

# **EAS 4300: Introduction to Oceanography, FALL 2016**

## **INSTRUCTORS:**

Emanuele Di Lorenzo  
phone 404-894-3994  
office ES&T 3244  
email [edl@gatech.edu](mailto:edl@gatech.edu)

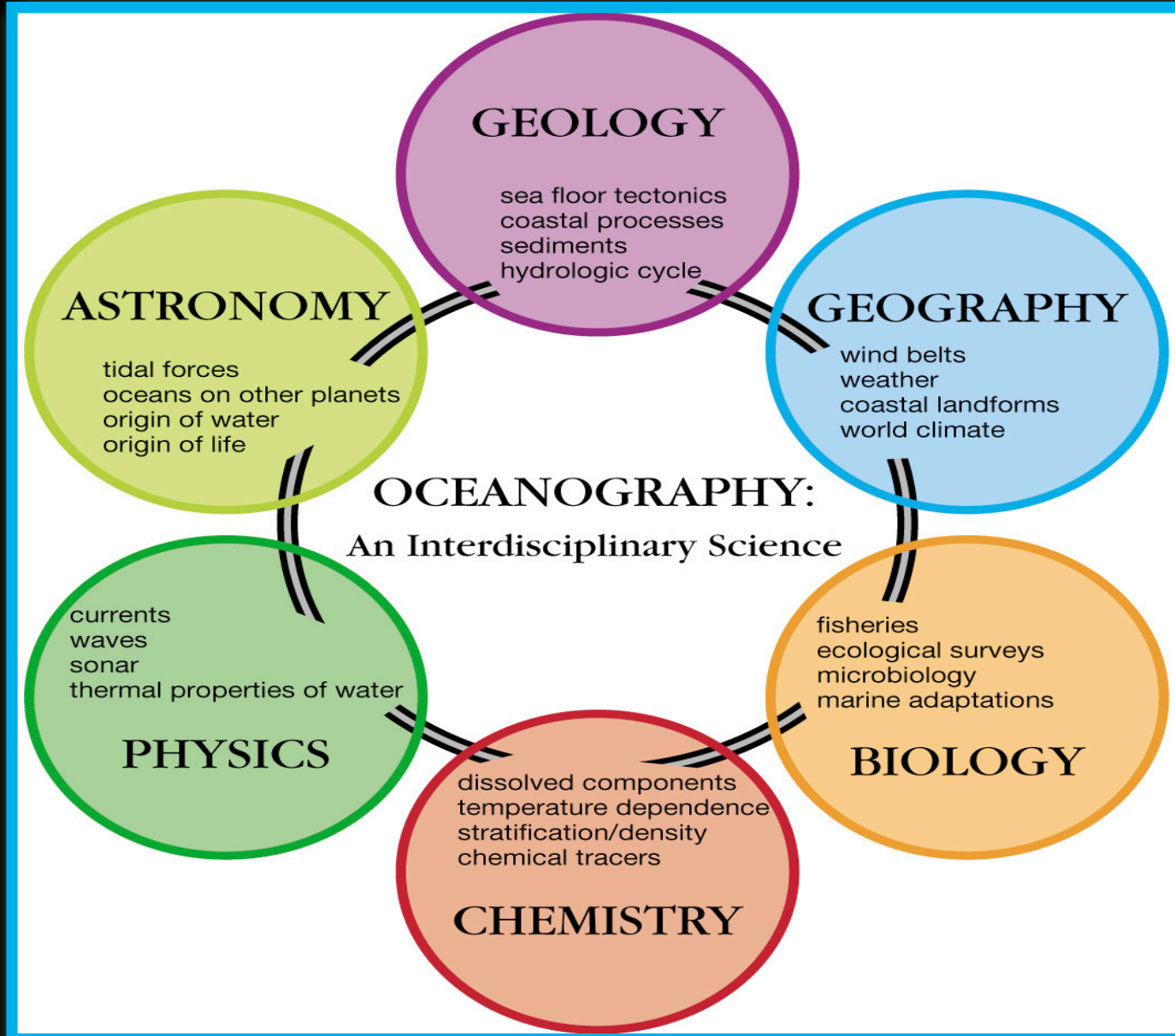


## **TA:**

Shellby Miller  
Email [smiller94@gatech.edu](mailto:smiller94@gatech.edu)

**Course Website <http://ocean3d.org/eas-4300>**

# How do we define the science of Oceanography?





# Why do we care about Oceanography?

# Things to think about



Biodiversity

Medical potential/drug discovery

New models of life

Climate

Fisheries

Recreation

Fossil fuel resource

Ocean energy

Navigation/transportation

Carbon cycle

Marine biology

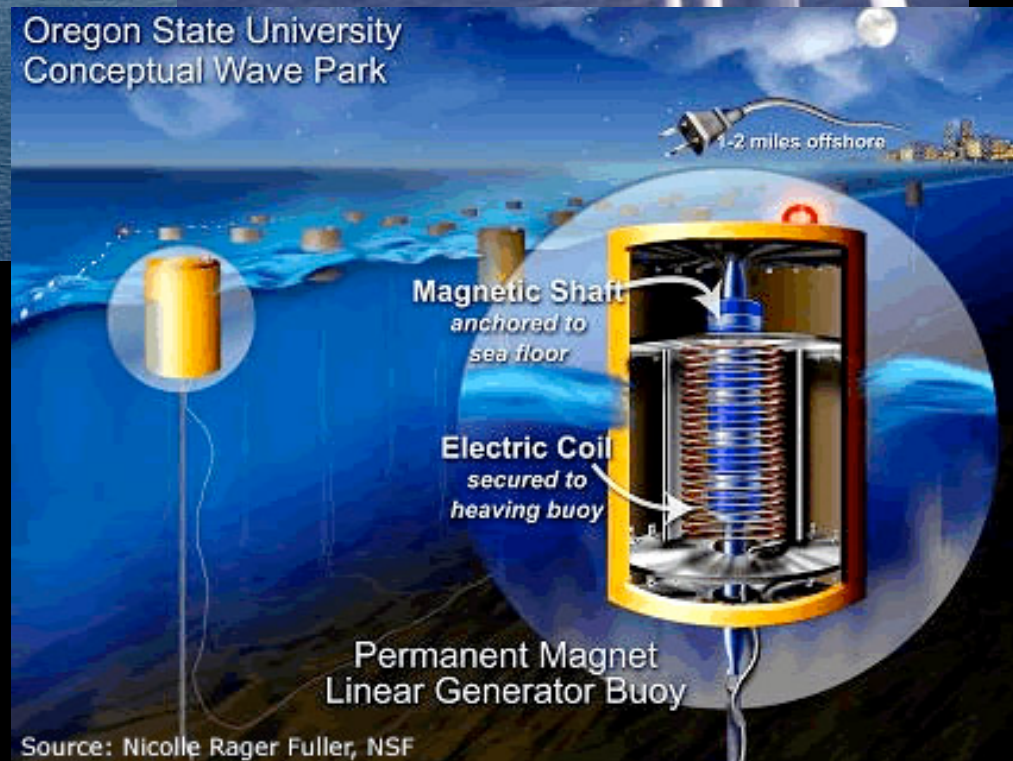
Hazards



# Ocean & Energy



Oregon State University  
Conceptual Wave Park



Source: Nicolle Rager Fuller, NSF







# Ocean & Energy



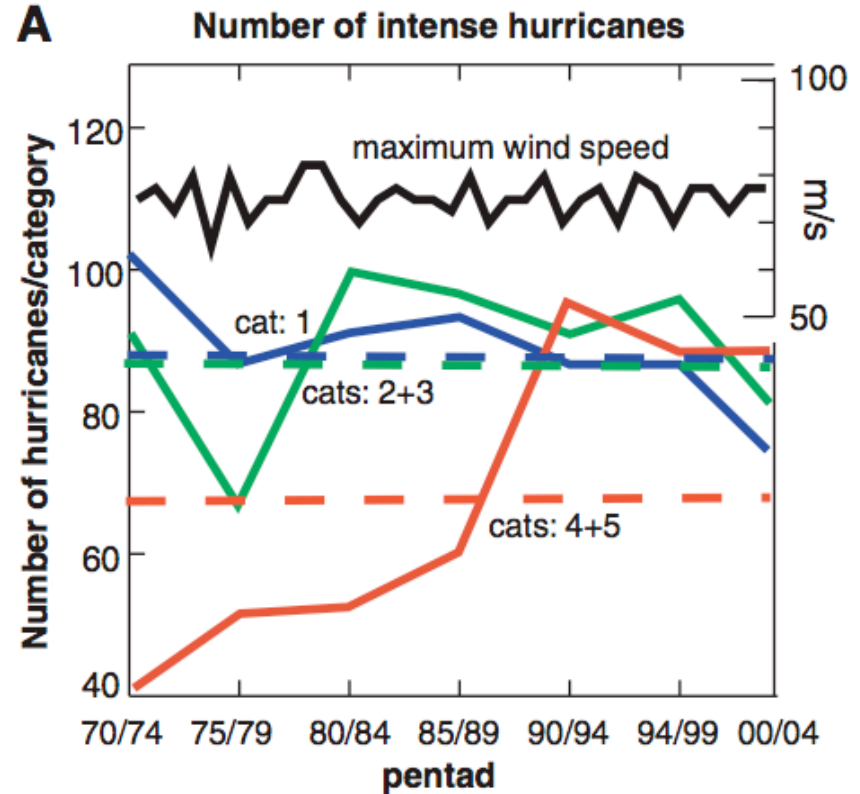
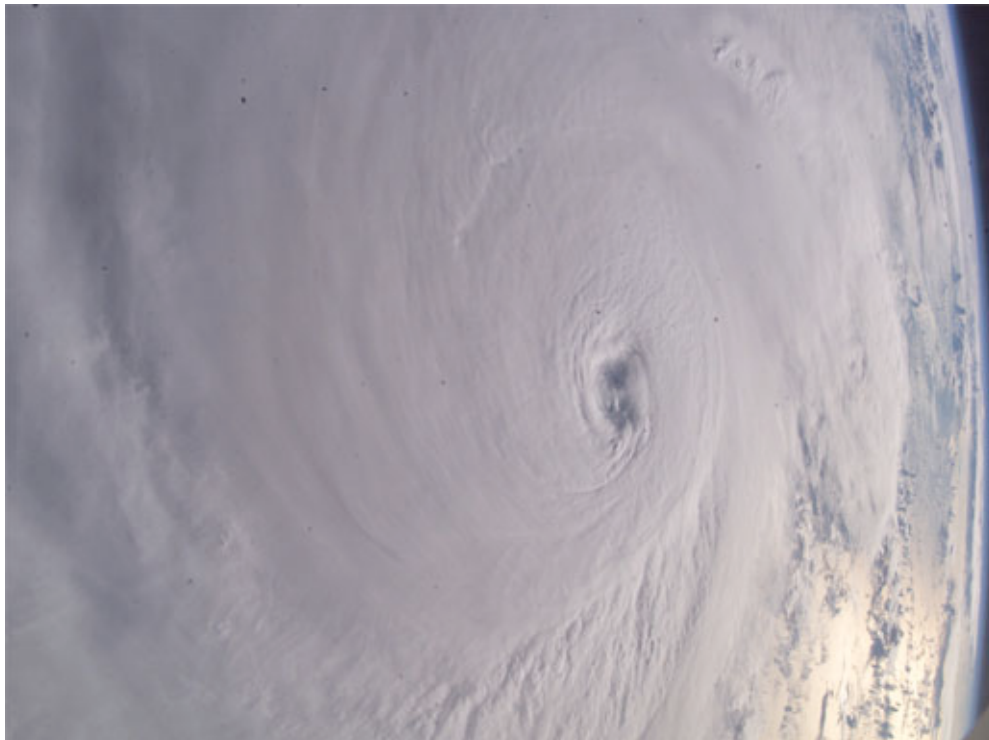
# Ocean & Hazards

Sea surface temperature in the tropical oceans fuel hurricanes

## Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment

P. J. Webster,<sup>1</sup> G. J. Holland,<sup>2</sup> J. A. Curry,<sup>1</sup> H.-R. Chang<sup>1</sup>

16 SEPTEMBER 2005 VOL 309 SCIENCE

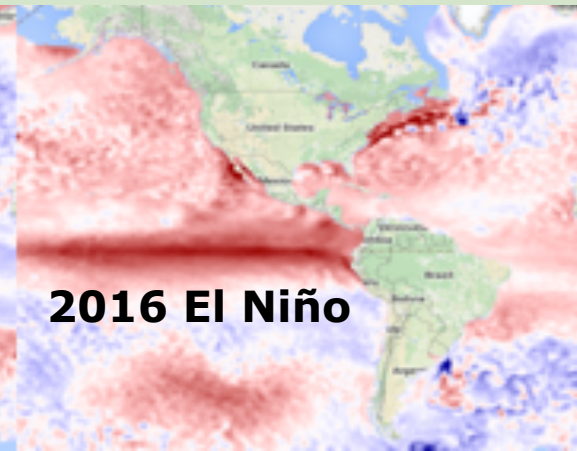
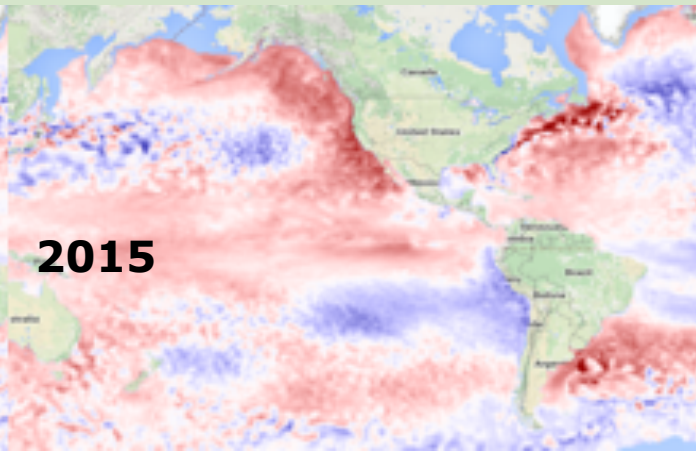
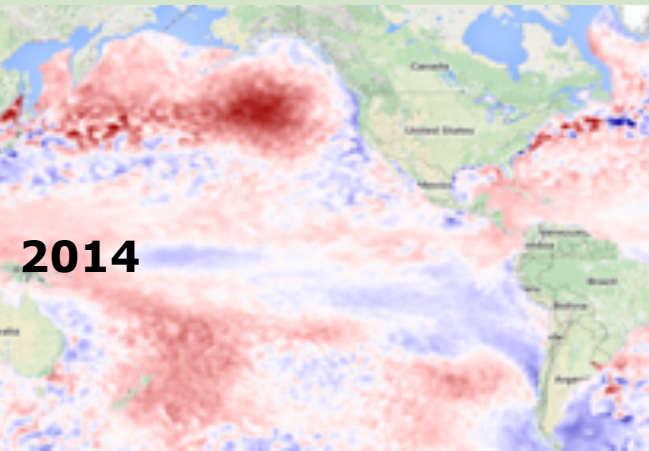


**Hurricanes becoming more intense as ocean warms?**



# Ocean & Hazards

# Marine Heatwaves of 2013-2016



## Tuna Crab Massive Die offs California

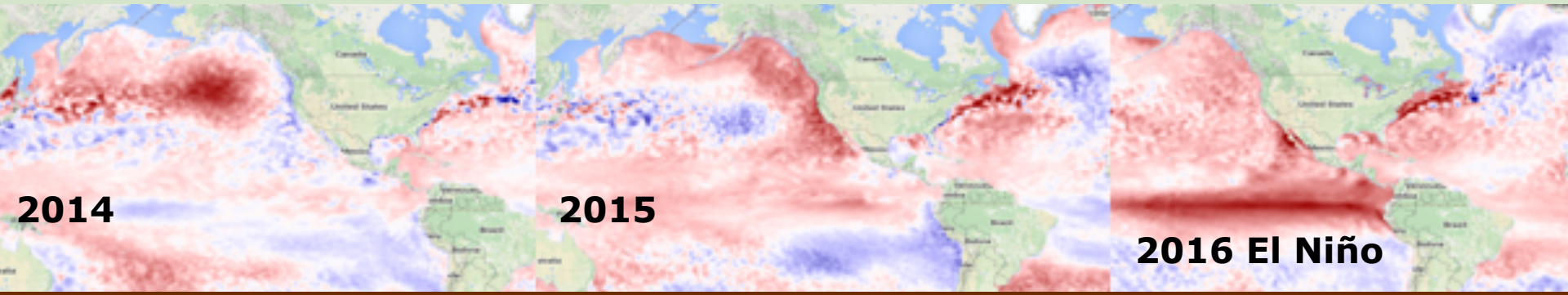


## Sea Birds Massive Die offs



# Ocean & Hazards

## Marine Heatwaves of 2013-2016



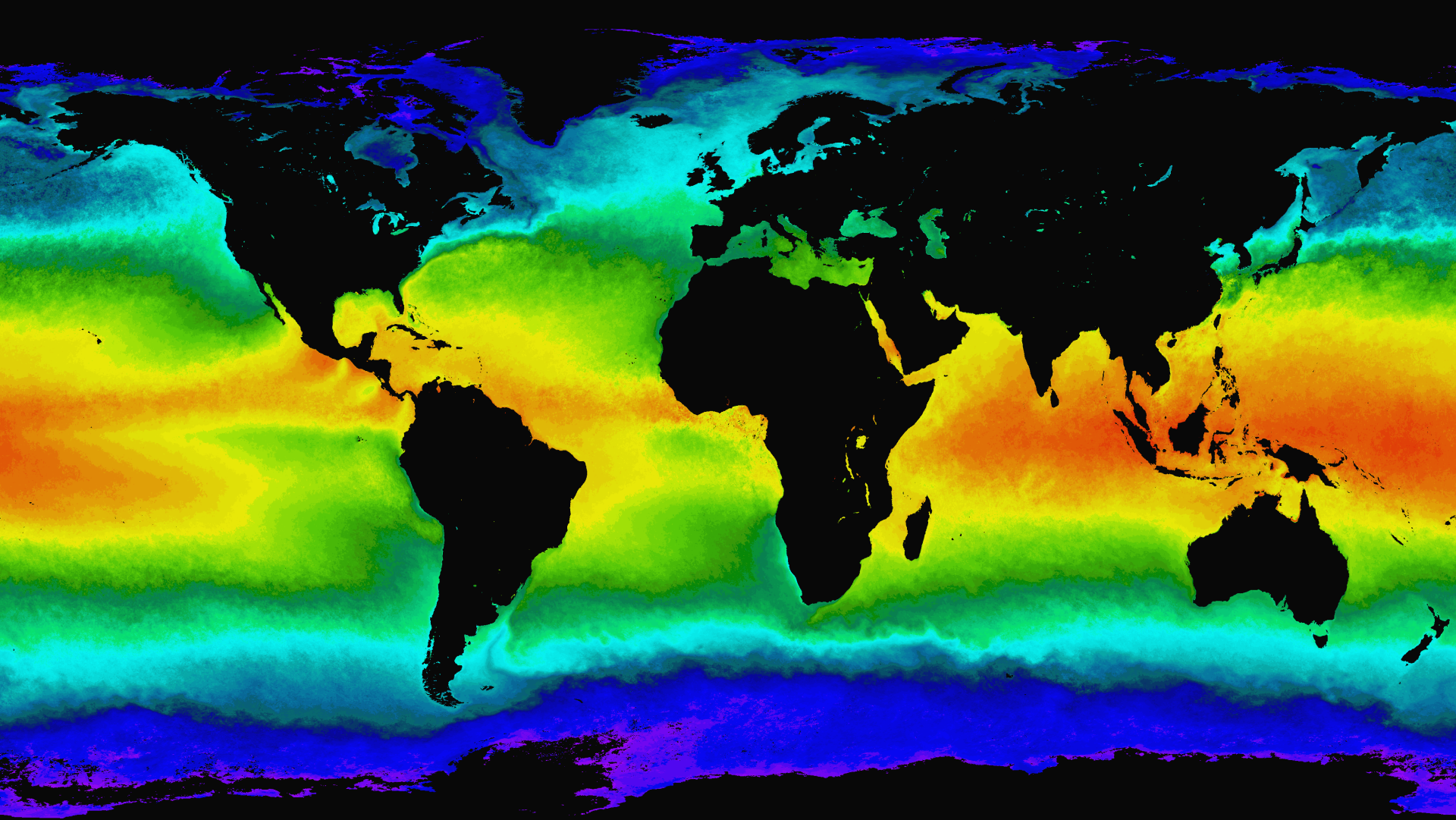
**Harmful Algal Blooms**  
(domoic acid neurotoxin)





# Ocean & Climate

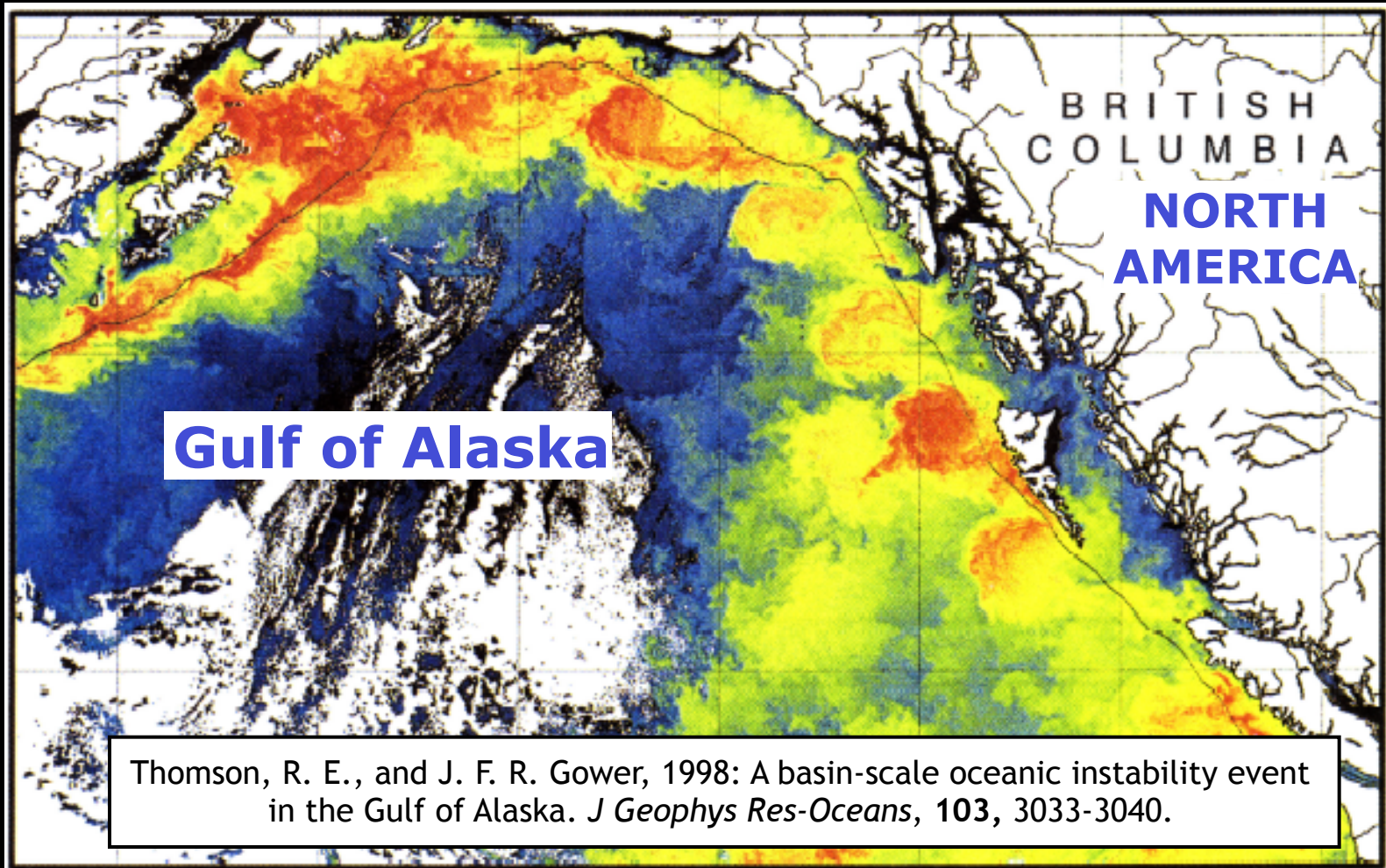
The ocean plays a dominant role in heat transport and mixing





# Ocean & Climate

Vortices are the strongest mixing agent in the ocean. They influence the ocean circulation and biology.

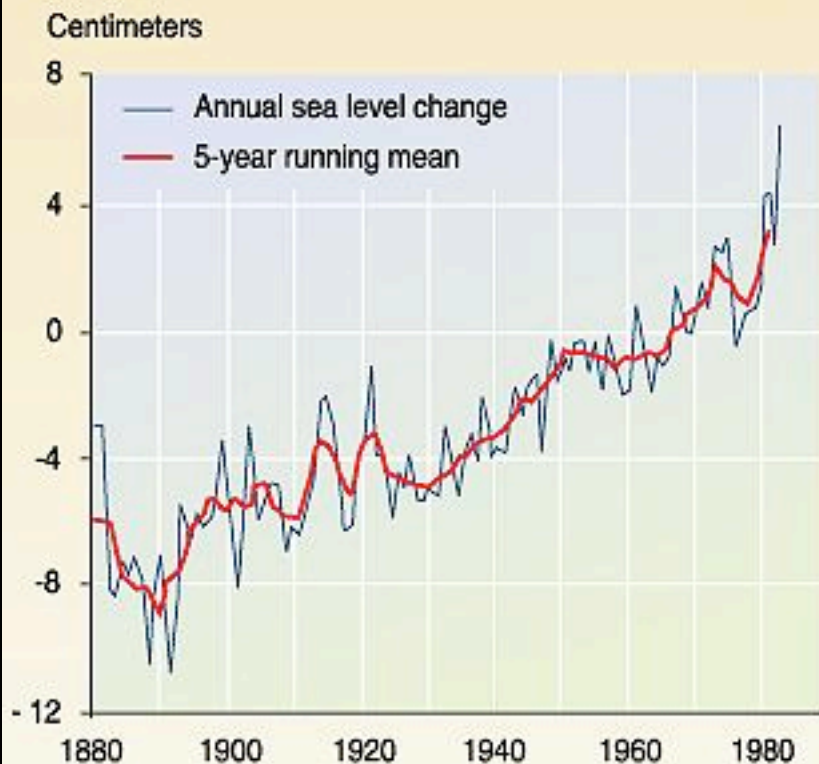


# Ocean & Climate Change

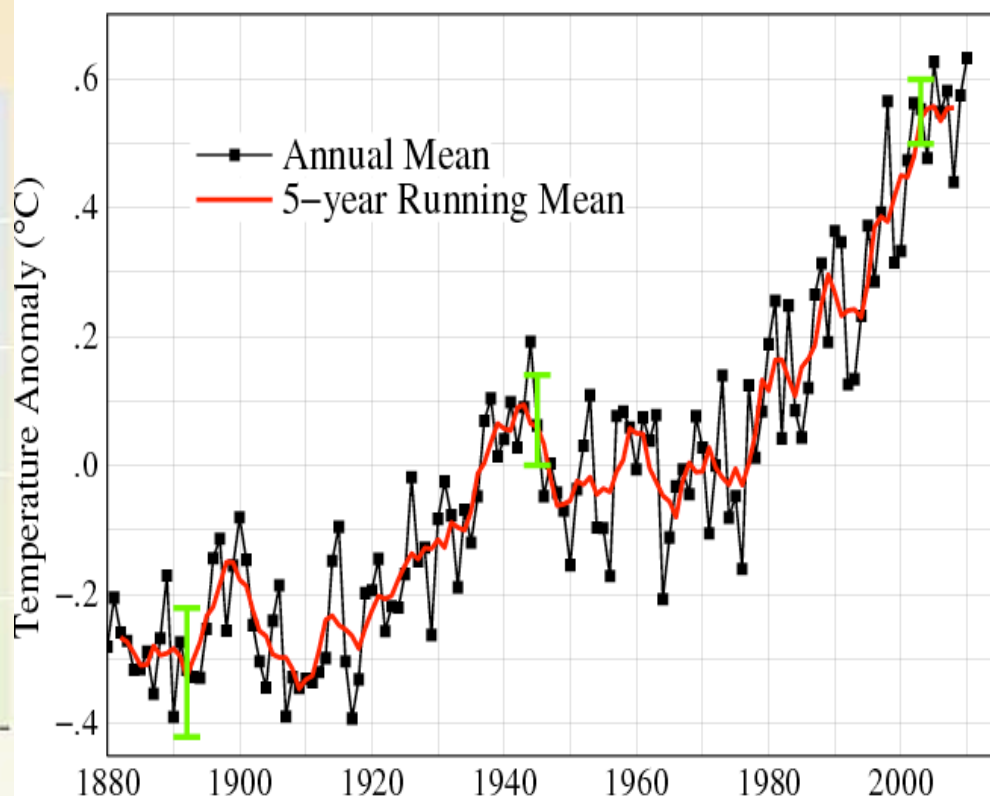
Global Surface Temperatures and Sea Level are rising

## Sea level rise due to global warming

### Sea level rise over the last century



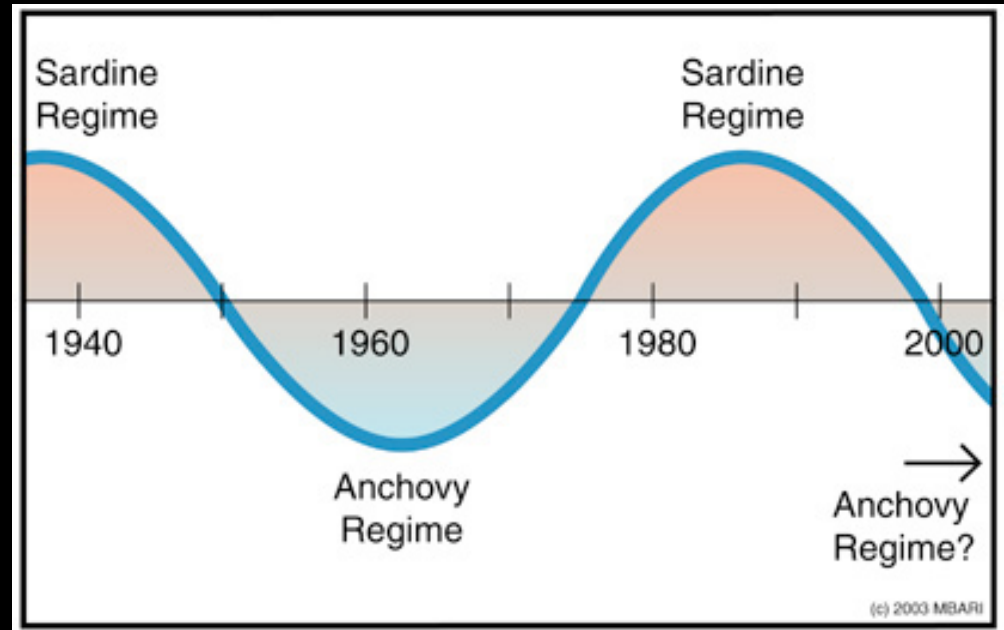
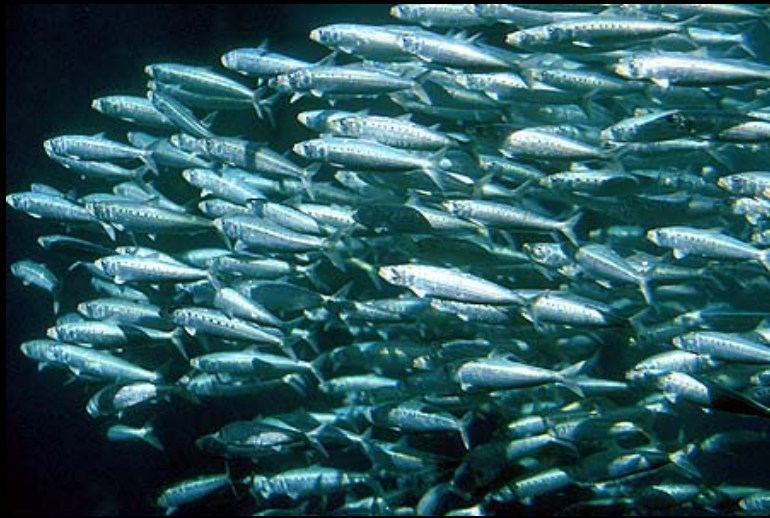
### Global Land–Ocean Temperature Index



# Ocean & Climate & Marine Ecosystems

Ocean climate affects fish distributions and abundance

## Sardines/Anchovies

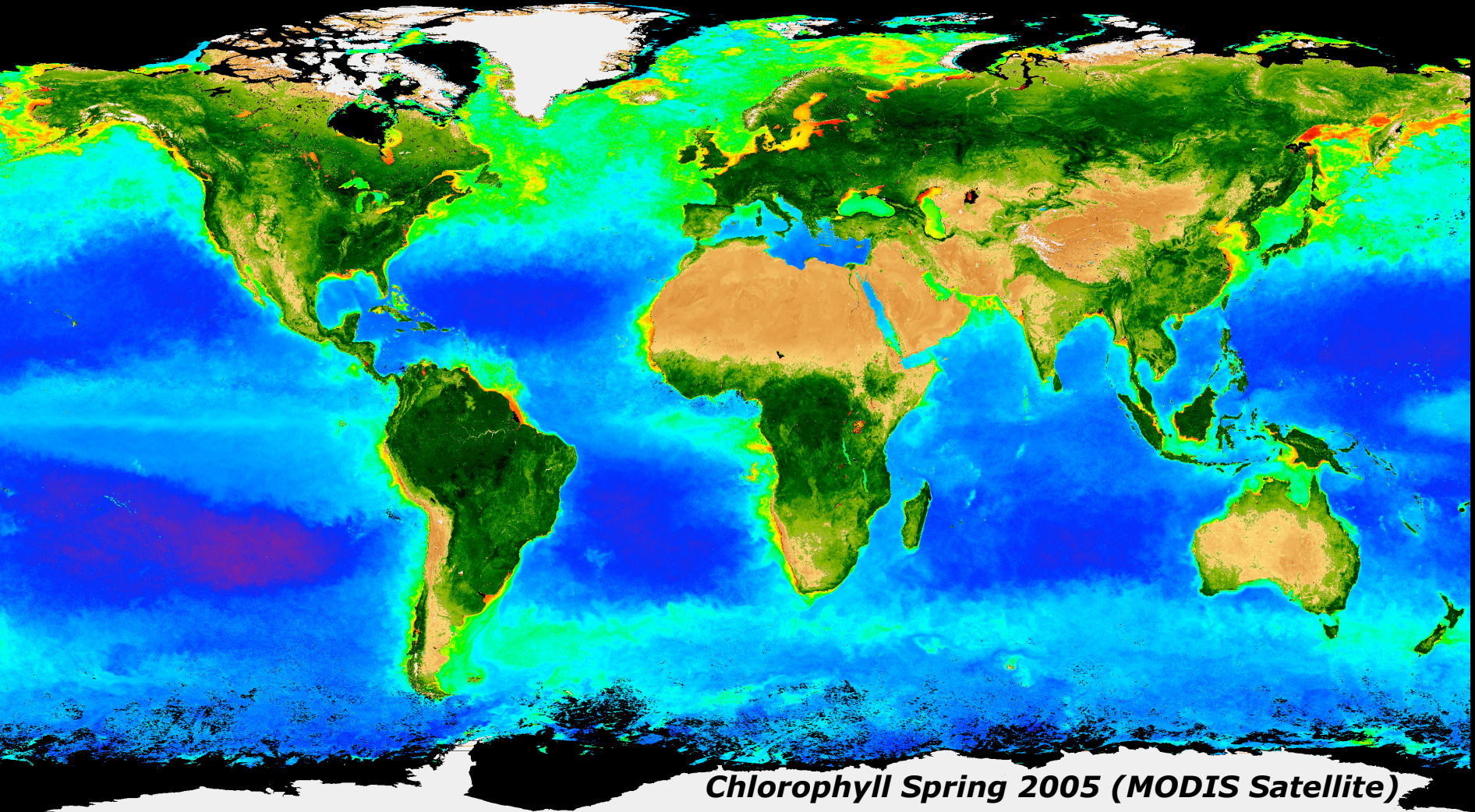


**synchronized alternations between sardines/anchovies over the entire Pacific Ocean?**



# Ocean & Carbon Cycle

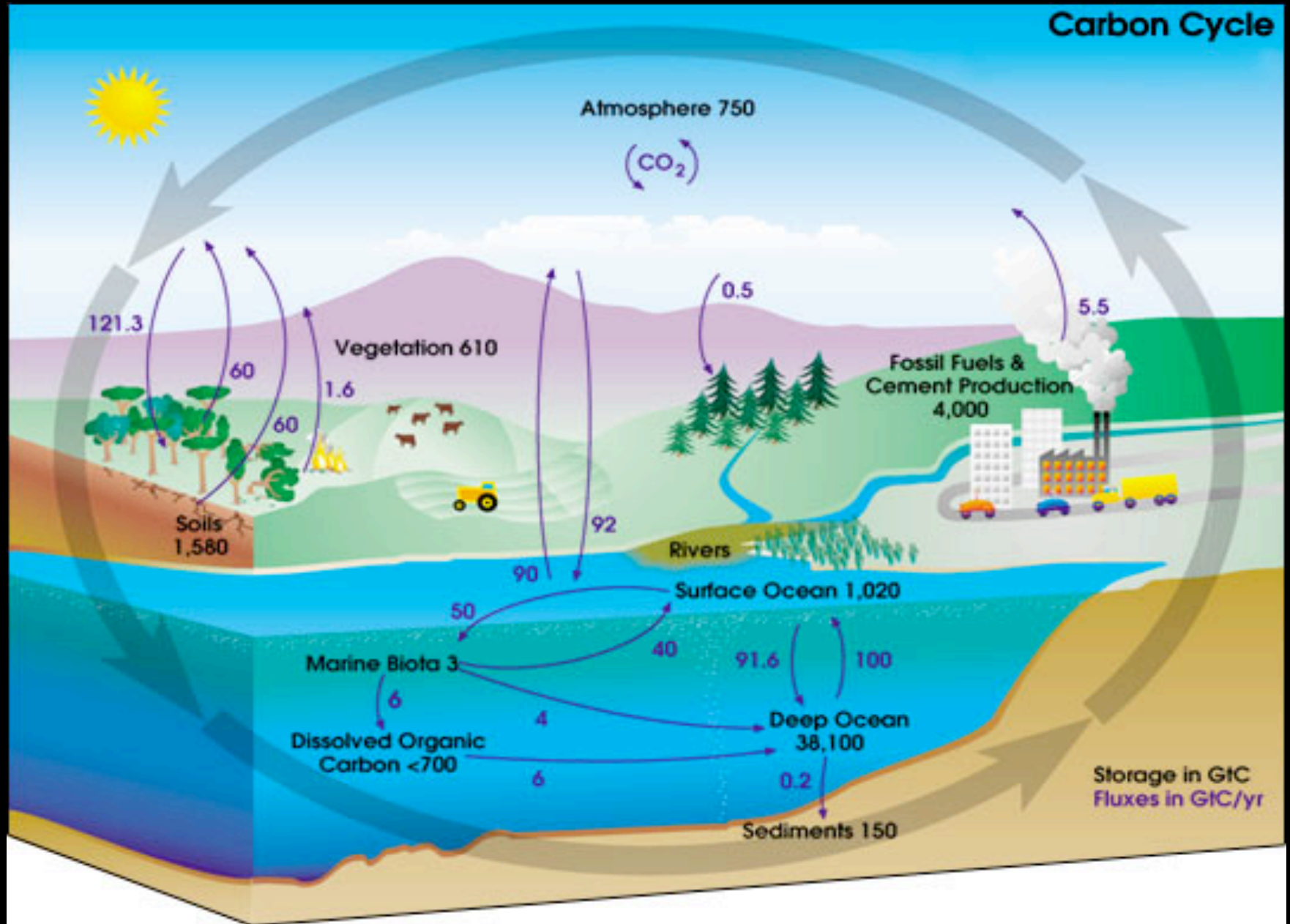
Marine Ecosystem regulate the cycling of chemical species relevant to climate (e.g. Carbon Dioxide)



*Chlorophyll Spring 2005 (MODIS Satellite)*



# Ocean & Carbon Cycle



# Ocean & Marine Biodiversity





# Ocean & New Model for Life





# **Ph.D. in oceanography in San Diego at the *Scripps Institution of Oceanography***

## **Manu**

- Ocean and climate dynamics
- Physical-biological interactions in the ocean
- Ocean Forecasting





# The Scientific Method

**Observation**

Collection of scientific facts through observation and measurement



**Hypothesis**

A tentative, testable statement about the natural world that can be used to build more complex inferences and explanations



**Testing**

Development of observations, experiments, and models to test (and, if necessary, revise) the hypothesis



after much testing and experimentation



**Theory**

In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, logical inferences, and tested hypotheses