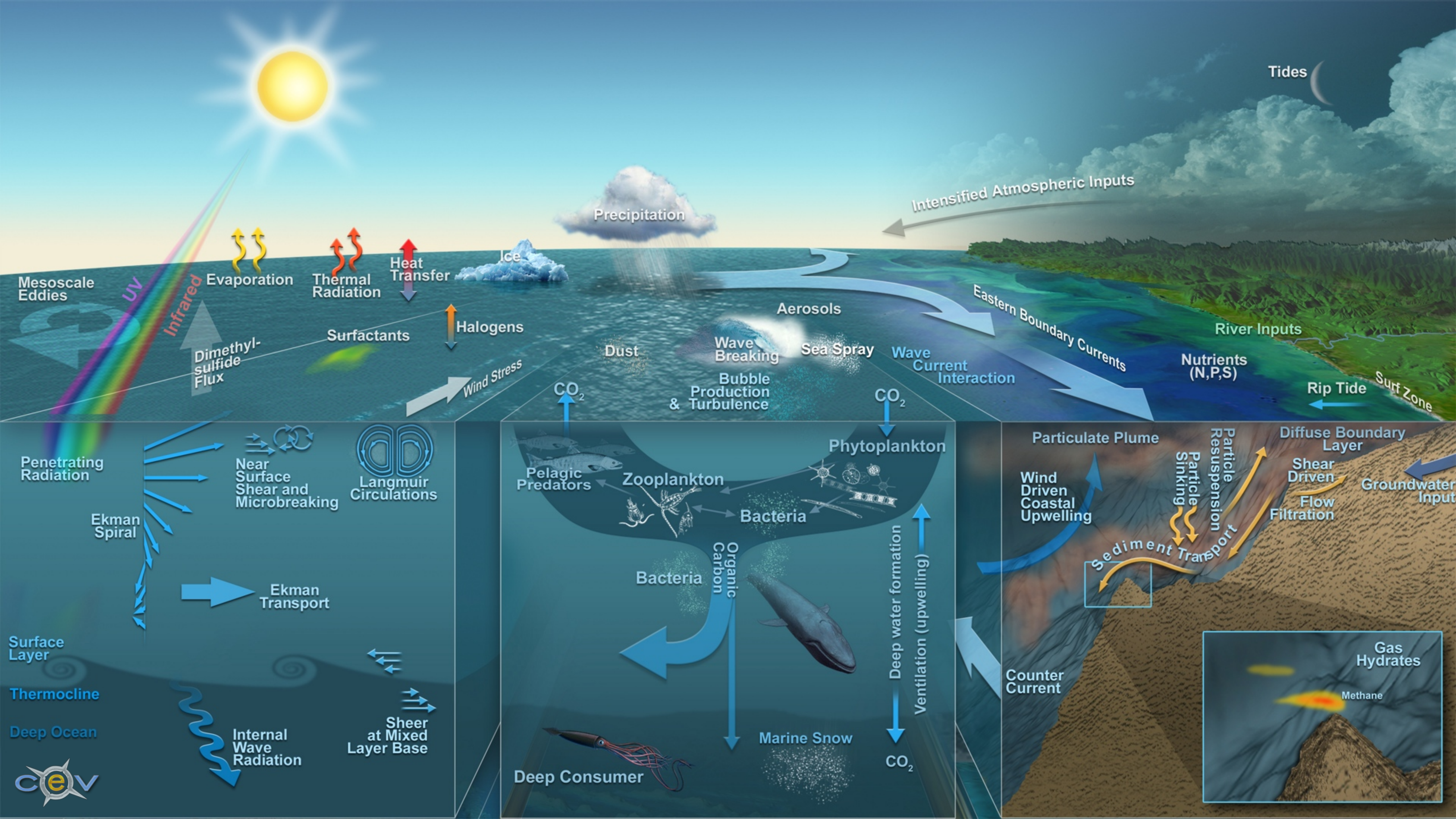
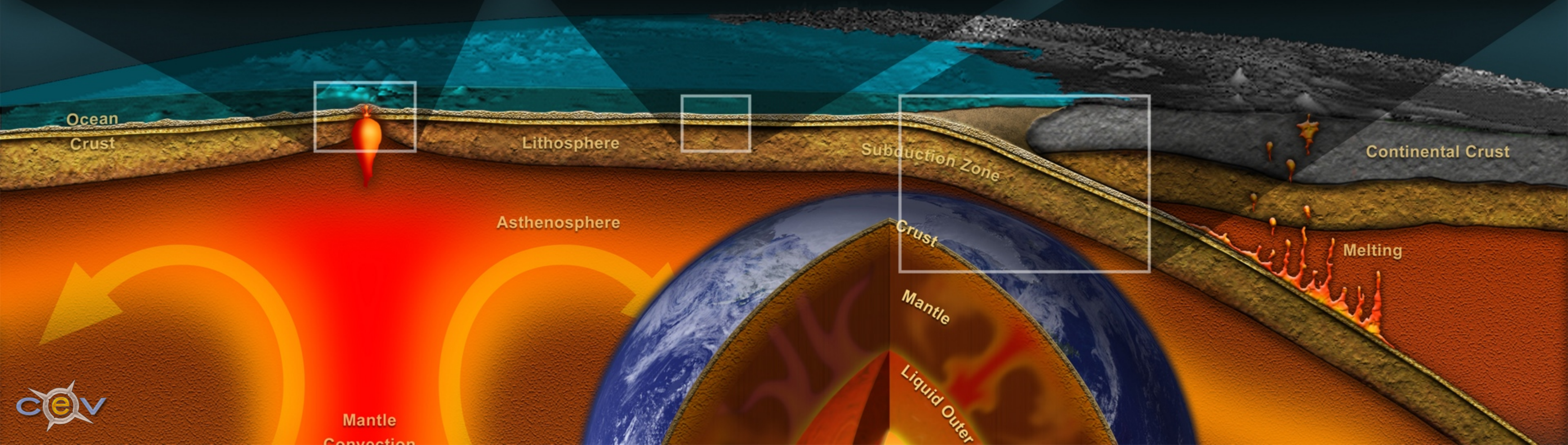
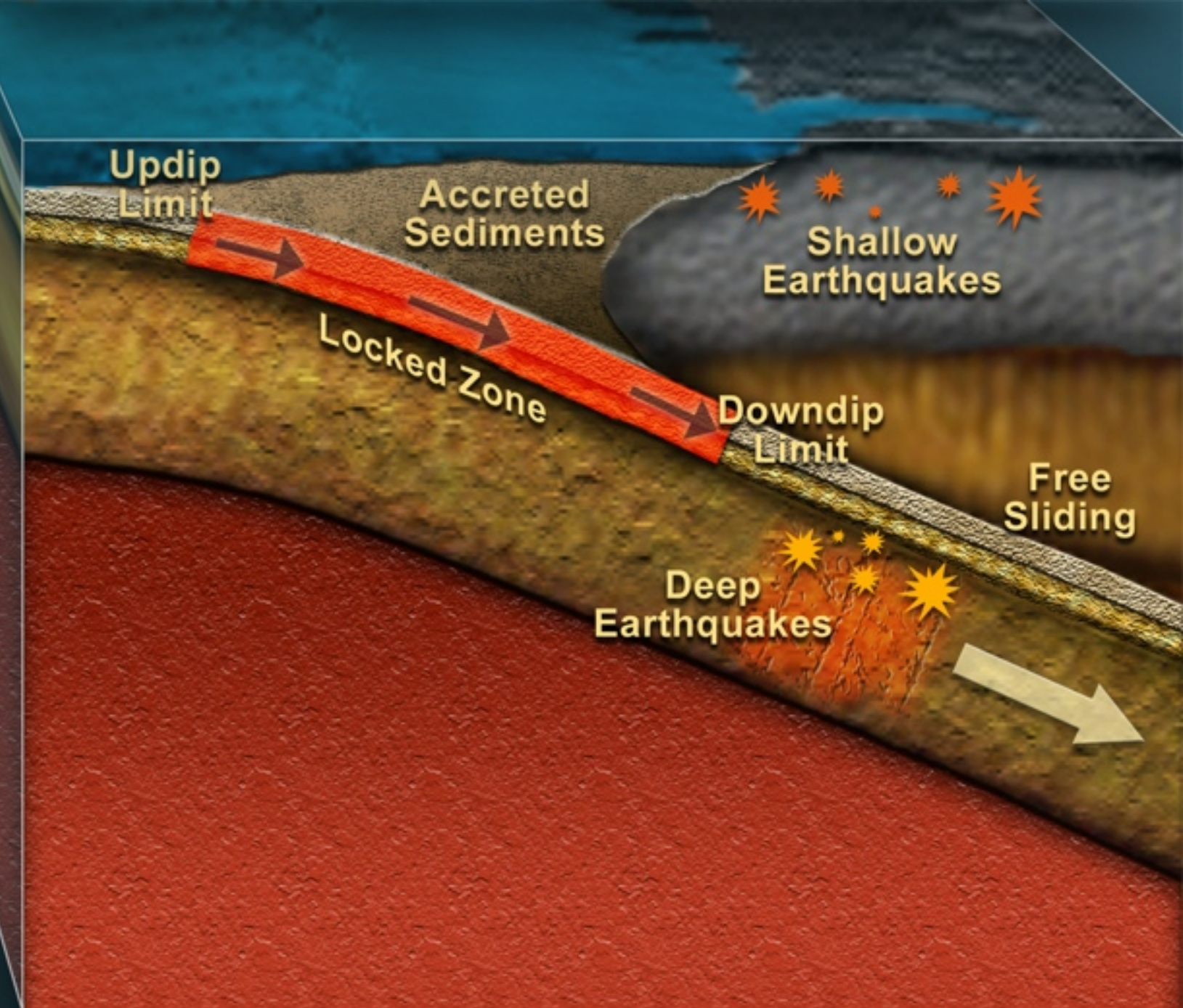
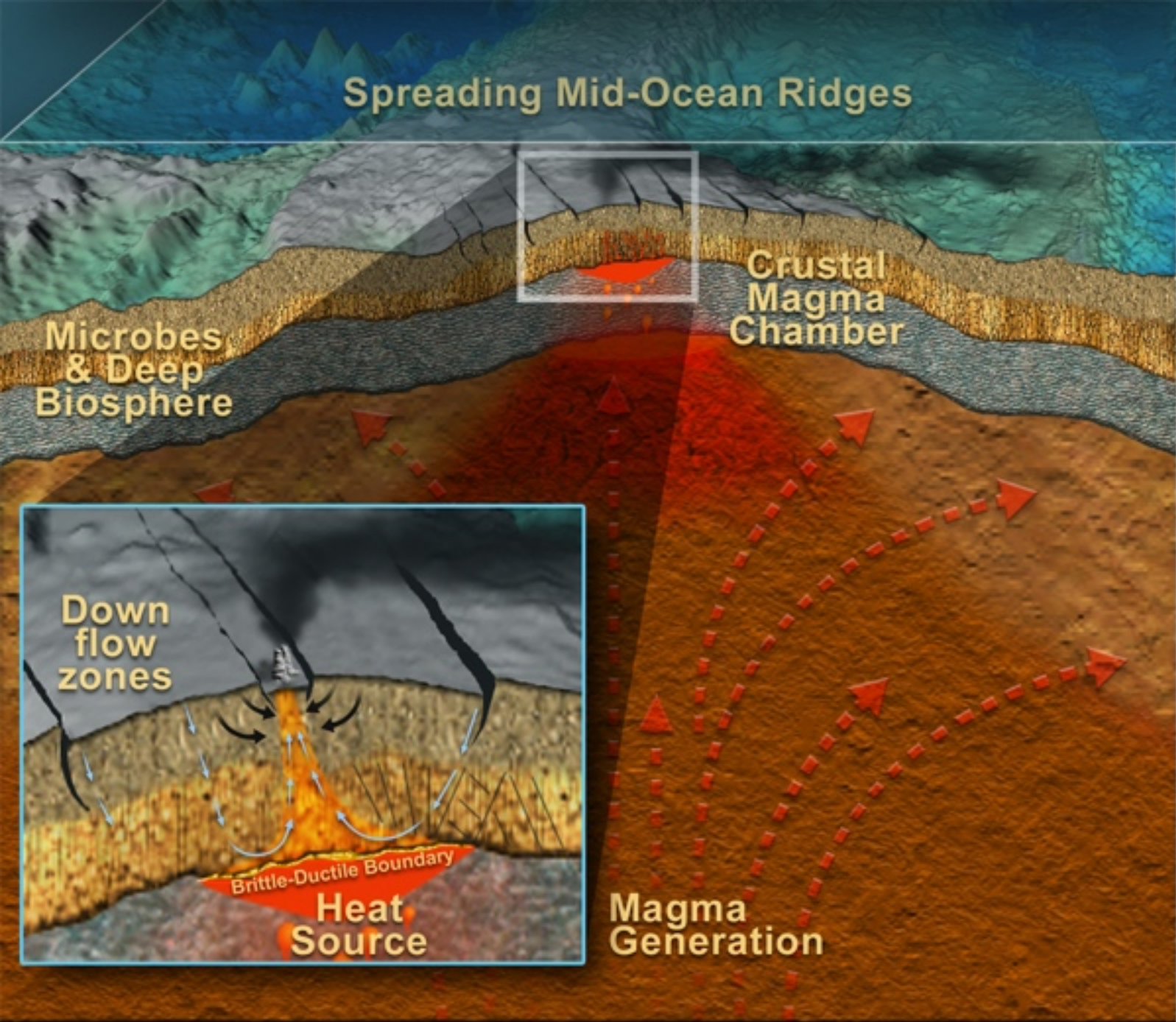


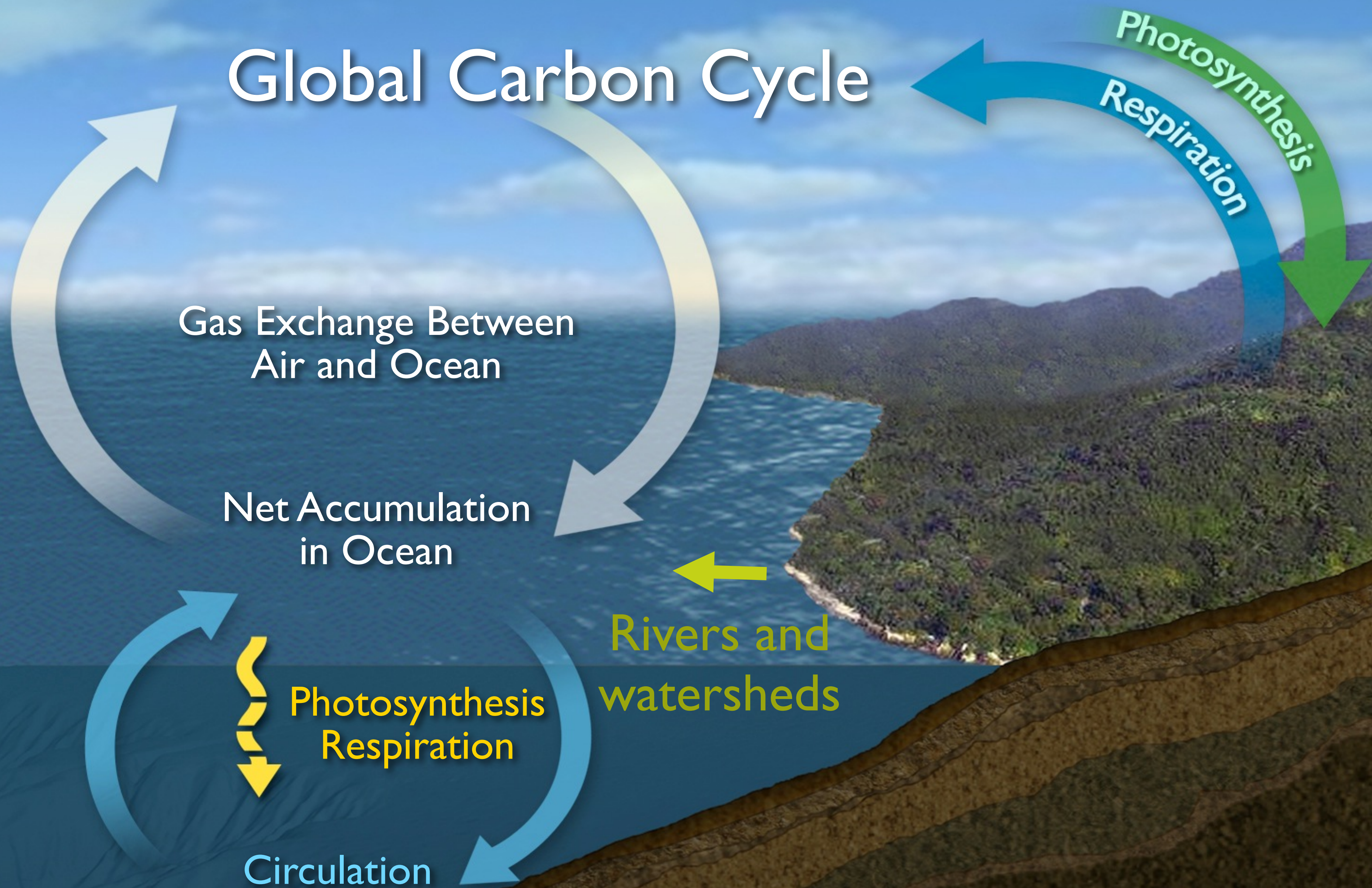
Dawn in the age of robotic ocean exploration
Rutgers Marine Science: Oscar Schofield, Scott Glenn, Josh Kohut



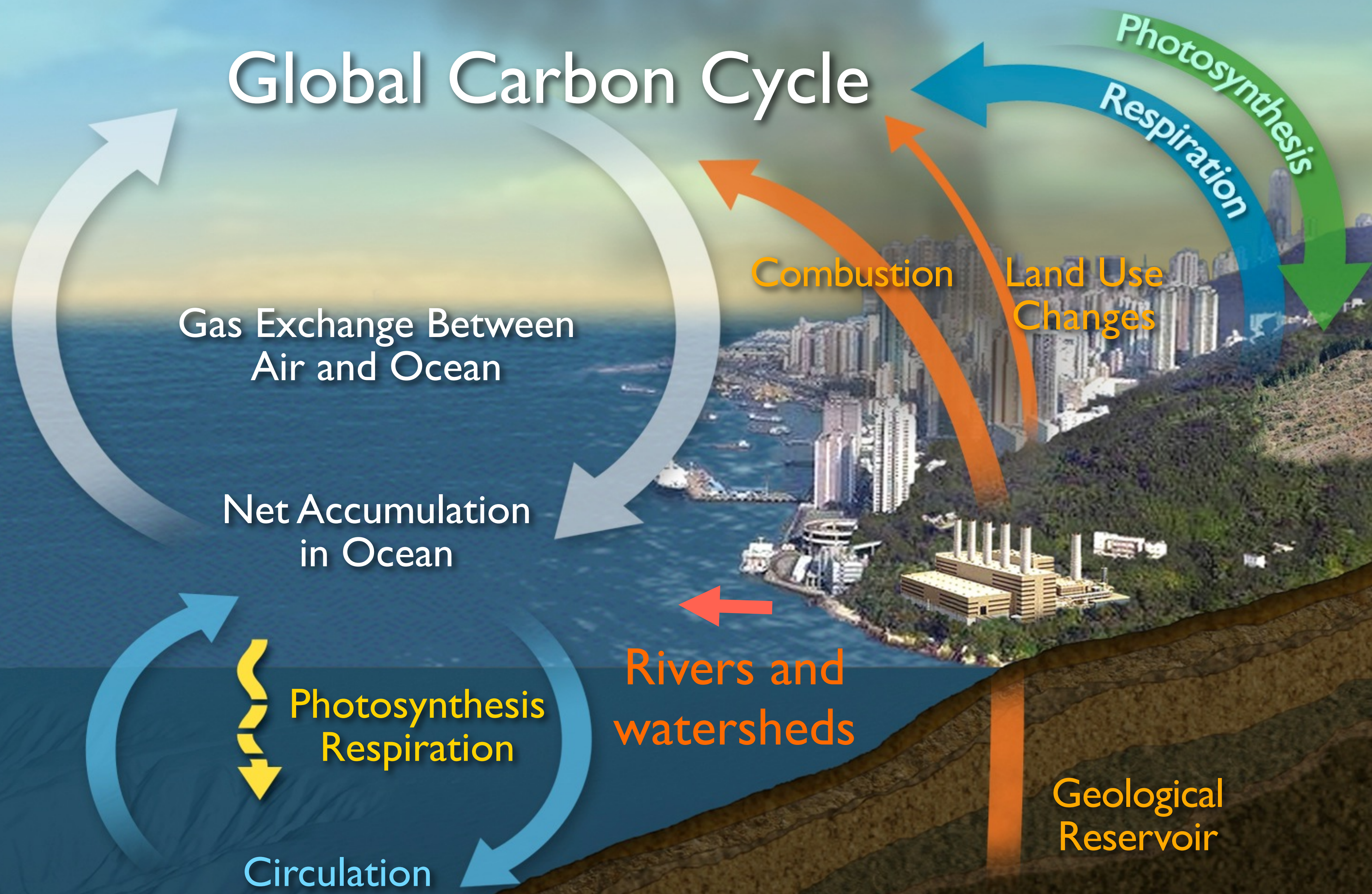


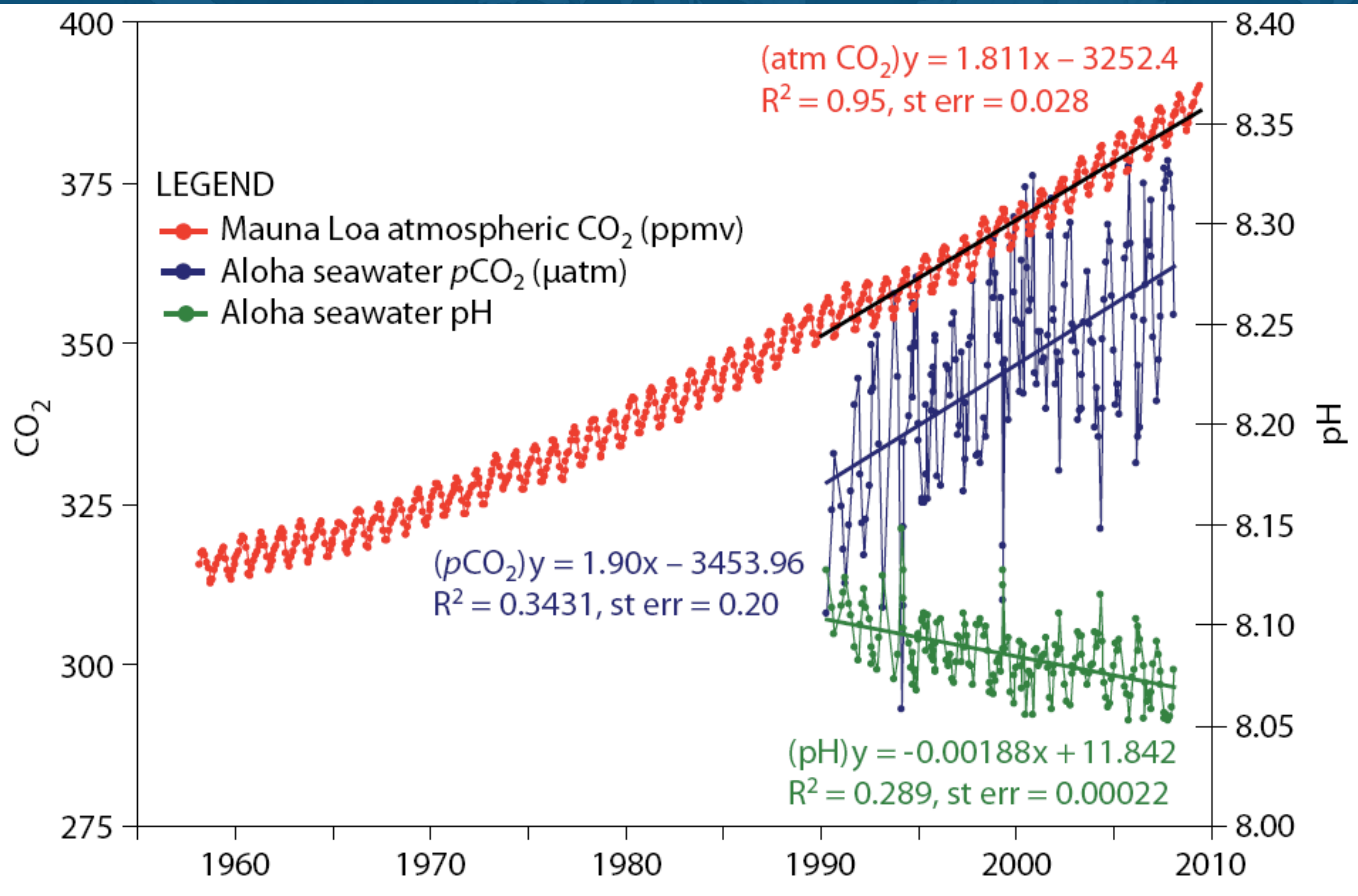


Global Carbon Cycle



Global Carbon Cycle

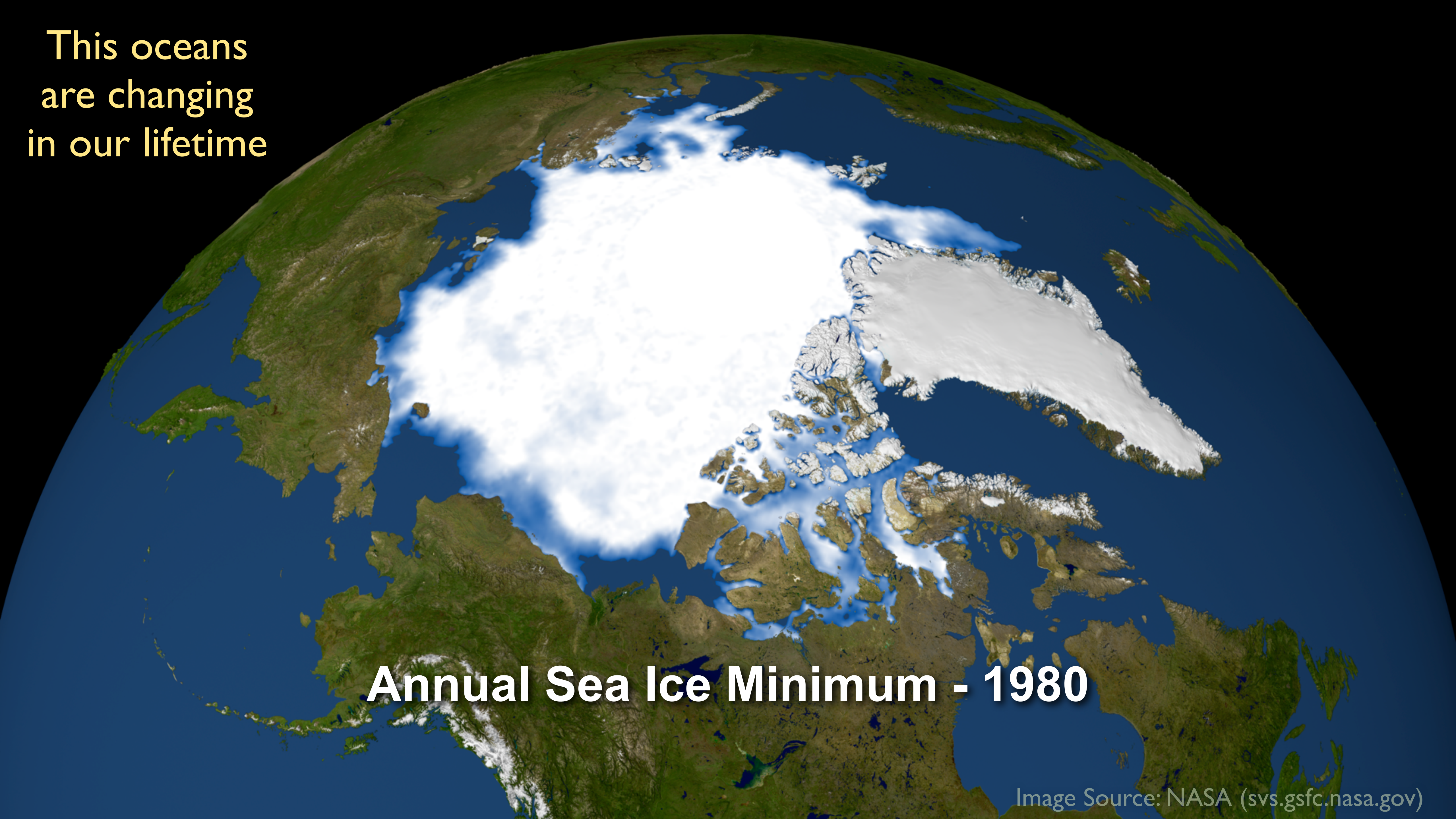




This oceans
are changing
in our lifetime

Annual Sea Ice Minimum - 1980

Image Source: NASA (svs.gsfc.nasa.gov)



This oceans
are changing
in our lifetime

Annual Sea Ice Minimum - 2007

Image Source: NASA (svs.gsfc.nasa.gov)

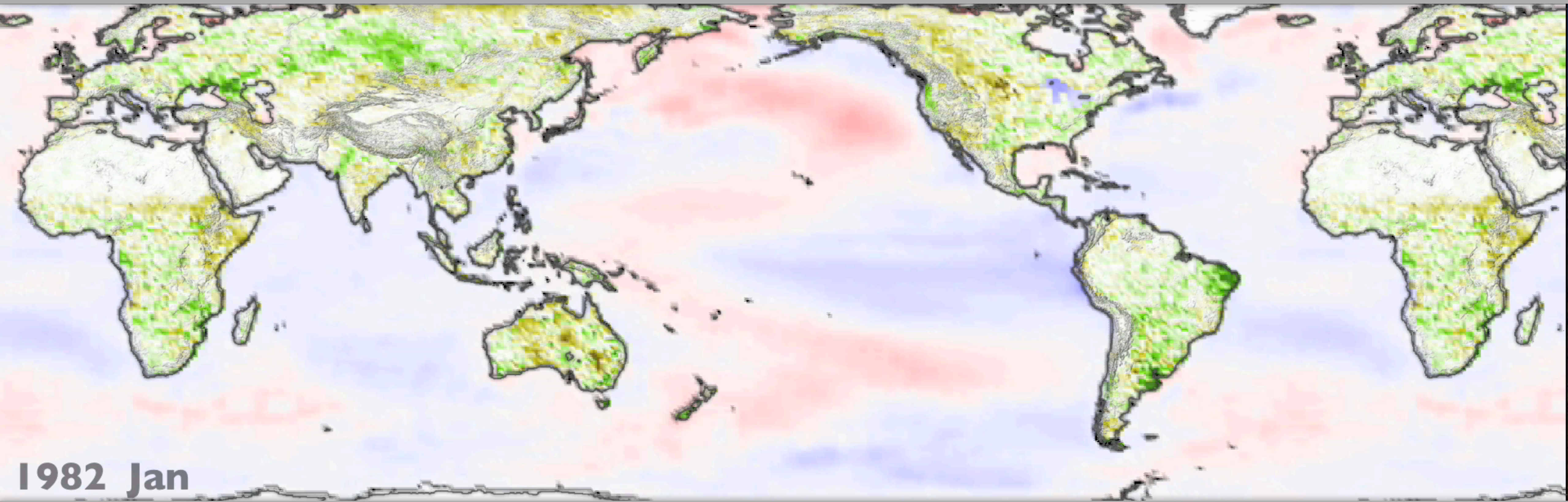
This oceans
are changing
in our lifetime



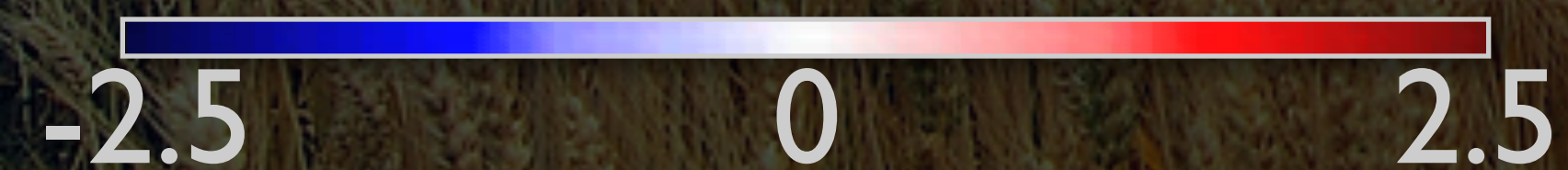
Problem: My kids

Annual Sea Ice Minimum - 2007

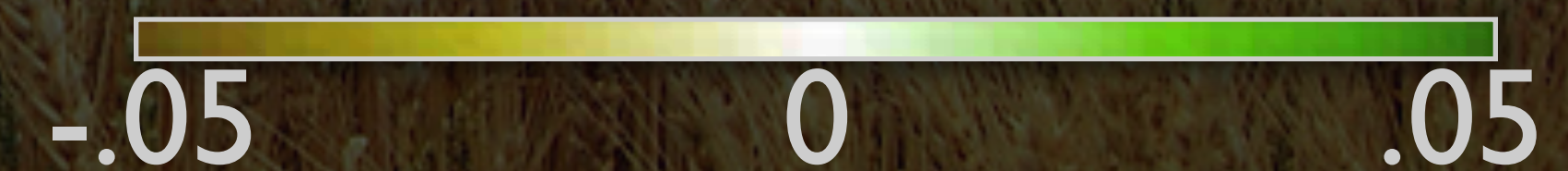
This is important for ALL humans who rely on the weather to provide them food... Everybody



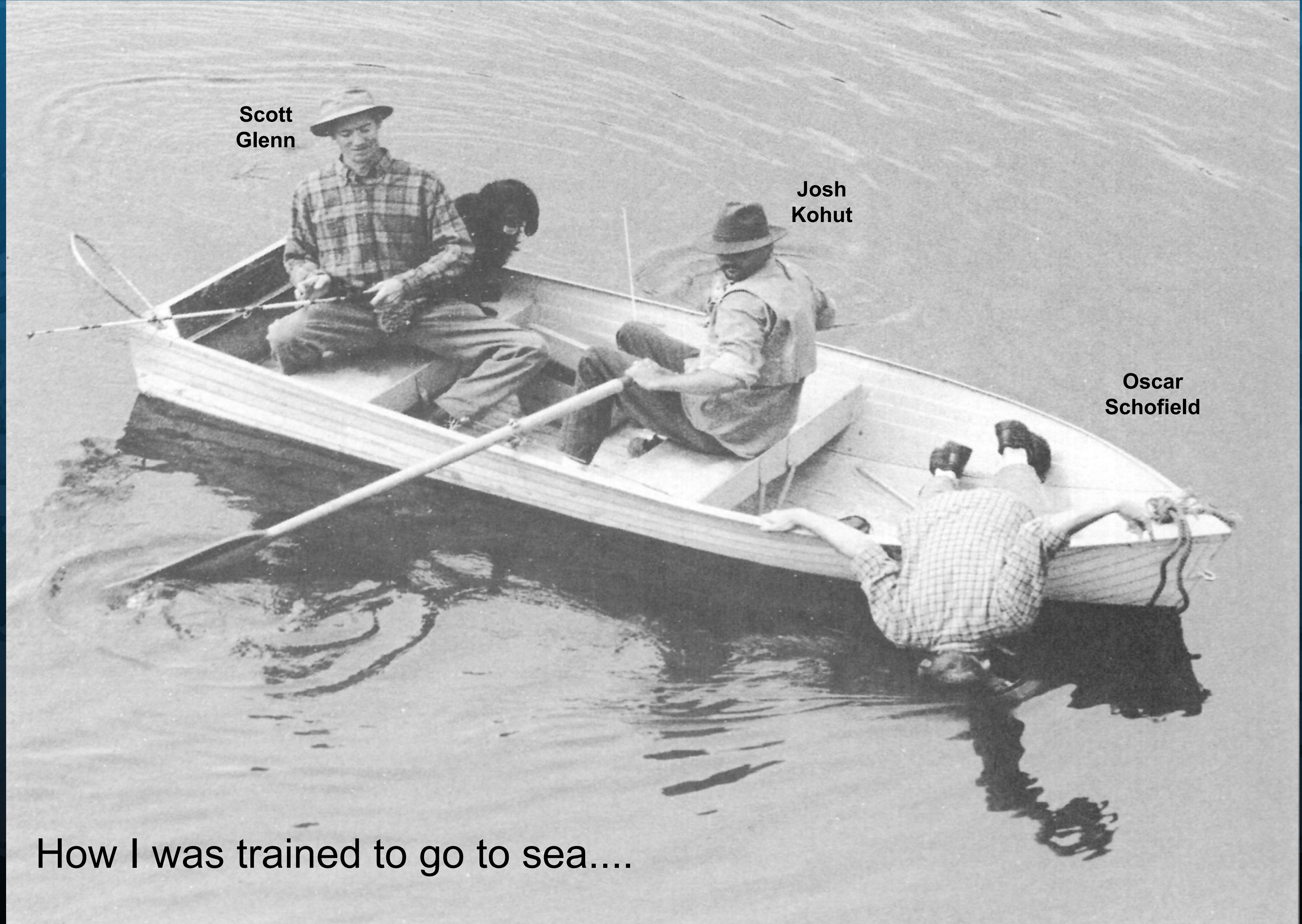
Sea Surface Temperature Anomalies



Vegetation Index Anomalies



Adapted from, Earth Observatory story:
"Watching Plants Dance to the Rhythms of the Ocean"
<http://earthobservatory.nasa.gov/Study/SSTNDVI/>



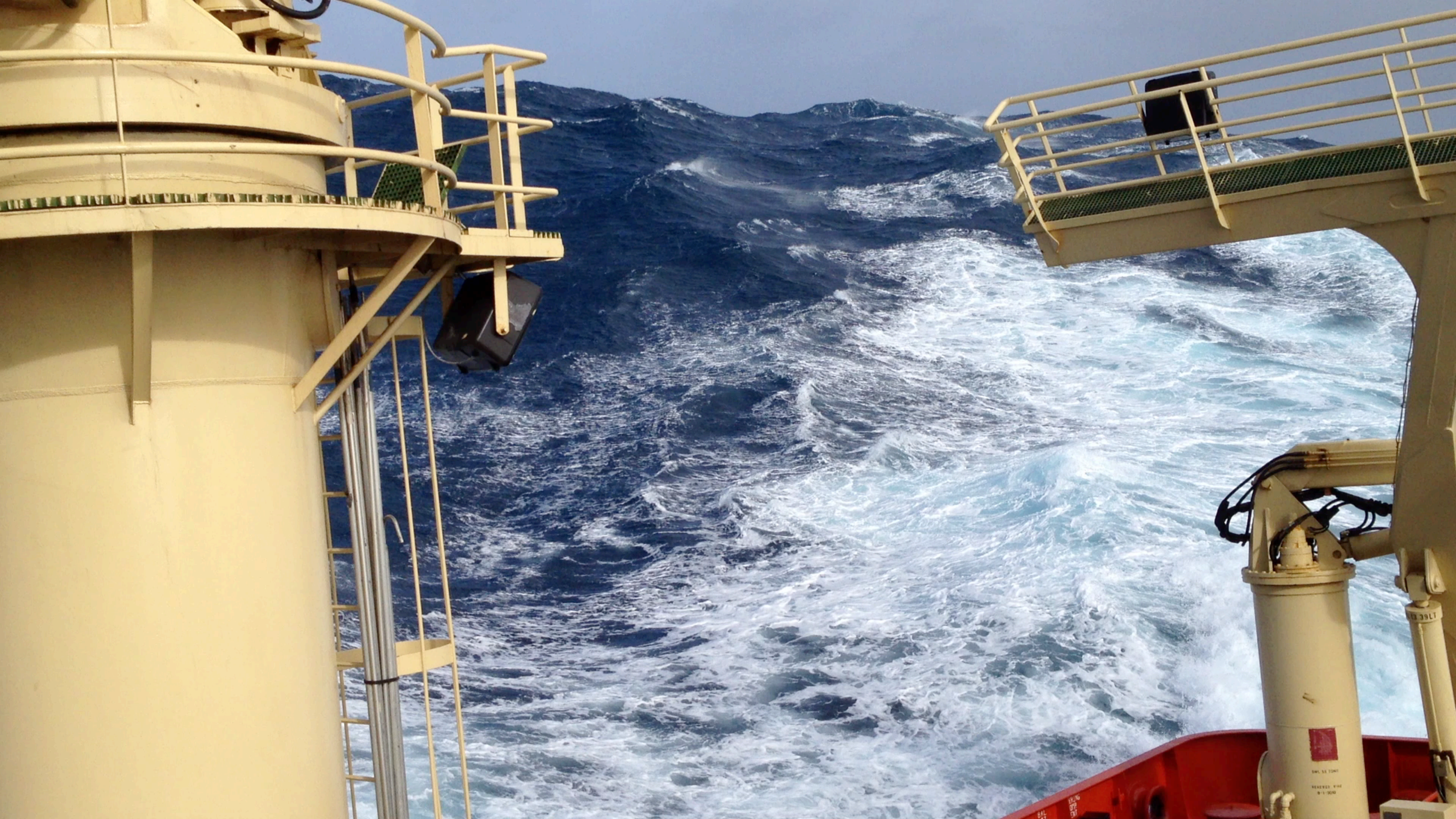
**Scott
Glenn**

**Josh
Kohut**

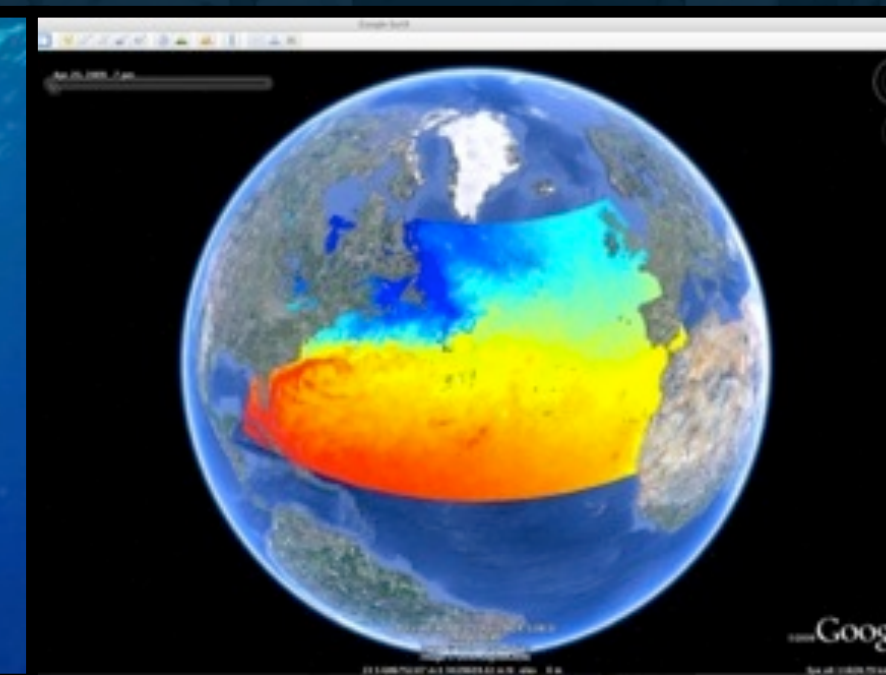
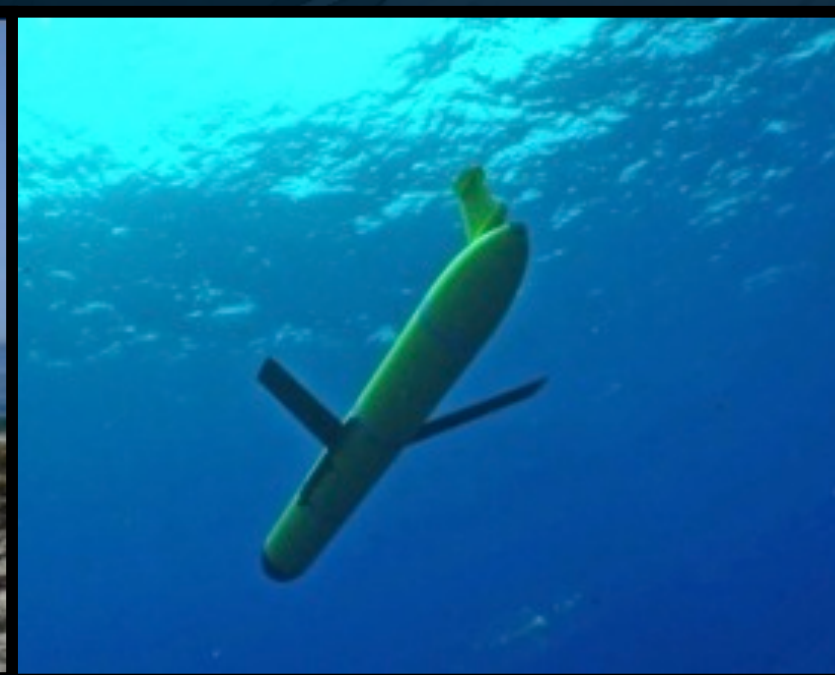
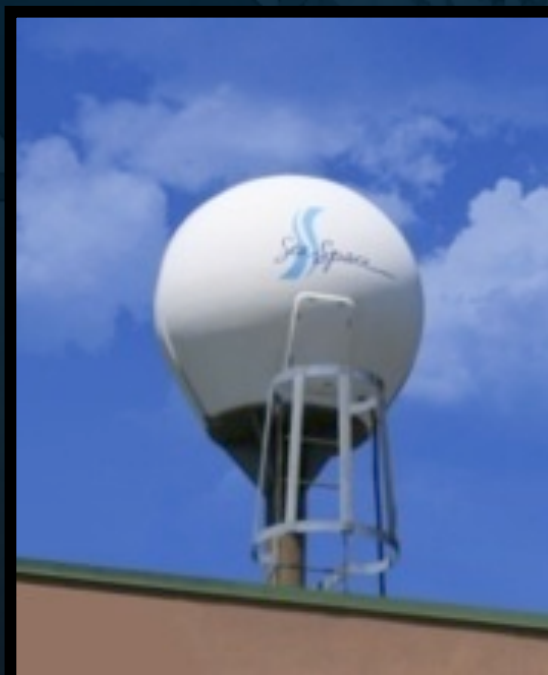
**Oscar
Schofield**

How I was trained to go to sea....





The COOL Room



Satellite Data Acquisition Stations

CODAR Network

Glider Fleet

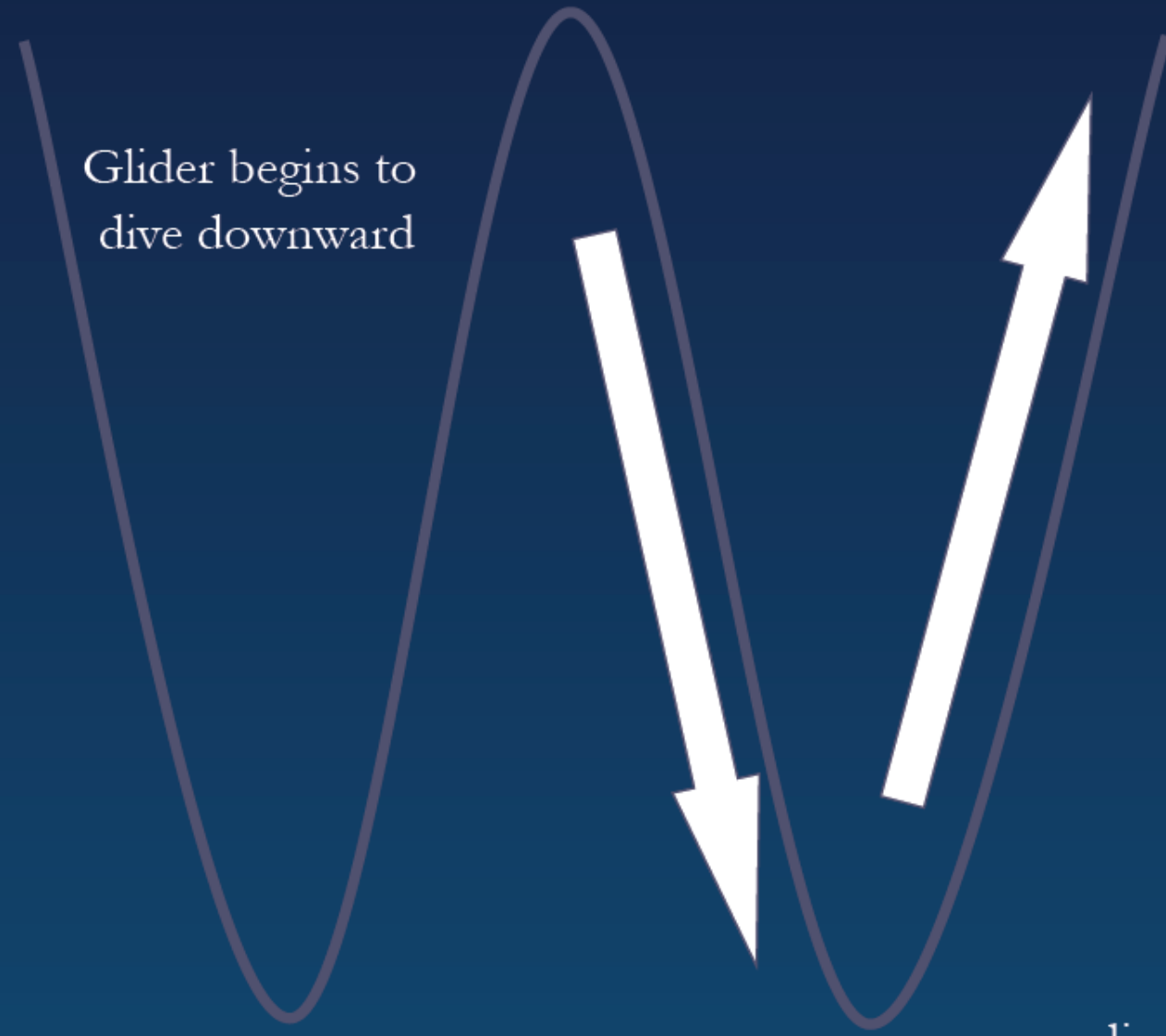
3-D Forecasts

How do Gliders "Fly"?

Buoyancy pump in ← the glider pulls in 0.5 L of water

When surfacing to connect glider inflates air bladder

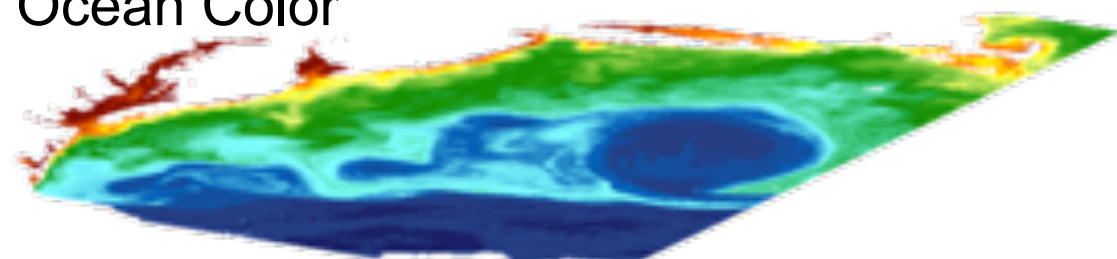
Glider begins to dive downward



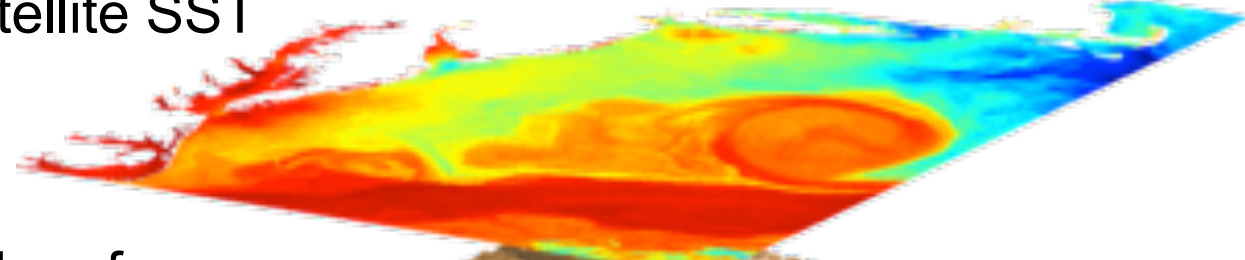
Subsurface glider network



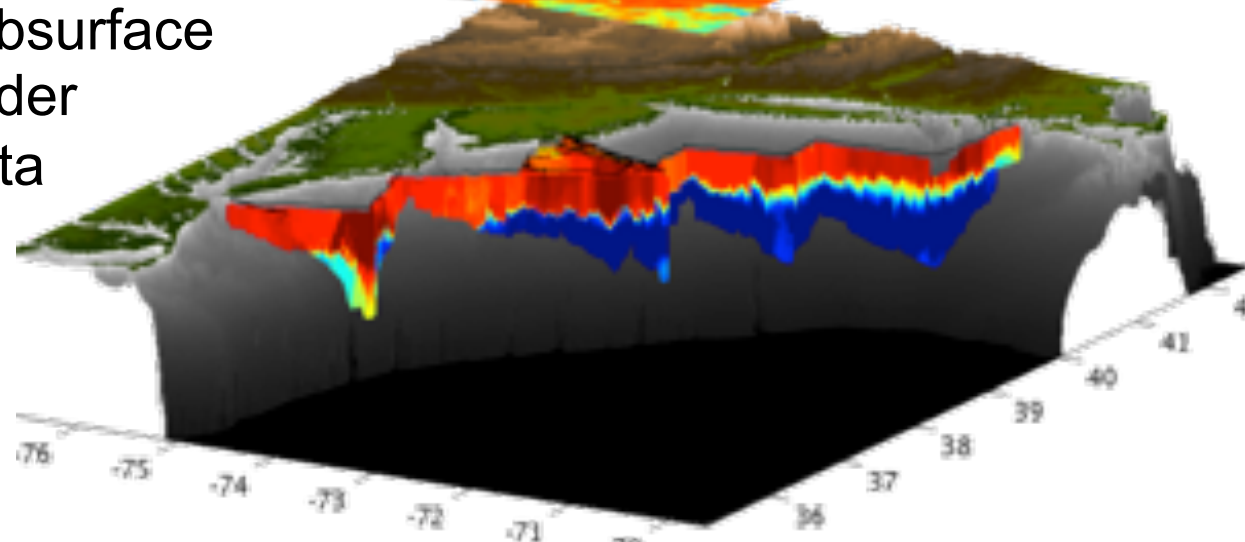
Satellite Ocean Color



Satellite SST

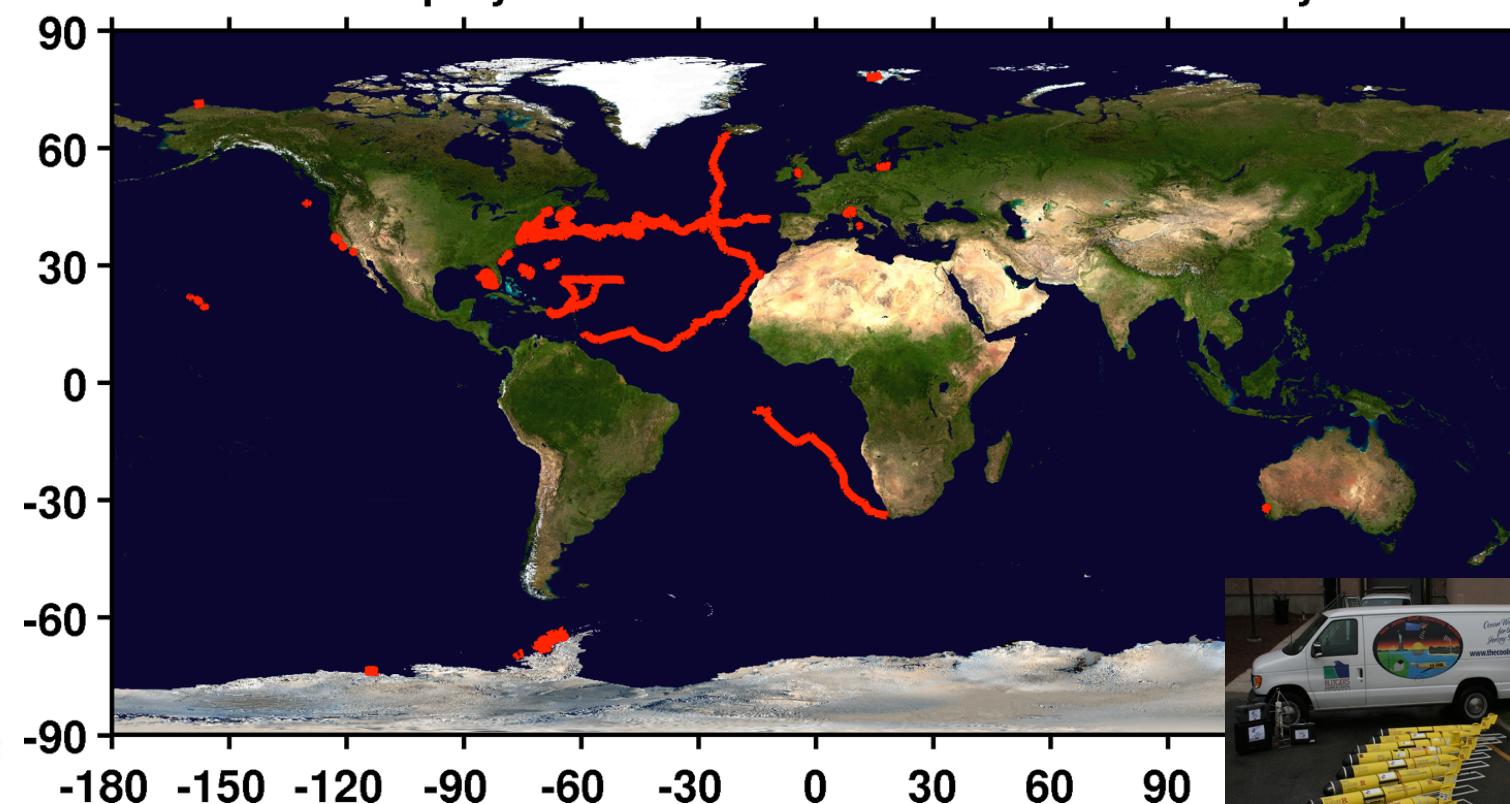


Subsurface
Glider
Data



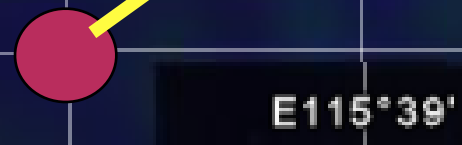
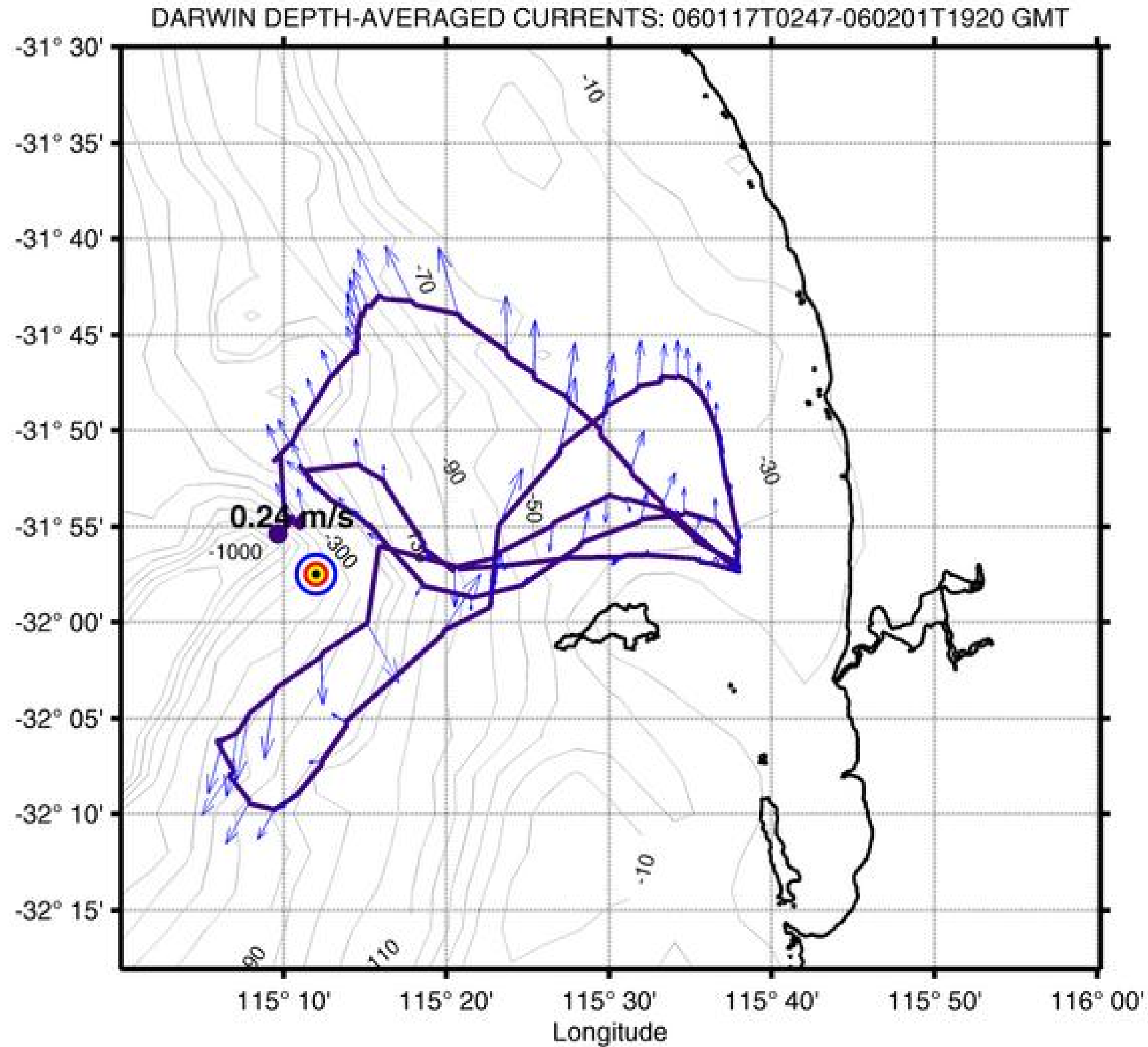
Industry Partner: Teledyne Webb Research

349 deployments - 148603.54km flown - 7011 days

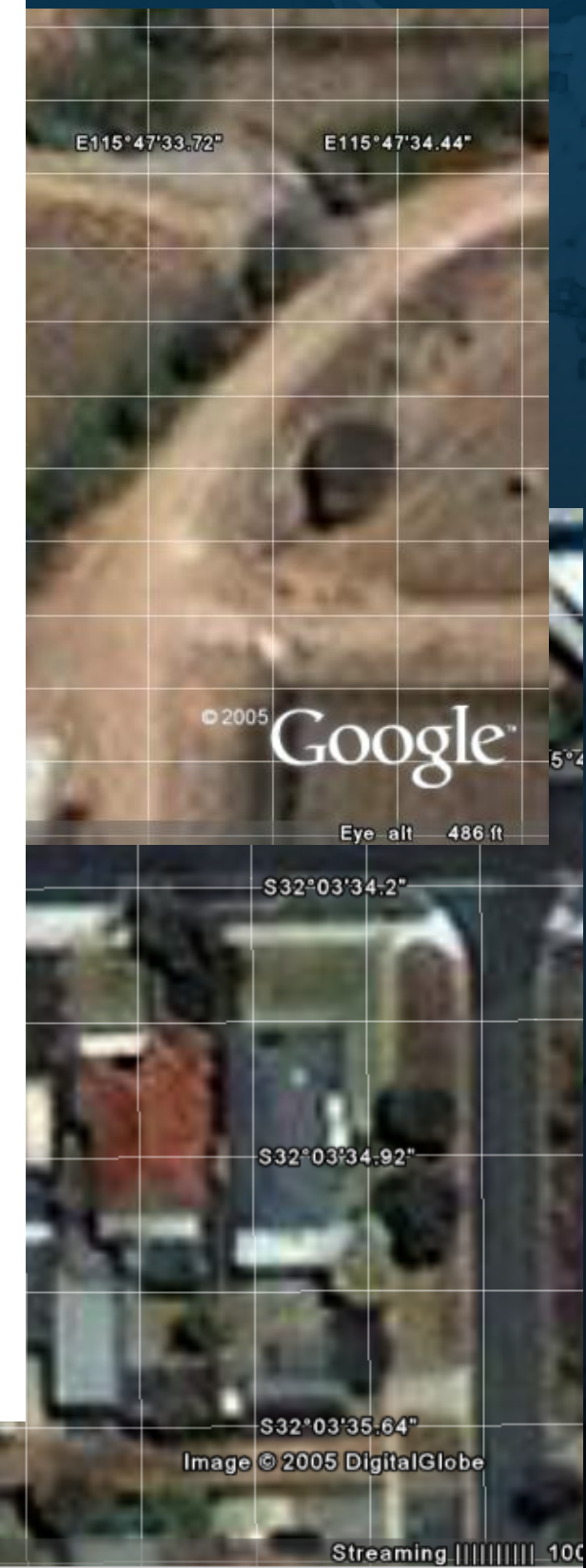


 **TELEDYNE
WEBB RESEARCH**
Everywhere you look™

Just another day in the Cool Room: Darwin's Odyssey

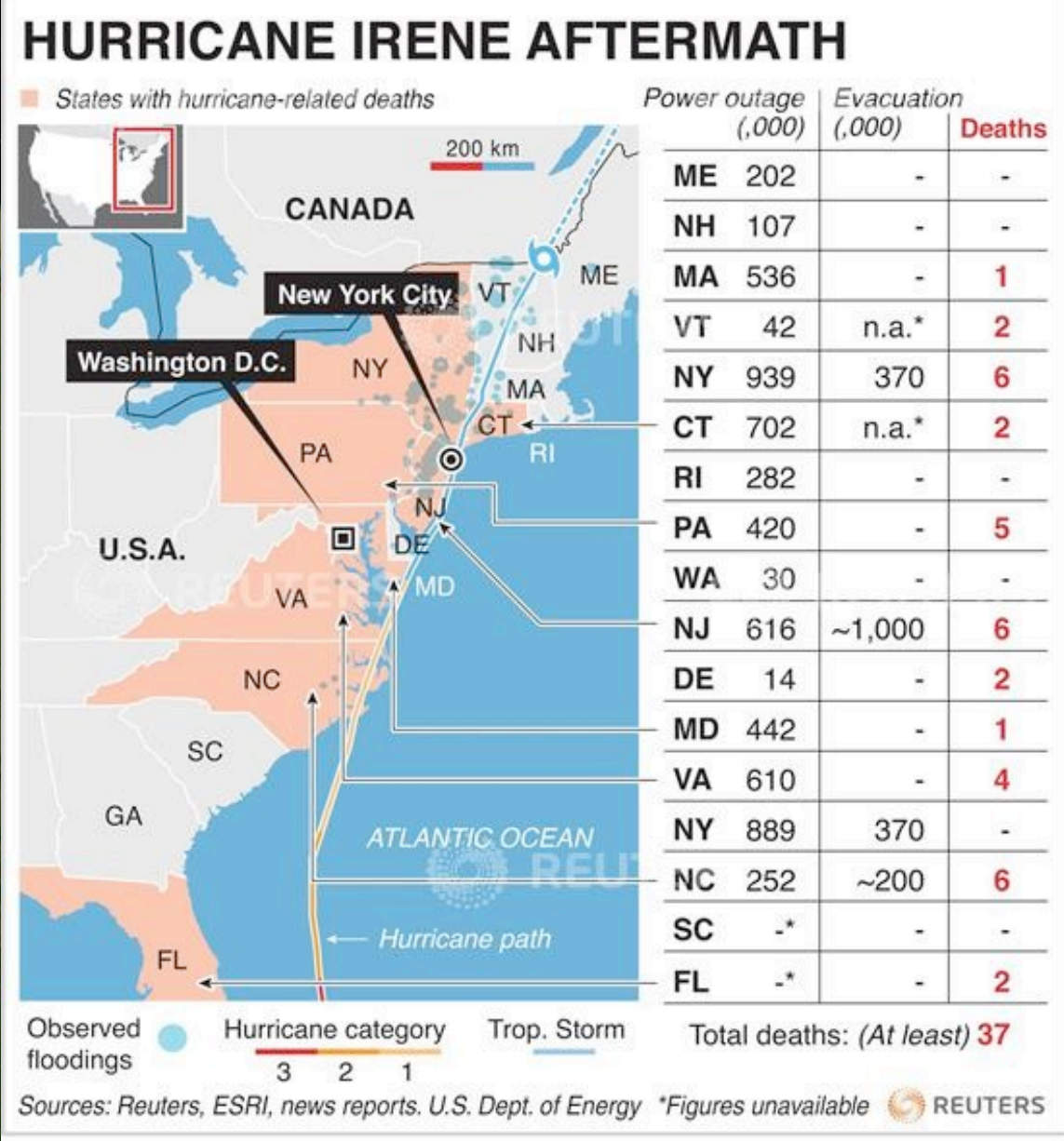
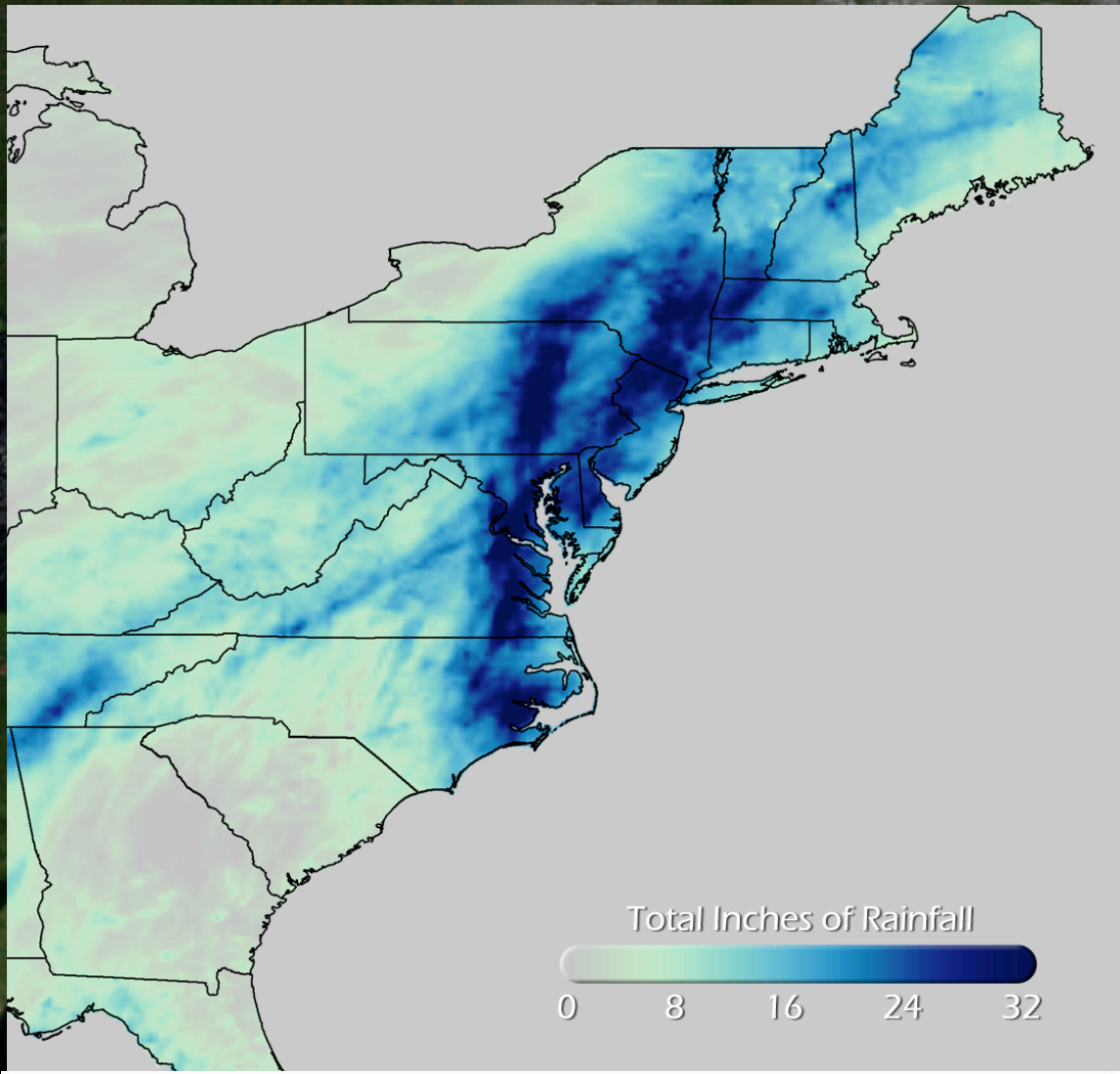


E115°39'



115°46'54.74" E

Hurricane Irene



- First tropical storm to threaten NYC since Hurricane Gloria in 1985
- Flooding records broken in 26 rivers
 - Caused at least 56 deaths
 - Damage nearly \$8 billion

Hurricanes

Sunday, 02.19.12 Welcome Guest •

HOME NEWS SPORTS ENTE

Miami-Dade | Broward | Keys |

Posted on Friday, 09.02.11

HURRICANE SEASON

Intensity remain

f Like 1

The National Hurricane Center says it wasn't the first time — but the increasing standards of

BY CURTIS MORGAN
MORGAN@MIAMIHERALD.COM

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

POLITICS EDUCATION BAY AREA CHICAGO TEXAS

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Challenges in Predicting the Intensity of Storms

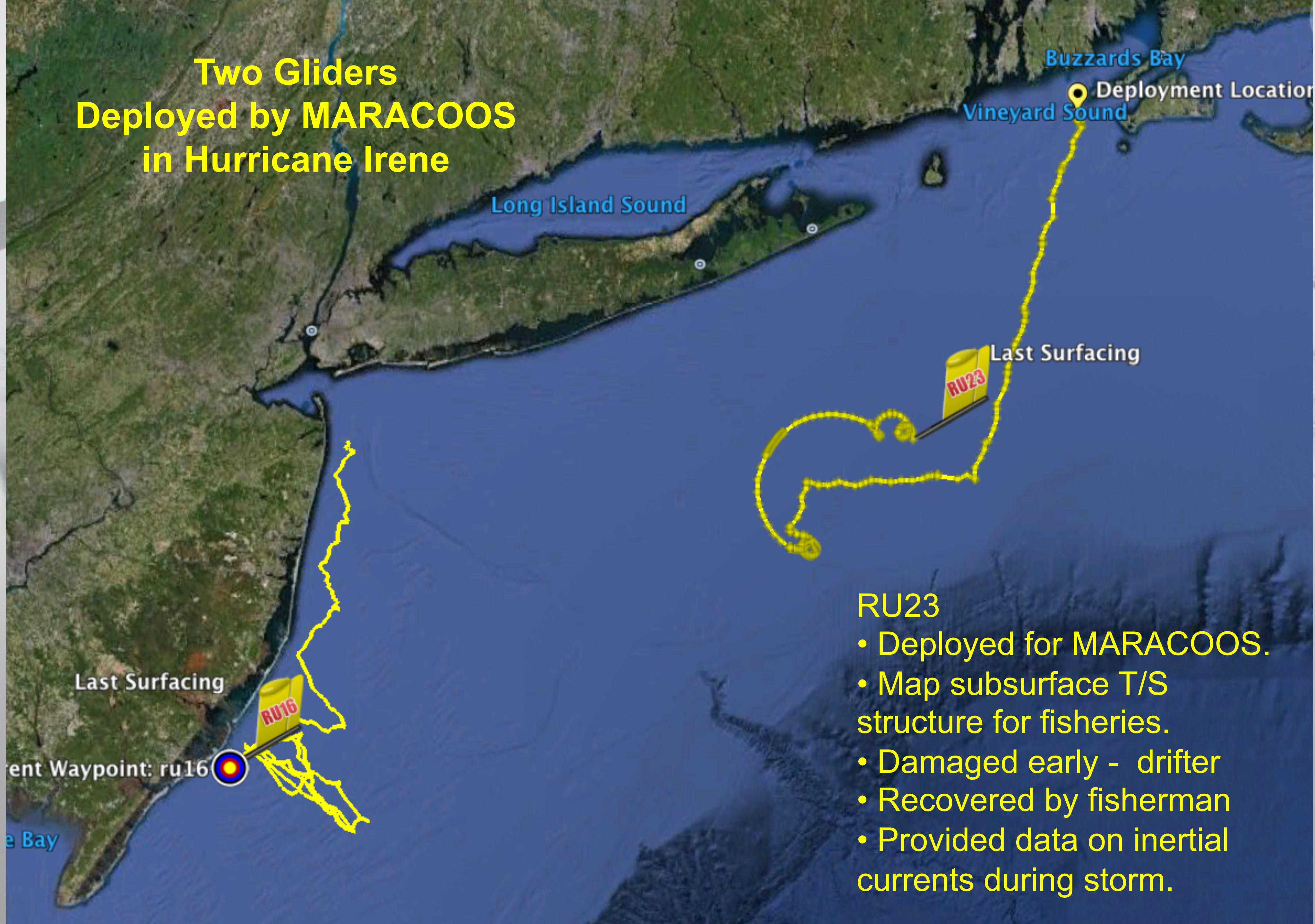


Andy Newman/Associated Press

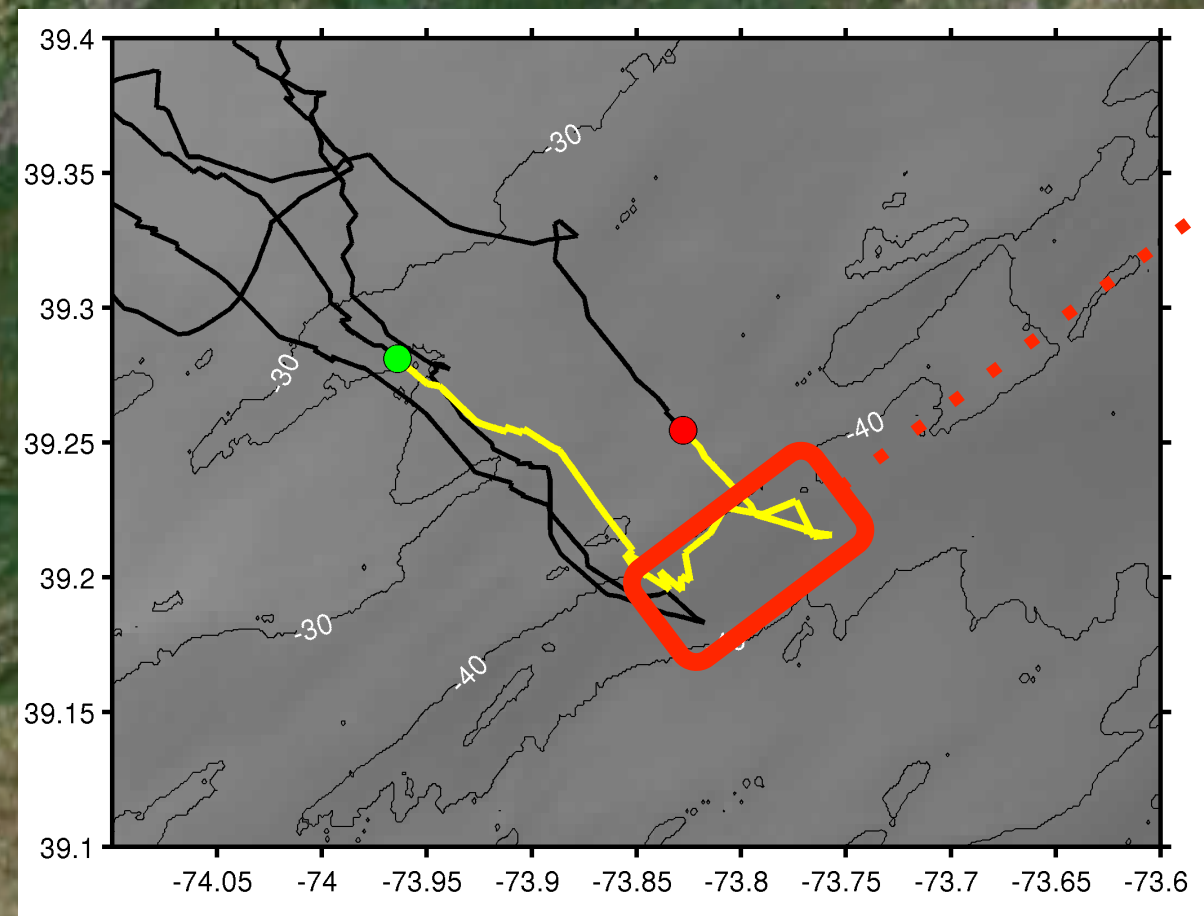
Scientists say that it is much easier to accurately predict what path a hurricane will take.

By HENRY FOUNTAIN
Published: August 27, 2011

Two Gliders Deployed by MARACOOS in Hurricane Irene



- RU23**
- Deployed for MARACOOS.
 - Map subsurface T/S structure for fisheries.
 - Damaged early - drifter
 - Recovered by fisherman
 - Provided data on inertial currents during storm.



Hurricane Irene

Long Island Sound

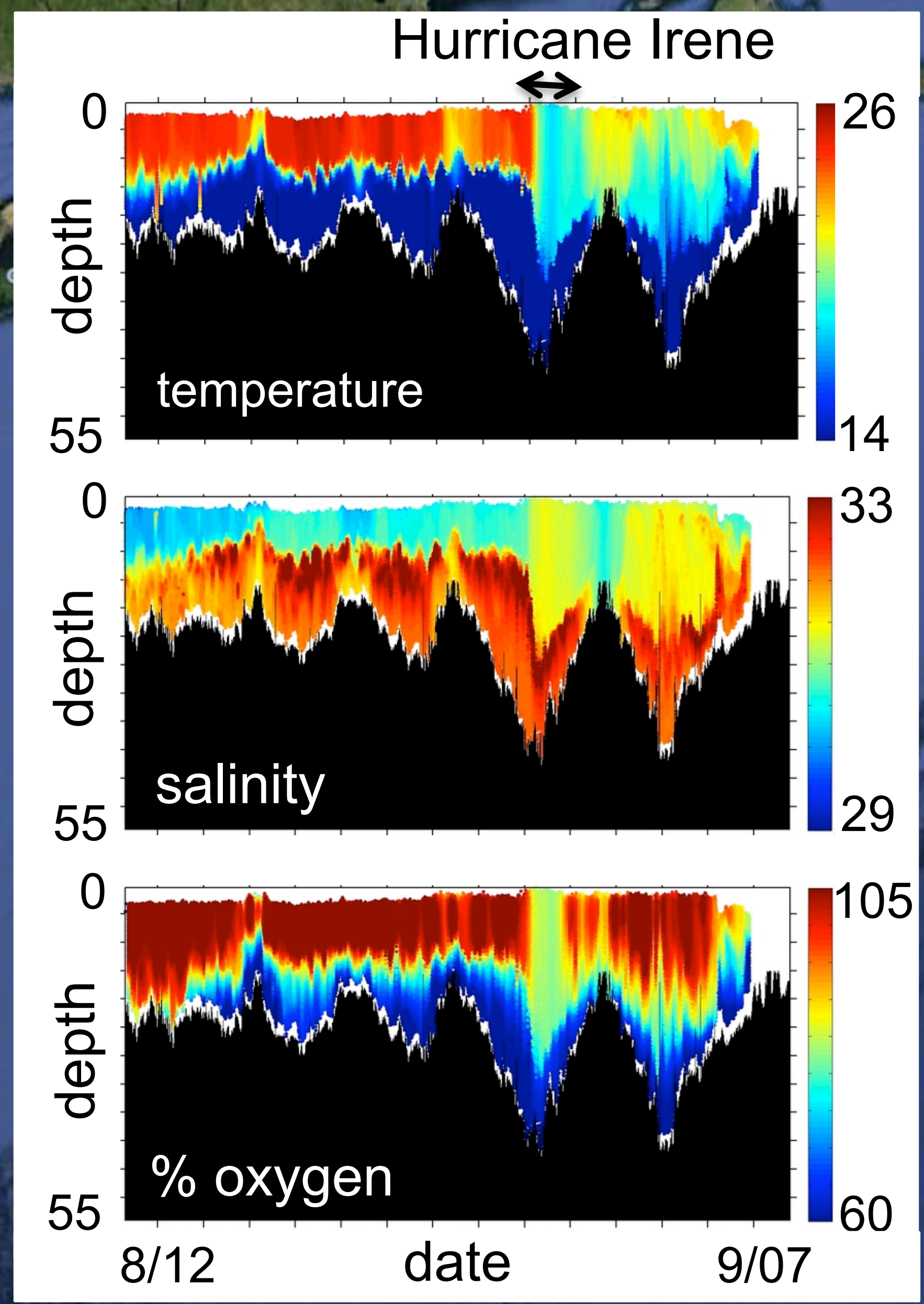
Buzzards Bay

Last Surfacing

Current Waypoint: ru16

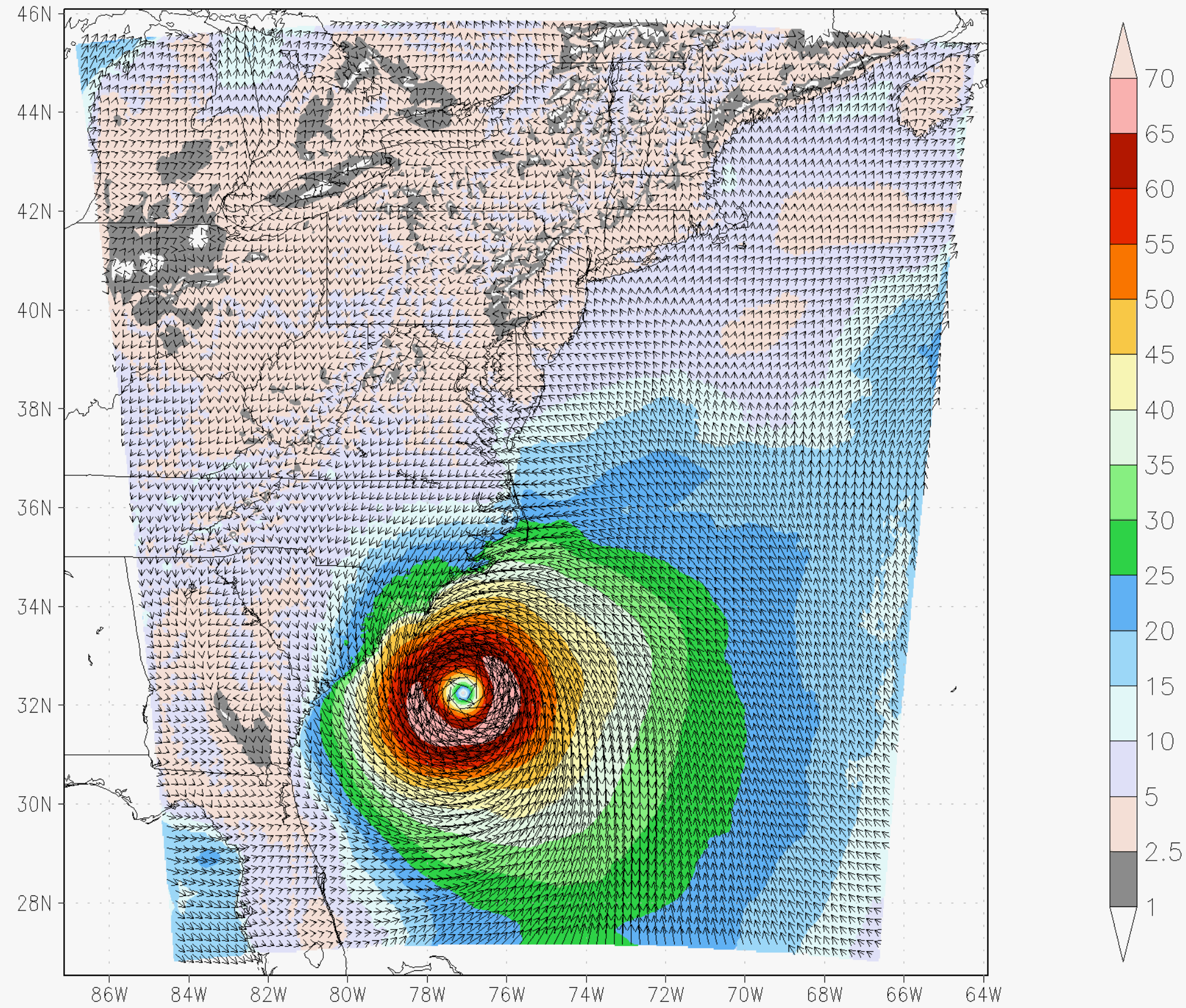


Delaware Bay



Warm water (standard)

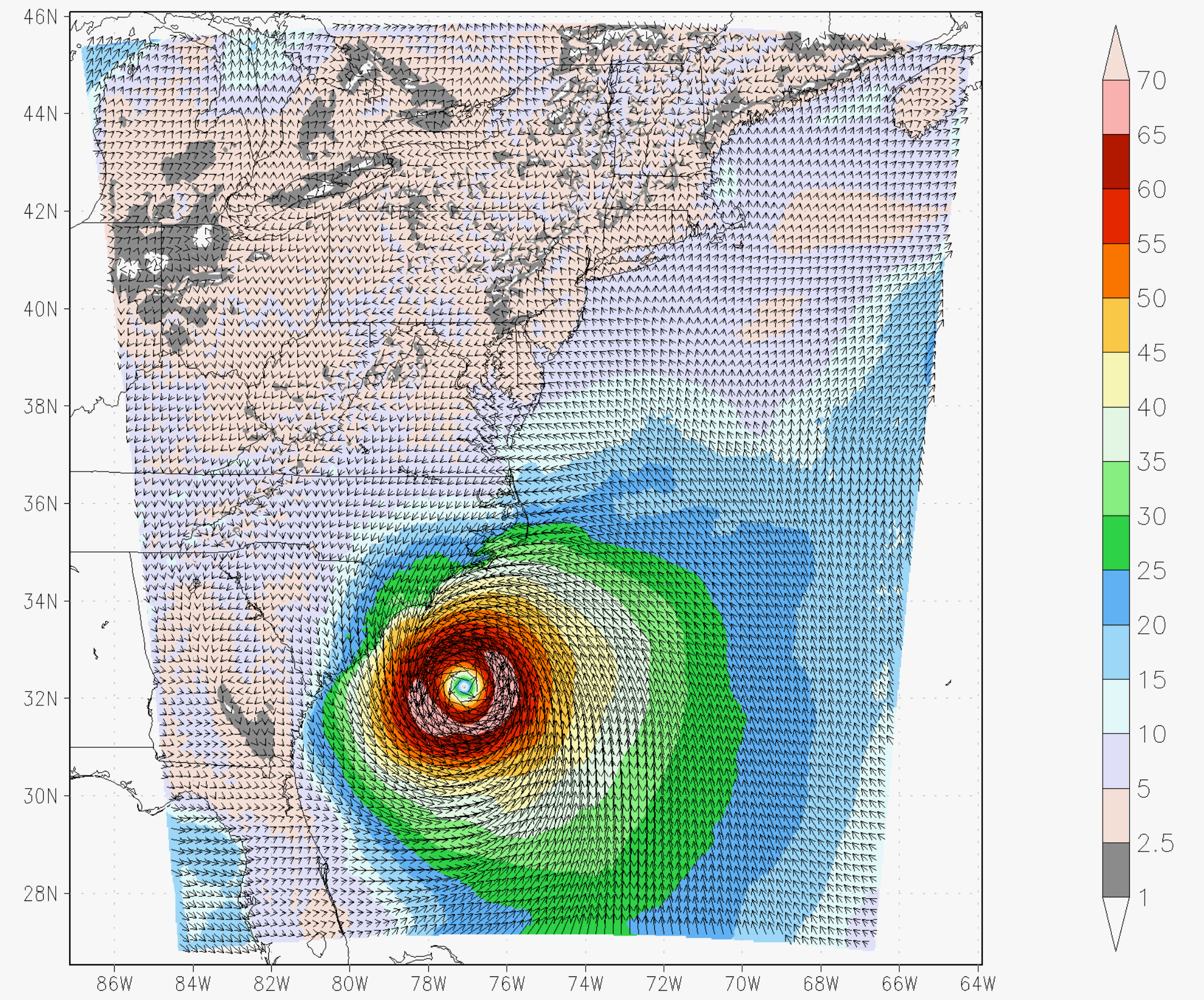
Wind Speed at 10 m [kts]



RU Coastal Ocean Observation Lab: WRF-ARW 6 KM
<http://marine.rutgers.edu/cool/weather> Model Initialized 00Z27AUG2011
Valid 00Z27AUG2011 (Sat) | Forecast Hour 0

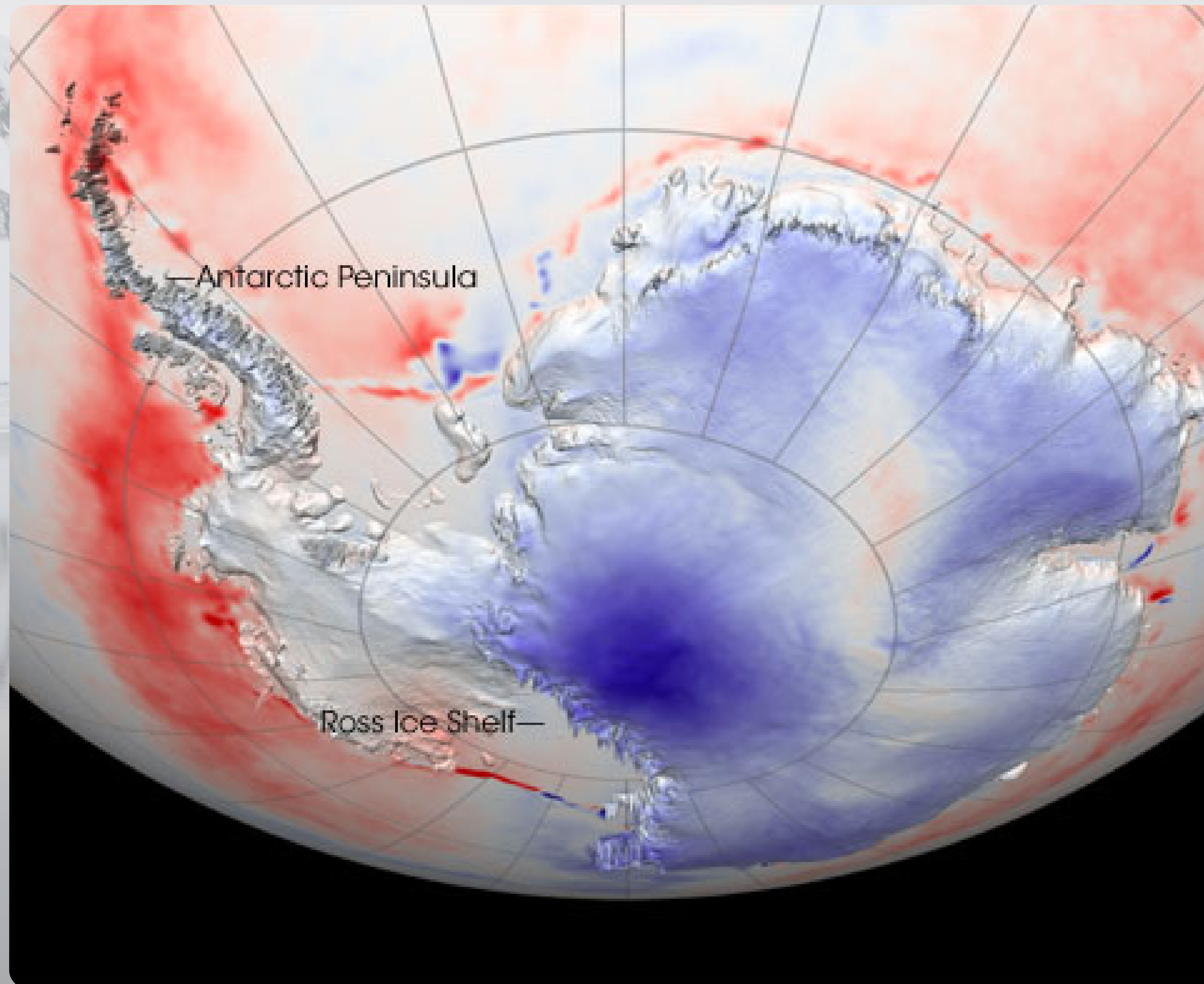
Cold water (glider)

Wind Speed at 10 m [kts]

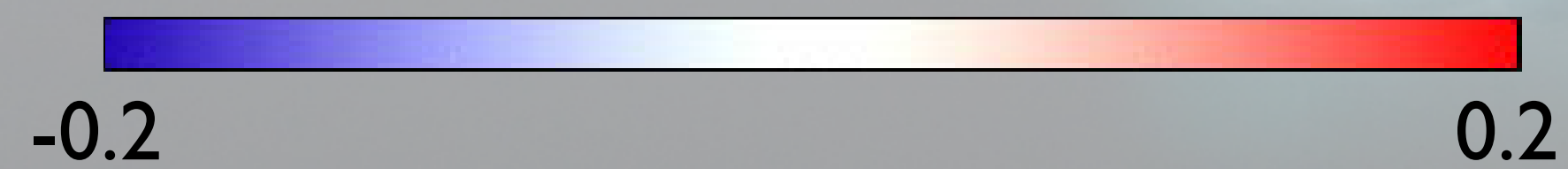


RU Coastal Ocean Observation Lab: WRF-ARW 6 KM
<http://marine.rutgers.edu/cool/weather> Model Initialized 00Z27AUG2011
Valid 00Z27AUG2011 (Sat) | Forecast Hour 0

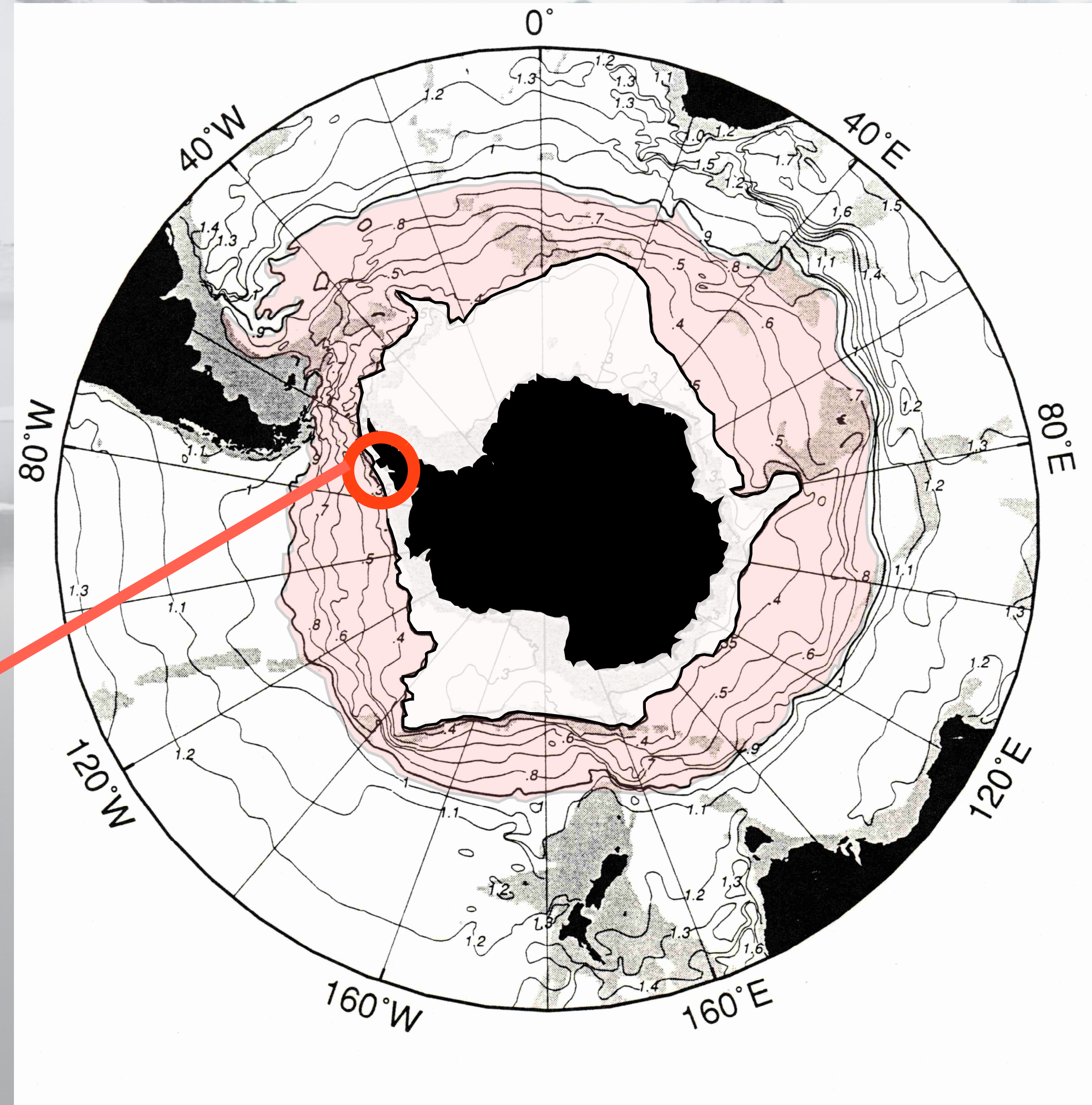




Temperature Trends (degrees C per year)



Heat input from Antarctic Circumpolar Current (ACC - world's largest ocean current = ~30,000 Niagara Falls). The heat is driven onto the shelf by intensification of upwelling-favorable winds.



The WAP is the only location in the Antarctic where the ACC is adjacent to the shelf break. The ACC is Antarctica's warmest water

The WAP peninsula is experiencing the largest winter warming on Earth

Larson-B ice shelf after its collapse
Thanks to BAS & A. Clarke



Melt pools on surface of King George VI Sound

(from a BAS twin otter, January 2004)





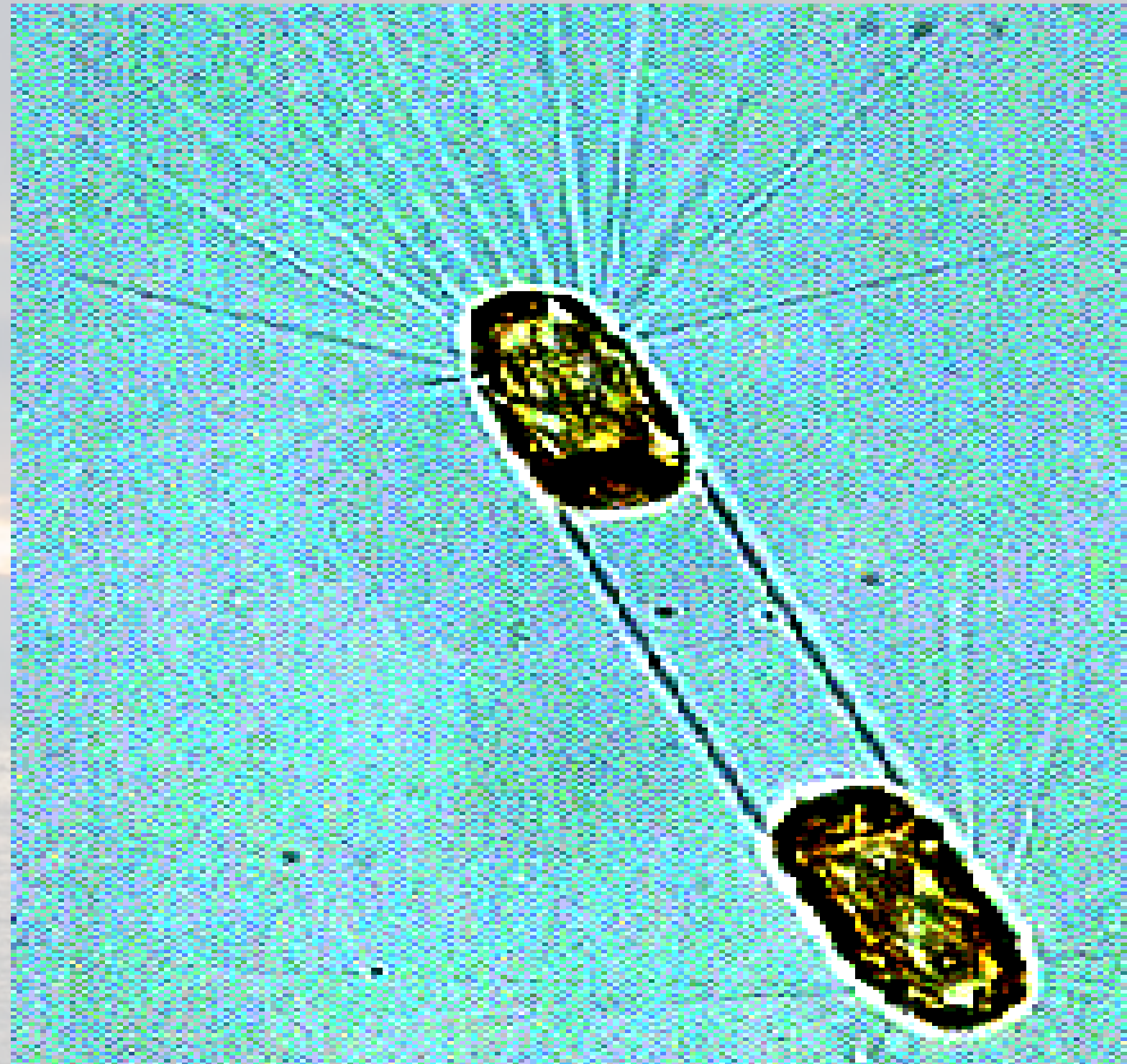
Palmer Station in the present



photo by Bill Fraser

Plants at Palmer Station, the greening of Antarctica

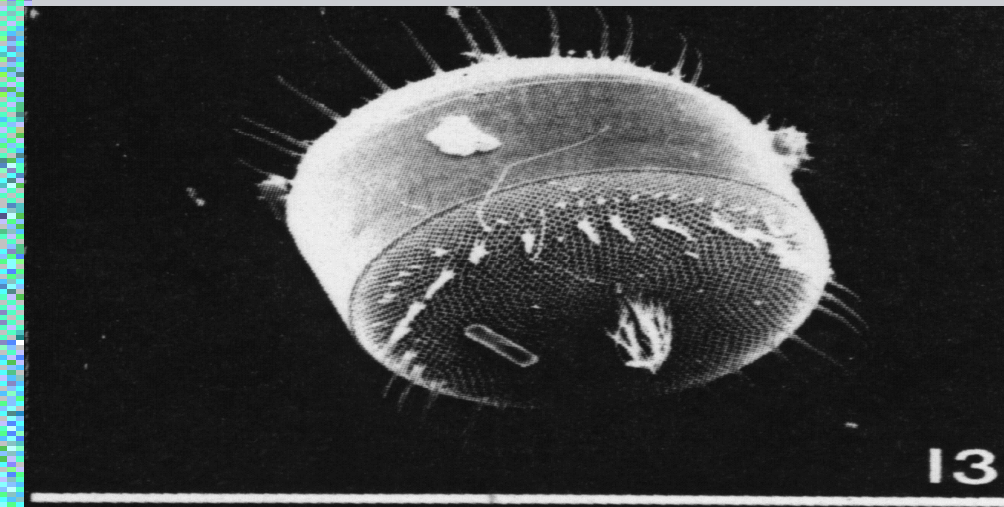




Corethron criophilum

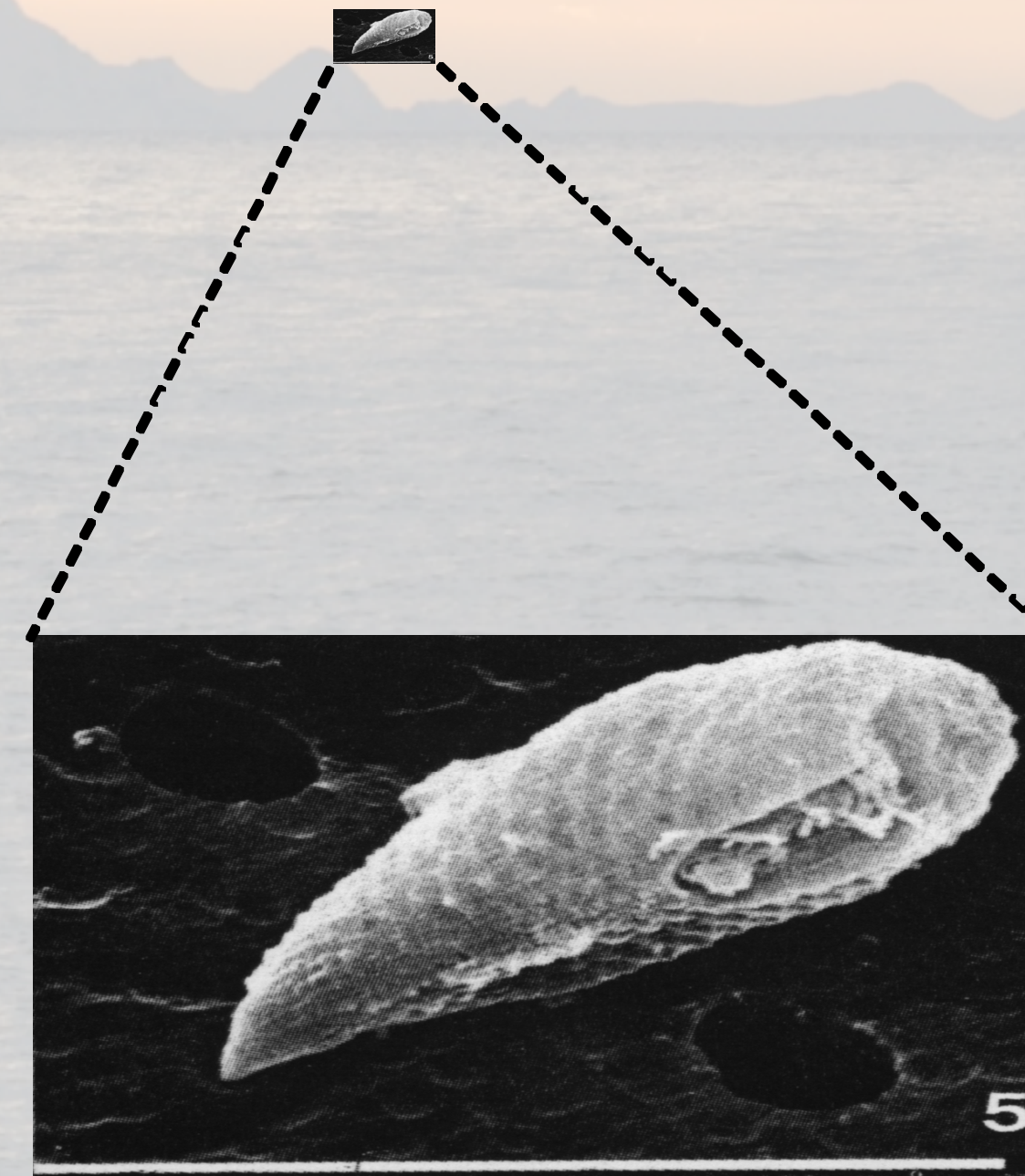
Palmer Cryptophytes --> $8 \pm 2\mu\text{m}$

SEM Micrographs from McMinn and Hodgson 1993



100 μm

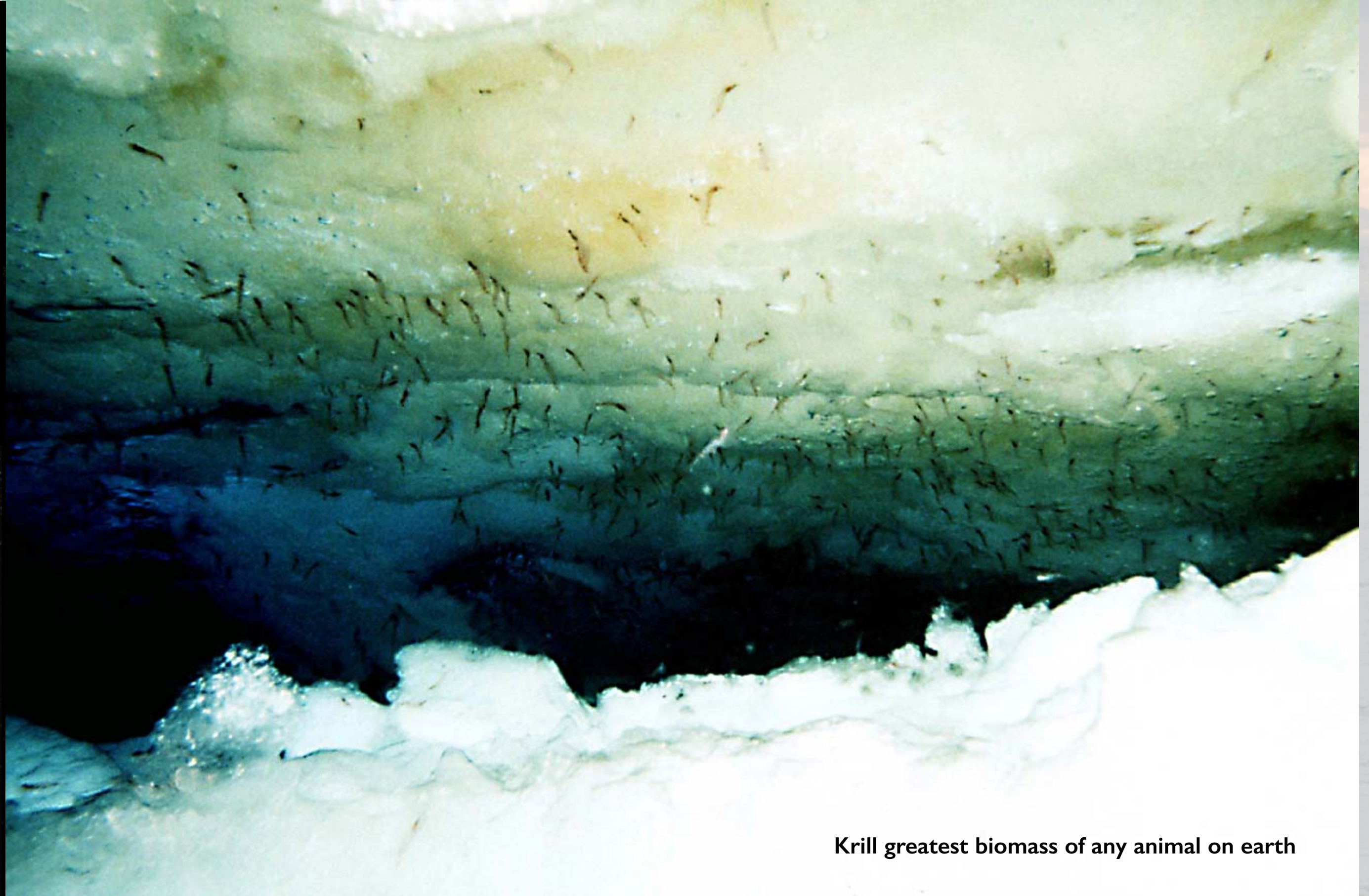
Thalassiosira antarctica



10 μm

Cryptomonas cryophila

Zooplankton are dominated by krill or salps



Krill greatest biomass of any animal on earth

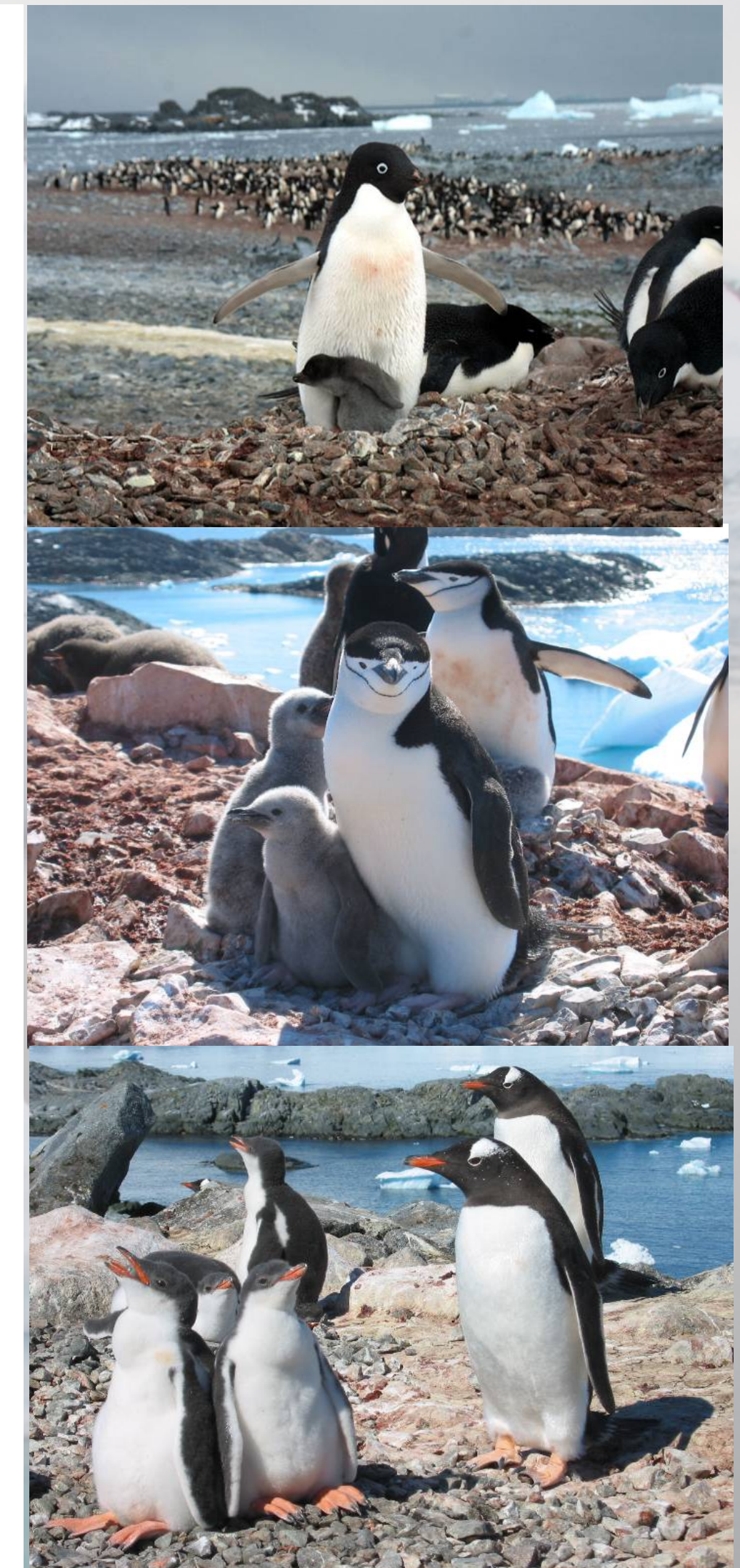
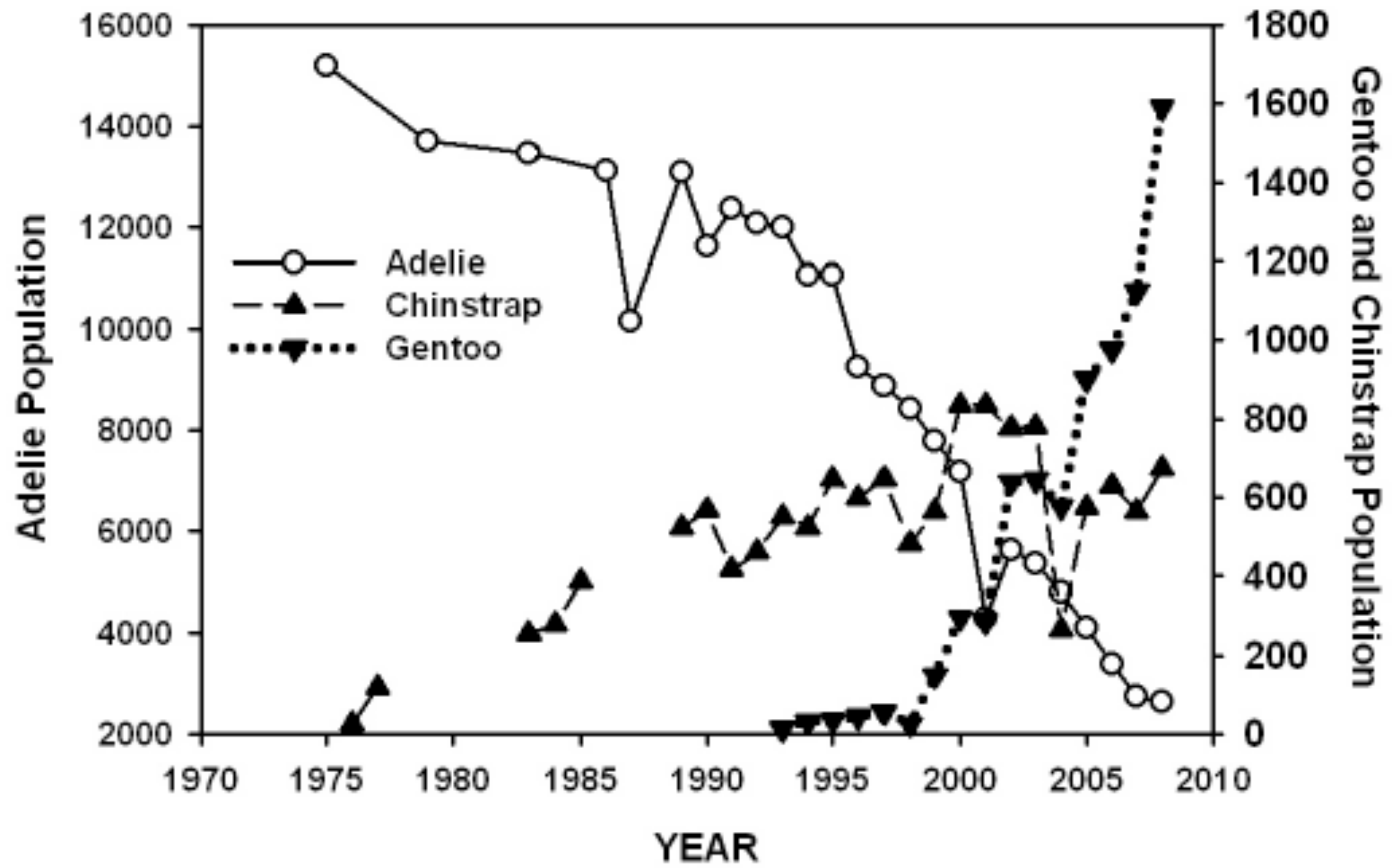




Is there an impact on higher trophic levels?

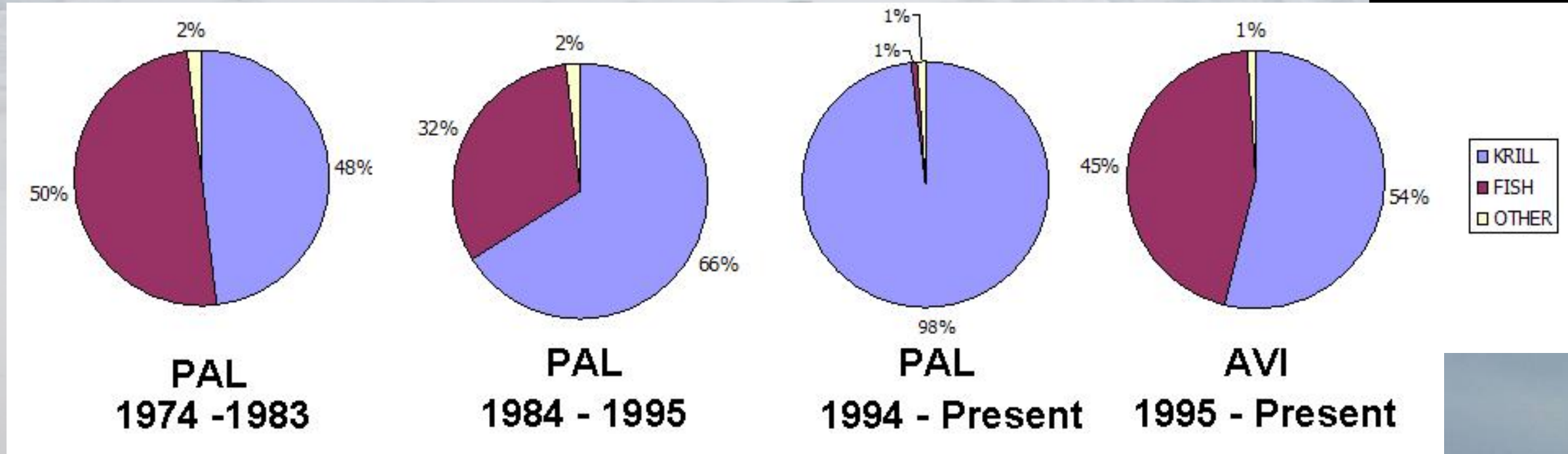
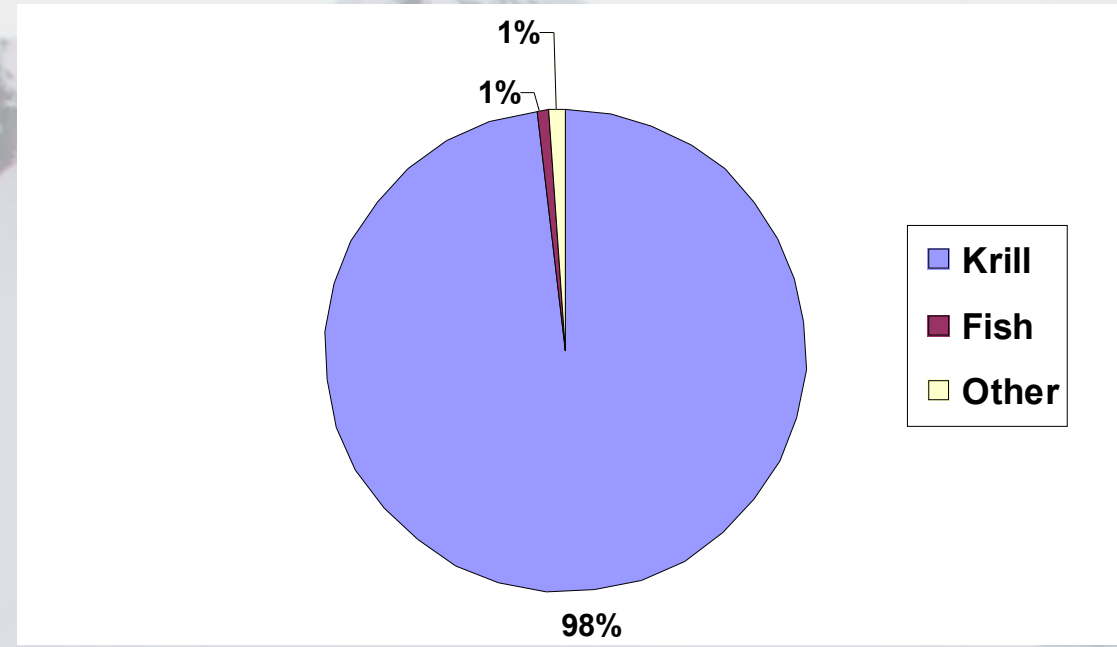




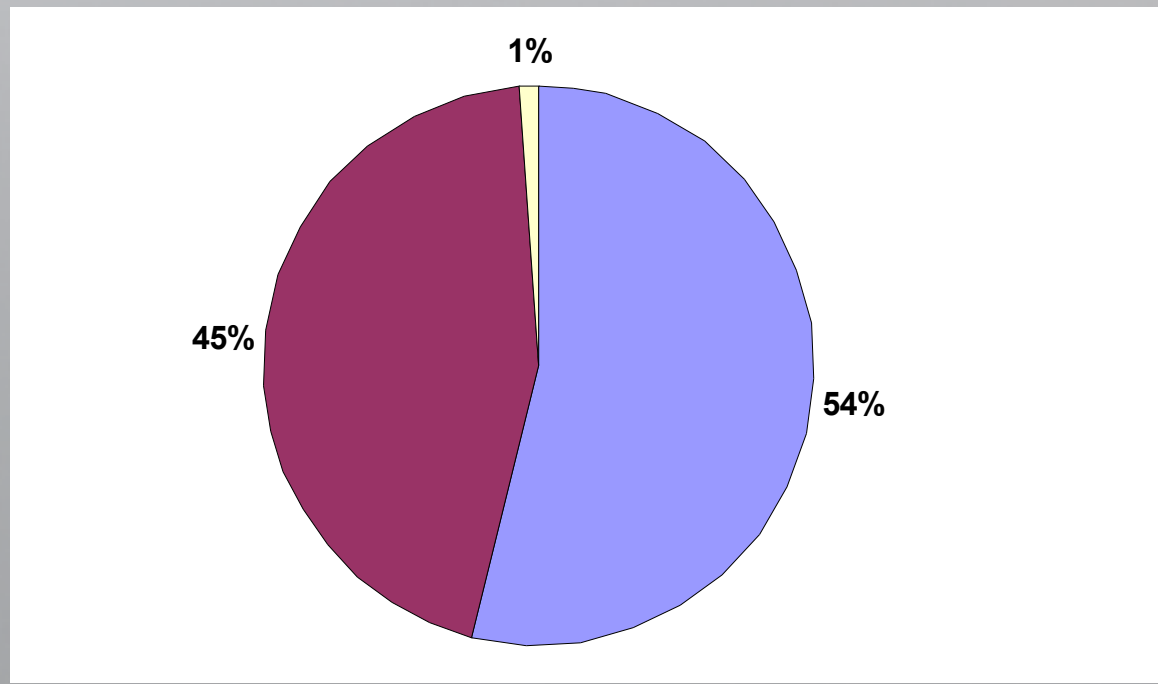


Changing diets for the Adelie penguins

1994-present



1995-present



Warmer moister

Colder drier

A climate gradient along the peninsula; Warm, moist maritime conditions migrating south

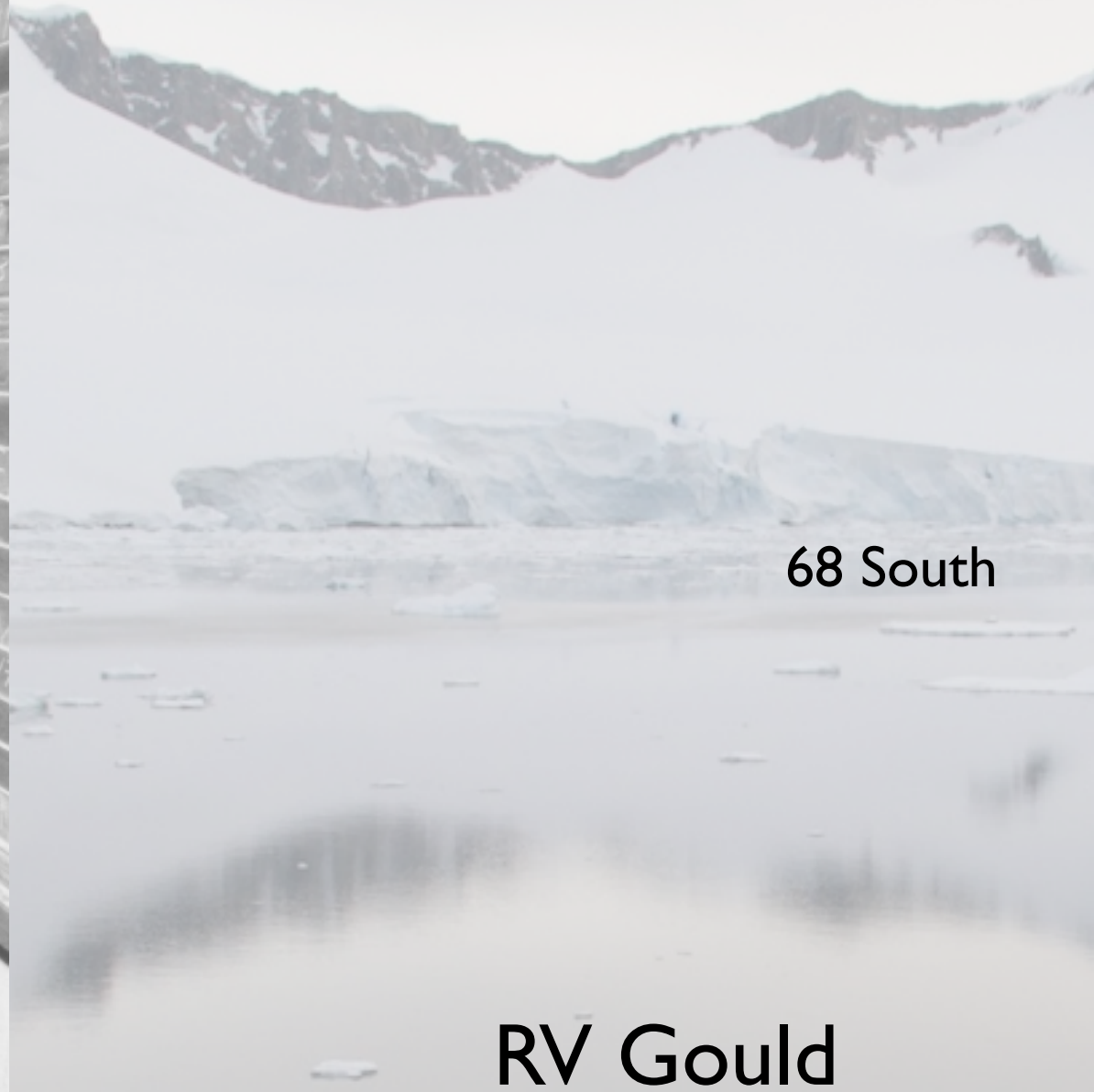


Old Day Communication



HAM Operator Coms Palmer Station 1988

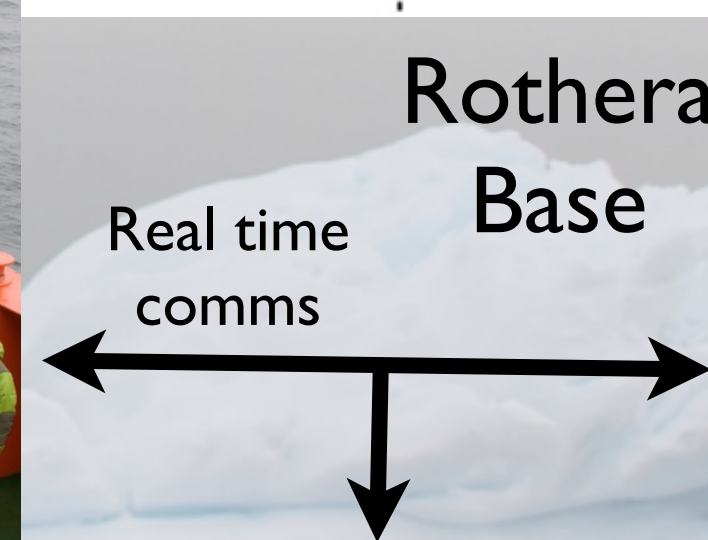
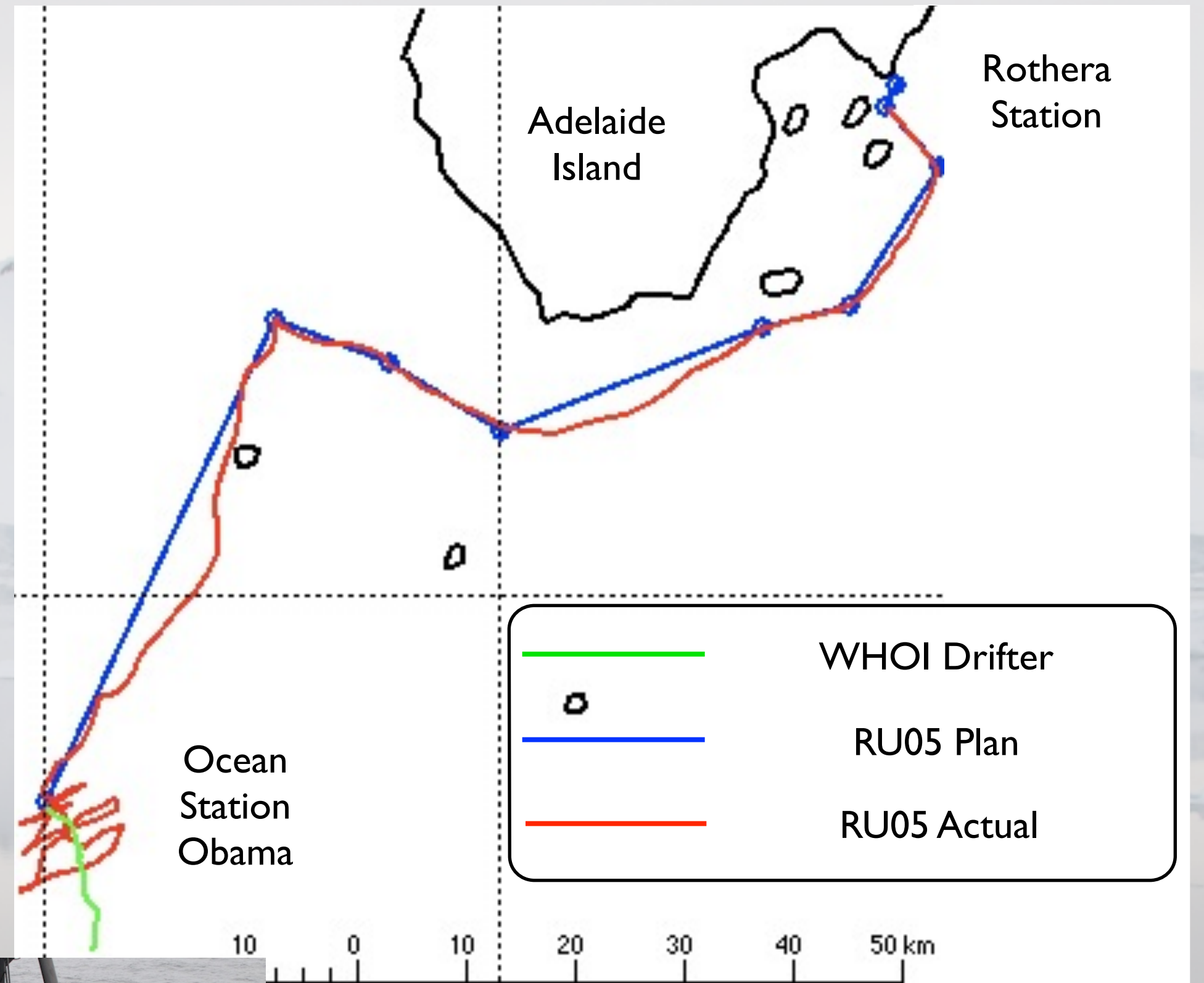
Brave New Day



RV Gould

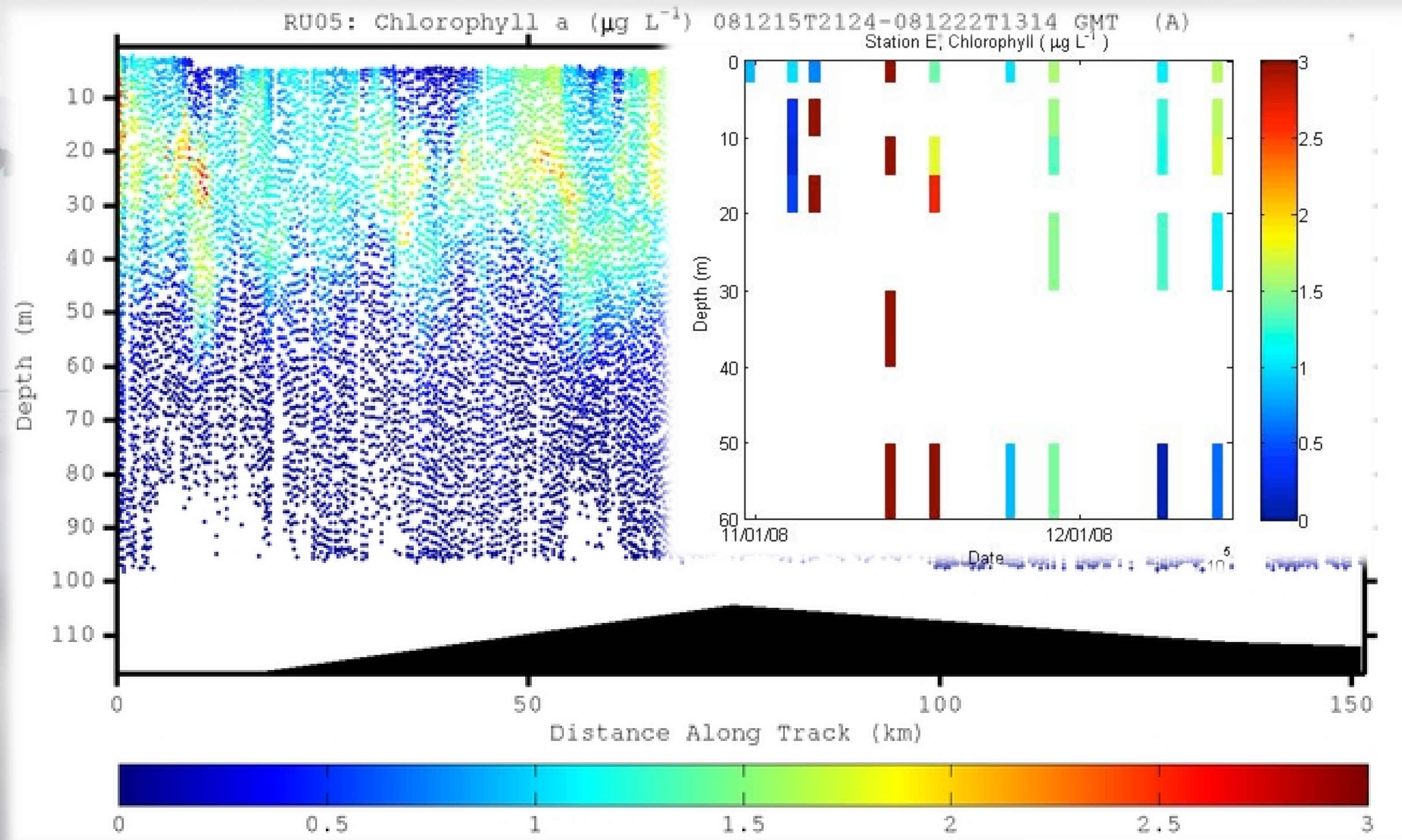
70 West

69 West



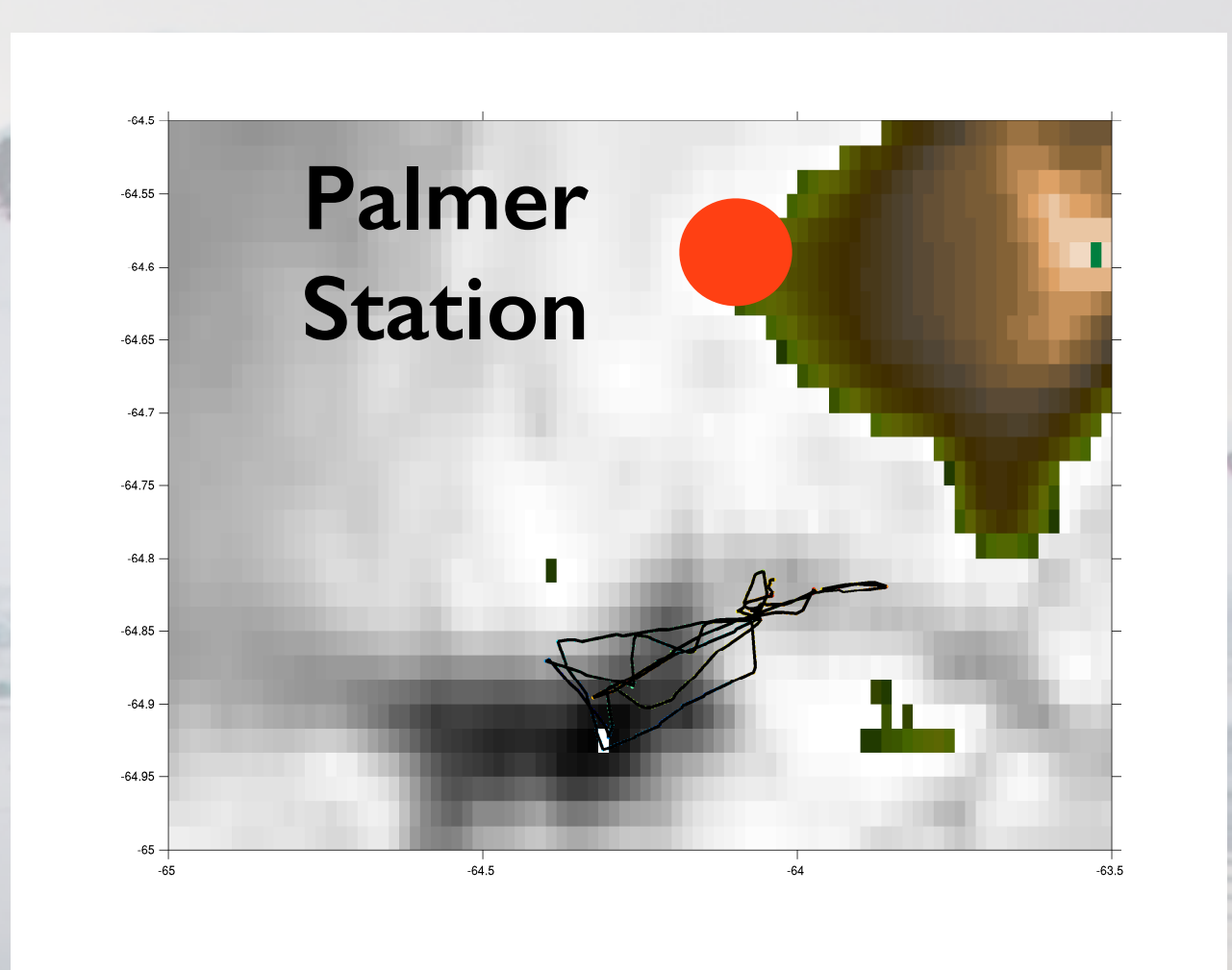
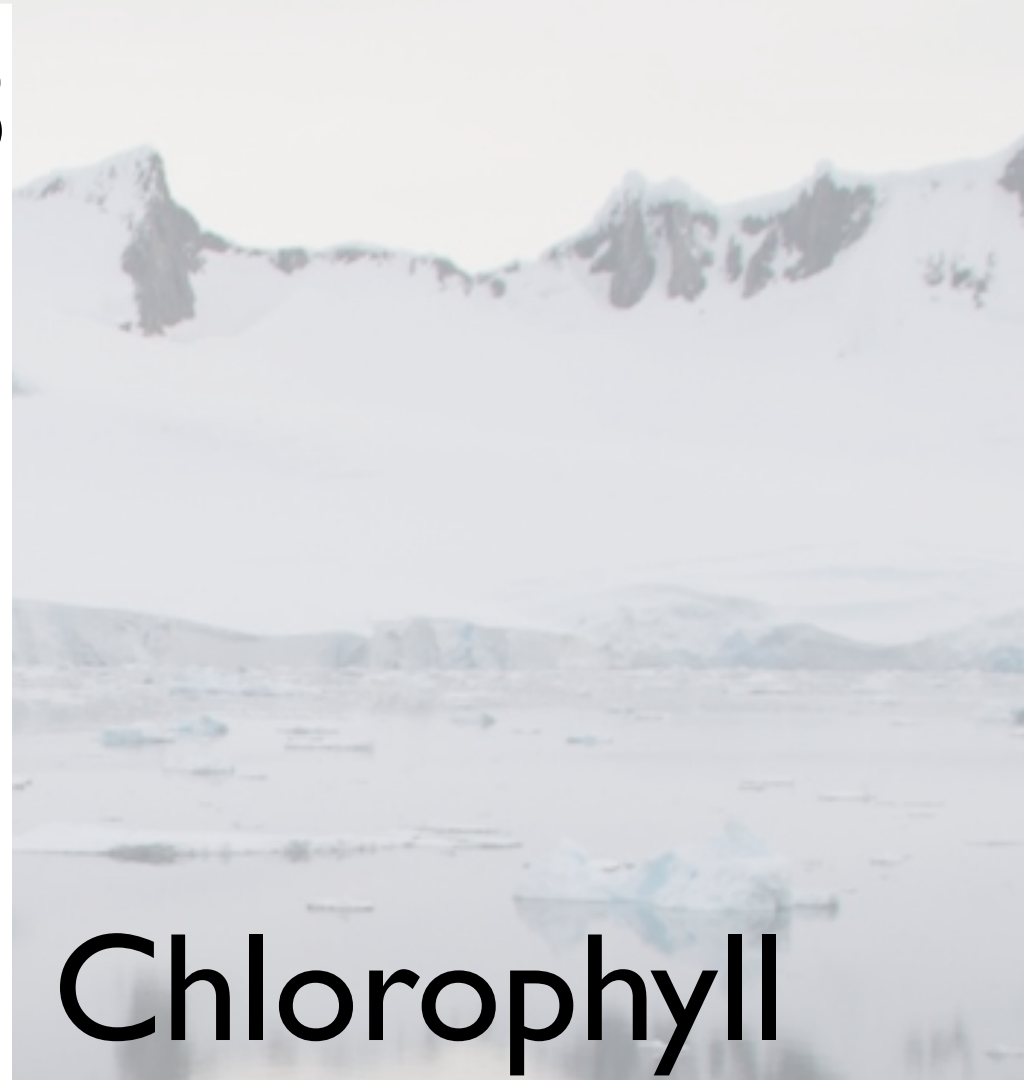
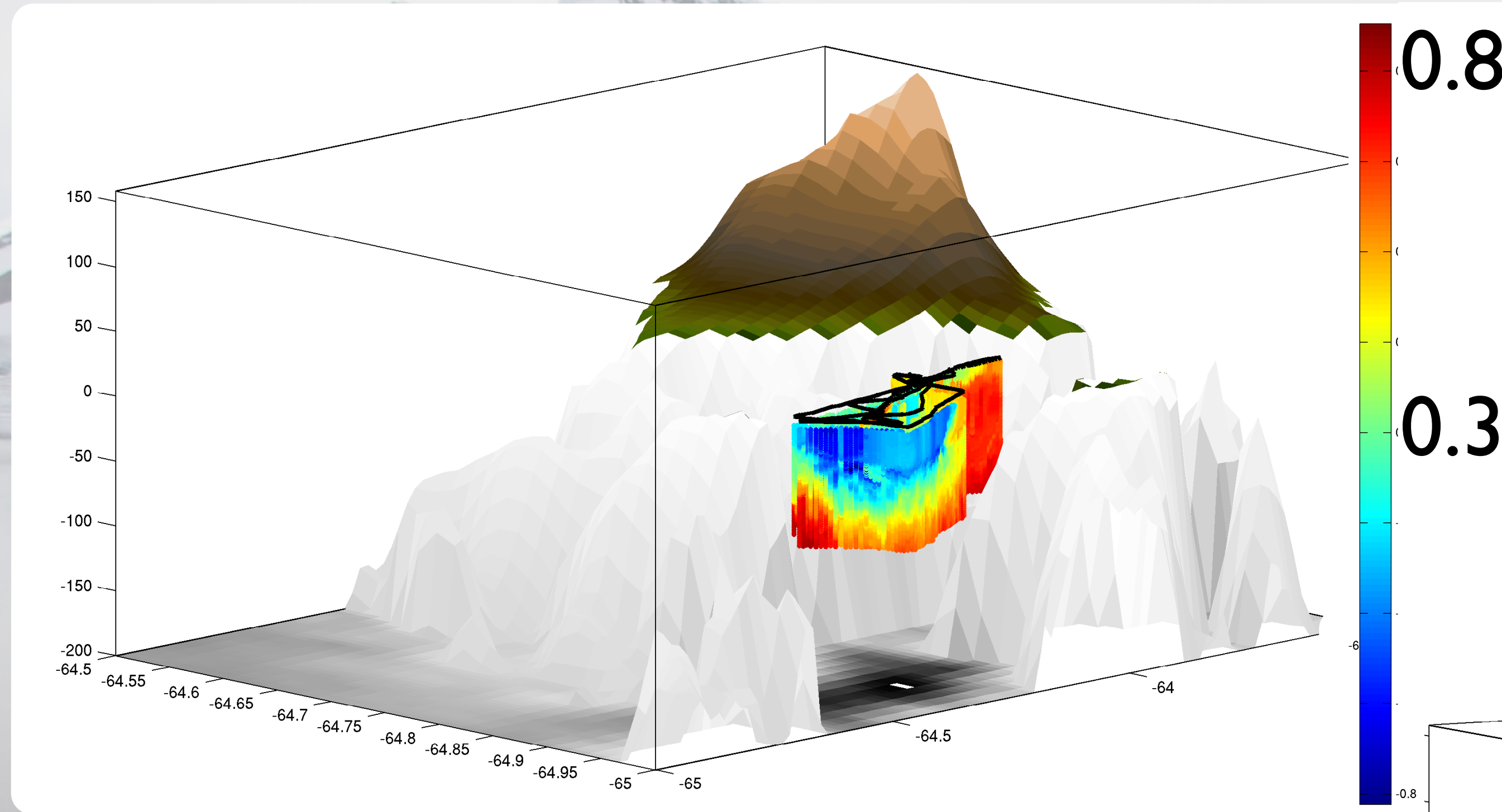
Rutgers COOLroom



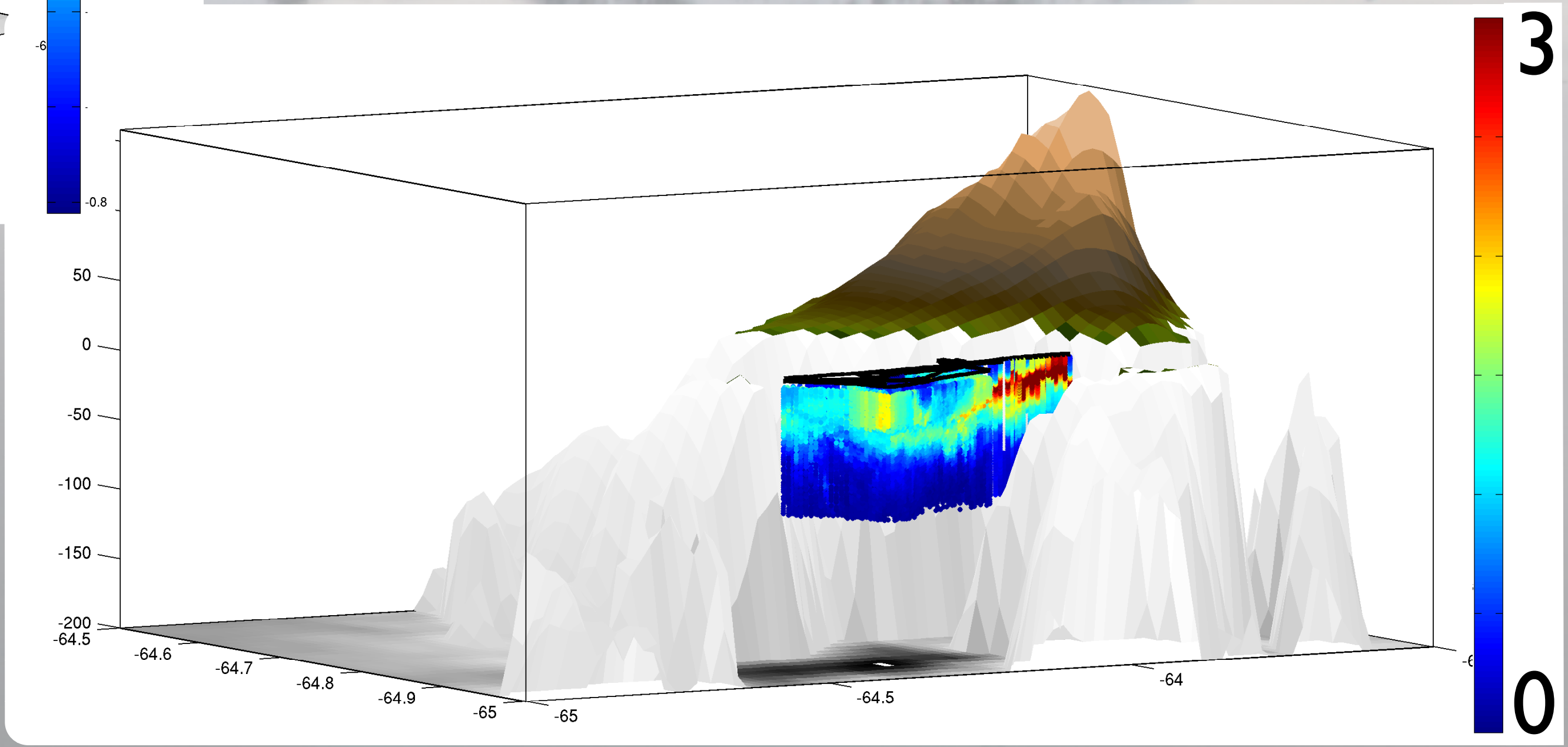


Topographic Coupling to Ecosystem Dynamics

Temperature



Chlorophyll



Trans-Atlantic Glider Challenge – May 24, 2006 – UNESCO E.U./U.S. Baltic Sea Conference in Lithuania



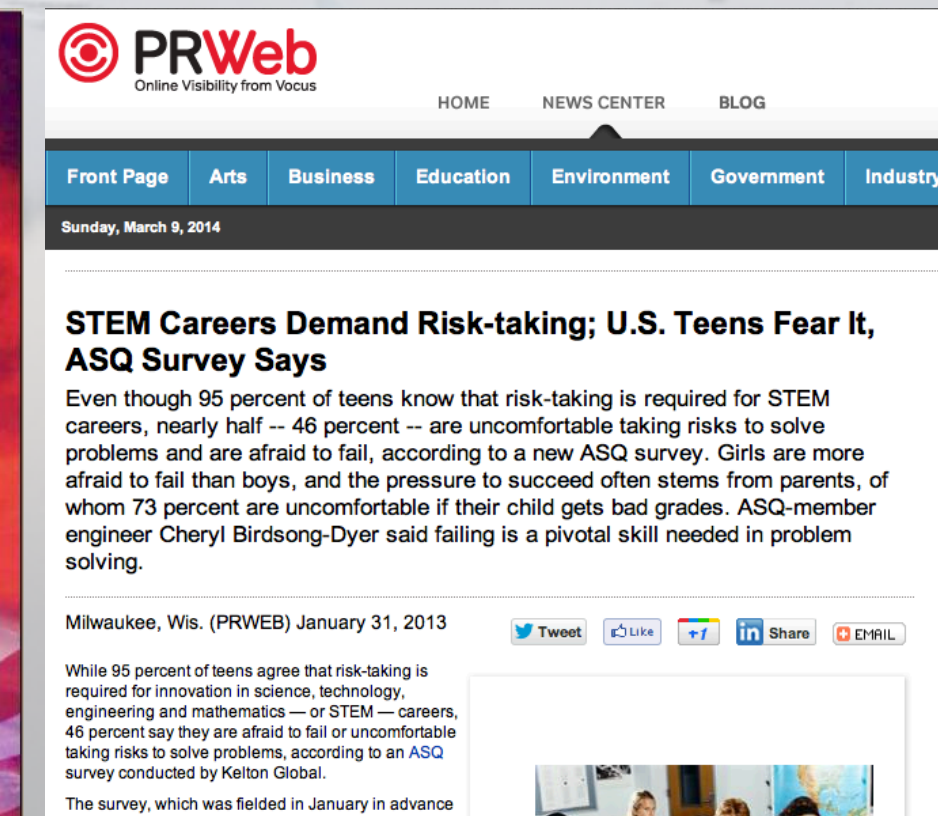
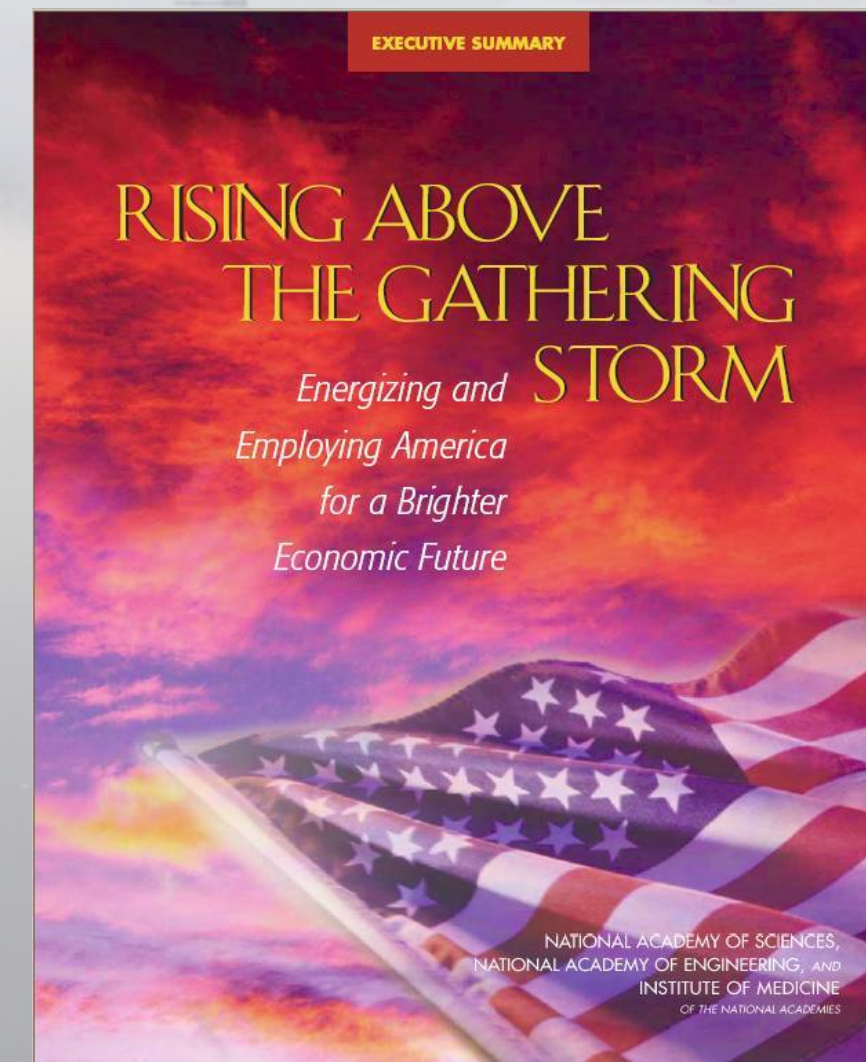
Dr. Rick Spinrad
Assistant Administrator
NOAA
Office of Oceanic and Atmospheric Research

“I have something you need to do for the good of your country.”

“Take one of your gliders, modify it, and fly it across the Atlantic, inspiring students along the way.”



RU27: 7,400 km in 221 days



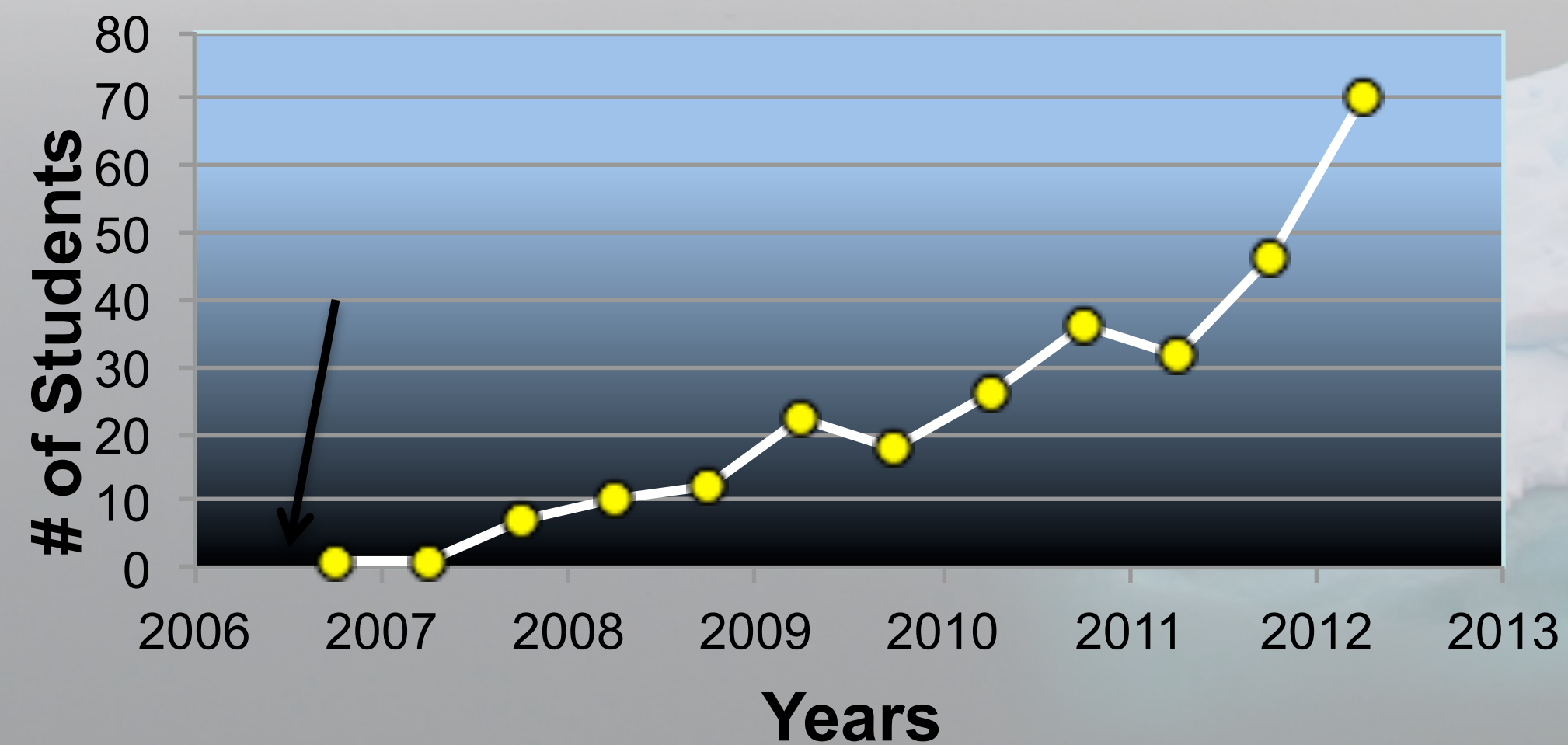
Positive risk-taking is required for innovation in STEM careers!

The Trans-Atlantic Glider Challenge

December 9, 2009 – Baiona, Spain



Glider Research Course



Challenger Glider Mission



16 Global-Class Gliders



Challenger Society	NOAA	Teledyne	PLOCAN	U. Las Palmas	USNA
POGO	ONR	Rutgers	ANFOG	U. Cape Town	CLS
U.S. IOOS	NSF	Vetlesen	KIOST	U. Sao Paulo	Iridium



Glider RU29: Launched from Cape Town 11 Jan 2013, flown >8,700 km

