Challenges to Teaching Climate Change

Group Discussion Led by

Dr. Michael J Passow
“HOW DO WE KNOW WHAT WE KNOW ABOUT CLIMATE?”

• Where do teachers and students obtain the information they bring to the classroom?
• How accurate is a teacher’s personal knowledge of what to teach about “climate”?
• What resources (print and online) should a teacher include in lessons?
“Climate” vs. “Weather”

• People experience “weather” every day and adjust behaviors to current conditions.

• People are less aware of “climate” unless the “weather” seems to be very unusual (for example, very cold or hot, wet or dry).

• “Climate” should be one factor in long-term planning (for example, preparing for drought or other stresses on a community).
We “measure” weather and “calculate” climate

• “Climate” often means **data records** of:
  --means, maximums and minimums
  --expected ranges and patterns over time
  --extreme values (“most”/”least”)

• **Reliability** depends on monitoring system
  --how extensive is the area coverage?
  --what’s the period of time?
  --officially, “climate” covers at least 30 years
  But is this long enough to cover all situations?
USP IAG Weather Station
Parque Cientec, São Paulo
Operated since 1933
Often, we try to understand climate by “classification” into “zones”

http://www.dailygalaxy.com/photos/uncategorized/2007/03/27/world_climates_zones_2.gif
So I can sit in my house in New Jersey and learn “all about” climate on the Internet

- The **Amazon Basin region (1)**, with an equatorial climate characterized by agreeable temperatures but plenty of rain and humidity.

The **Northeastern Coastlands (2)** from Fortaleza to the Bahian south coast, with an all year round travel climate pattern.

The **Rio de Janeiro, Vitoria** and **Sao Paulo coast (3)**, with a hybrid pattern.

The **South States Region (4)**, with a temperate four season climate pattern; and

The **Inland Plateau (5)**, from the northeast inland to the Pantanal, with a hard dry season and more extreme temperatures.

Much information is available for tourists and conference attendees

Average Iguazu Falls Temperatures

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<tr>
<th>Month</th>
<th>High °C</th>
<th>Low °C</th>
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<tbody>
<tr>
<td>January</td>
<td>32</td>
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<td>December</td>
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- The climate of Foz do Iguaçu is subtropical, with two distinctive seasons: humid and hot in the summer and dry and cool, in the winter. Annual average temperature is 23.8°C, but can be as high as 40°C in the summer or as low as -5°C in the winter. The average in the summer is 26.5°C and in the winter 15.4°C.

- Generally, the city is sunny, but rain is fairly common during the spring and in the summer. The weather changes frequently because the region where the city stands is the zone where frequently three fronts meet. As consequence, it is not uncommon to see thunderstorms.
Most people only want to know if the climate of an area is “hot/cold/wet/dry”

- Such general zones may be useful to understand what exists now
- But we need to look more closely to find out how climate is changing
“Micro-climates”

Also, we know that geographic or anthropogenic conditions often produce ‘small-scale’ climates within larger zones

Examples:

• elevation (consider SP and Santos)
• mountain ranges (rainy side and arid side)
• north- vs. south-facing hills and valleys
• adjacent water bodies (oceans, lakes)
Weather and Climate in the News

Pakistan flooding death toll reaches 800
By the CNN Wire Staff
July 31, 2010 11:07 a.m. EDT

Russia mobilises 240,000 to fight deadly wildfires

Firefighters are battling blazes in 14 of Russia's 83 regions
http://www.bbc.co.uk/news/world-europe-10828039

Egypt seeks wheat as drought slashes Russian crop

http://af.reuters.com/article/investingNews/idAFJOE66U03X20100731
National and local climate and weather data are available through the Internet

http://www.inmet.gov.br/

http://www.wmo.int/pages/themes/climate/index_en.php

Argentina

http://www.smn.gov.ar/

Paraguay

http://www.meteorologia.gov.py/
http://www.ncdc.noaa.gov/oai/ncdc.html
http://www.ametsoc.org/amsedu/ecs/home.html

DataStreme ECS Learning Files

Weekly Climate News
Supplemental Information...In Greater Depth

Last Week's Climate News
Last Week's Supplemental Information

Climate Information
Climate Variability
Climate Change

Societal Interactions and Climate Policy
Discussion

• How do you learn about the climate of your country and region?
• What do you teach about climate in your classes? Why?
• What do you teach about climate in other parts of the world? Why?
Is the Climate Changing?

Atmospheric CO₂ Changes

“The Keeling Curve”

http://scrippsco2.ucsd.edu/

Sea Ice Coverage

Northern Hemisphere Extent Anomalies Jun 2010

http://nsidc.org/data/seaice_index/images/n_plot_hires.png
How do we know what we know about climate change? “Direct” and “Proxy” Data

- Ice cores from Greenland and Antarctica (atmospheric gases and isotope studies)
- Sea level changes
- Dendrochronology (tree rings)
- Palynology (pollen studies)
- Microfossils in sea floor sediments
- Glaciers
- Flora and fauna diversity changes
- Other (sunspots and solar emissions, etc.)
Creating a “Theory” of Climate and Climate Change

• Understanding what causes weather and why weather changes based on ‘air mass-front-pressure system theory’
• General climate patterns explained by latitude and geographic factors
• But more needed to explain details of how and why climates change over time
• Efforts underway at IRI and other research centers
Intergovernmental Panel on Climate Change (IPCC) [http://www.ipcc.ch/](http://www.ipcc.ch/)
IPCC Fourth Assessment Report: Climate Change 2007 (AR4)

**Working Group I Report**
"The Physical Science Basis"

**Working Group II Report**
"Impacts, Adaptation and Vulnerability"

**Working Group III Report**
"Mitigation of Climate Change"
Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.

Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.
The Long-Term Perspective

• Determining what constitutes “dangerous anthropogenic interference with the climate system” ... involves value judgements. Science can support informed decisions on this issue, including by providing criteria for judging which vulnerabilities might be labeled ‘key’.

• There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change.
• Responding to climate change involves an iterative risk management process that includes both adaptation and mitigation and takes into account climate change damages, co-benefits, sustainability, equity and attitudes to risk.

Examples of International Responses

Brasil Climate Change Policy

World Climate Impact Assessment and Response Strategies Program
US Global Change Research Program

- Key Findings
- Regional Climate Change Impact
- Climate Change Impact by Sector
  (examples, Water Resources, Energy Supply, Human Health)
Politics of “Climate Change”

• Why should something that has received such thorough “scientific” and “socio-economic” study and unanimous approval prior to publication have become “political”?
• Why do certain countries appear to be more “politicized” than others?
• What motivates “Climate Change Deniers”?
“Climategate”

• Accusations of scientific fraud and deceit based on “hacked” e-mails from an English research university

• Widely disseminated charges through the Internet (not always fact-checked or documented)

• Formal reviews determined no validity to charges “Climategate debunked” – many, many web links

  But is the ‘damage’ to teaching already done?
Failure of Leadership

• The World looks to the United States to provide leadership, but political battles caused the U.S. Senate to fail in efforts to pass climate and energy legislation at this time

“IN U.S. SENATE, CLIMATE CHANGE BILL DIES WITH A WHIMPER”

Senator from Oklahoma (oil & gas state) makes snow structures during winter storm as publicity stunt about ‘fake global warming’

June & July among hottest in decades
Some Final Thoughts

• We can’t “unlearn” anything – we can only try to learn something else that overwhelms false information

• Learning is “constructed” by individuals, so we need to provide students with accurate and appropriate information and resources

• Understanding potential impact of climate change and mitigation/adaptation strategies may be one of keys to world future
Discussion

• What do you see as important challenges to teaching about climate change?
• How do you suggest we teach about failure of current leadership to resolve the problems?
• How might we create future leaders who will be “scientifically literate” enough to deal with conditions they will face?
To continue our discussion:
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