Environmental Stewardship and Climate Datasets

Dr. Alan K. Betts
Atmospheric Research, Pittsford, VT 05763

akbetts@aol.com
http://alanbetts.com

High School Streams Project
VT EPSCoR RACC

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• Earth sustains life
• Weather changes fast
• Climate changes slowly
• Greenhouse gases keep Earth warm
• Burning fossil fuels – coal, oil and gas – is having a big effect on climate by increasing greenhouse gases: CO₂ and H₂O

January 2, 2012: NASA
Will Attitudes Change?

• Changing climate and extreme weather will raise awareness

• ‘Managing’ Lake Champlain is a microcosm for ‘managing’ the Earth
Environmental Stewardship

• You will understand how humans interact with the Lake Champlain Basin

• And that understanding will give you the tools and the responsibility to be environmental stewards
The CO$_2$ Problem Looks Insoluble?

- The CO$_2$ problem looks insoluble (and the consequences bleak) (and the political system paralyzed)

- Is it hopeless???
The CO$_2$ Problem Looks Insoluble?

- The CO$_2$ problem looks insoluble (and the consequences bleak) (and the political system paralyzed)

- Is it hopeless??? Not at all!

- Hope is central as it opens doors to creativity and possibilities that we cannot yet imagine

- We are active participants in the creation of the future – it is not under our ‘control’ but nothing is a foregone conclusion
Exxon-Mobil’s View (6/27/2012)

• Exxon-Mobil CEO, Tillerson, in a break with predecessor Lee Raymond, has acknowledged that global temperatures are rising. "Clearly there is going to be an impact," he said Wednesday.

• He said that people would be able to adapt to rising sea levels and changing climates that may force agricultural production to shift.

• "We have spent our entire existence adapting. We'll adapt," he said. "It's an engineering problem and there will be an engineering solution."
Just an Engineering Problem?

• Parts can be solved by engineering

• Much of the Earth’s biosphere cannot be ‘engineered’ – and this includes humanity
Waste Streams

- Thrown into the frozen flood plain of the Otter Creek
- Around 10 million tonnes of plastic ends up in the sea.
- Ends up on beaches and in one of the five ocean gyres as plastic fragments
How Do We Manage the Earth?
(When there is so much we don’t know)

• Need a long time horizon:
  • Generational to century (*Forest timescale*)

• We need some new rules / guidelines
  • Our numbers are so great
  • Our industrial impact is too large
  • Much of the Earth cannot be engineered
Engineering Guidelines to Minimize Human Impacts

- Minimize the lifetime of human waste-streams in the Earth system and eliminate waste with critical biosphere interactions
- Minimize the use of non-renewable raw materials, and
- Maximize recycling and re-manufacturing
- Maximize the efficiency with which our society uses energy and fresh water, and
- Maximize the use of renewable resources
Examples of Long-Lived ‘Waste’

• CO$_2$ from fossil fuels – lifetime centuries – greenhouse gas (that with water vapor greenhouse and ice-albedo feedbacks) pushes earth to warmer climate

• CFCs – refrigerants – lifetime centuries - broken down by sunlight in stratosphere – catalyze destruction of ozone that protects earth from UV. (1989 Montreal protocol phase-out avoided UV
Greater Efficiency Critical

• We need to double or triple our energy efficiency because…
  • We cannot replace current fossil fuel use with biofuels & renewable energy
  • Oil and gas reserves are limited, but coal & oil shale reserves are sufficient to push CO$_2$ to 1,000 ppm—and in time melt icecaps
    • How much CO$_2$ can we “sequester” back in the earth?
As climate changes....

- Everything is interconnected
- Human society and waste streams: people’s choices, actions and adaptations
- Precipitation, seasons, streams, and forests; habitat and wildlife; biosphere’s adaptation

- You have specific tasks in a large project
- But keep your eyes open to the big picture and draw connections
- Record more than the project lists/protocols
- Keep sharing your discoveries and asking us for guidance
Climate Data Sets

• A sea of WEB sites (see list) – weather data came first, so ‘climate data’ is often buried (And Congress has refused to set up proper climate service – guess why!)

• New datasets every year

• What would help you understand the data you are collecting?
• What would be interesting to connect?
Weather, Climate and Educational Websites

• National Weather Service/Burlington, Vermont: http://www.erh.noaa.gov/er/btv
• National Weather Service/Albany, New York: http://www.erh.noaa.gov/er/aly
• National Weather Data: weather.gov
• (Climate Diagnostics center www.cdc.noaa.gov)

• Vermont State Climate Office http://www.uvm.edu/~vtstclim/

• Your specific need – Browse and then ASK!
Leslie-Ann has collected many links under data.
NWS-BTV
(Chuck McGill)

- Local Climate
Monthly Climate Data (5yr)

- Preliminary data: final archive is at CDC: ask Leslie-Ann or Chuck for guidance
Climate Context: NCDC


Climate Monitoring
National Oceanic and Atmospheric Administration
National Climatic Data Center

- State of Climate
- US products
  - Climate At A Glance
  - Temperature and Precipitation Maps

- State of the Climate
- U.S. Products
- Global Products
- Drought Monitoring
- U.S. and Global Extremes
- Hurricanes/Tropical Storms
- Tornadoes
Temperature and Precipitation Maps

March-May 2012 Statewide Ranks
National Climatic Data Center/NEISDIS/NOAA

Temperature
1 = Coldest
118 = Warmest

Precipitation
1 = Driest
118 = Wettest

- Visual grasp of spring 2012 climate
Other weather data sources

• As technology gets cheaper, large amounts of weather data are now being collected automatically (typically every 5mins) to monitor conditions on roads, by utilities and by renewable energy installations (interested in the downward solar flux, temperature or wind speeds). Some like the solar flux data (which is an indirect measure of absorption and reflection by clouds and aerosols) have not been available before in the state.

• Vermont does not yet have a systematic archive for these data; and the siting and instruments are not ‘standard NWS’, so you must take care if you use these data.
VT has 24 RWIS weather stations

• Along the main road network: I-89, I-91, Rtes 2, 4, 7, 9, 103.

• WAS at http://511.vermont.gov/main.jsf

• Maps/data temporally unavailable (since 6/21) – site being redone
Solar Arrays

Ferrisburgh Solar Farm

Current Weather Conditions in Ferrisburgh, VT

- Wind Speed: 5.0 MPH
- Wind Direction: North
- Ambient Temperature: 82.1°F
- Barometric Pressure: 29.7 in
- Relative Humidity: 43.0%

- And downward solar flux = 535.6 W m\(^{-2}\)
School in Richmond

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Without data science is just models in a virtual reality

• What would help you understand the data you are collecting?
• What would be interesting to connect?

• A specific need – Browse and then ASK!
• Look around – we are getting buried in data!

• Other RACC scientists please advise on a few data sources relevant to each schools project.
• Stay in touch