GLOBAL WARMING

GEOLOGY IN THE NEWS: new island forming near Japan as a result of underwater volcanism.

Q: Why do we care?

A: News, political debates, science and facts. People talk about it using hypotheses, facts, & opinions.

2 questions that get mixed up: "Is the Earth warming up?" and "If so, why?"

I. IS EARTH WARMING UP?

- Temperature calculations can get confusing because of different places, statistical averages, etc. (Also, there are too many ways to measure temperature).
  - How to do it: use a proxy (glaciers)
    - If temperature increases, glaciers melt
    - 1980-2002, glacier almost completely melted
    - 1941-2004, Alaskan glacier almost completely melted
- Conclusion: lots of places are getting warmer

II. WHY IS EARTH WARMING UP?

- More than one reason
  - Earth is naturally warming due to coming out of ice age; Milankovich cycles, etc.; this accounts for ~50% of warming
- Unusual warming patter: the warming is occurring faster & has greater magnitude than other warming trends we have data for in recent history
- Is the amount of greenhouse gases increasing?
  - Yes, started increasing in 1800s.
- Is the amount of escaping insolation decreasing?
  - Yes, greenhouse gases are trapping insolation.
- Conclusion: ~50% of the temperature change is due to buildup of greenhouse gases

- To argue against this, you have to have a better hypothesis that is consistent with the facts
- Humans % greenhouse gases
    - Is the greenhouse gas buildup anthropogenic?
        - Possibly, burning fossil fuels starting in 1800s (Industrial Revolution), population increase
        - CO_2 buildup (A LOT): increases almost 100 ppm in 50 years, however this is not necessarily due to humans
        - CO_2 buildup from past 400,000 years alternates but currently is way higher than ever; still does not prove a source
- Finding the Carbon Source
    - Investigate which carbon isotopes are building up
    - In atmosphere, C-14/C-12 ratio is decreasing (this means either C-14 is decreasing or C-12 is increasing)
        - We know C-14 is at a steady state, so C-12 must be increasing
    - Seuss Effect- amount of C-12 is increasing
- Finding the C-12 Source
    - Several things add carbon to the atmosphere, so which is responsible?
        - Volcanoes emit C-13; forest fires emit C-12 & C-14; fossil fuel burning emits C-12
    - Conclusion: the Seuss Effect strongly supports the anthropogenic hypothesis
- Fact: human activity is increasing atmospheric CO_2
- Fact: CO_2 helps increase temperature
- Conclusion: we are responsible for some of the warming
- One would still need a better hypothesis to be able to refute this
- Still skeptical? We have to deal with changes global warming causes regardless of what is causing it (sea level rising, deserts, hurricanes, polar bears dying, etc.)

III. GLOBAL WARMING MYTHS

- Both sides exaggerate & twist facts

- Be skeptical, not paranoid
- Think for yourself
- If you don't make up your own mind, others will be glad to tell you what to think
- 1. "The Coasts Are About to Flood"
  - Consider timescale of changes- it's coming but it's not coming that fast
  - Significant sea level change will occur but on a decadal or centurial scale
- 2. "The Planet is Burning Up"
  - Consider how data is presented
    - Reds & blacks together freak people out (black widows, sith lords, USC)
    - When maps are flattened out, things get distorted
- 3. "Record Low Temps Disprove Global Warming"
  - "1100 record lows were recorded in the US during summer '14... so much for global warming"
  - Sounds authoritative but data do not support conclusion
    - 1 place
    - 1 season
    - Data distribution info lacking
    - Data on record highs & norms lacking
    - Weather & climate getting mixed up
- 4. "It's Only 3 Degrees, Who Cares?"
  - 3°C ~ 5.4°F
  - Global average of 3° increase
    - Last ice age: global average temperature was ~4.5°C lower than today
  - Many organisms can't tolerate temperature shifts of even a few degrees
- 5. "Scientists Can't Decide Between Global Warming & Cooling"
  - Goes back to 1975