

# Let's Go Outside!

Putting RDM into Practice

Steve Diggs

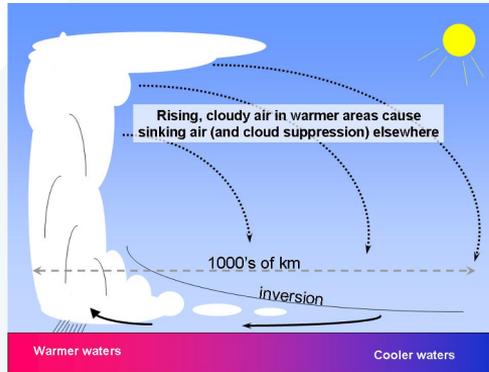
Scripps Institution of Oceanography

*RDA/CODATA School*  
*2021.10.20*

UC San Diego



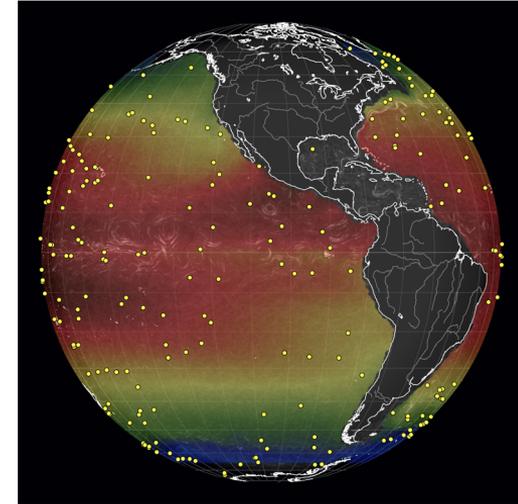
SCRIPPS INSTITUTION OF  
OCEANOGRAPHY



Atmospheric Physics



Physical Oceanography



Integrated Climate Observations

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## CCHDO: CLIVAR & Carbon Hydrographic Data Office

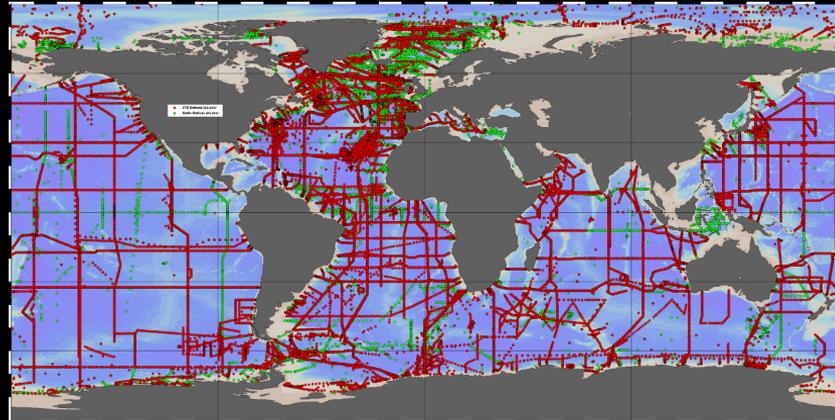


**Purpose:** The Data Assembly and Dissemination Center for sustained hydrographic observations of *trans-oceanic reference quality hydrographic*, ocean carbon, and tracer measurements.

**Location:** Scripps Institution of Oceanography / UCSD

**Contacts:**

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# Practical RDM: what we will be doing

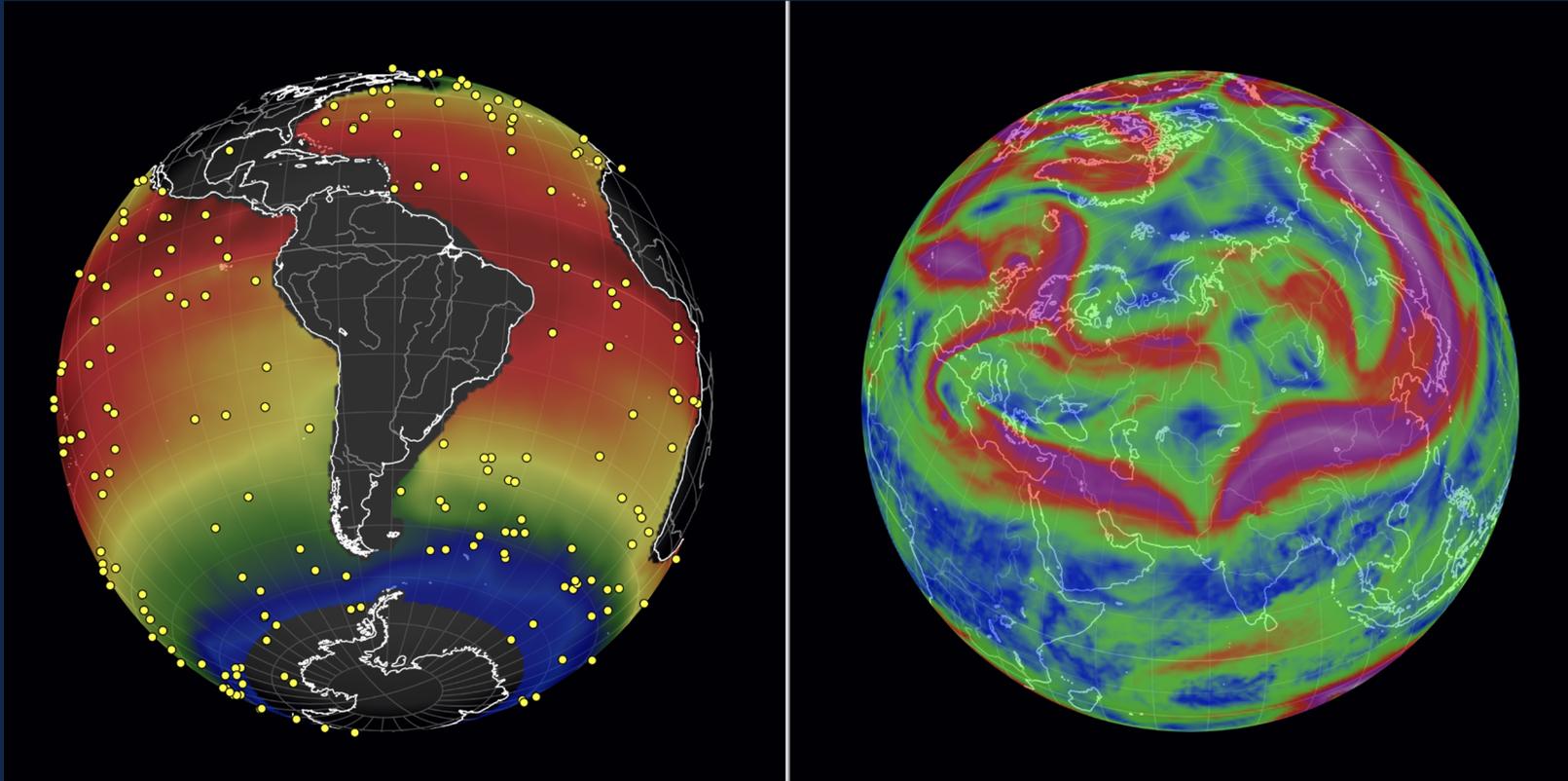
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This part of the course is hands-on, but looking at Research Data Management from the consumer, or data user perspective. There will be assigned reading, and the goal is to reinforce the FAIR principles and responsible data curation through a simulation - we will discuss what it takes to actually access the data to reproduce the science published in refereed journals.

But first, you will need a light primer in both oceanography and atmospheric chemistry.



# Oceans and Atmosphere

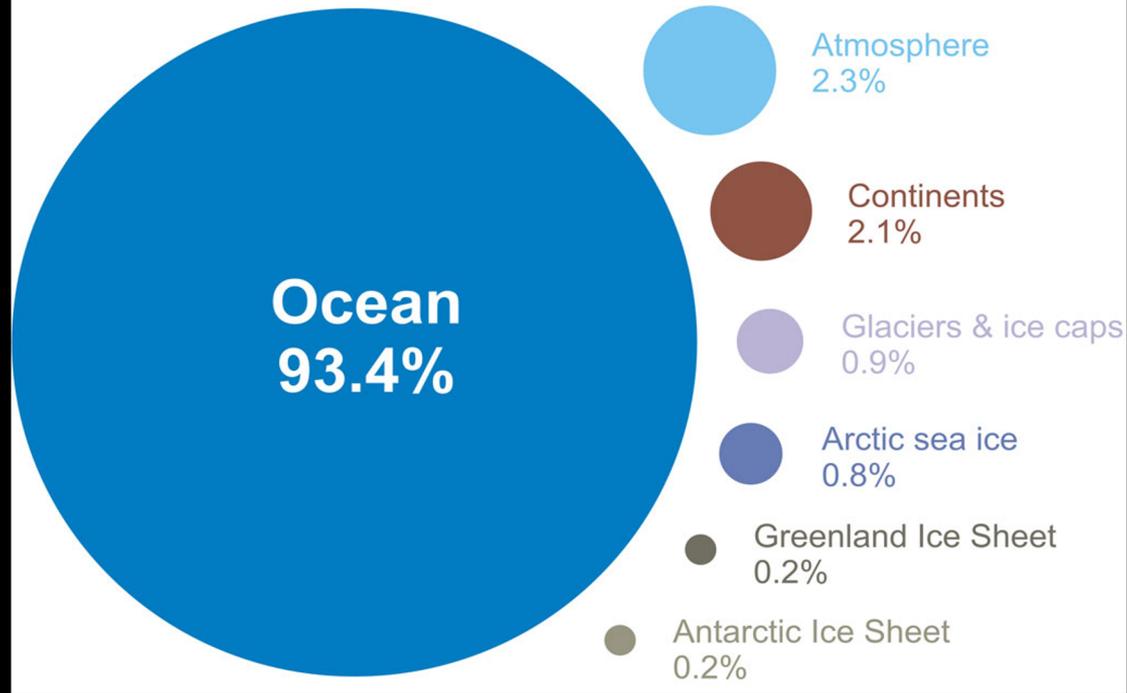


**1.332 x 10<sup>21</sup> Liters of Water**  
**~352 Quintillion Gallons**



# Oceans are the “flywheel of climate”

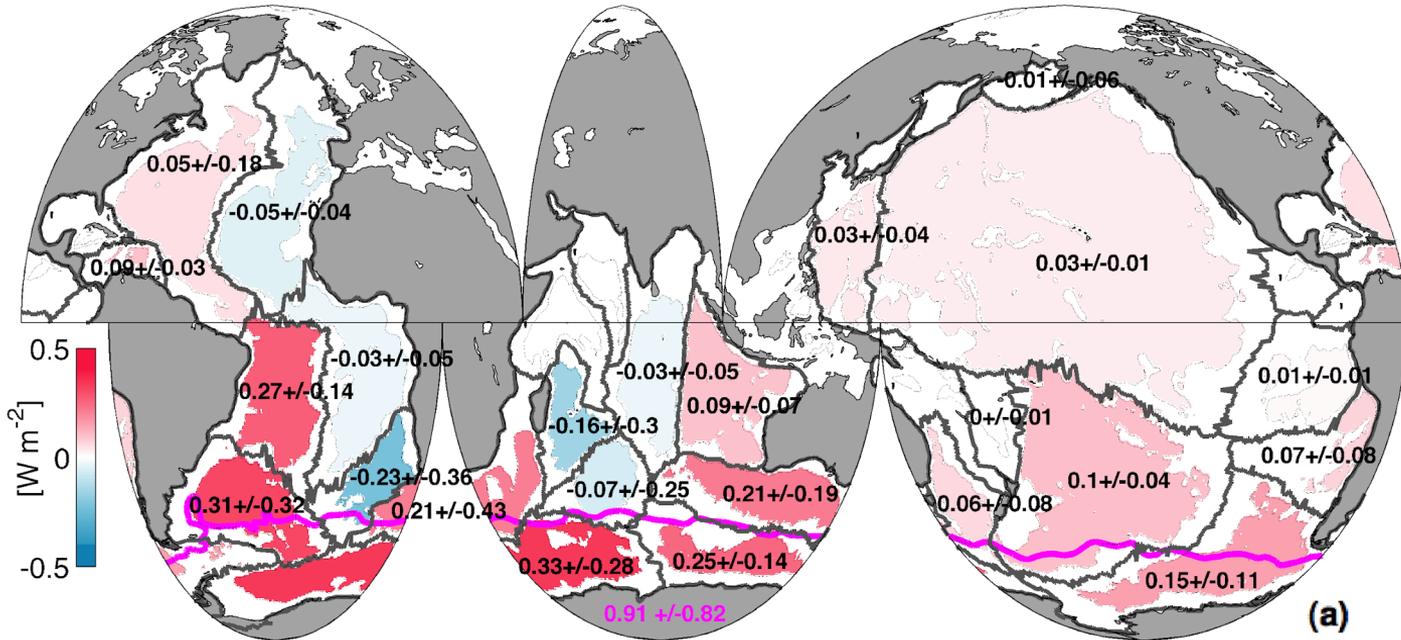
## Where is global warming going?



# Why Measure the Deep Ocean?

## Deep ocean heat content changes

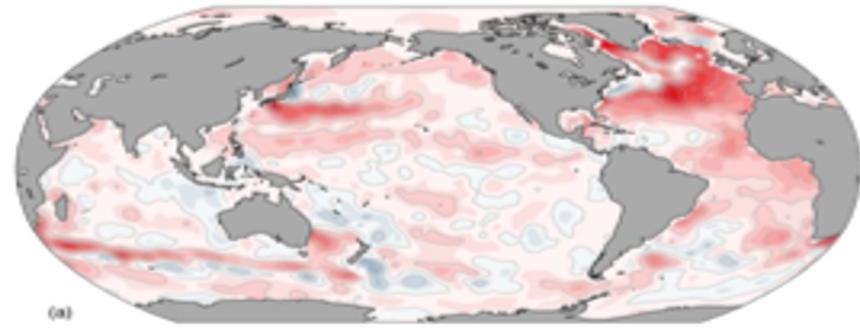
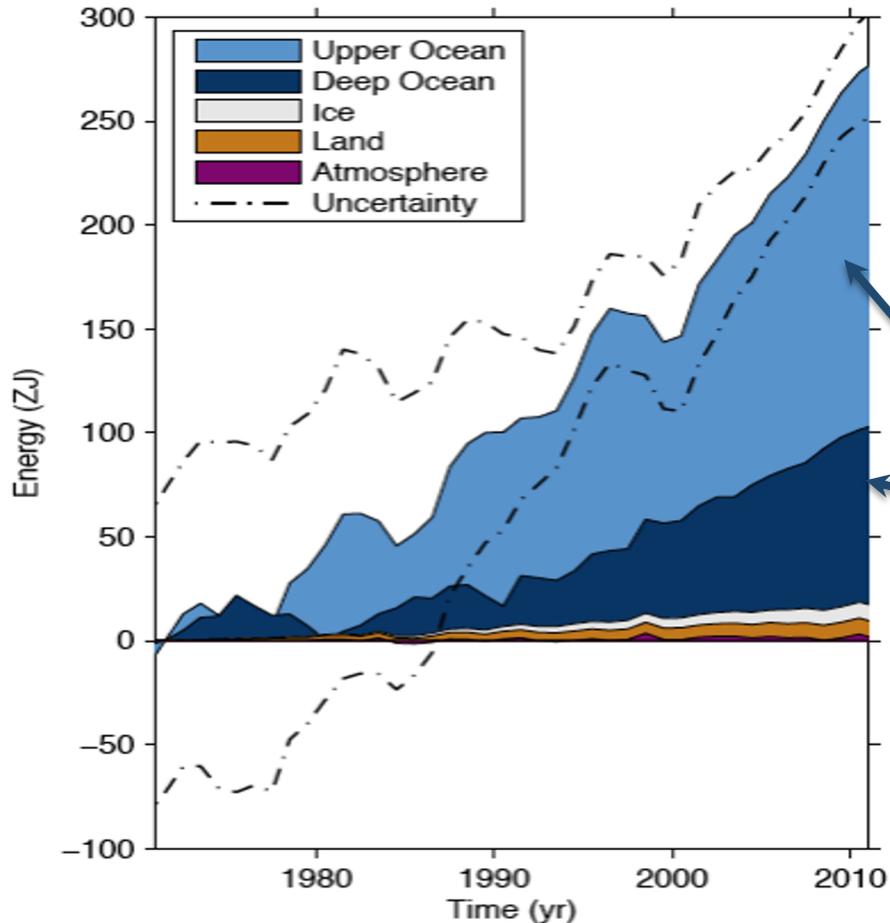
(Purkey and Johnson, 2010: Below 4000 m, in  $\text{W/m}^2$ )



More than 90% of the Earth's increase in heat content (1971-2010) occurs in the ocean, with roughly 15% in deep waters below 2000 m. This is more than double the increase in Earth system's heat content in the atmosphere, land, ice combined.



# Global warming is ocean warming



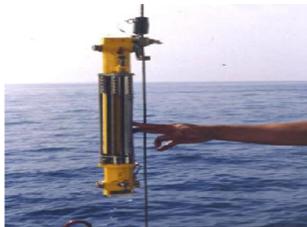
The global energy excess is mostly in the ocean

If the excess heat in the system that is now in the ocean were in the atmosphere, surface air would be 100°C warmer.



# NCEI: The World Ocean Database

Heterogeneous aggregation of worldwide ocean profile data (17.5 million casts 1772–2020)



(1a) OSD: 3,233,756 casts



(1b) MBT: 2,426,301 casts



(1c) XBT: 2,337,800 casts



(1d) CTD: 1,095,334 casts



(1e) UOR: 127,574 casts



(1f) PFL: 2,305,608 casts



(1g) MRB: 1,670,821 casts



(1h) DRB: 255,608 casts



(1i) APB: 1,940,844 casts



(1j) GLD: 1,733,012 casts



(1k) SUR: 9,284 cruises



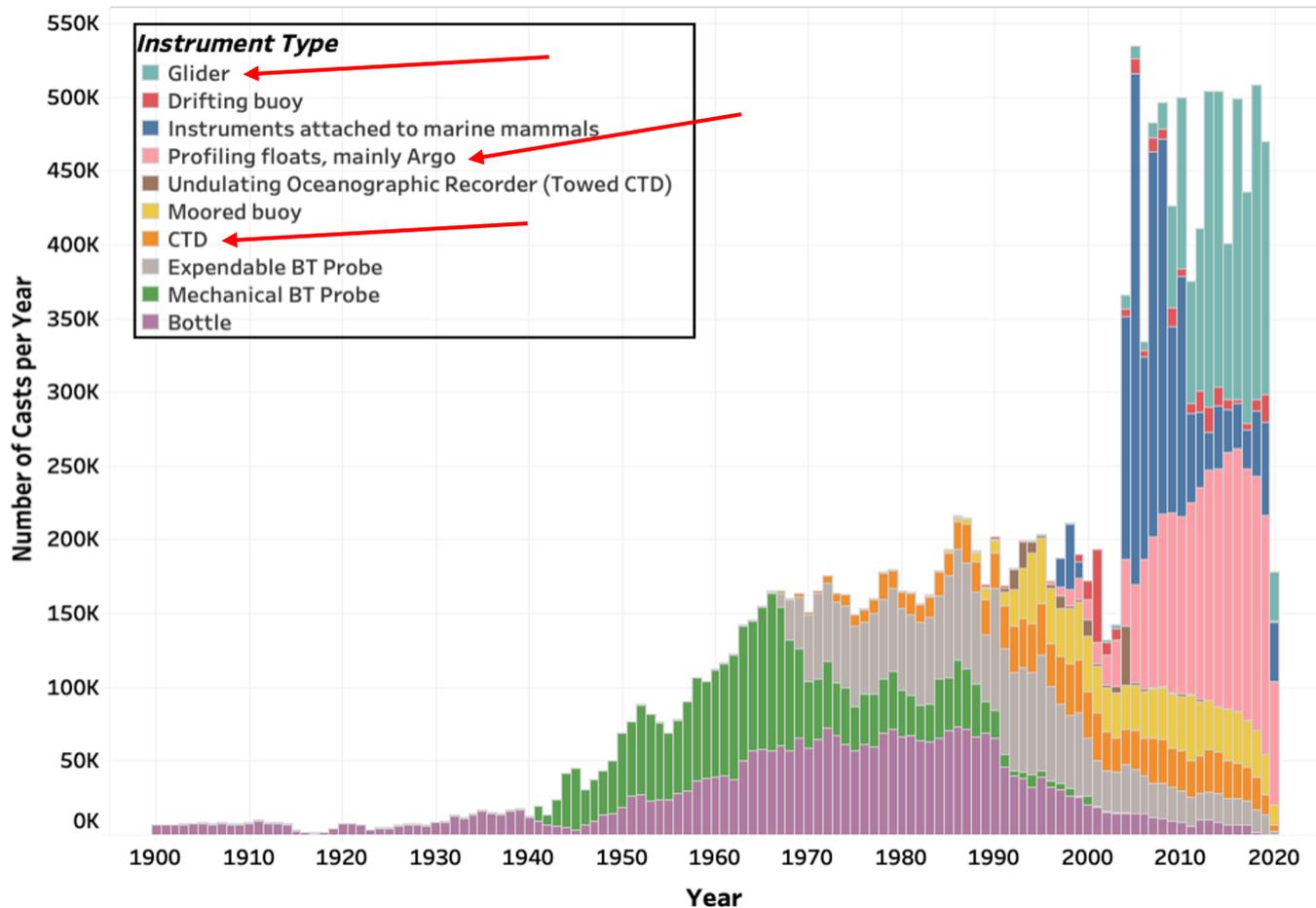
(1l) Plankton: 243,374 casts



Conductivity Temperature Depth (CTD)  
Glider (GLD)  
Mechanical Bathythermograph (MBT)  
Expendable Bathythermograph (XBT)  
Ocean Station Data (OSD)  
Undulating Oceanographic Recorder (UOR)  
Profiling Float (PFL)  
Moored Buoy (MRB)  
Drifting Buoy (DRB)  
Autonomous Pinniped Bathythermograph (APB)  
Gliders (GLD)



# Number of Casts per Year for Different Instruments in WOD



# Each Oceanographic Measurement is Expensive!

*In more ways than one ...*



# Atmospheric CO<sub>2</sub> (ppm)

