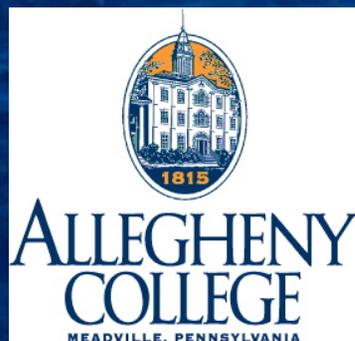


Preparing for an Academic Career in  
Geosciences Workshop: Summer 2009

# Incorporating Local and Global Data into Courses

Rachel O'Brien, Allegheny College

Ellen E. Martin, University of Florida



# Types of data available

- Online datasets
  - Teach particular concepts and/or skills
  - Recreate research, test hypotheses
- Hands-on data
  - Field work and/or lab work in your course
  - A genuine research experiment
- Published literature
  - Journal articles, government documents, NGO reports

# Datasets are flexible

- Data and assignments can be tailored to reach a broad range of student groups
  - Primary and secondary education (K-12)
  - Introductory undergraduate courses
  - Upper-level undergraduate courses
  - Graduate courses

# Datasets are cost-effective

- Majority of online sources are now free
- Simple, low-cost field and lab work

# Datasets are concept-effective

- Allow for compare/contrast work at a range of spatial & temporal scales
- Single or multi-concept patterns

# Example: Online Data Ocean Circulation

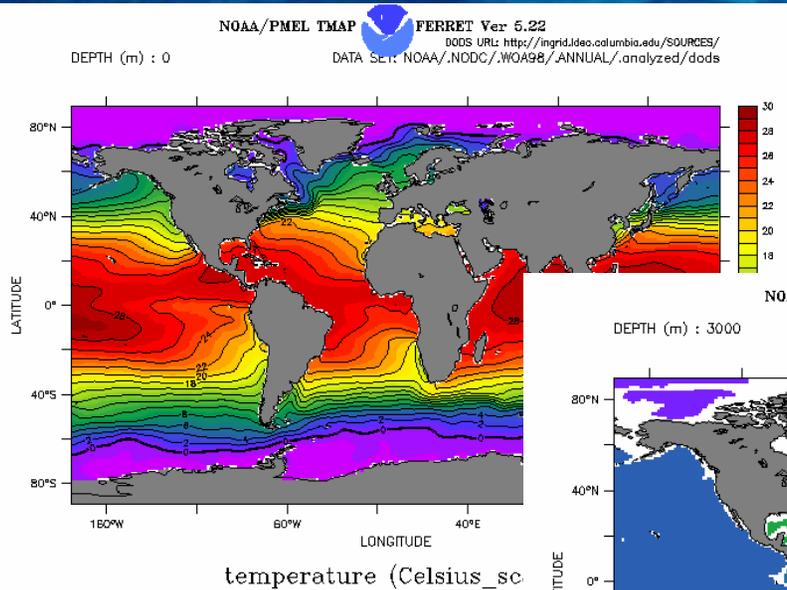
## NOAA's Live Access to Climate Data

- map views and cross sections
- range of variables for a range of depths
- Compilation of multiple data sets

## NOAA's Oceanographic In-Situ Data Access

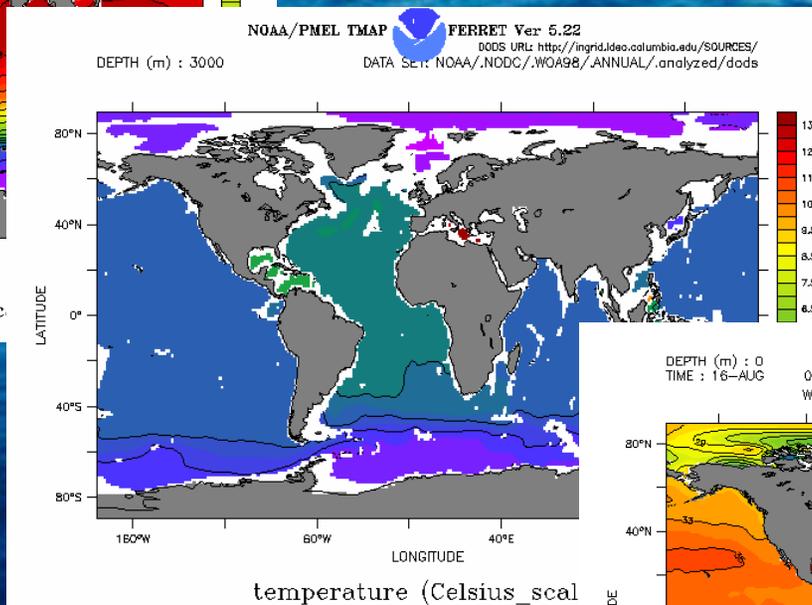
- CDT (conductivity, temperature, depth) data
- Depth profiles or Time series

# Ocean Circulation



Surface temperature

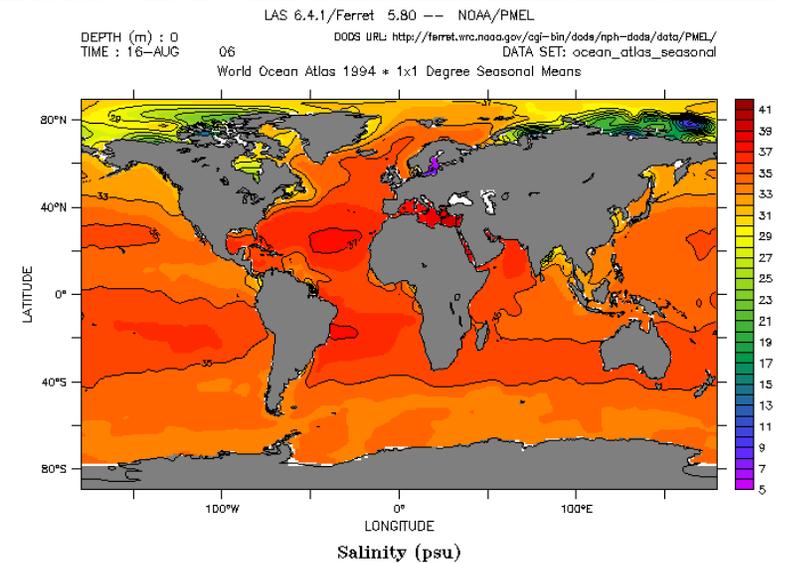
Map view



Temperature 3000 m

<http://ferret.wrc.noaa.gov/nvods>

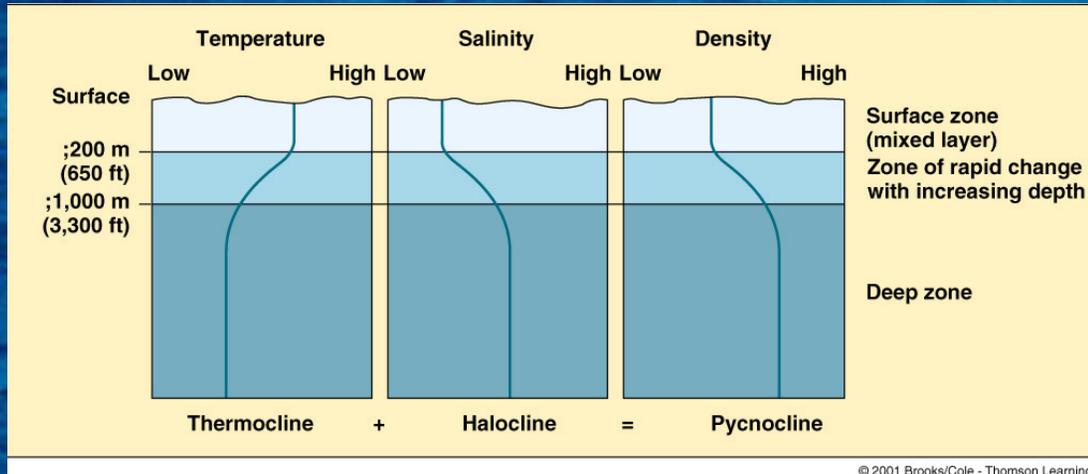
Surface salinity



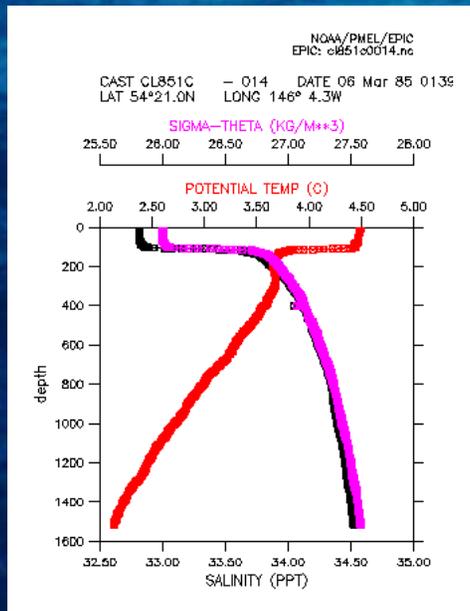
# Ocean Circulation

Profiles

Classic textbook



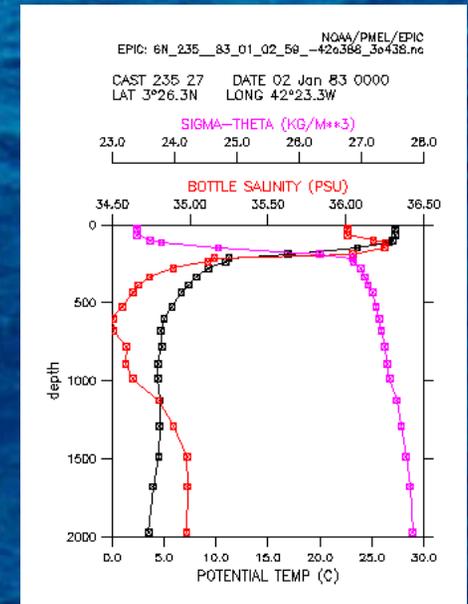
© 2001 Brooks/Cole - Thomson Learning



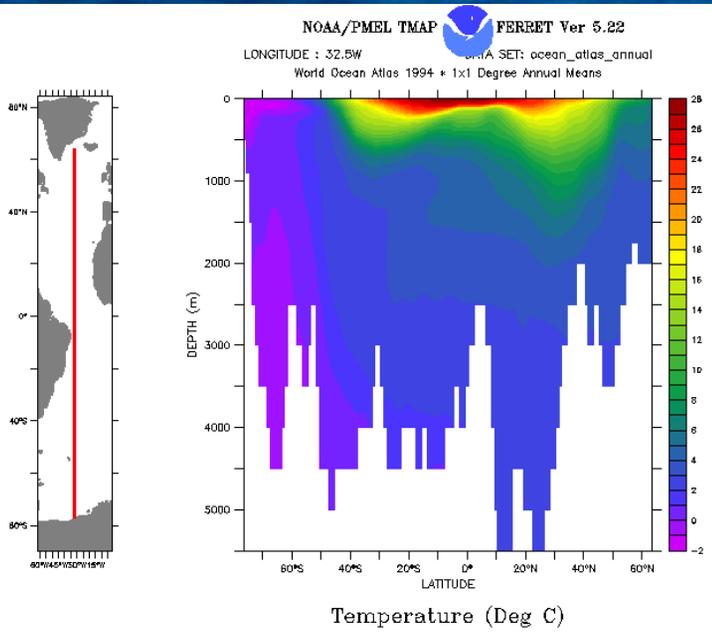
Pacific  
high  
latitude

Atlantic  
low  
latitude

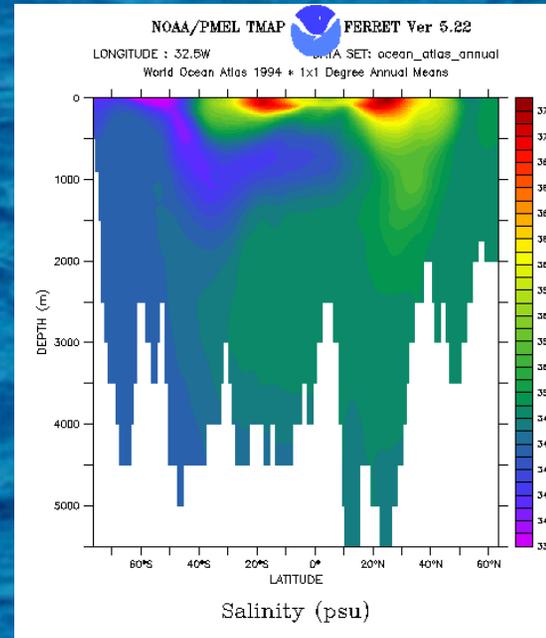
<http://www.epic.noaa.gov/epic/ewb/>



# Cross Sections

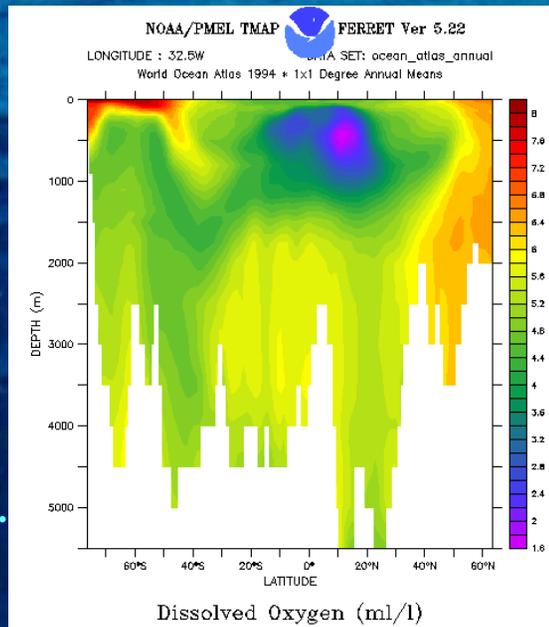


Temp

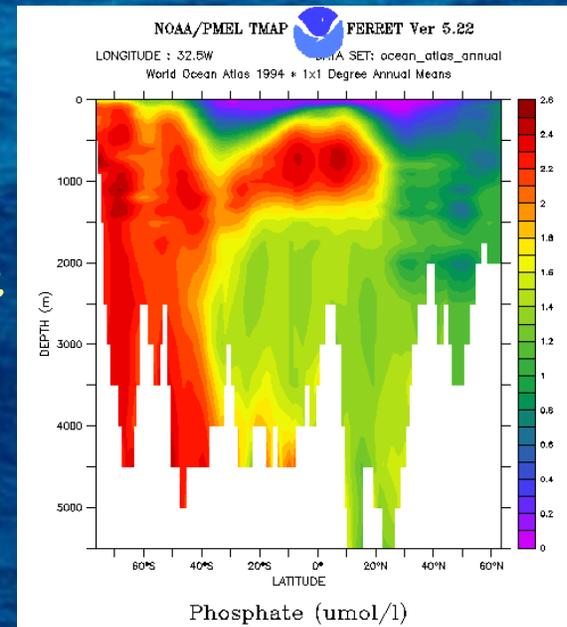


Salinity

Oxygen



Phosphate



<http://ferret.wrc.noaa.gov/nvods>

# Ocean Circulation Questions

1. Pick out areas of anomalous temperature (reconstruct circulation patterns)
2. Where do deep waters form today? (T and S acquired at the surface)
3. What controls density? (relative contributions of T and S under varying conditions)
4. Identify a salinity anomaly, come up with a theory for what might cause the anomaly and how you might test it (observation, testable hypothesis)
5. What is the relationship between oxygen and phosphate in the ocean? (nutrient cycling)

...

# Example: Hybrid, project-based course

•  
First-year seminar: Water and the Earth

H<sub>2</sub>O & N budgets: increasing spatial scale; increasing complexity

Hands-on and online data sources used

# What is a watershed?

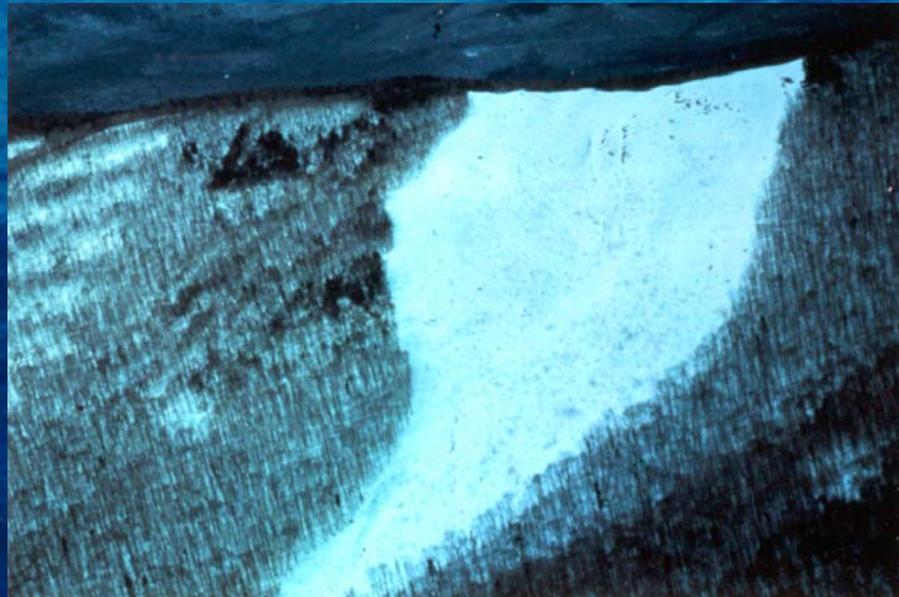
## Local watershed ( $10^{-1} \text{ km}^2$ )



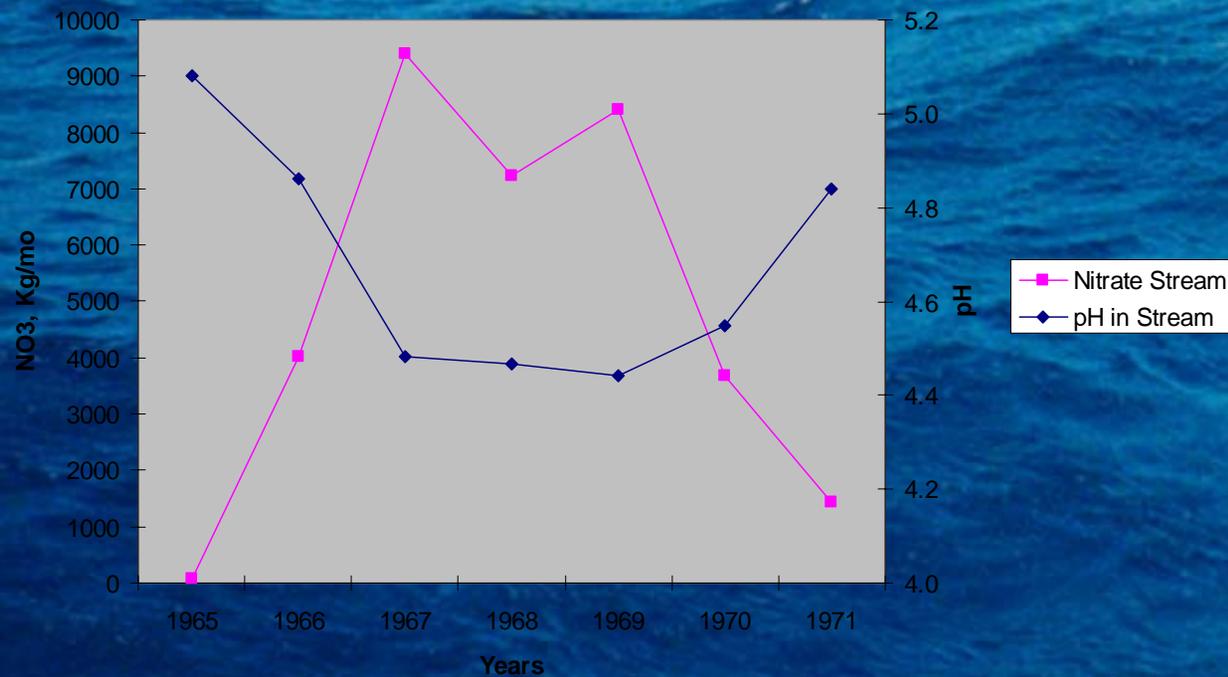
# What is a watershed?

RESERVOIR	VOLUME OF WATER, m <sup>3</sup>	PERCENTAGE OF TOTAL
Saturated groundwater	820,000	94%
Biomass	43,000	5%
Snow pack	7,800	<1%
Stream channel	22	2.5x10 <sup>-5</sup> %
<hr/> Total volume	<hr/> 870822	

What happens to water and N budgets when a forest is clear cut??  
NE watershed (10 km<sup>2</sup>)

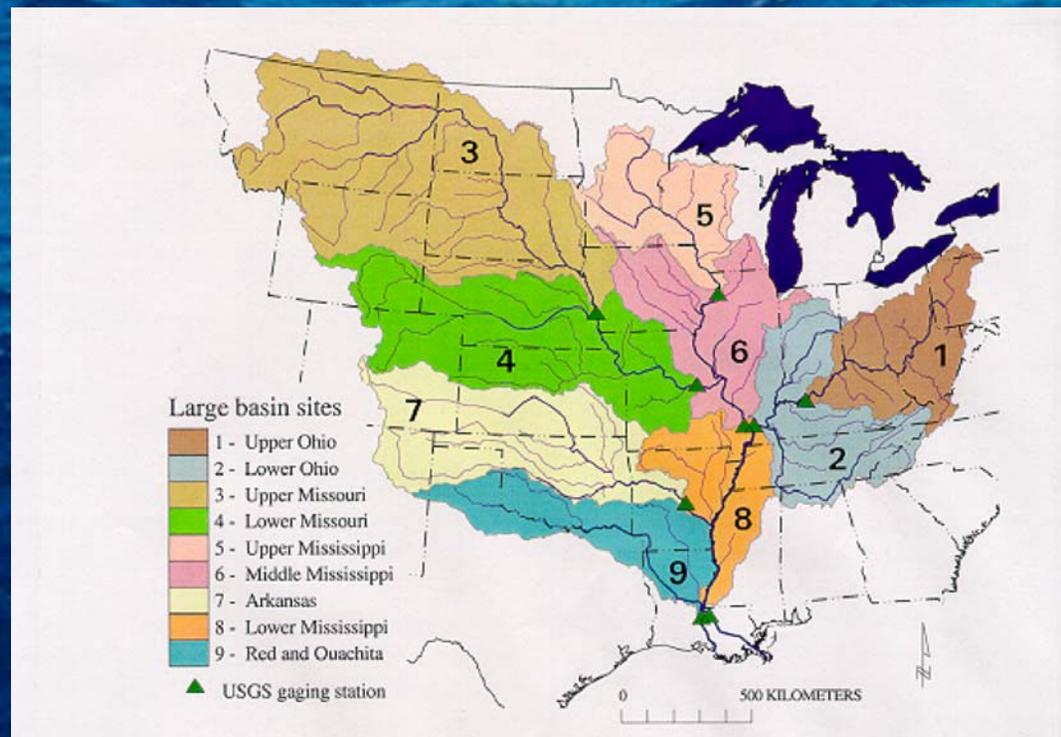


# What happens to water and N budgets when a forest is clear cut??



# What is causing the "Dead Zone" in the Gulf of Mexico?

## Mississippi River watershed ( $10^6 \text{ km}^2$ )



# What is causing the "Dead Zone" in the MRB?

Figure 4. Comparison of Urban and Agricultural Nitrogen input densities

