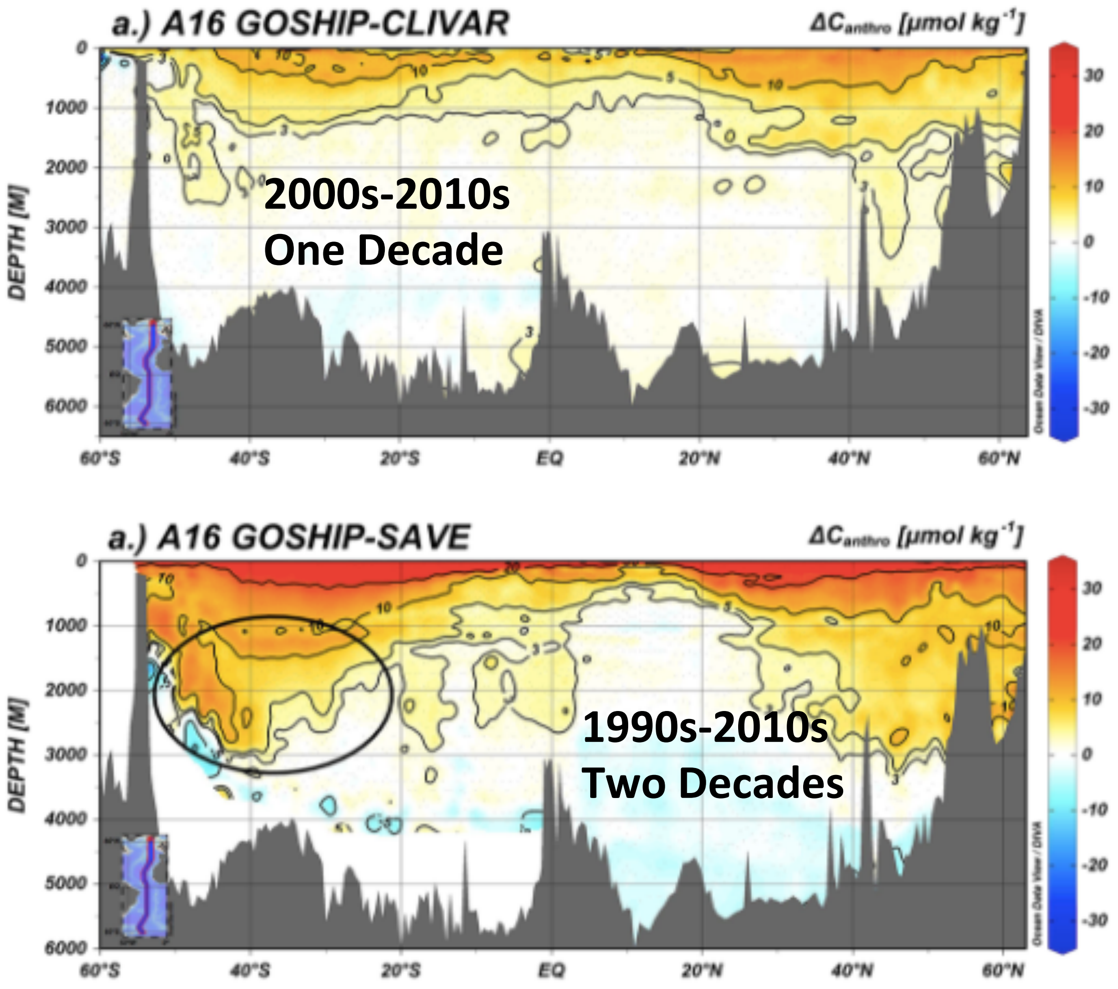



Gruber et al., 2009

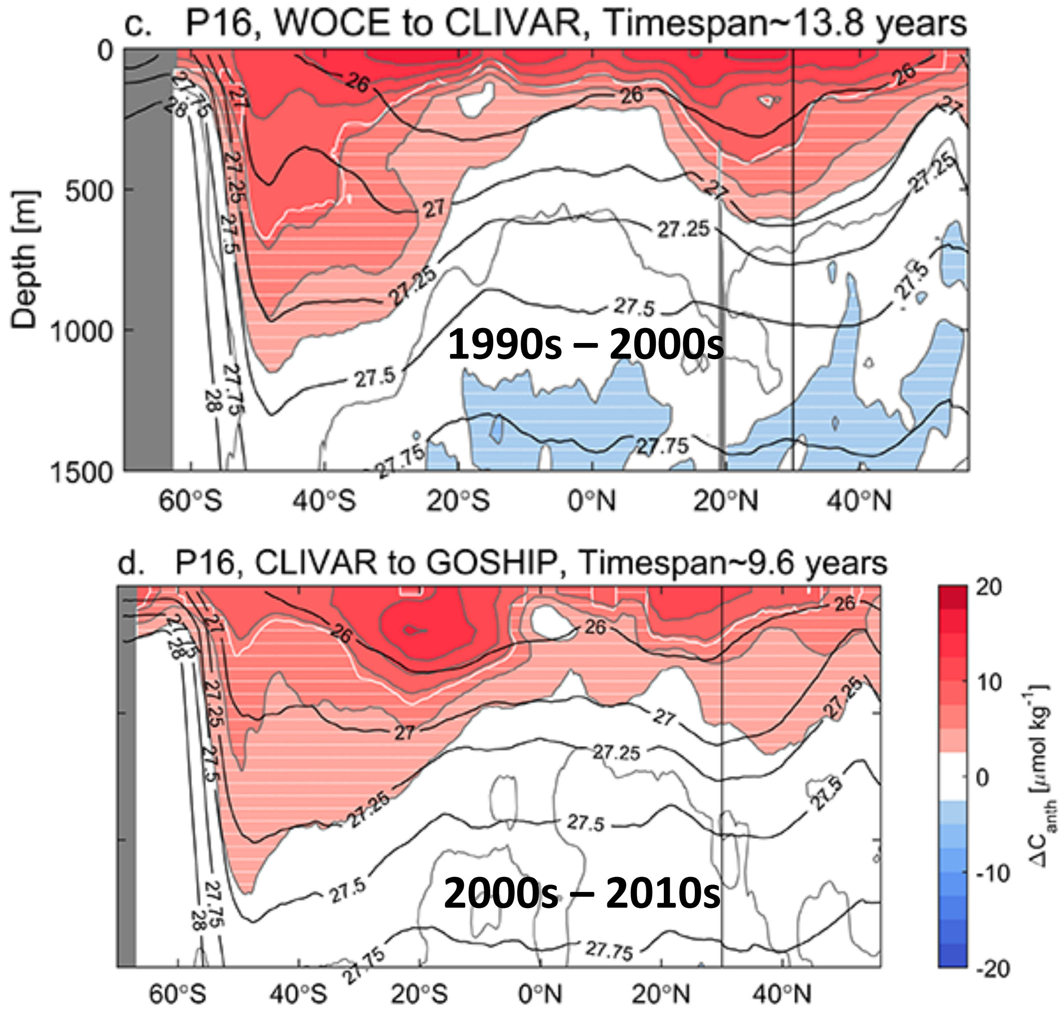
Khatiwala et al., 2014



# Decadal variability in carbon inventory

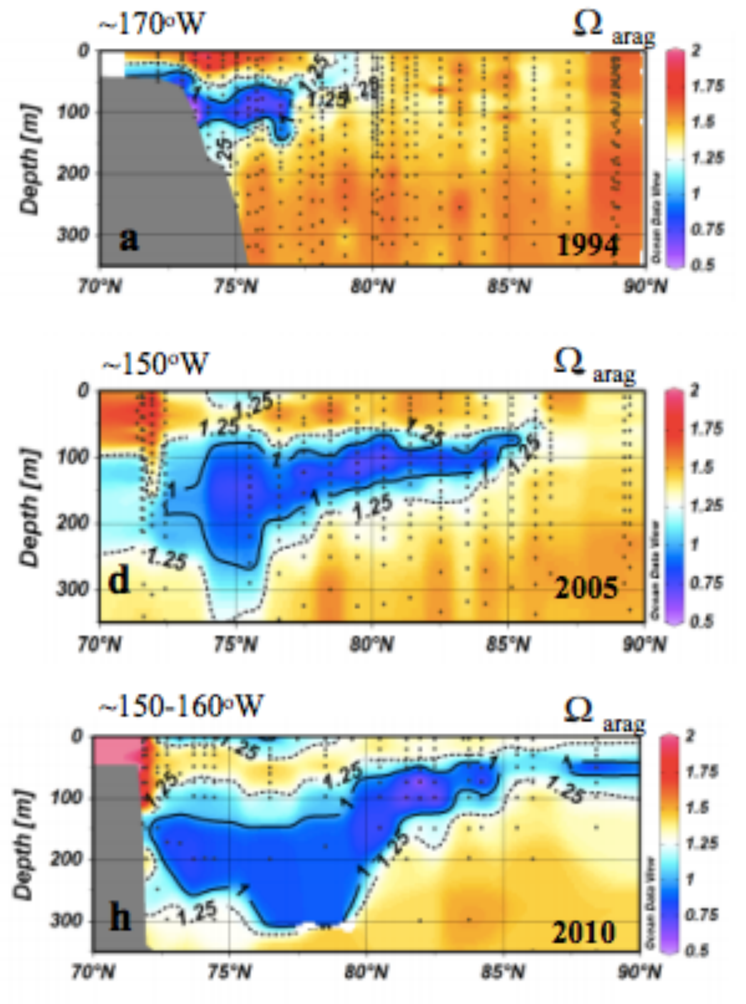



Wanninkhof et al., 2016



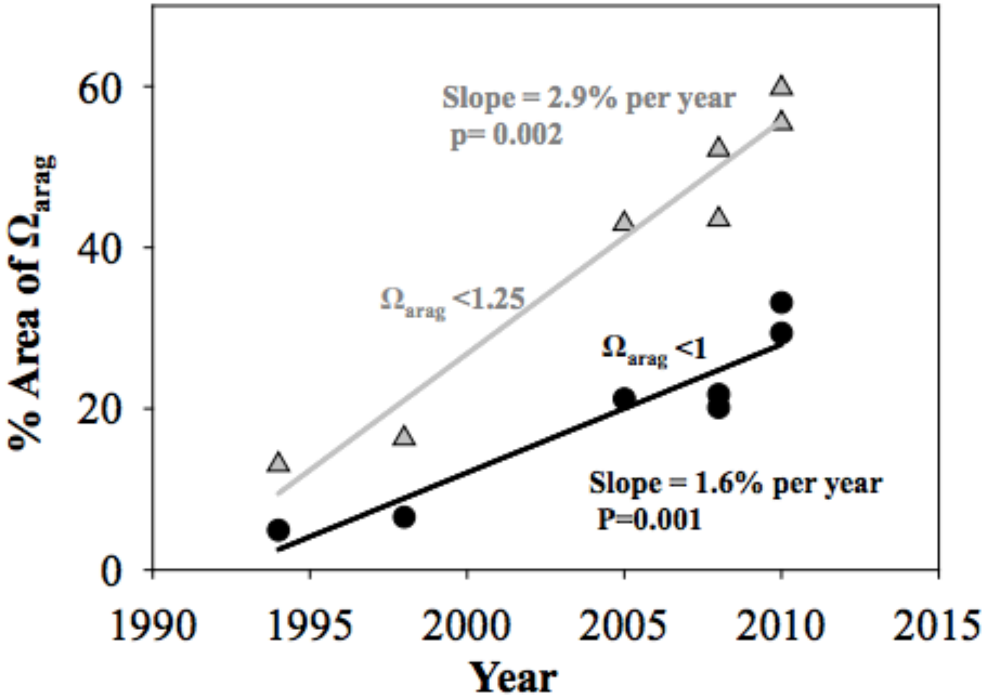

Carter et al., 2017

# Expansion of corrosive water masses

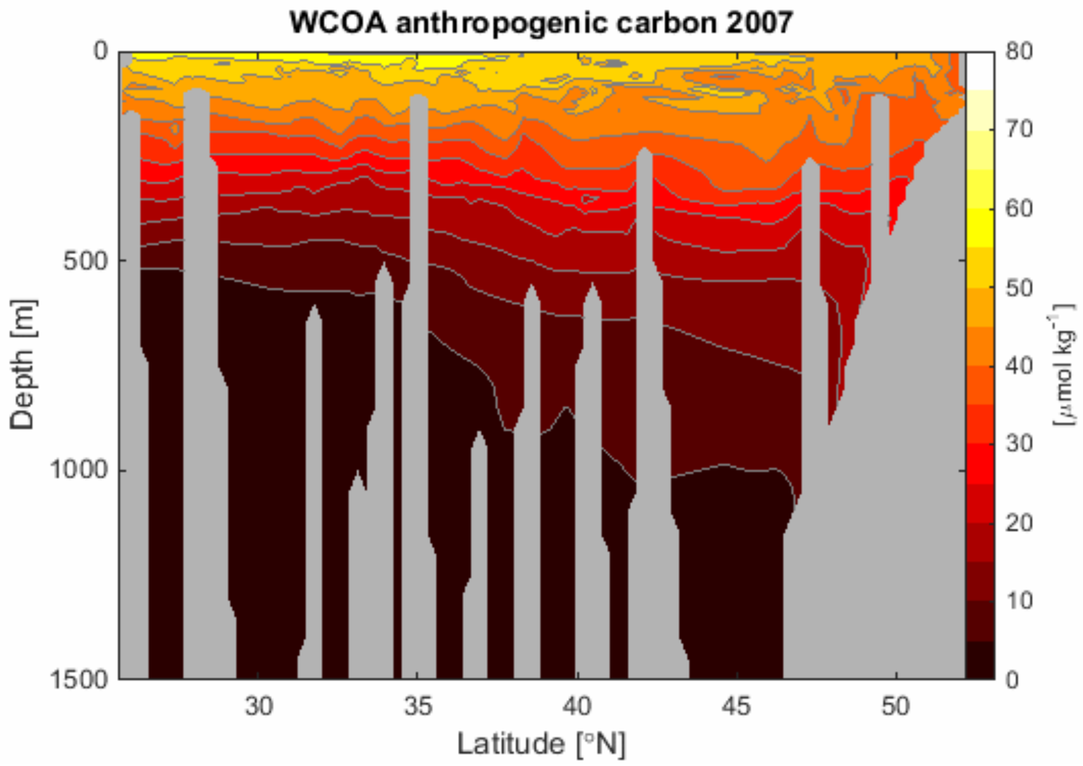



Increase in acidifying water in the western Arctic Ocean

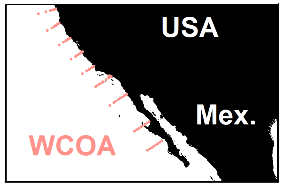
Di Qi, Liqi Chen, Baoshan Chen, Zhongyong Gao, Wenli Zhong, Richard A. Feely, Leif G. Anderson, Heng Sun, Jianfang Chen, Min Chen, Liyang Zhan, Yuanhui Zhang & Wei-Jun Cai

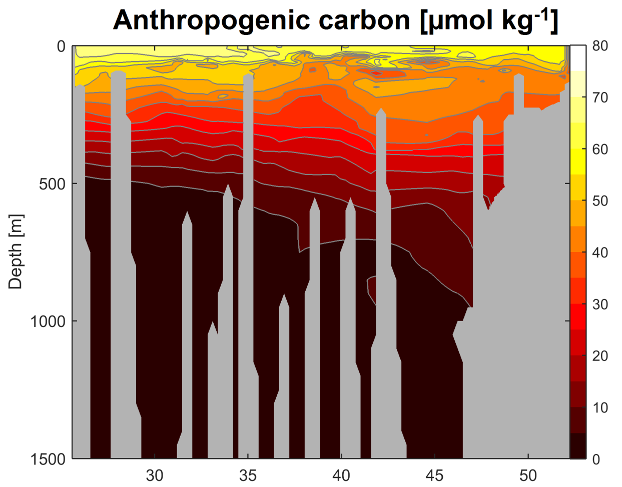


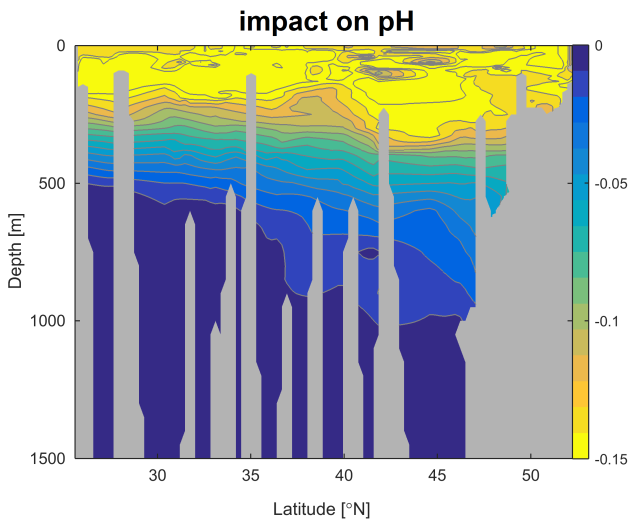
# OA Attribution and direct BGC impacts

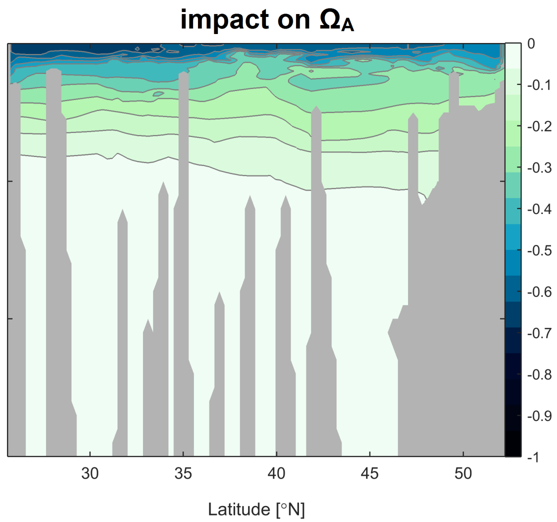



West Coast Ocean Acidification cruise in 2016



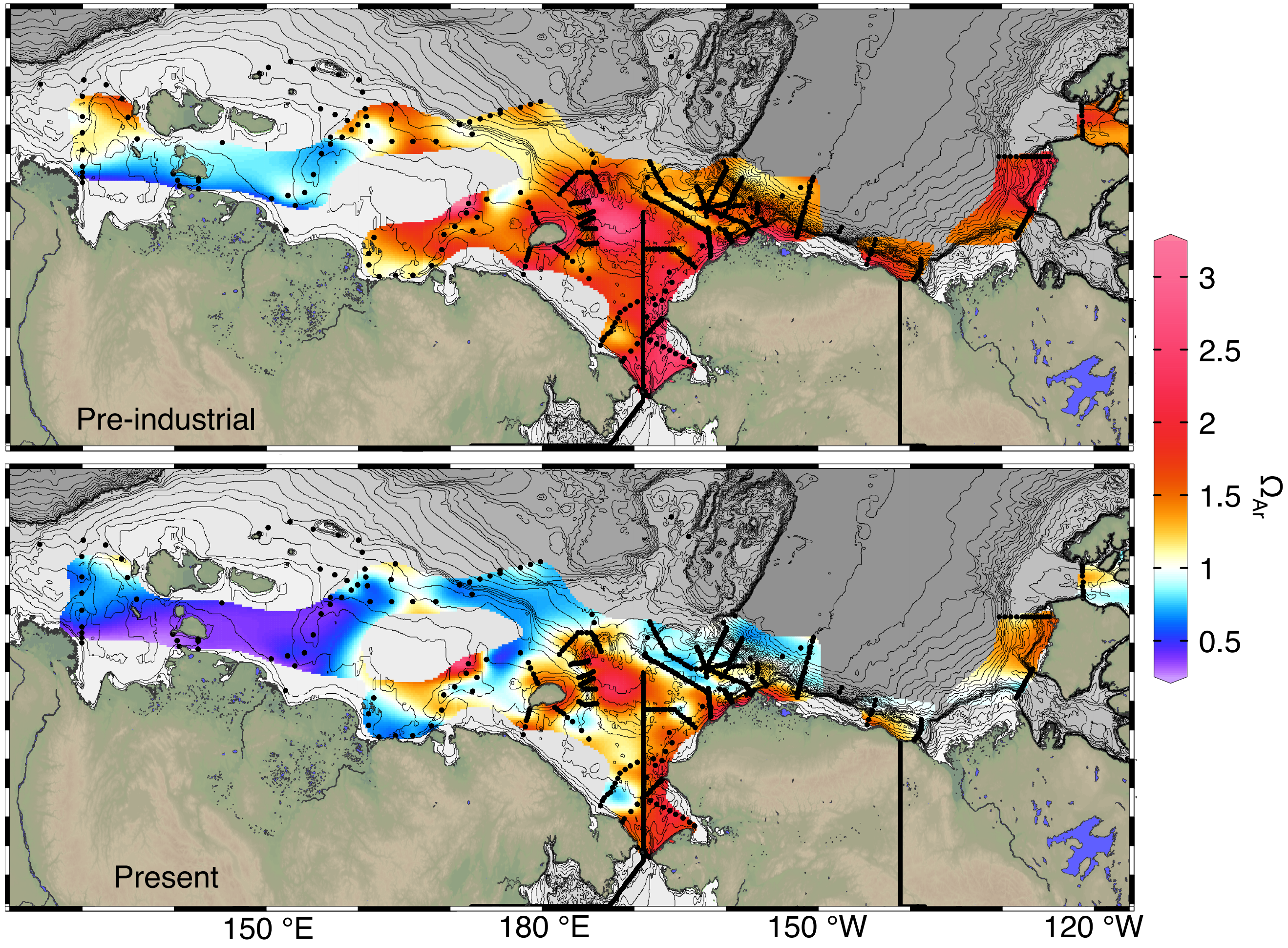




Courtesy Brendan Carter, 2018

# OA Hotspots and Natural Hi-CO2 Labs




Cross et al., 2018

*NATURE GEOSCIENCE* | LETTER

## Acidification of East Siberian Arctic Shelf waters through addition of freshwater and terrestrial carbon

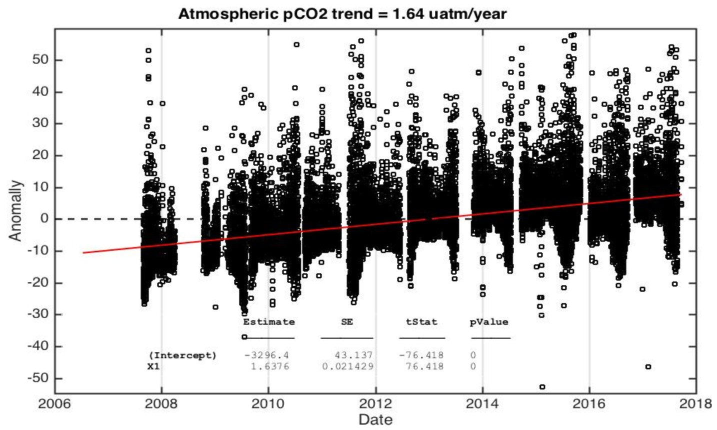
Igor Semiletov, Irina Pipko, Örjan Gustafsson, Leif G. Anderson, Valentin Sergienko, Svetlana Pugach, Oleg Dudarev, Alexander Charkin, Alexander Gukov, Lisa Bröder, August Andersson, Eduard Spivak & Natalia Shakhova

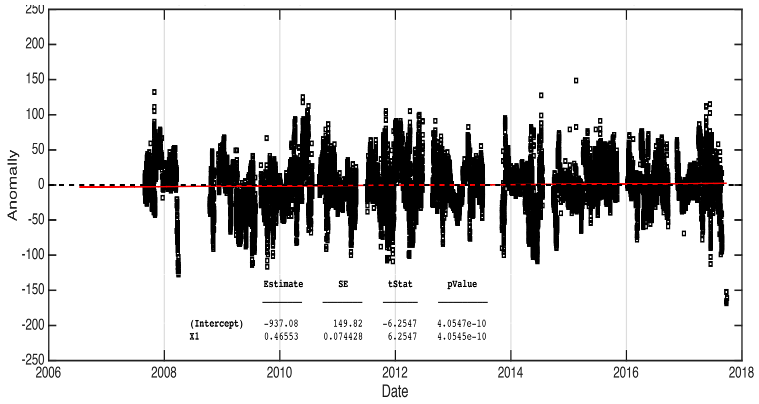
# ...And hiding hotspots

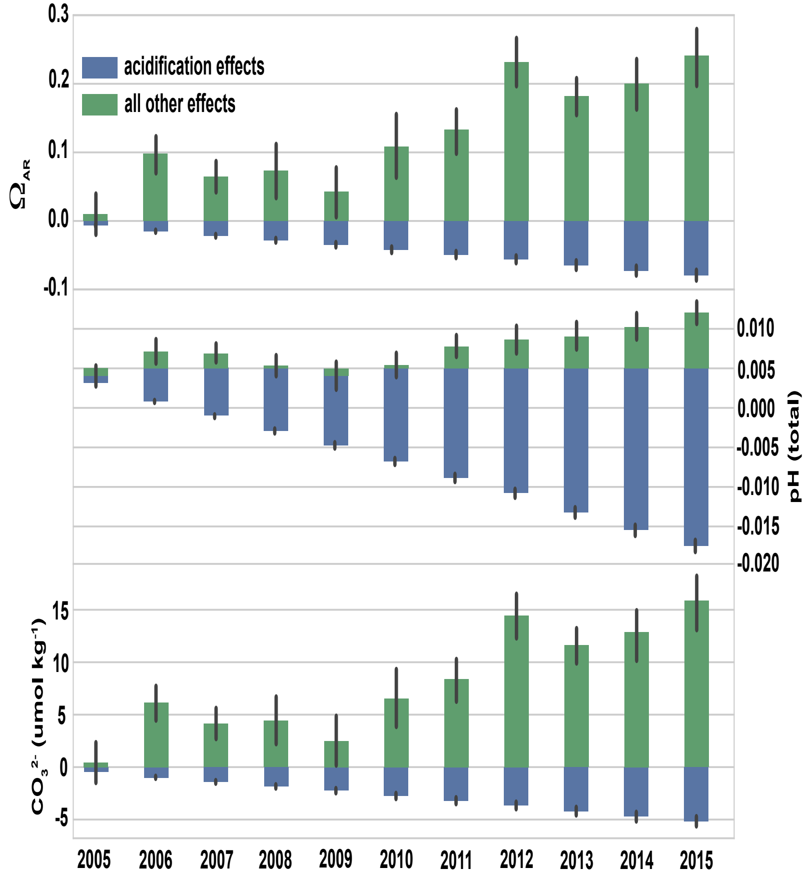
## Acidification monitoring in the U.S. Northeast

**Where does ocean acidification hide?**

a) Atmospheric $CO_2$ trend, ***but no*** in- water trend
b) Sensitivity of Omega A to variability in 1) acidification 2) temperature, 3) alkalinity
c) Last ten years of relative processes affecting Omega, pH and carbonate ion
***Physical variability drives omega and affects pH; big changes over decadal scales!***

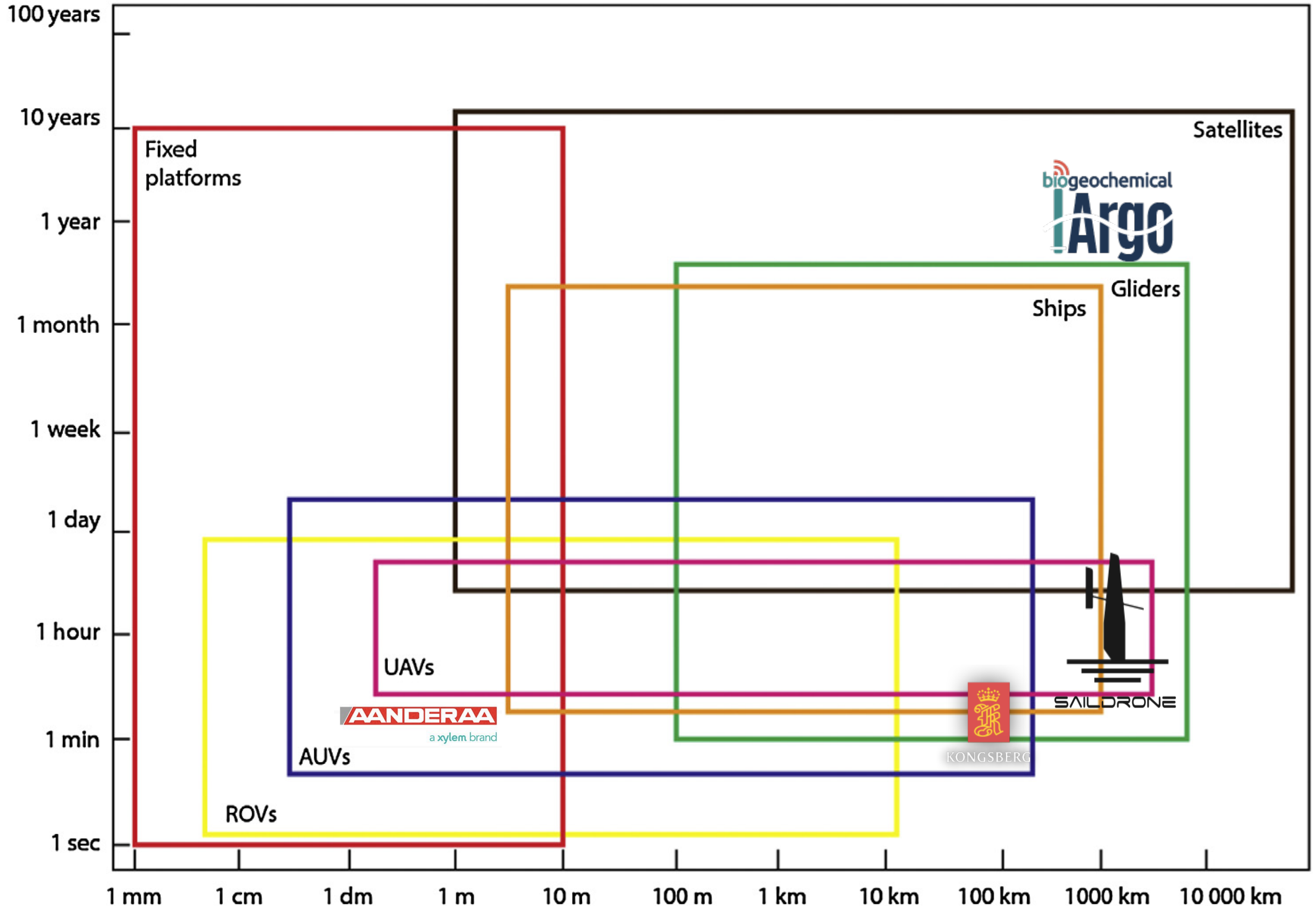



Courtesy Joe Salisbury, 2018

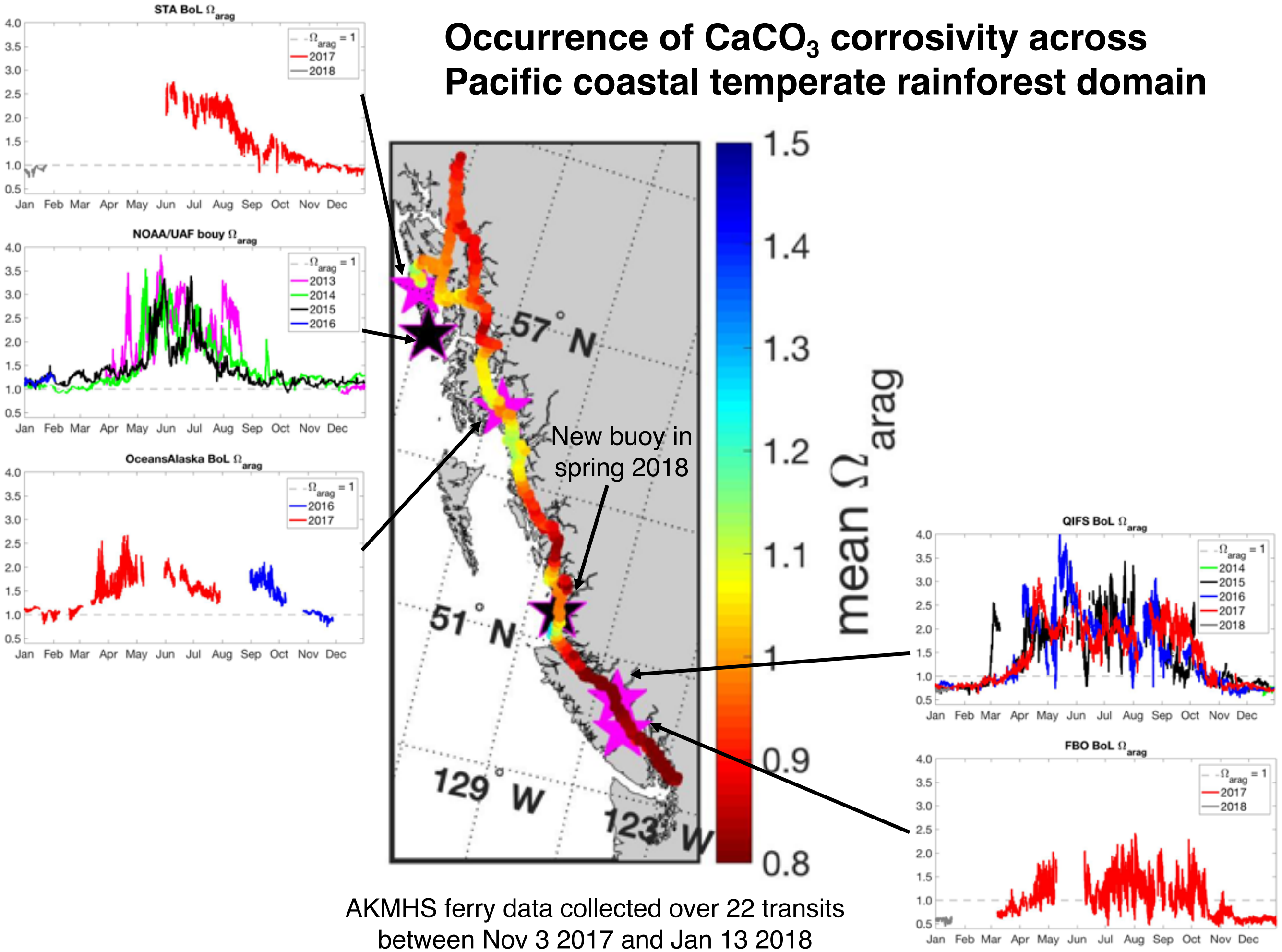
# New technologies span scales




Nilssen et al (2015) based on Haury et al (1978)

# Complex environments need complex observatories

Occurrence of $CaCO_3$ corrosivity across Pacific coastal temperate rainforest domain




AKMHS ferry data collected over 22 transits between Nov 3 2017 and Jan 13 2018

## Multiscale Observing Systems:

- Ships
- Ships of Opportunity
- Moorings
- Coastal Observatories

Courtesy Wiley Evans, 2018

# Coastal Acidification Networks

IOOS Association

OAP NOAA OCEAN ACIDIFICATION PROGRAM

Alaska Ocean Acidification Network

C-CAN California Current Acidification Network

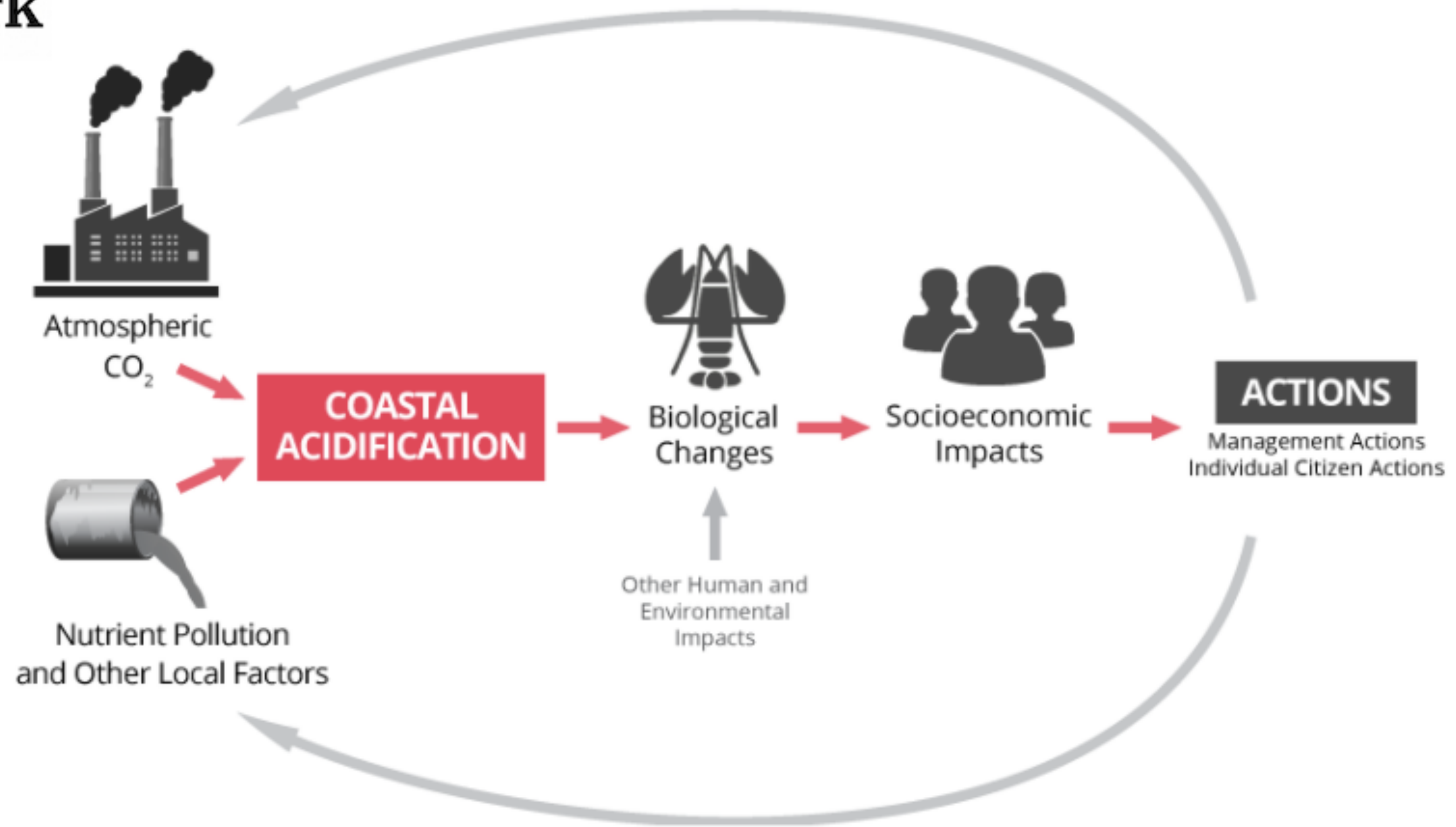
NORTHEAST COASTAL ACIDIFICATION NETWORK

SOCAN Southeast Ocean and Coastal Acidification Network

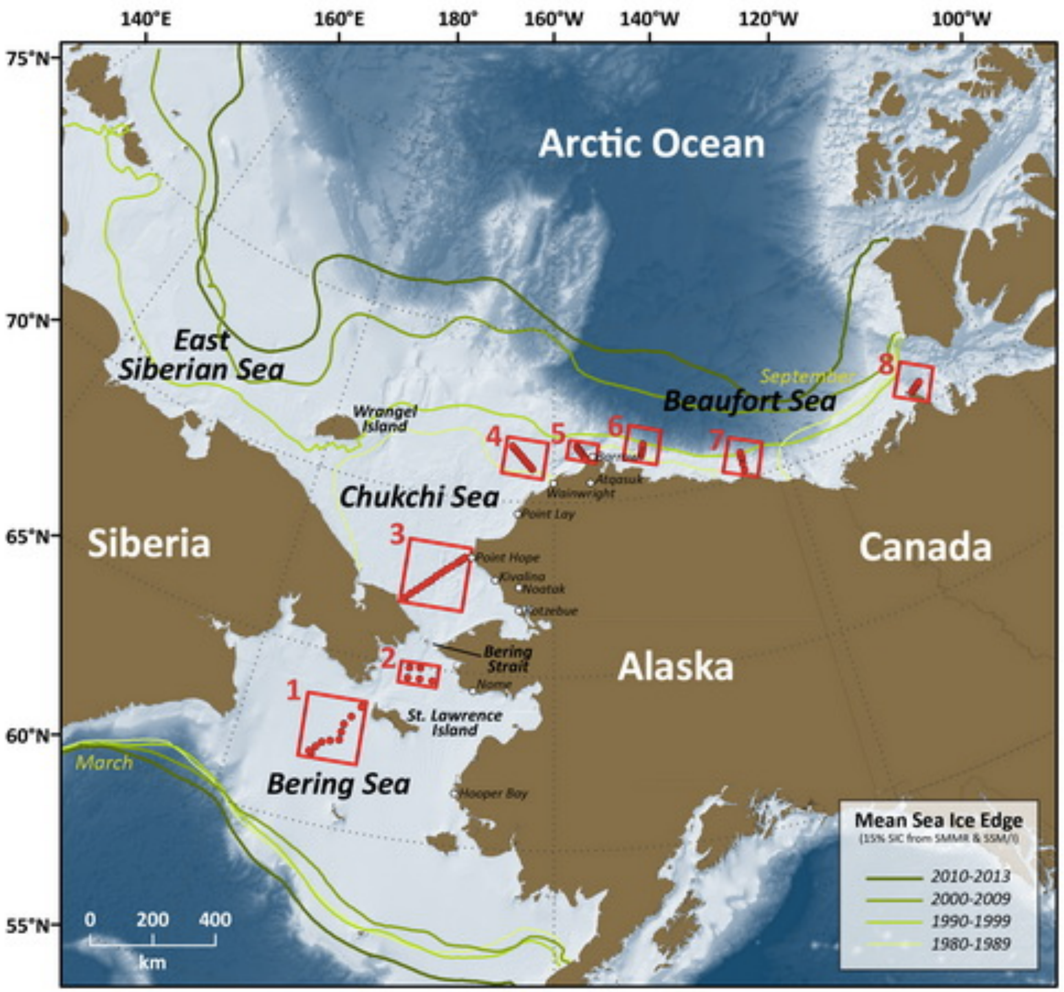
MACAN

GCOOS GULF OF MEXICO COASTAL OCEAN OBSERVING SYSTEM

Links Between People and Coastal Acidification



# Change Detection Arrays: Distributed Biological Observatory Model

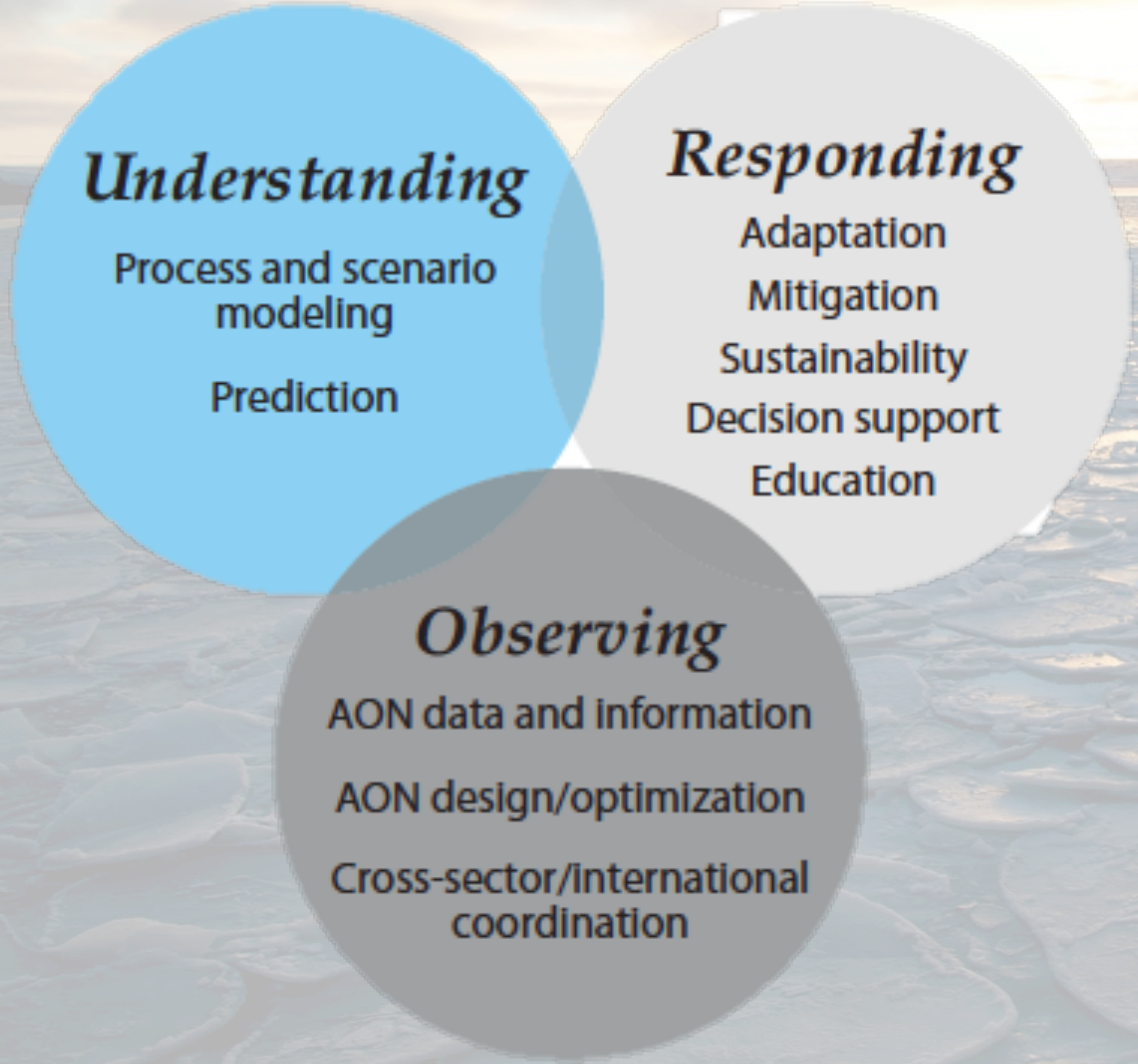



## DBO sites (red boxes) are

- regional "hotspot" transect lines and stations located along a latitudinal gradient
- considered to exhibit high productivity, biodiversity, and overall rates of change

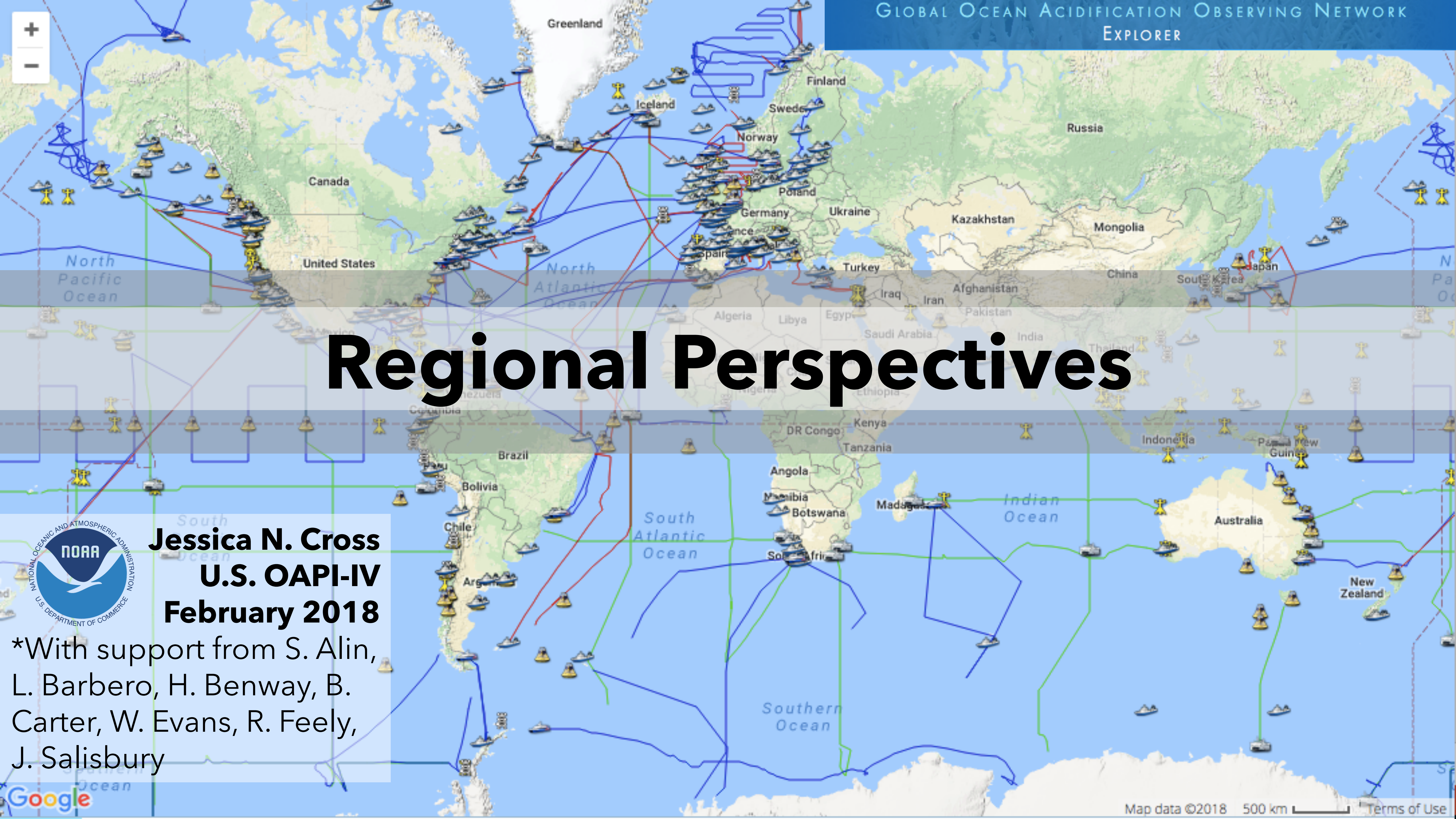
## DBO sites will

- serve as a change detection array for the identification and consistent monitoring of biophysical responses
- be occupied by national and international entities with shared data plan




**Observing systems designed for rapid responses to rapid changes:**

**Time Series**
**Technology**
**Partnerships**




# Regional Perspectives

Jessica N. Cross
U.S. OAPI-IV
February 2018
*With support from S. Alin, L. Barbero, H. Benway, B. Carter, W. Evans, R. Feely, J. Salisbury