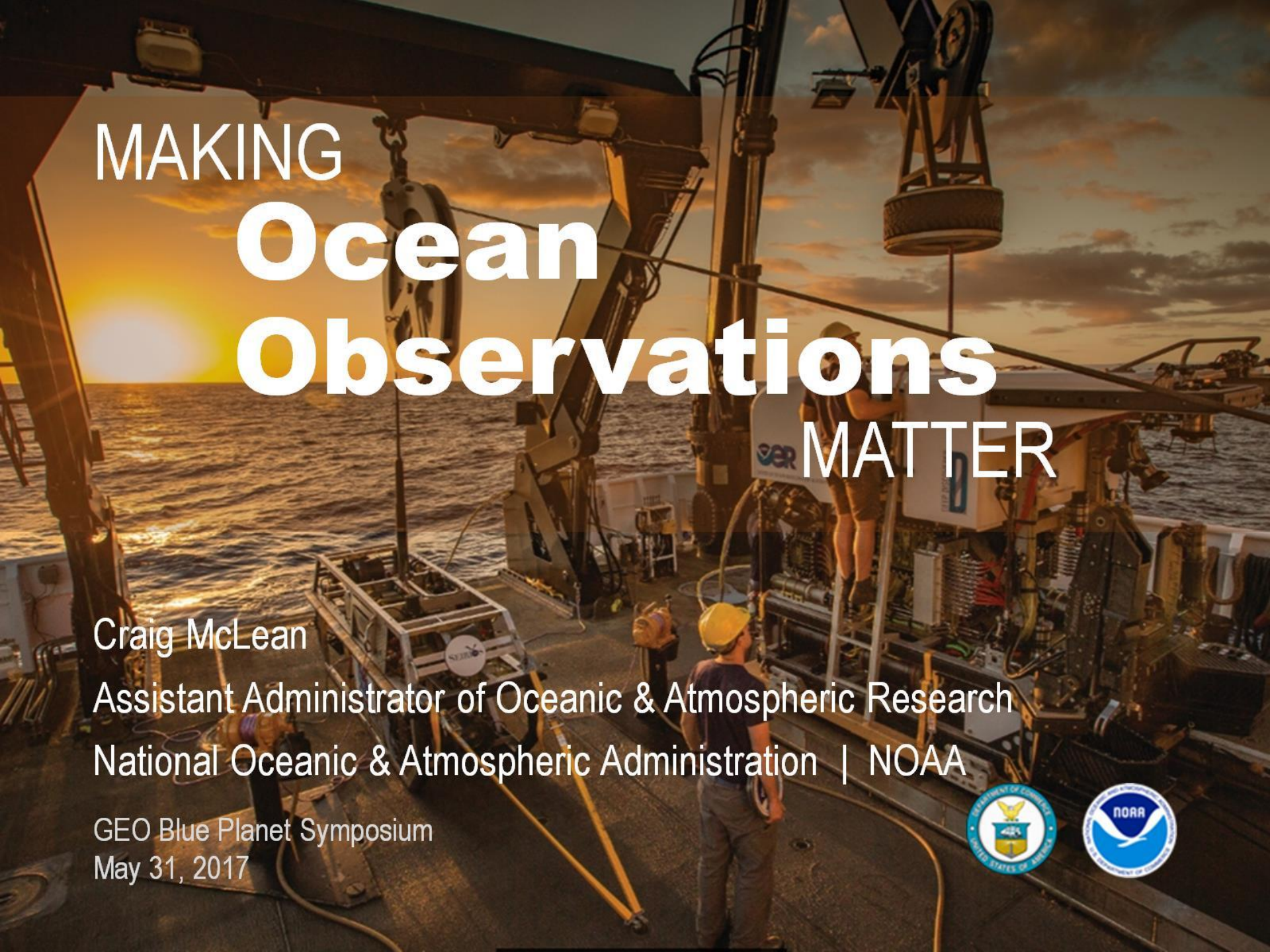


MAKING Ocean Observations MATTER

Craig McLean
Assistant Administrator of Oceanic & Atmospheric Research
National Oceanic & Atmospheric Administration | NOAA

GEO Blue Planet Symposium
May 31, 2017

Warming + El Niño

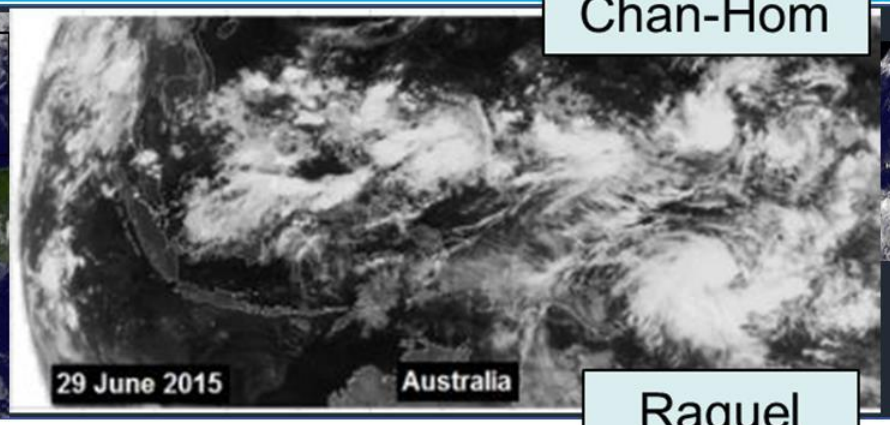
Indonesian Wildfires

July-October 2015

"The combination of **heat** [from greenhouse gas forcing] and **drought** [from El Niño] contributed to fires across much of the country….

--King et al, 2016, BAMS

2015 Record Year for Tropical Storms in the Pacific

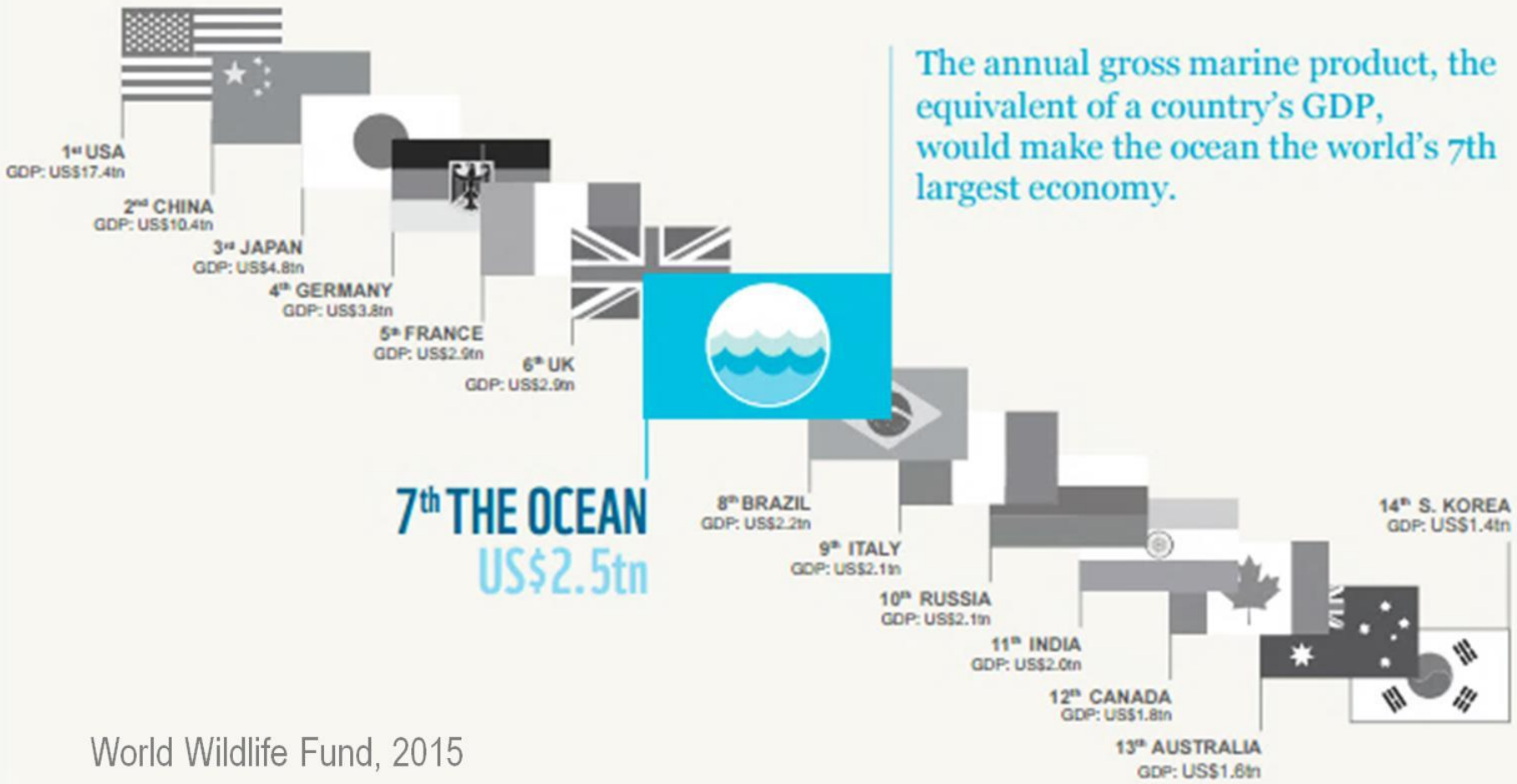


"…caused by El Niño...but more extreme because of anthropogenic forcing..."

--Zhang et al, 2016, BAMS


Why should people care?

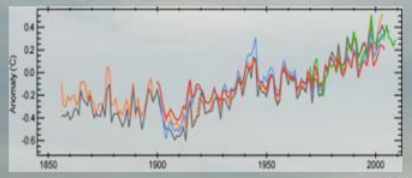
Why should people care?



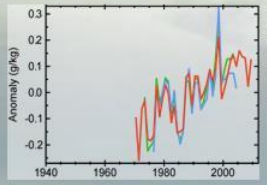
World Wildlife Fund, 2015

12 Indicators of a **Changing** Environment

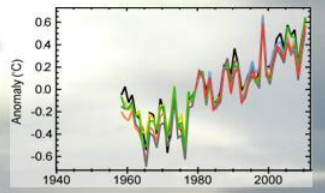
Air temperature over ocean



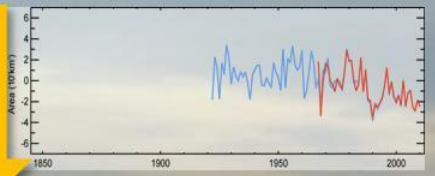
Humidity



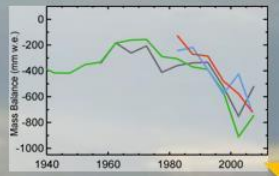
Temperature of the lower atmosphere



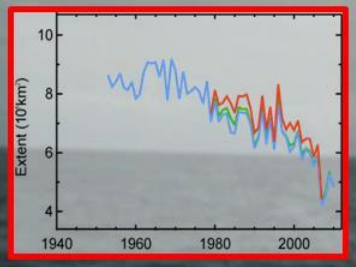
Snow



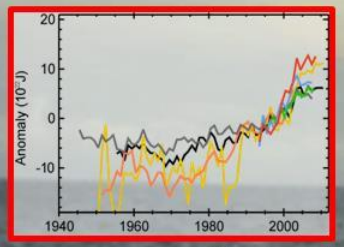
Glaciers



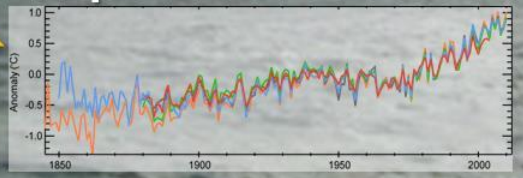
Arctic sea ice



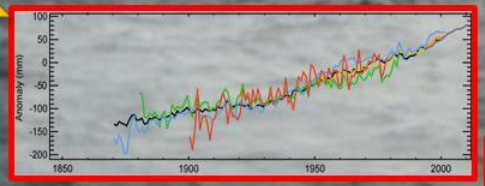
Ocean heat content

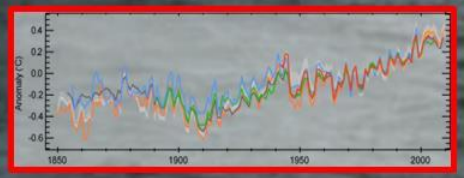


Air temperature over land



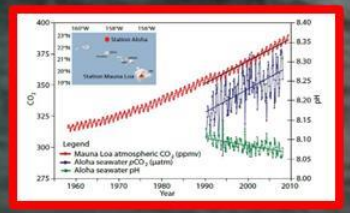
Global sea level



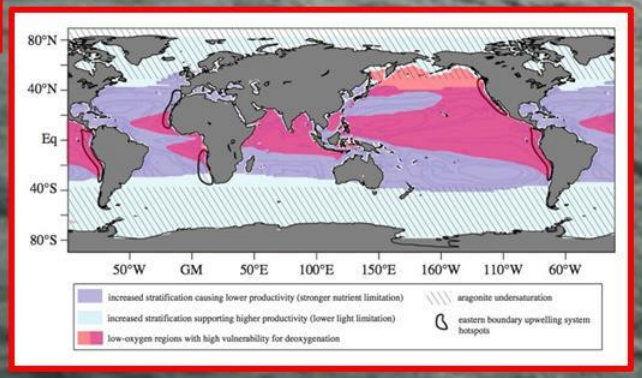


Sea surface temperature

Ocean pH



Vulnerability to deoxygenation



Plymouth Marine Laboratory *et al*. 2011

HOT

OCEAN HEAT CONTENT

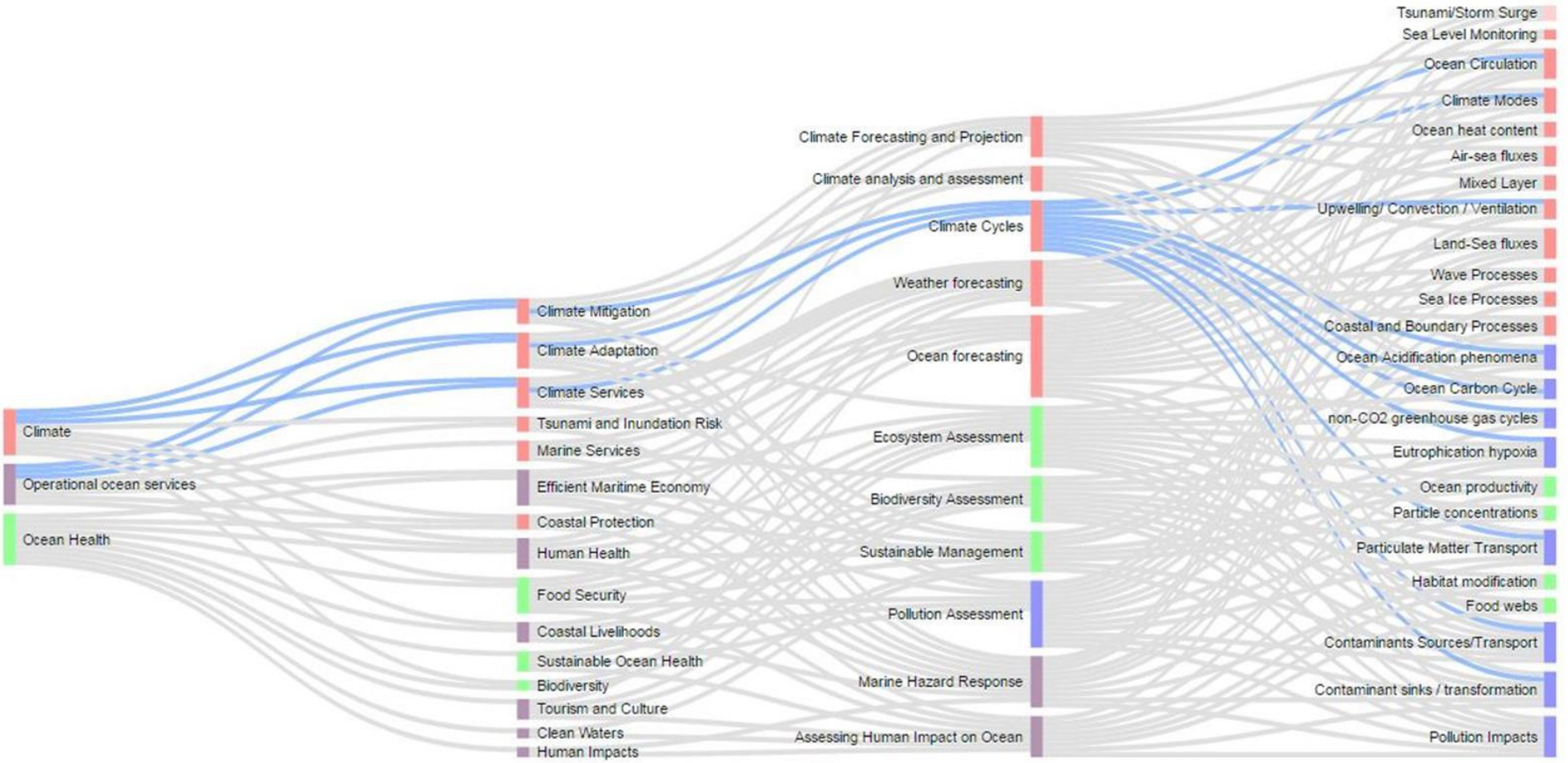
SOUR

OCEAN ACIDIFICATION

BREATH*LESS*

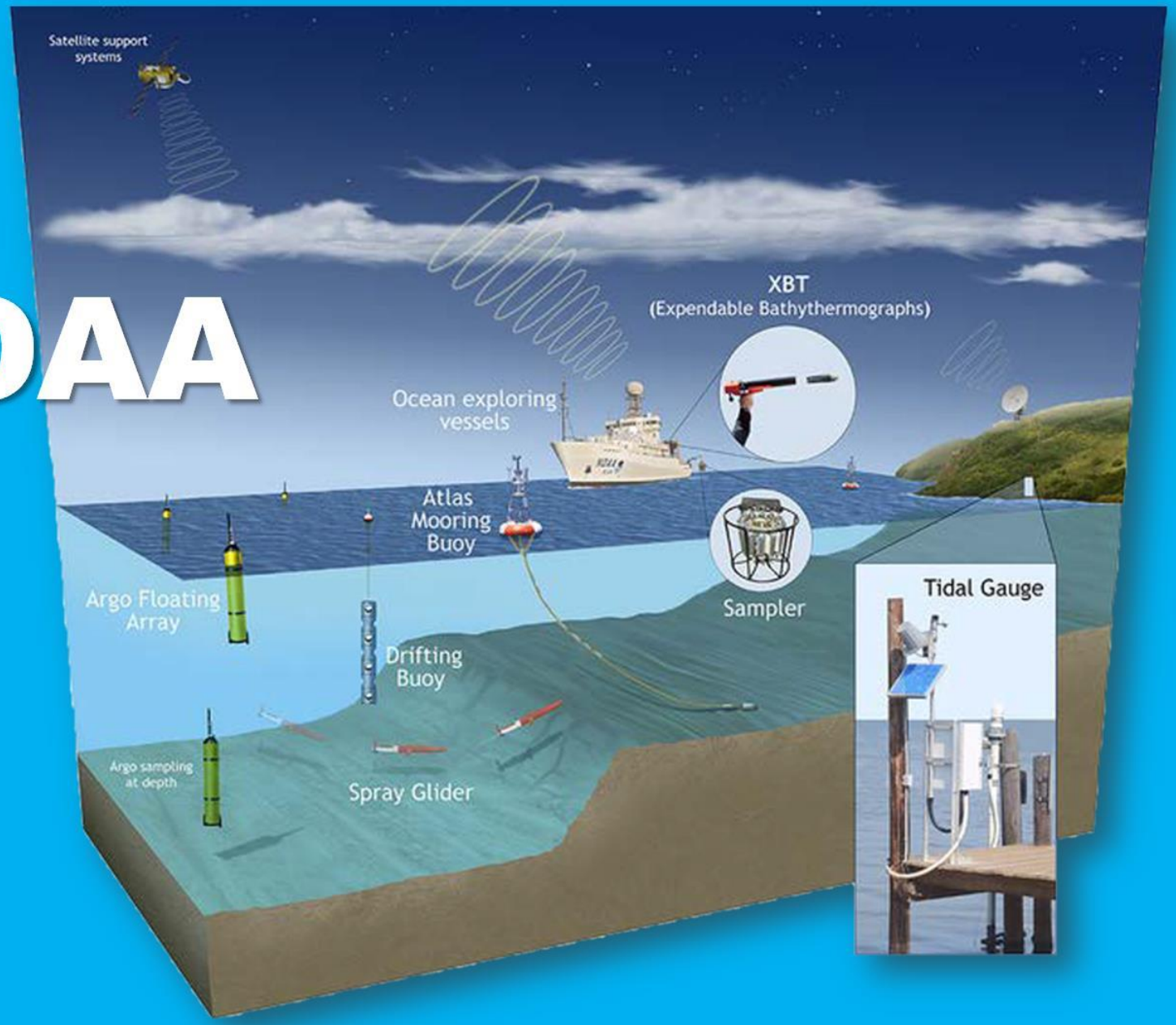
OXYGEN CONTENT

VALUE | OCEAN OBSERVATIONS

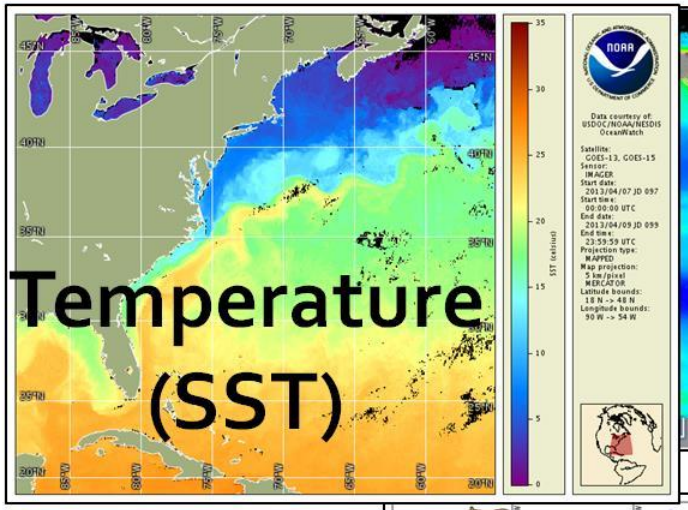


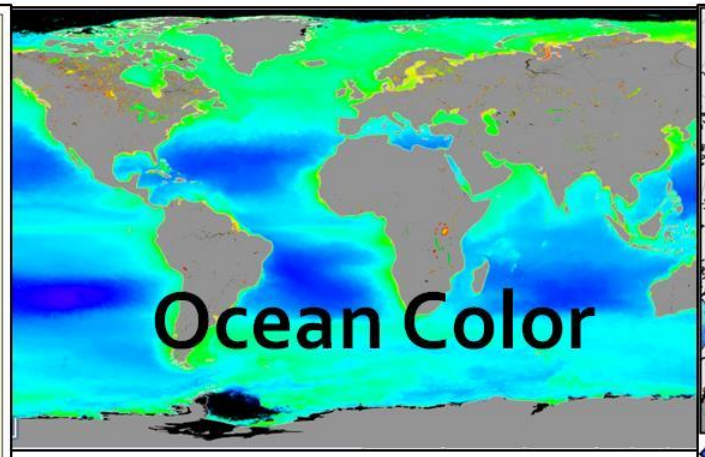
Source: GOOSocean.org

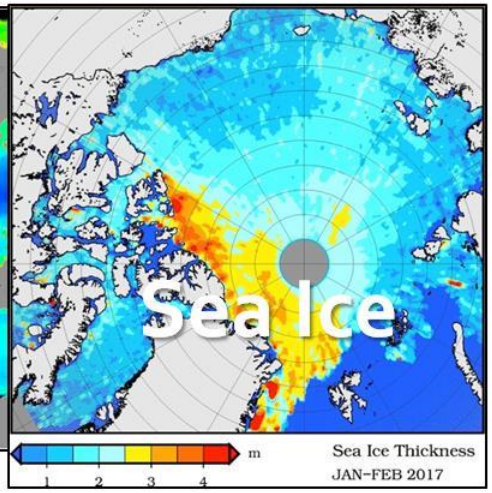
NOAA

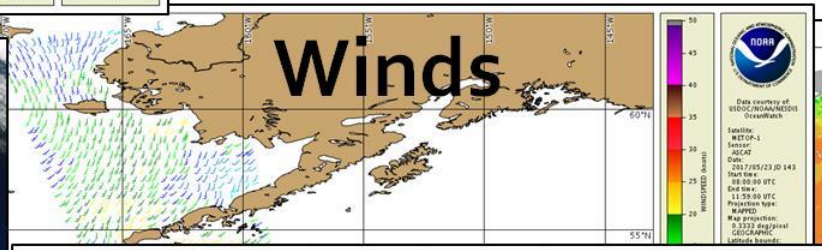

Satellite support systems
XBT
(Expendable Bathythermographs)
Ocean exploring vessels
Atlas Mooring Buoy
Argo Floating Array
Drifting Buoy
Sampler
Tidal Gauge
Argo sampling at depth
Spray Glider

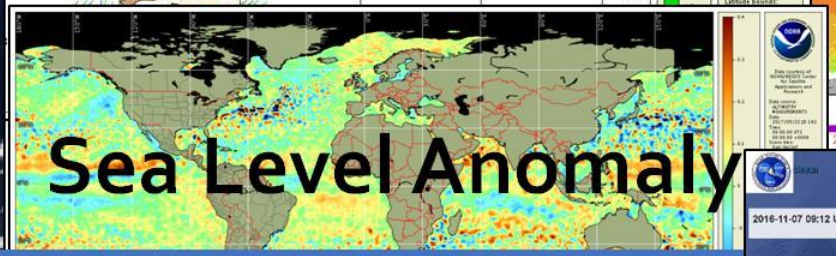
OCEAN PARAMETERS **FROM SPACE**

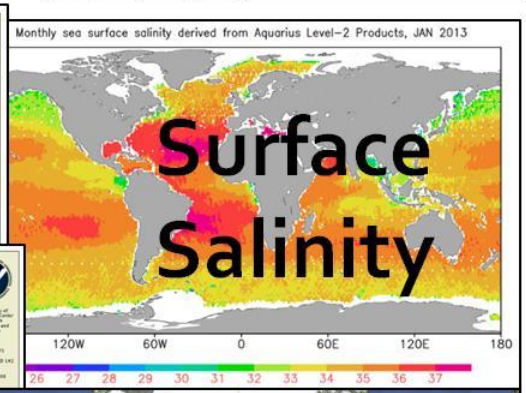


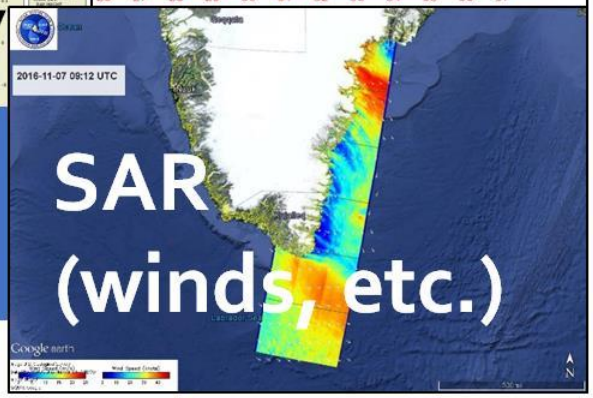






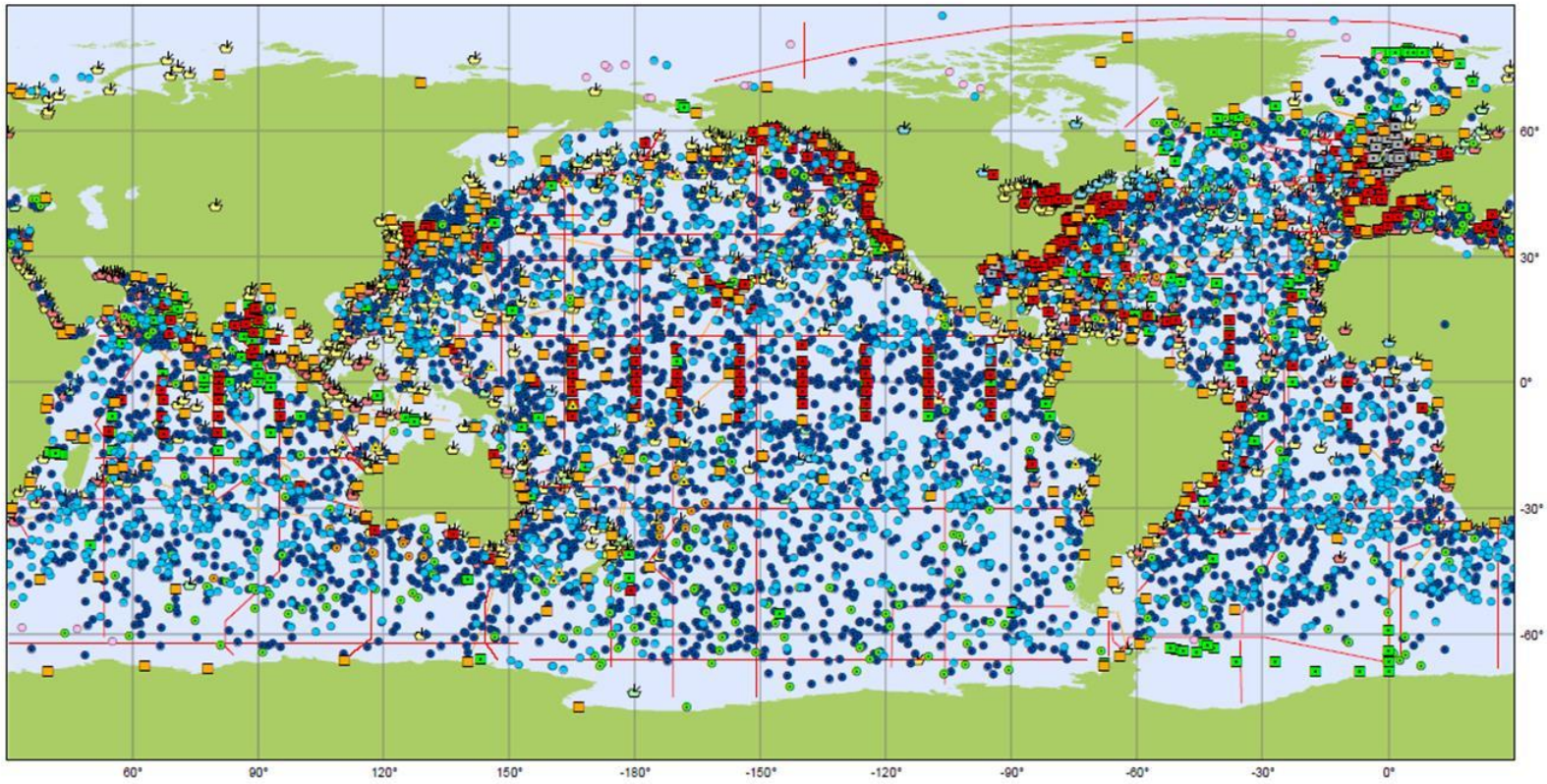






Utility of satellite data: broad spatial coverage for detecting patterns, frequency of observations for monitoring change over time

GLOBAL OCEAN OBSERVING SYSTEM



jcommops

Main in-situ Elements of the Global Ocean Observing System — **April 2017**

Argo
- Argo (3929)
- Deep-Argo (29)
- BGC-Argo (289)

DBCP
- Surface Drifters (1488)
- Fixed Platforms (103)
- Ice Buoys (22)
- Moored Buoys (405)
- Tsunameter (35)

OceanSITES
- Platforms (332)

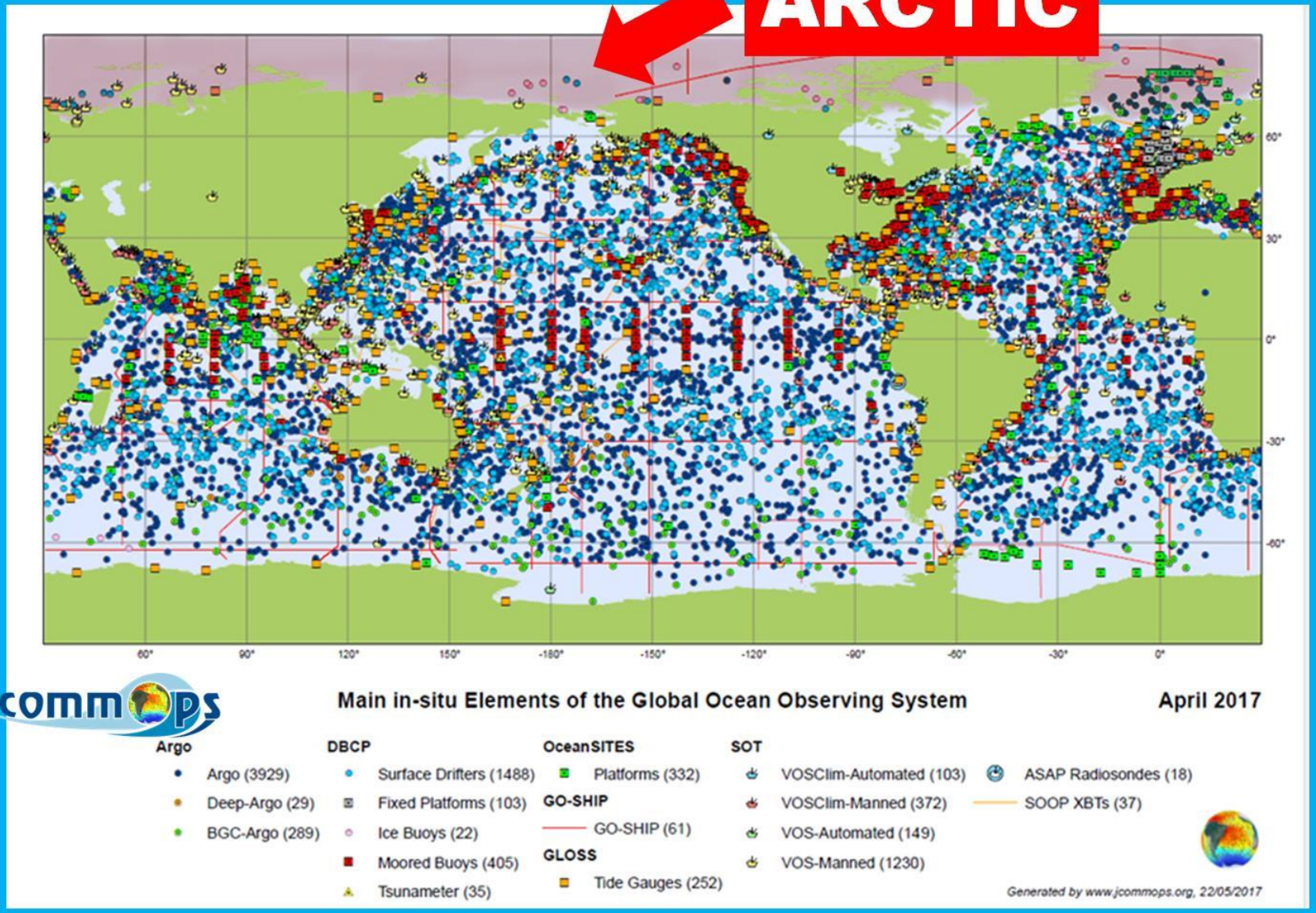
GO-SHIP
- GO-SHIP (61)

GLOSS
- Tide Gauges (252)

SOT
- VOSClim-Automated (103)
- VOSClim-Manned (372)
- VOS-Automated (149)
- VOS-Manned (1230)
- ASAP Radiosondes (18)
- SOOP XBTs (37)

Generated by www.jcommops.org, 22/05/2017

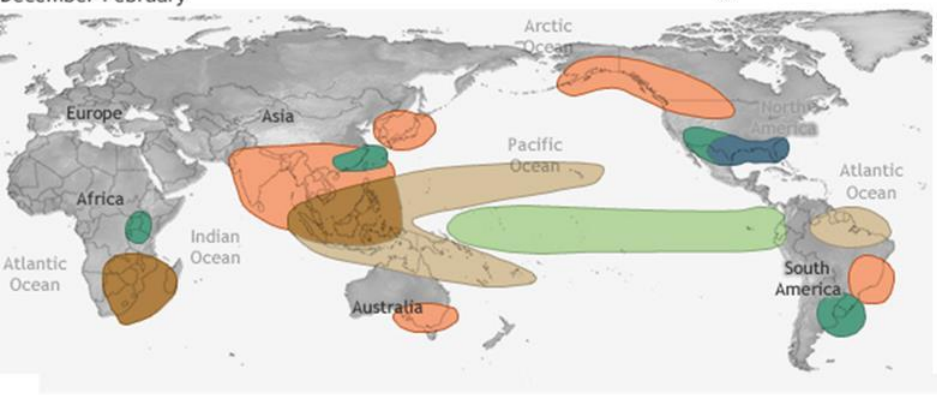
GLOBAL OCEAN OBSERVING SYSTEM



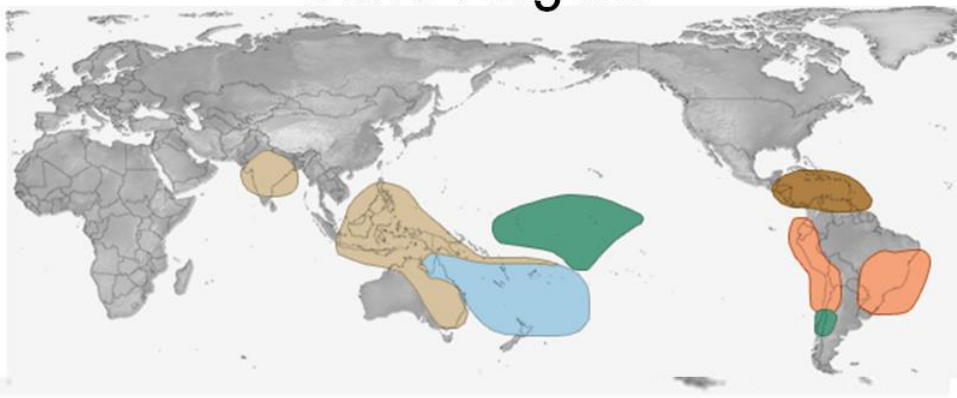

OCEAN OBSERVATIONS
that MATTER

El Niño Impacts

December-February

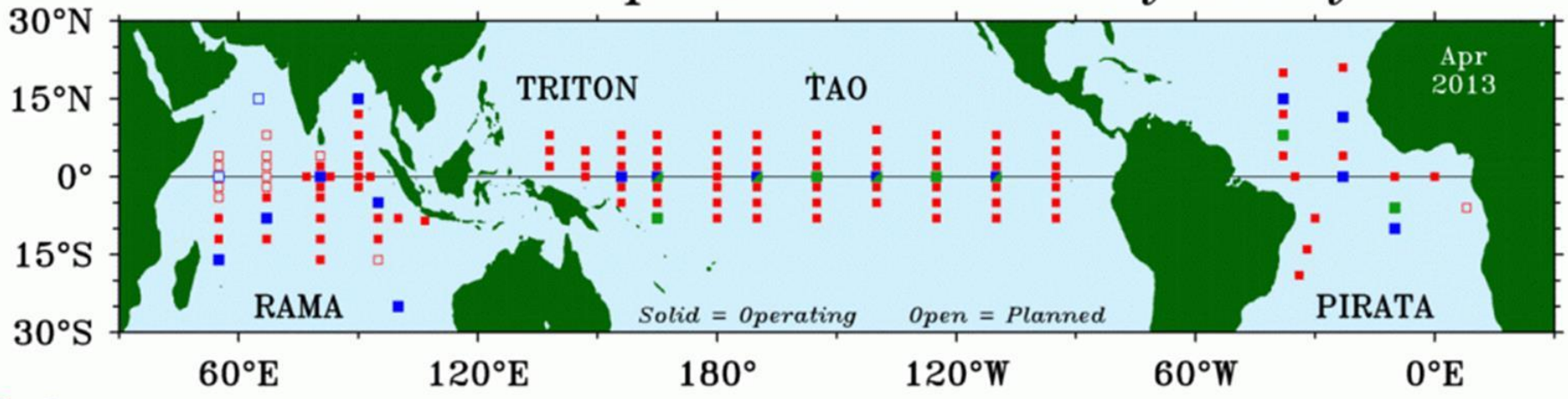


June-August



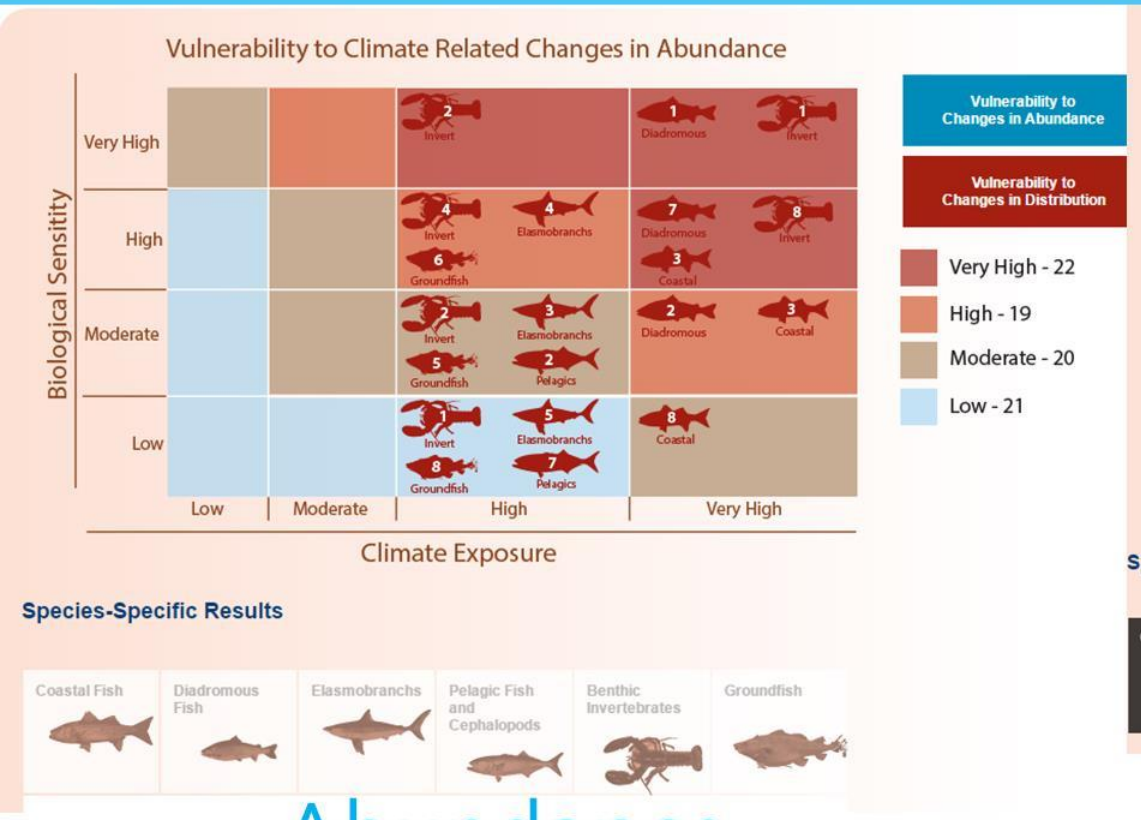
Cool
Warm
Wet
Dry
Cool and dry
Warm and dry
Cool and Wet
Warm and wet

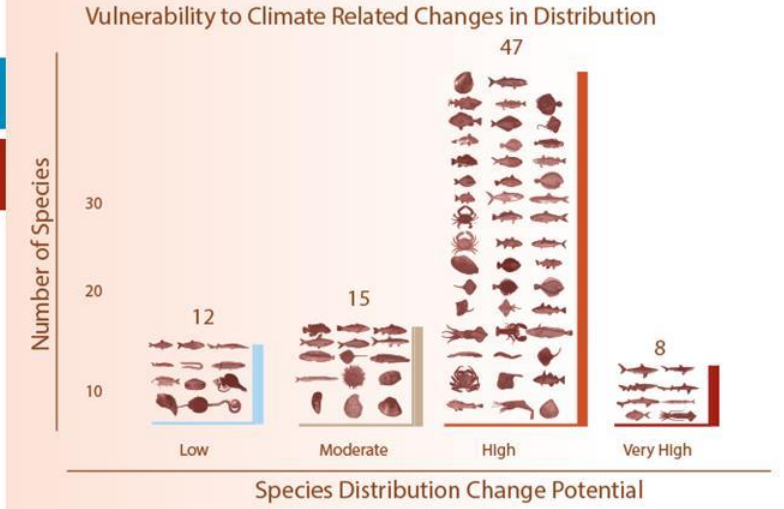
Global Tropical Moored Buoy Array



Standard Mooring
Flux Reference Site
Flux and CO_2 Enhanced
CO_2 Enhanced

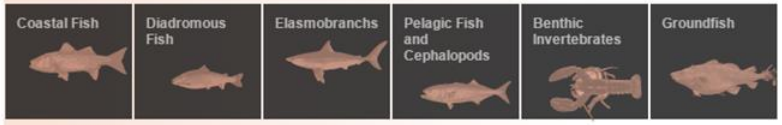
Vulnerability to Climate Change
U.S. NORTHEAST FISHERIES





Species-Specific Results

Species-Specific Results



Abundance

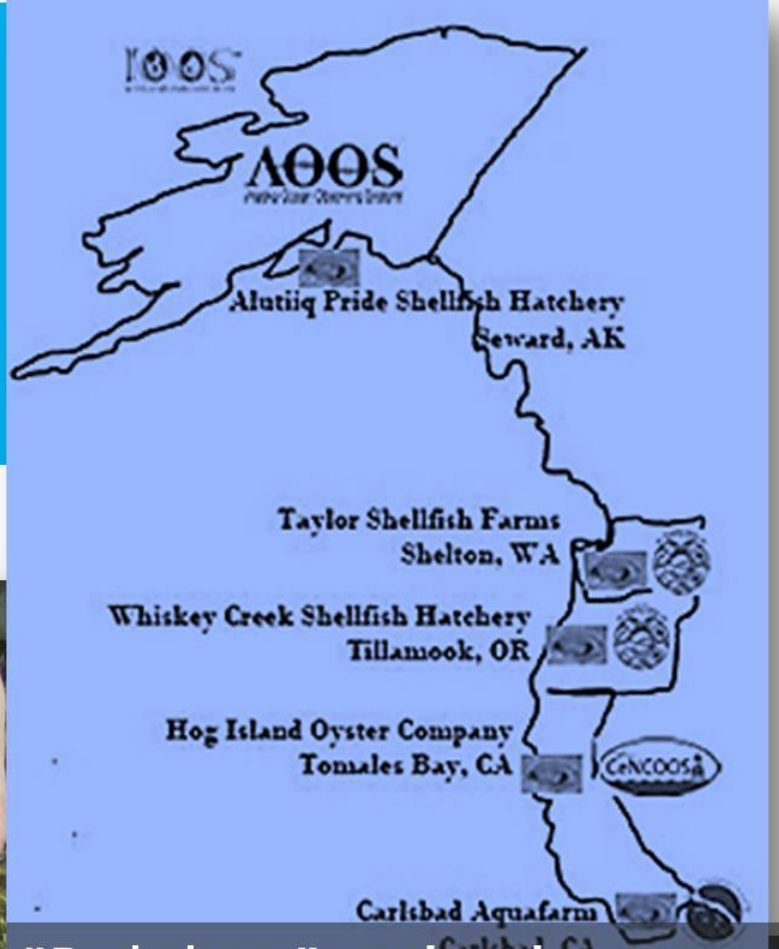
Distribution

Approximately half the species assessed are estimated to a high or very high vulnerability to climate change

OCEAN ACIDIFICATION

Understanding risk

Photo: Taylor Shellfish



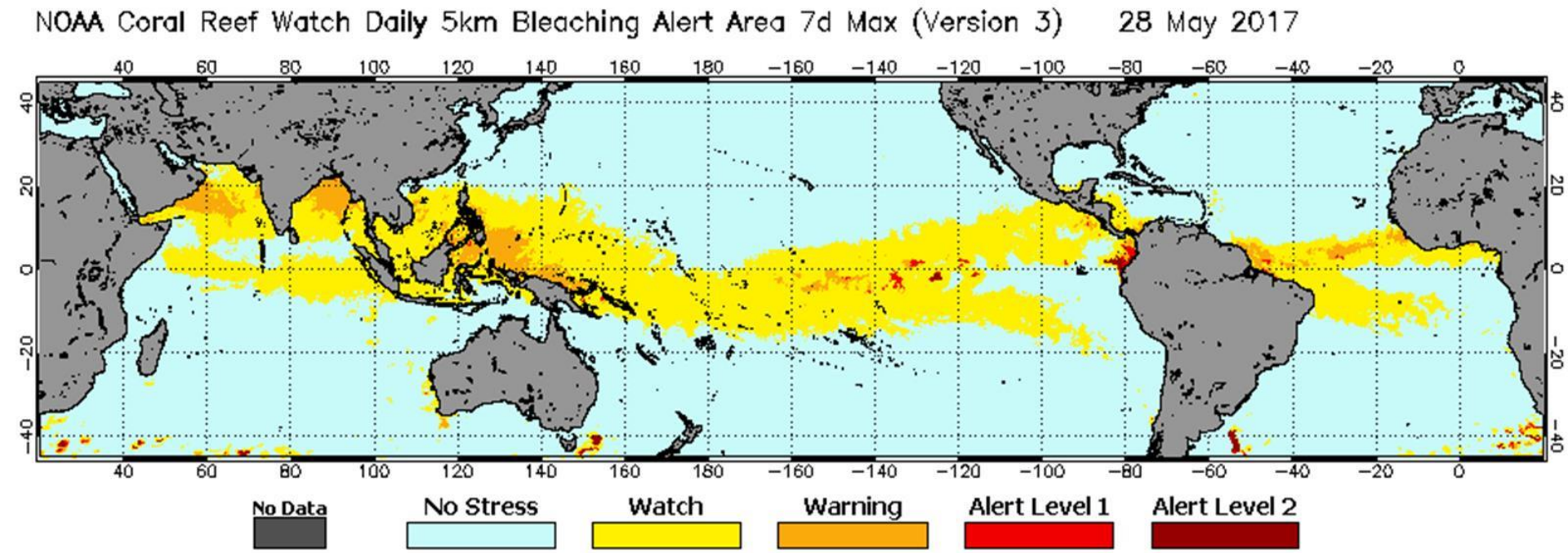
"Burkolator" stations in west coast shellfish hatcheries

Mitigating Risk

Develop resilient oysters

Photo: Oregon Sea Grant

Coral Reef Watch



coralreefwatch.noaa.gov

THE **GLOBAL** EFFORT

GLOBAL OCEAN OBSERVATIONS

MANY ORGANIZATIONS

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission
RESOURCES, MEETINGS, DOCUMENTS, PEOPLE

ICES
CIEM

GROUP ON EARTH OBSERVATIONS

BLUE PLANET
Oceans and Society

pogo

CEOS
Committee on Earth Observation Satellites

IOC's ROLE

Commitment
Coherence
Collaboration
Communication
Capacity development

SDG 14

Ocean Acidification
Science Capacity Development &
Marine Technology Transfer

GLOBAL OCEAN OBSERVATIONS

MANY ORGANIZATIONS

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission
RESOURCES, MEETINGS, DOCUMENTS, PEOPLE

ICES
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Thank you
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