HONR 229L: Climate Change: Science, Economics, and Governance

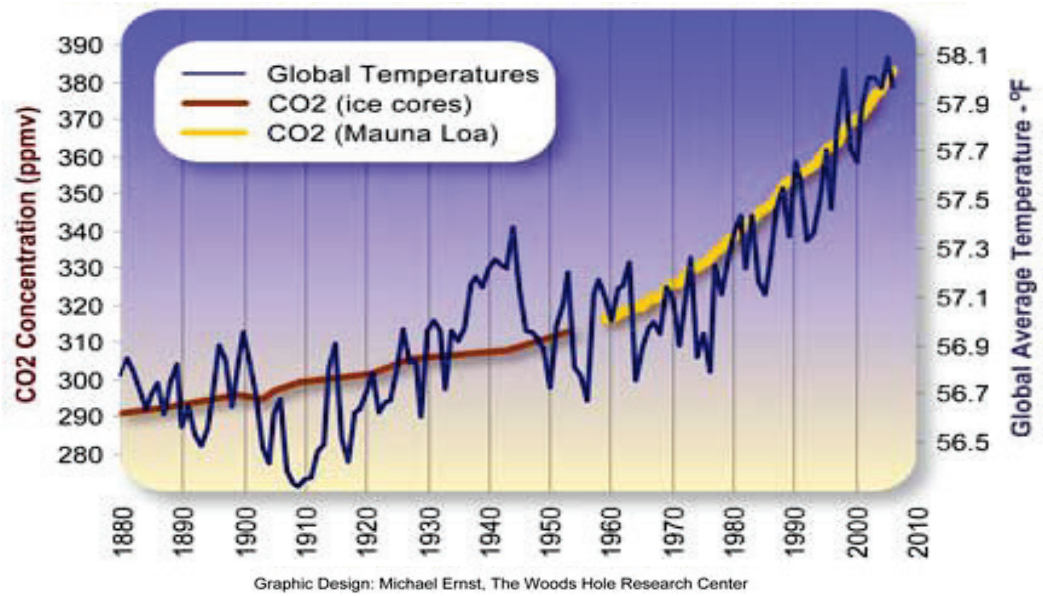
Discussion #8: Introduction to Climate Change

Ross Salawitch

rjs@atmos.umd.edu

Class Web Site: http://www.atmos.umd.edu/~rjs/class/honr229L

ELMS Page: https://myelms.umd.edu/courses/1269254



Rise in Global Average Temperature over past century is 1.4 °F or (5/9) × 1.4 = 0.8 °C

27 September 2019

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AT 7, Q1: What does Diamond state as his motivation for writing this chapter?

Diamond states that his motivation for writing this chapter is the " practical one of identifying what changes would be most effective in inducing companies that currently harm the environment to instead spare it."

In this chapter, Diamond discusses the relationship between large companies and the environment. He explores many examples of these relationship, such as the oil, hardrock mining, and logging. Though these examples, he hopes to discover a way for the two to mutually exist. By looking at successful and unsuccessful examples of them, we can determine which roads to follow and which to avoid.

I admire Jared Diamond for his consistently optimistic outlook.

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AT 7, Q2: Compare and contrast conditions at the Salawati oil field in what is known as Indonesian New Guinea to conditions in the Kutubu oil field of Papau New Guinea

In the Salawati oil fields **Jared Diamond encountered flames shooting out of high towers where natural gas was being burned off, many forests cleared to make way for roads destroying the rain forest habitat for many species, numerous oil spills on the ground, a limited number of fruit pigeons, and employees describing the practice of hunting these limited types of birds.**

In contrast the Kutubu oil field **was much more environmentally friendly. The company that worked there, Chevron, engaged in a world wildlife fund to protect the local environment. The conditions were also much different with a large rain forest covering the ground, only thin paved roads, regulations that prohibited firearms and hunting, other regulations that protected the safety of the wildlife and their habitat, safety and environmental regulations for the employees, and the numerous amount of species and wildlife in the Chevron. In fact there were *more species on the Chevron site than anywhere else in the island*, except for a few remote and uninhabitable areas.**

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AT 7, Q2: Compare and contrast conditions at the Salawati oil field in what is known as Indonesian New Guinea to conditions in the Kutubu oil field of Papau New Guinea

There is a sharp contrast in the way the conditions at the Salawati oil field and the Kutubu oil field are described by Diamond in his book. In the case of the Salawati oil field, the company interrupted large portions of the natural forest to install very wide access roads. These roads were too wide for many species to cross, thus hurting the biodiversity of the region. Furthermore, Diamond alluded to the idea that some of the employees may have hunted the pigeons and other species, thus hurting population numbers even more. Finally, the company did not try to create an amicable relationship with the local people, which, combined with the numerous oil spills and indifference the company showed towards the environment, likely led the people to have a negative opinion of the oil company.

In contrast, the company that owned the Kutubu oil field took special care to build access roads that were as narrow as possible and disrupting the local ecosystem as little as possible. Furthermore, the company had many strict policies, including against hunting and taking living organisms from the region. As a result, Diamond was shocked to find the rich biodiversity and strong population numbers of species in the area around and in the oil field. Finally, Chevron managers understood that a positive relationship with the local peoples was essential for the continuation of their operation in the area. By building this relationship, the company showed concern for the local people, which certainly had to make the locals feel more at ease with the idea of an oil field in their backyards. Thus, although the two oil fields are in a similar geographic area, beyond that, the two companies and their oil fields could not be any more different.

If all oil and gas extraction operations were conducted in the manner of the Kutubu oil field, the world would be a better place. The world would be a much better if oil and gas extractions no longer occurred. For this to happen, renewable energy and/or nuclear energy must be developed to fill the gap.

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AT 7, Q 3: Write a few sentences summarizing Diamond's take on the modern logging industry.

Feel free to note the positive benefit of trees, some of the statistics on deforestation given in the book, the story of Aloysius should you so desire, and /or the impact of deforestation on climate.

Trees are beneficial in that they are habitats for animals and that they prevent soil erosion and provide humans with a resource to make paper, furniture, houses, and more. Diamond's take on the modern logging industry is that unsustainable logging practices still exist in some Southeast Asia and Pacific countries. Loggers bribe leaders that own forests and threaten to kill those opposed to them, just like how Aloysius and his family were threatened, which prompted him to move his family out of the country. On the other hand, Diamond believes unsustainable logging is less successful in first world countries, and that many loggers there seek certification from the FSC (Forest Stewardship Council) to improve the public perception of their companies. Since the FSC was established, there are 156,000 square miles of certified forests, of which 33,000 miles are in North America.

FSC certification has moved into the Amazon and Africa, albeit slowly:

https://globalforestatlas.yale.edu/conservation/forest-certification

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AT 7, Q 4: The reading also includes a link to a Aug 2019 statement regarding environmental responsibilities of American businesses that is signed by CEOs of companies such as Amazon, American Express, etc.

Please:

a) pick one specific company

b) in your own words, briefly summarize what this company is doing to help the environment

c) state whether you believe this action from the company you have chosen is a meaningful action for helping the environment

Alcoa Foundation: gave a $300,000 grant to the All In On Recycling Challenge, an effort to get the US to recycle more and better. **Meaningful action because getting people to recycle correctly is a major challenge and many recyclables get sent back.**

Alcoa Foundation: gave a $300,000 grant to the All In On Recycling Challenge, an effort to get the US to recycle more and better. Much more action needs to be taken in order for Alcoa to claim they are a part of a recycling movement. **Whether that be in terms of service or monetary support, Alcoa has much more to give.**

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I think a company the size of Alcoa, with a market capitalization (i.e., net worth) of $3.8 billion could so much more.

$300,000 / $3.9 billon = $3\times10^{5} / 3.8\times10^{9} = 7.9 \times10^{-5}$

$300,000 is 0.008 % of $3.8 billion.

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Apple: Actions include getting itself and other companies in its supply chain to run on 100% clean energy, generating a portion of that clean energy, and starting a fund to finance renewable energy projects in China and environmental initiatives around the world. **Meaningful actions to help the environment.**

Apple: Actions include getting itself and other companies in its supply chain to run on 100% clean energy, generating a portion of that clean energy, and starting a fund to finance renewable energy projects in China and environmental initiatives around the world. I feel that they are completely missing the e-waste aspect. **Apple is always trying to come out with newer products and persuade consumers the buy them, rather than keeping their well-functioning cellphone.**

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American Airlines: Reduced plastic waste; **seemingly small sustainable switches can inspire the public to care about the planet and fight against unsustainable business practices**. **x 2**

American Airlines: Reduced plastic waste; kind of **overlooks the fact that airplanes are a major contributor to global emissions of CO_2**

--

Johnson & Johnson: reduction of packaging **is absolutely in favor of protecting the environment without any side effects.**

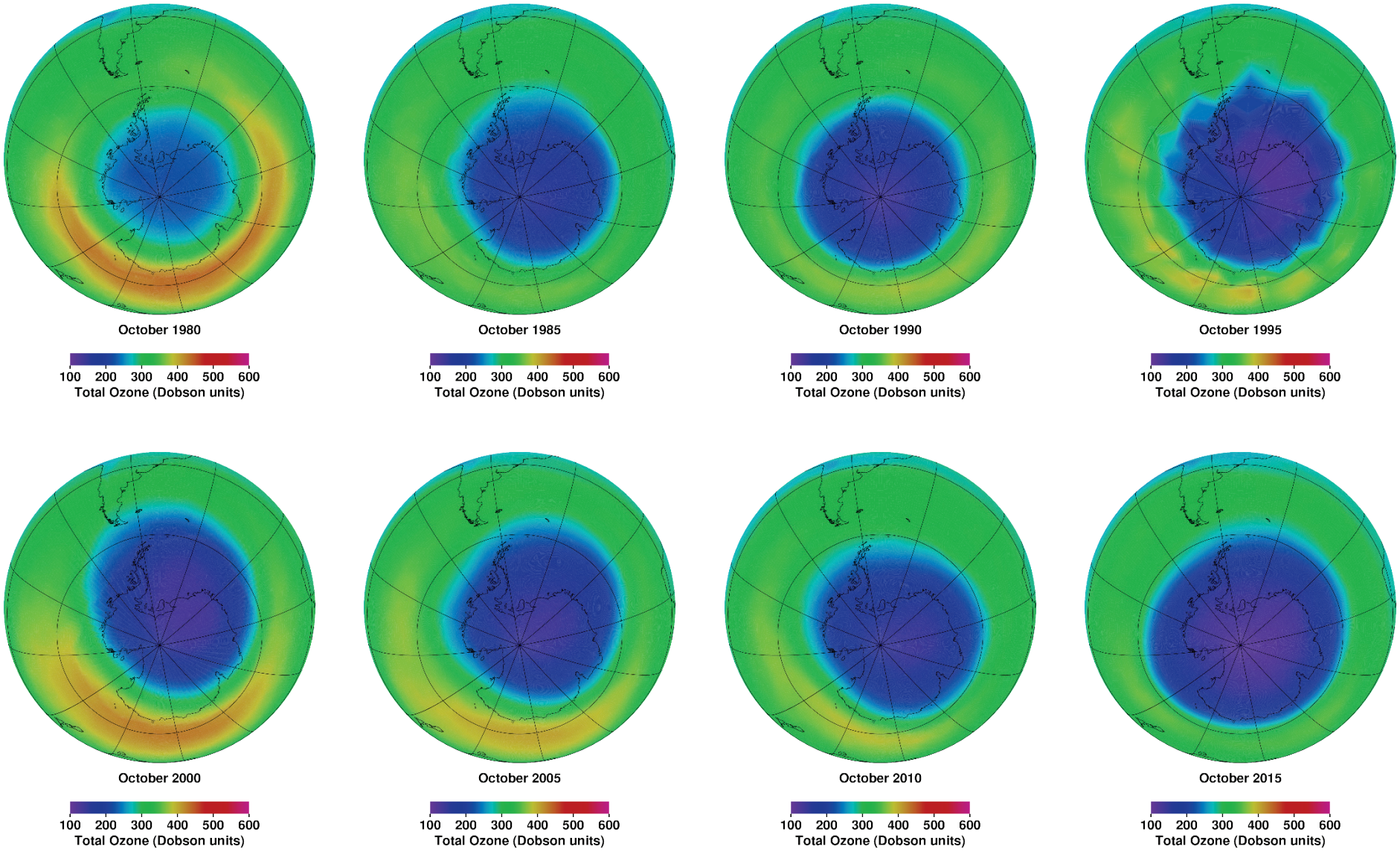
Johnson & Johnson: reduction of packaging is not nearly enough because this action is in the self-interest of the company, and **this action will not significantly affect the amount of energy used to produce their products**.

--

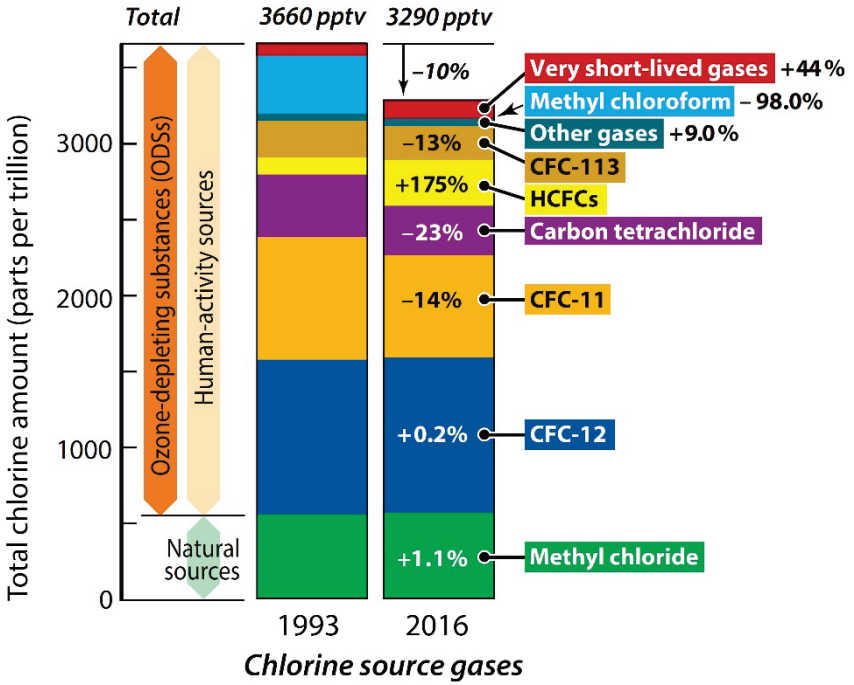
Novelis: Recycling at Mercedes-Benz stadium is used to fund a new Habitat for Humanity home. These actions and goals and aims are those that should be adopted by more companies, as they **reflect more sustainable approaches and really do align with the agreements for environmental responsibilities**. x 2

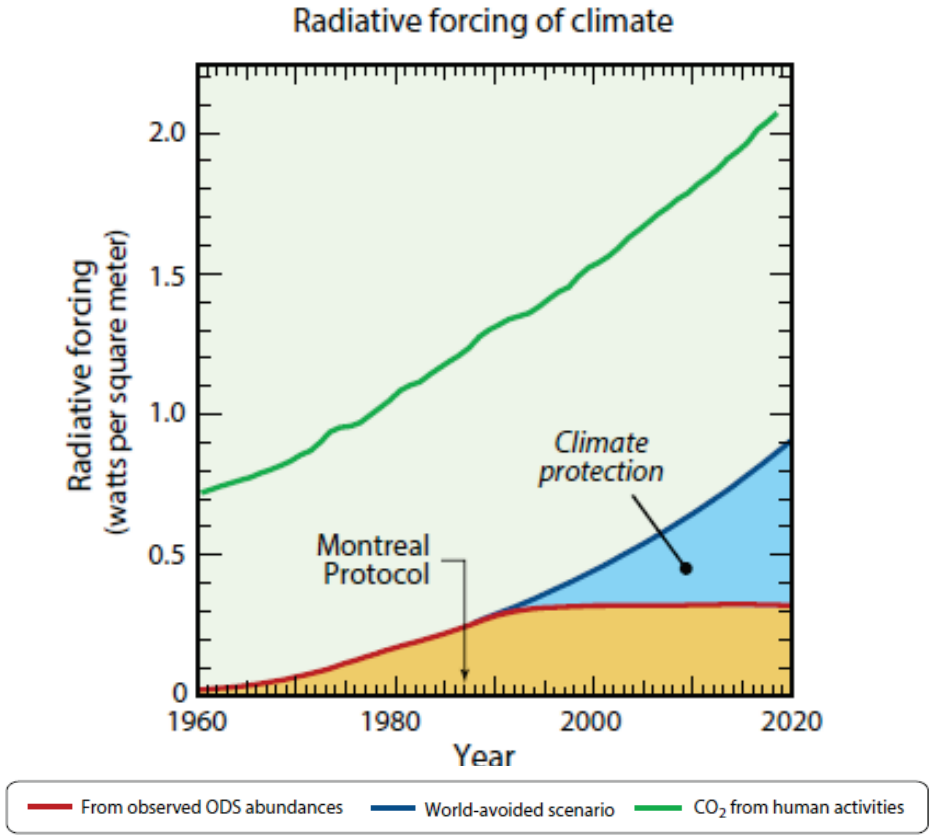
Novelis: Recycling at Mercedes-Benz stadium is **simply not enough**.

Antarctic ozone hole: world's second modern global environmental crisis



CFCs were banned by the Montreal Protocol, replaced by HCFCs (short-term) and HFCs (long-term)





CFCs: contain chlorine, fluorine, and carbon: nearly all reach the stratosphere and deplete the ozone layer

HCFCs: contain hydrogen, chlorine, fluorine, and carbon: most do not reach the stratosphere; those that reach the stratosphere deplete the ozone layer

HFCs: contain hydrogen, fluorine, and carbon: many reach the stratosphere; since no chlorine is in these compounds, no ozone depletion results. However, HFCs are potent GHGs

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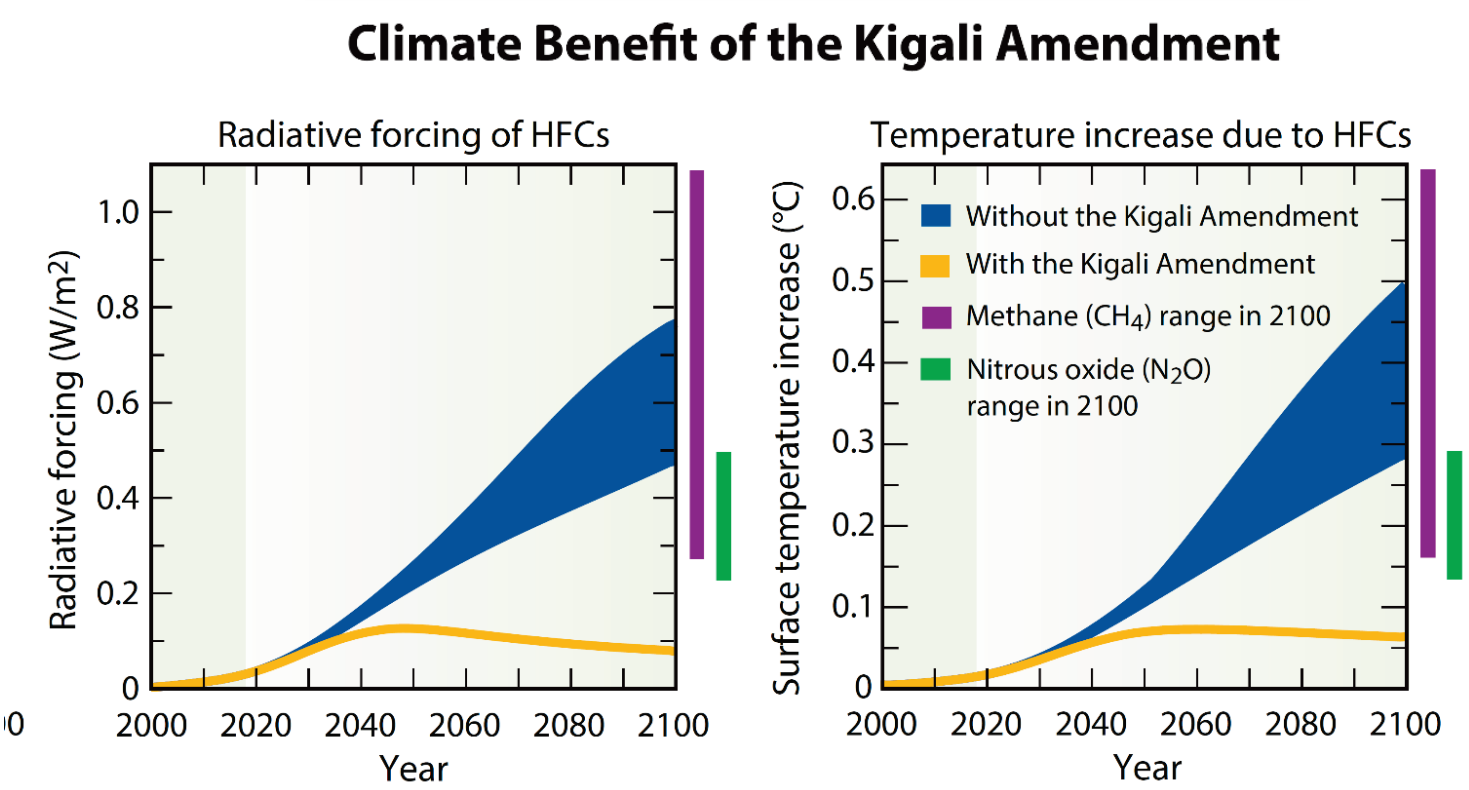

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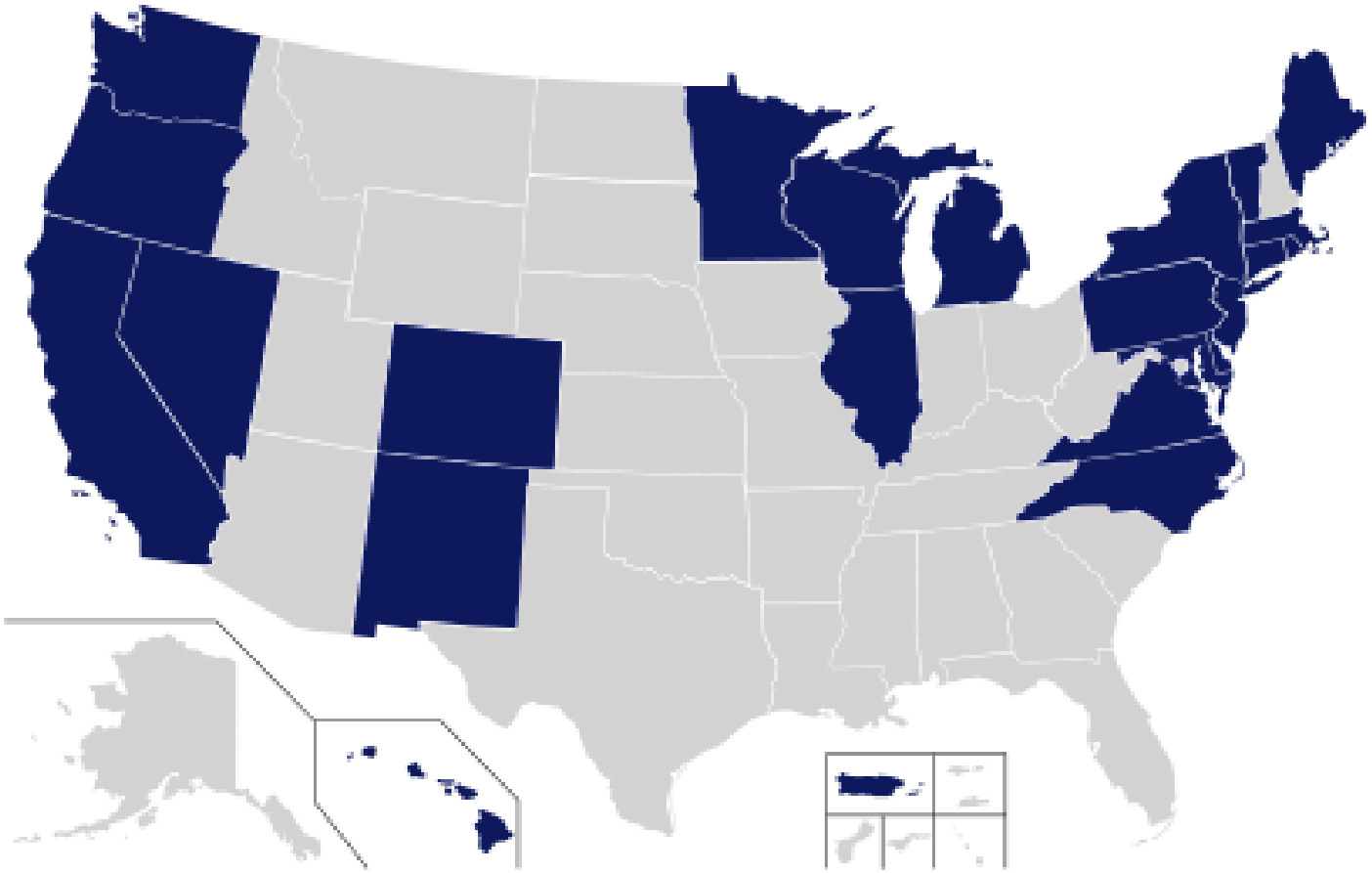
The US has not yet ratified the Kigali Amendment:

Actions to limit future use of high global warming potential HFCs are underway in states that belong to the US Climate Alliance



https://en.wikipedia.org/wiki/United_States_Climate_Alliance

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https://mde.maryland.gov/programs/Regulations/air/Pages/ARMARegulationsStakeholders.aspx

International Ozone Commission

Public group

About

Discussion

Members

Events

Videos

Photos

Files

Search this group

Shortcuts

International Ozone Co…

Mental Health Nutri… 20+

Cornell University Class…

CUDelt

I Grew Up in North… 20+

Chevy Volt Owners 20+

Paul Newman shared a link.

Admin · September 24 at 12:46 PM

Susan Solomon explains some of the differences between why we acted to control CFCs, and how that differs from climate policy.

TIME.COM

In the 1980s, the World Acted to Save the Ozone Layer. Here's Why the Fight Against Climate Change Is Different

Jim Elkins, Jose M Rodriguez and 26 others — 7 Comments 4 Shares

Like · Comment · Share

Jos De Laat Science historians have argued that there were a handful of factors that contributed much the success, of which the three most relevant were (in no particular order): relatively small group of manufactuerers, relatively small economical impact of refrigerant alternatives, and a few alternatives actually already were produced by the industry (some HCFCs). The latter was because the manufacturers were doing R&D on refrigerants not because of the ozone issue but for business reasons & product portfolio (different chemicals have different properties which allows for new/other/better applications).

Like · Reply · 1d

Sammy Yurtnik those points are true but I think there is more to it if you want to compare this issue to climate. For example everything described by jos reflects the fact that these companies were/are makers rather than extractors. Makers like to make new stuff, extractors have to protect the mineral rights they own. Fossil fuel companies would have trillions in stranded assets if we switch fuels. Chemical companies had very small investments to lose by switching, I'm writing a book that will get much deeper into this and more. Susan S

Like · Reply · 1d 4

← http://time.com/5681661/climate-change-ozone-history

Learning Enrichment Event

Event: Carbontech on the Hill

Date: Thurs, September 26 Time: 4:30 to 7:30 pm

Location: U.S. Capitol Visitor Center, First St NE, HVC 201, Washington, DC 20515

Speakers: Dr. Marcius Extavour, Carbon XPRIZE, Roxanne Brown, United Steelworkers, and John Litynski, U.S. Department of Energy

Website: https://www.eventbrite.com/e/carbontech-on-the-hill-registration-70805843183?aff=ebdssbdestsearch

All non-congressional attendees must be registered.

Third Way, Carbon180, and XPRIZE are excited to host the second annual "Carbontech on the Hill" event, which brings together carbontech innovators from across the country to share their work and progress toward building a new carbon economy.

From jet fuel to plastics and building materials, the carbontech sector is turning the carbon equation on its head; helping to create a world where we remove more carbon than we emit. Not only is the carbontech sector good for climate, it can create and preserve high-paying jobs and secure U.S. leadership in lucrative new industries.

Please join us for a briefing where we'll explore the tremendous opportunity for carbontech in the United States, and what it could mean for American businesses, workers, and climate efforts.

Sponsors: Third Way, Carbon180, and XPRIZE
https://www.thirdway.org/about
https://carbon180.org
https://www.xprize.org/prizes/carbon

We'll leave 3:25 pm sharp in front of the Atlantic Bldg, then take campus shuttle to College Park Green Line Station. Welcome to join us 3:25 pm or meet at room venue at 4:30 pm.

TODAY !

Business and the Environment

Eric Festa

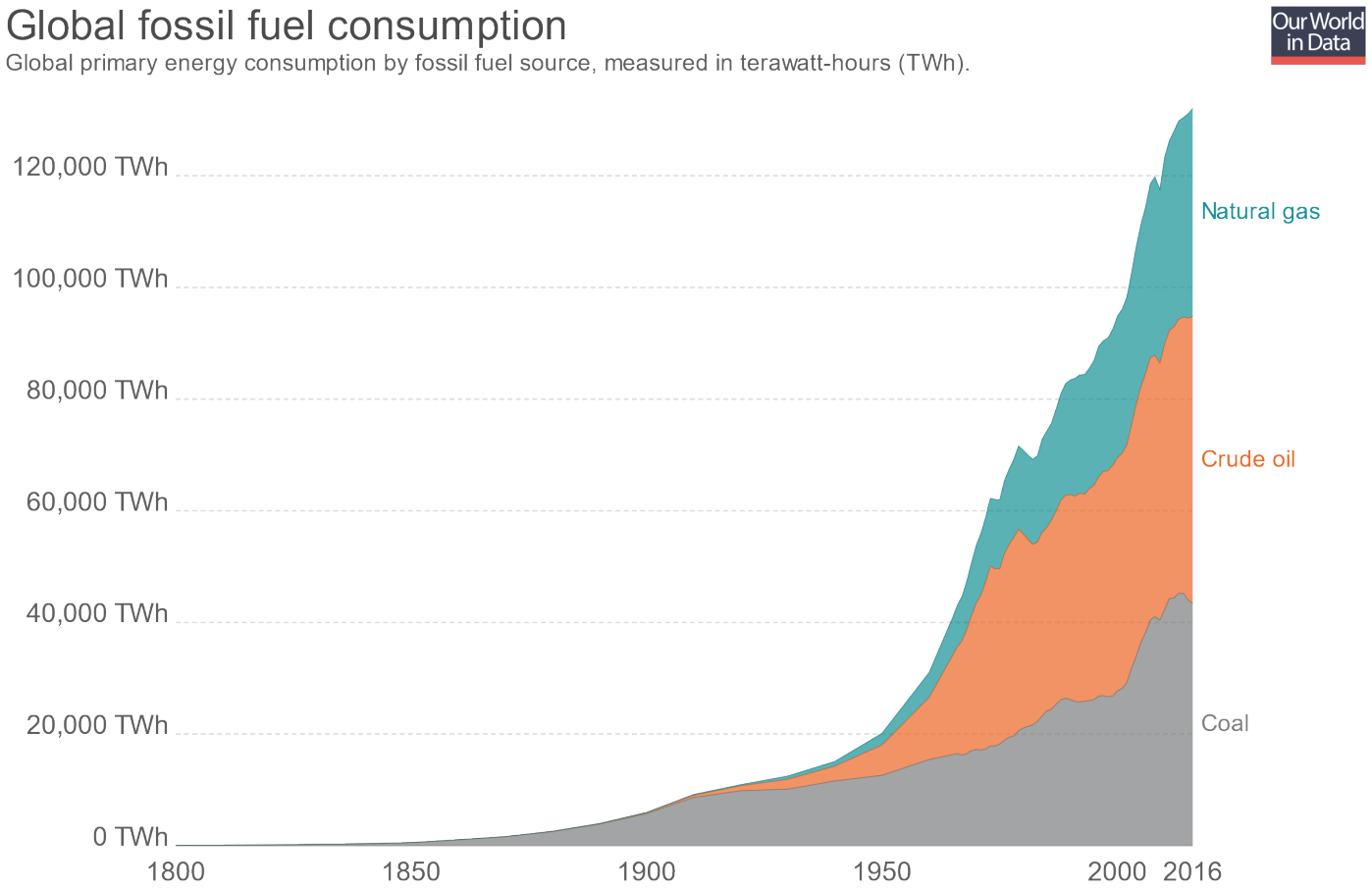
9/24/2019

Source: Google Maps

Salawati Oil Field

PERTAMINA

- Heavily deforested for access roads
- Numerous oil spills
- Fruit pigeon hunting
- Natural gas burning: *Wasted opportunity?*



https://ourworldindata.org/fossil -fuels

Kutubu Oil Field

- Few access roads
- Chevron -WWF partnership
- Forest management and protection
- Traveler regulations
- More difficult environment

https://www.geoexpro.com/articles/2015/06/png -lands-on-the-petroleum -map

Motivation

Preventing environmental & PR disasters

Pictured: Exxon Valdez (1989)

https://www.hakaimagazine.com/news/wounded-wilderness-the-exxon-valdez-oil-spill-30-years-later/

Bottom-up pressure from area natives

What about Salawati?

https://reliefweb.int/report/papua-new-guinea/el-nino-affects-million-people-png-highlands

Cost of countries' increasing environmental standards

https://www.latimes.com/business/story/2019-08-07/money-market-funds-wont-keep-you-safe-from-negative-yields

Bougainville Island

Source: Google Maps

An autonomous region of Papua New Guinea

- **Population:** ~250,000 (2011)

Bougainville Island

- Home to the Panguna copper mine, opened in 1972
- Mine caused environmental damage and deepened socioeconomic rifts among locals
- Shut down in 1989, sparked civil war (ended in ceasefire, 1998)
  - Current leadership supports Panguna's reopening
- Independence referendum to be held in November
  - "Do you agree for Bougainville to have: (1) Greater Autonomy (2) Independence?"
  - http://bougainville-referendum.org/

https://www.abc.net.au/news/2017-05-04/bougainville-mine-moves-to-reopen-govermment-backing/8495496

Point Arguello

- Just off the coast of California
- Oil discovered by Chevron in 1981
- Residents wary of an oil spill like one in Santa Barbara in 1969
- Became too expensive as oil prices dropped in the 1980s
- Chevron exited in the late 1990s
- Kutubu field (1992) gave Chevron the chance to prove itself environmentally
  - Later won contract with Norway ($$$)

Source: Google Maps

More on Chevron

- "…the court found that Chevron [and subsidiary Texaco] deliberately dumped billions of gallons of toxic oil waste [in Ecuador]. The waste was dumped in the Amazon rainforest on indigenous lands."
  - $9.5 billion fine handed down last year
- "We've had our cows die... They drank the water where the oil had spilled. Back then, that whole area was full of crude oil. The water there was filthy. They came and stopped the leak and they just left all of the crude oil there. It's pure crude there. In the middle, it's a thick ooze and you'd sink right down into it."

https://news.mongabay.com/2018/08/chevron-must-pay-for-environmental-damage-in-ecuador-court-rules/
https://www.huffpost.com/entry/seven-years-documenting-c_b_7479948

Hardrock Mining

- Leading toxic polluter in the US
  - But on the decline
- Environmental impact:
  - Land surface disturbance
  - Water pollution from toxic mining chemicals
  - Waste dumping

https://www.wvpublic.org/post/stream-restoration-project-breathes-new-life-buffalo-creek#stream/0

Motivation

Significantly higher and more lengthy cleanup costs

https://www.denverpost.com/2015/10/22/review-gold-king-mine-spill-was-preventable-disaster-potential-not-understood/

Industry pressure to keep prices low

https://www.mrw.co.uk/knowledge-centre/material-focus-precious-metals/10029978.article

Which metal is used in everything from batteries in electronic devices and vehicles to gasoline refinement to pressure - resistant materials in airplanes?

http://www.yourchildlearns.com/africa_map.htm

Cobalt & Consumer Technology

Democratic Republic of the Congo

60%

Global cobalt production

Used for:

- Batteries in electronic devices and vehicles
- Gasoline refinement
- Pressure-resistant material (e.g. airplanes)

https://pixabay.com/vectors/democratic-republic-of-the-congo-flag-1758948/

US Response

- DRC has production issues such as child labor and political instability
  - US is the largest consumer of cobalt
  - Inactive Blackbird mine (Idaho) has over 3.8 million tons of waste rock
- **2012:** First US cobalt mine in 30 years opens in Idaho
  - Partially in response to predicted cobalt shortage
- **2018:** Mine set to meet targets
- **2019**: Scaling back production due to high supply from overseas

Logging

- Diamond: Deforestation destroys value of forests
  - Recreation
  - Carbon filter
  - Greater rainfall
  - 50-80% of the world's terrestrial plant and animal species
- Aloysius' story – industry silences opponents and bribes governments
- Forest Stewardship Council (1993)

https://www.abc.net.au/news/2017-05-08/tasmanian-logging-family-tells-their-life-story/8505742

- FSC-labeled plywood outsold unlabeled plywood of the same price by at least **19%**
- **37%** bought labeled plywood when it cost **2%** more
- Proves public's environmental awareness/power of the purse
  - Also pressured by the Rainforest Action Network

Your Thoughts

a // What was the company you chose?

b // What is this company doing to help the environment?

c // Do you think this company's actions are meaningful for helping the environment?

Slide 2 Images

- https://www.bloomberg.com/news/articles/2017-03-06/u-s-oil-industry-becomes-refiner-to-the-world-as-exports-boom
- https://112.international/society/law-on-enhanced-accountability-for-illegal-logging-timber-export-comes-into-force-in-ukraine-35566.html
- https://whatisnewinecomaterials.wordpress.com/tag/the-hardrock-mining-reform-and-reclamation-act-of-2015/

Data & Image Sources

- https://ourworldindata.org/fossil-fuels
- https://reliefweb.int/report/papua-new-guinea/el-nino-affects-million-people-png-highlands
- https://en.wikipedia.org/wiki/Autonomous_Region_of_Bougainville
- https://www.abc.net.au/news/2017-05-04/bougainville-mine-moves-to-reopen-govermment-backing/8495496
- https://en.wikipedia.org/wiki/Panguna_mine
- https://www.usnews.com/news/best-countries/articles/2019-07-01/bougainville-independence-vote-will-ripple-across-pacific
- https://www.latimes.com/archives/la-xpm-1991-06-18-fi-1089-story.html
- https://www.geoexpro.com/articles/2015/06/png-lands-on-the-petroleum-map
- https://www.mrw.co.uk/knowledge-centre/material-focus-precious-metals/10029978.article
- https://www.denverpost.com/2015/10/22/review-gold-king-mine-spill-was-preventable-disaster-potential-not-understood/
- https://www.ostermanconsult.com/services/surface-hard-rock-mining/
- https://www.abc.net.au/news/2017-05-08/tasmanian-logging-family-tells-their-life-story/8505742
- https://www.technologyreview.com/s/425273/high-tech-demand-sparks-return-of-cobalt-mines/
- https://investingnews.com/daily/resource-investing/battery-metals-investing/cobalt-investing/top-cobalt-producing-countries-congo-china-canada-russia-australia/
- https://www.streetwisereports.com/article/2018/05/29/the-only-us-based-primary-cobalt-mine-is-nearing-production.html
- https://www.postregister.com/messenger/news/idaho-cobalt-project-scales-back/article_20e1a63c-73fe-58ac-9927-6ff8e2ee373f.html

Introduction to Climate Change: Last Word

Ross Salawitch

AT08, Q5:

If you have a question about anything in the reading you would like to be explained in the "last word" segment, please express it here. I'll do my best to address all questions posted by 11:00 am day of class.

Could you explain radiative forcing a little more, I'm still not quite clear on it x 2

Radiation (light) can induce photo-dissociation, vibration, and rotation of molecules.

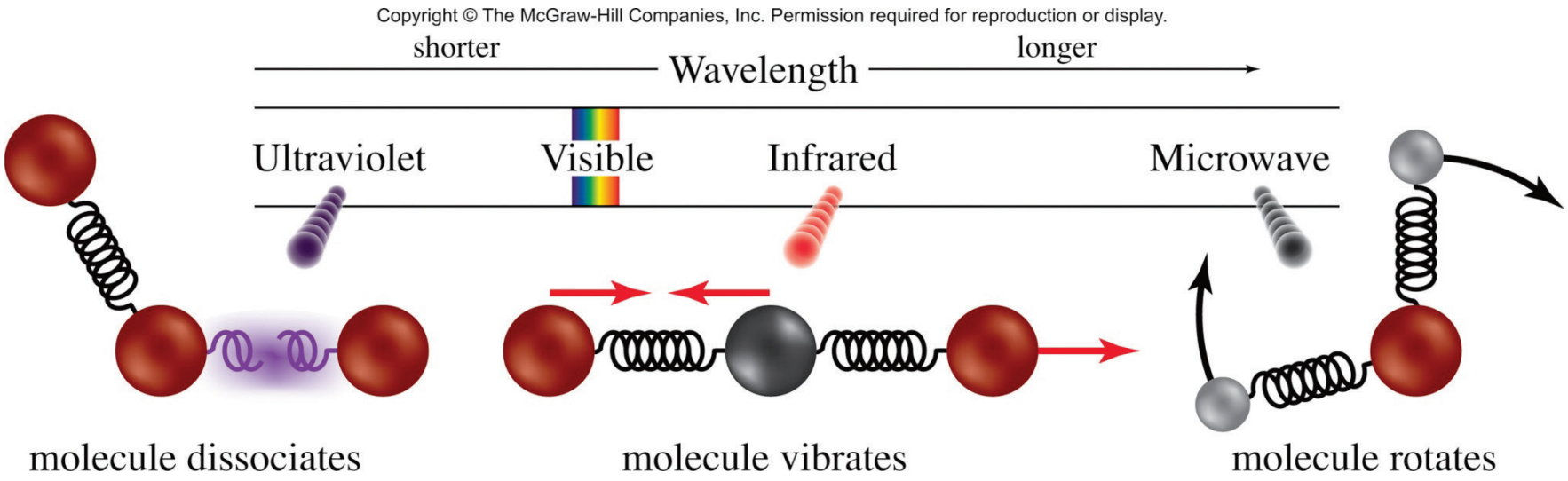


Fig 3.19, Chemistry in Context

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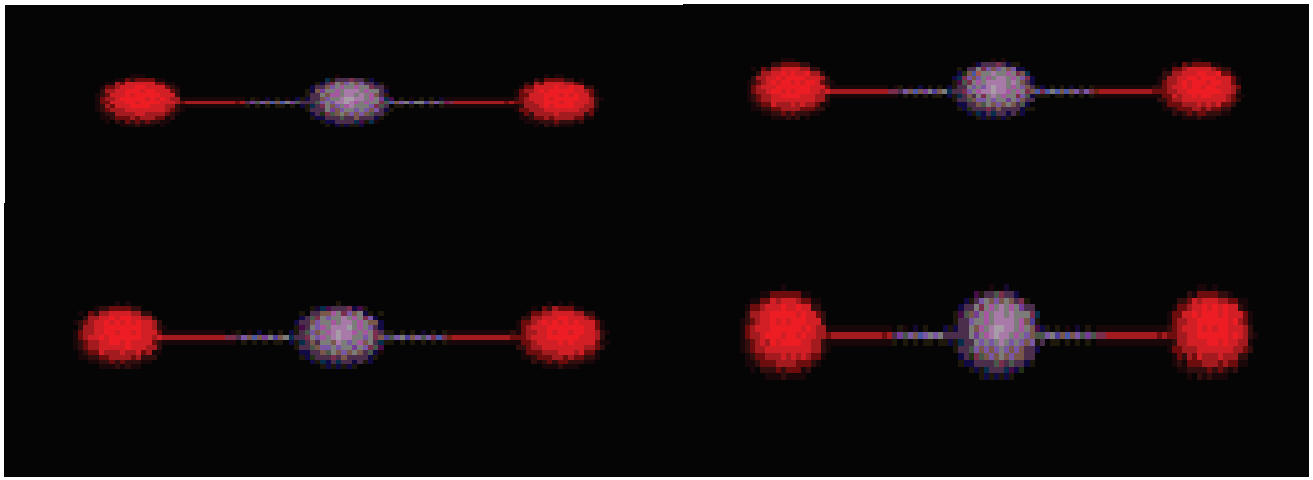
Upon absorption, thermal infrared light will increase the vibrational energy of a molecule

Soon thereafter, the light is emitted by the molecule, in a random direction



http://science.widener.edu/svb/ftir/ir_co2.html

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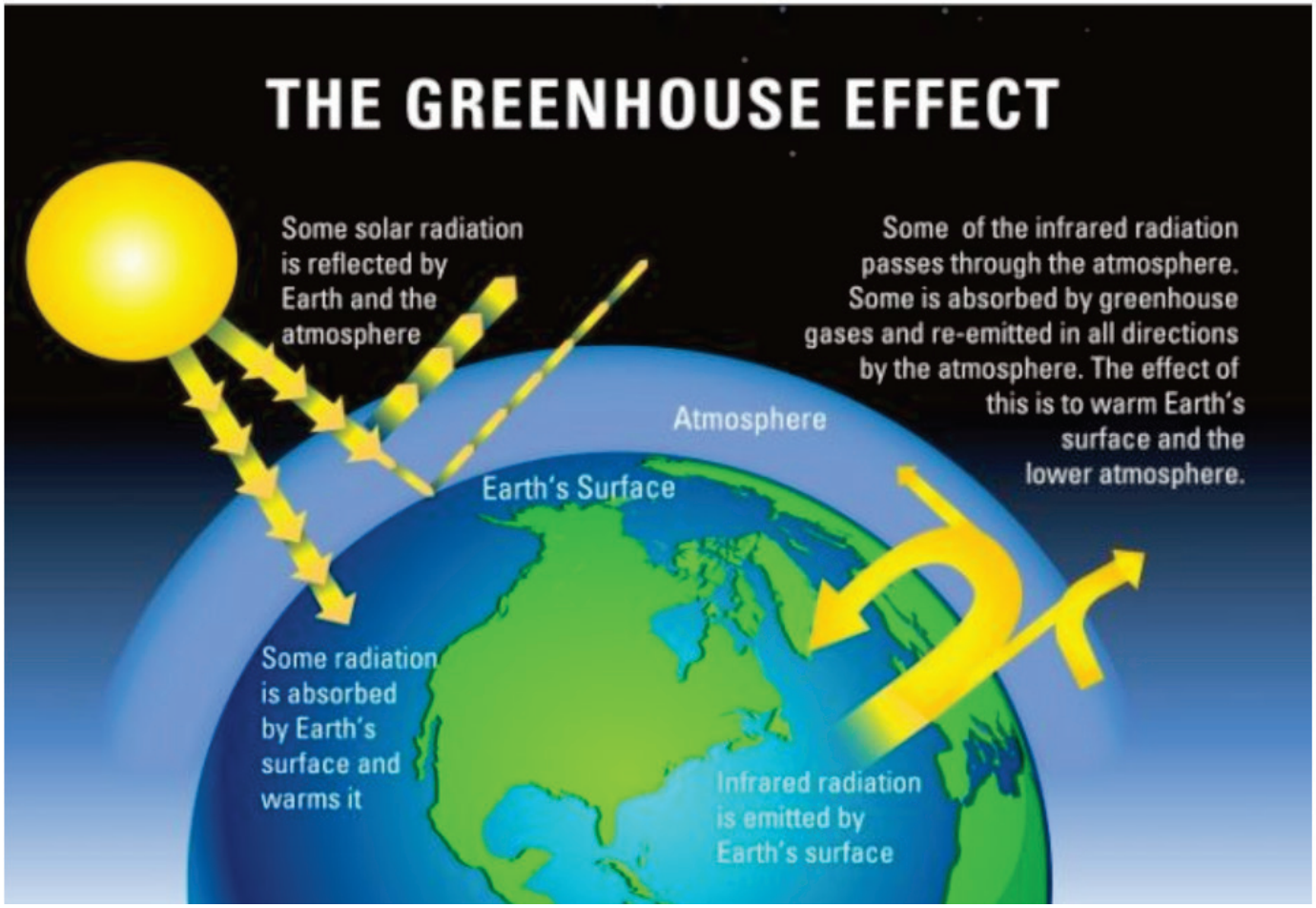

https://www.environmentblog.net/what-is-the-greenhouse-effect/

AT08, Q5:

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I don't have any super broad or large level questions, but I would like to ask of an example of a negative feedback loop relating to climate change and the greenhouse effect. It seems that I only came across positive loops, and fitting the theme of this class, we also want to find areas of hope regarding our precious climate, so *I just wanted to know if there was a good example of a negative feedback loop relating to climate change?*

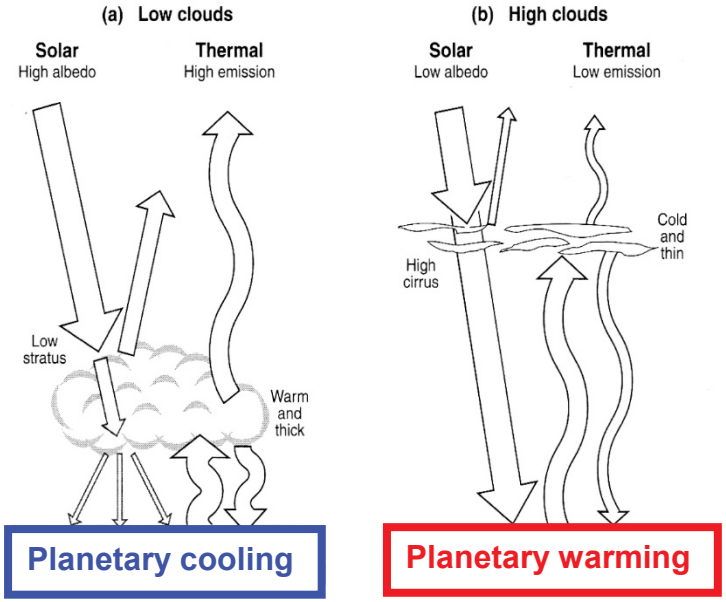
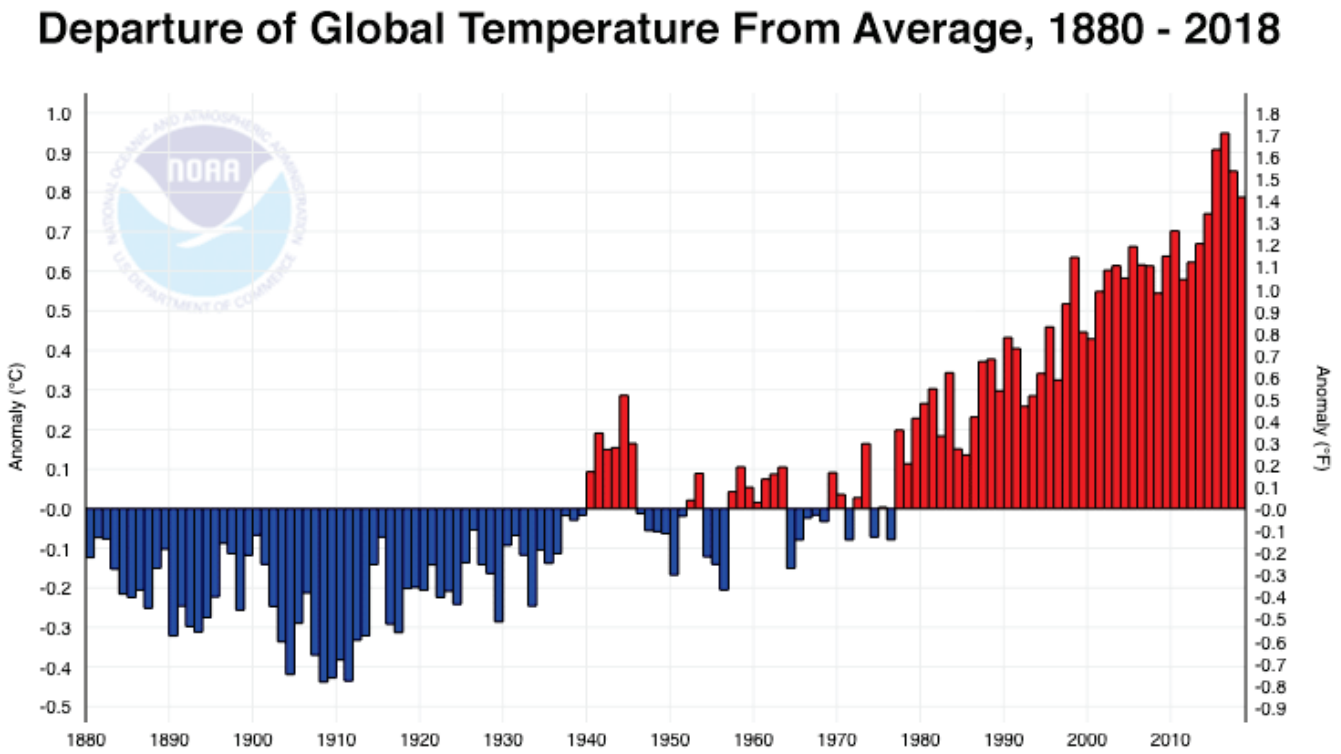


Figure 11.13 The effects of clouds on the flow of radiation and energy in the lower atmosphere and at the surface. Two cases are shown: (a) low clouds, with a high solar albedo and high thermal emission temperature; and (b) high clouds, with a low solar albedo and low thermal emission temperature. The solar components are shown as straight arrows, and the infrared components, as curved arrows. The relative thicknesses of the arrows indicate the relative radiation intensities. The expected impact on surface temperature in each situation is noted along the bottom strip.

Turco, *Earth Under Siege: From Air Pollution to Global Change*, 1997.

Just curious, on page 11 (FAQ 3.1), this reading (which I know was published in 2007) says that "11 of the 12 warmest years on record have happened in the past twelve years." Is this still accurate today? Have the years since this was published continued to be the warmest on record or has this trend changed?



2018 was fourth warmest year of the modern instrument record.
The five warmest years on record are the now past five years:
2016, 2015, 2017, 2018, and 2014, in that order.

https://www.wunderground.com/cat6/Earth-Had-Its-4th-Warmest-Year-Record-2018-Say-NOAA-and-NASA

Based on FAQ 3.1, Figure 1, the polar regions appear to be cooling (in blue), even though arctic ice thickness has been decreasing in all seasons. It makes sense for ice thickness to drastically decrease in the spring and summer, but why would it be decreasing in winter as well, especially if polar regions are becoming colder overall?

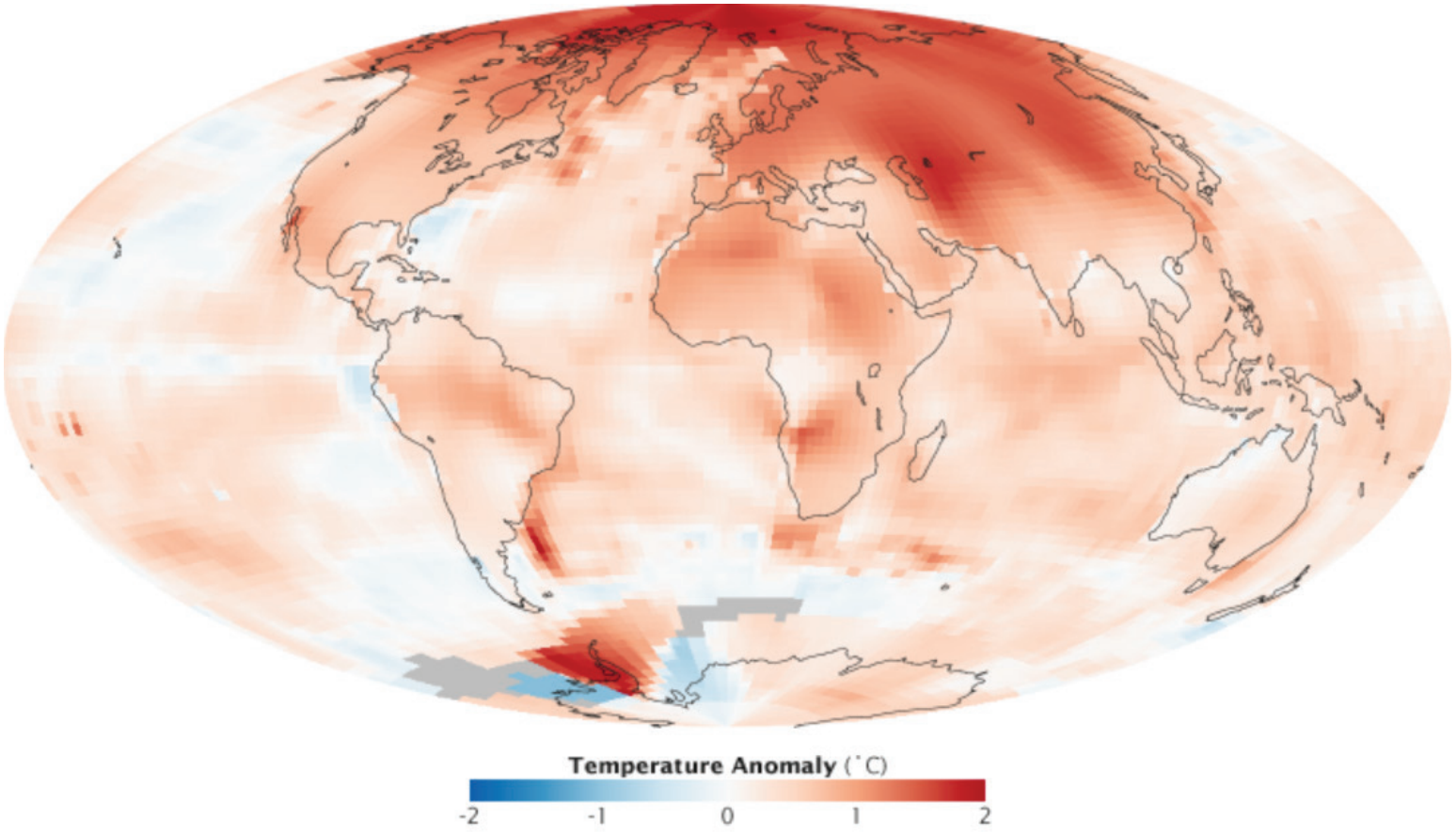


Figure depicts rise in surface temperature between pre-industrial and 2009.

https://en.wikipedia.org/wiki/Polar_amplification

Not so much a question, but a comment. In the introductory question, climate is described as "average weather" and continues on to describe a global climate. By the end of the article, the definition of climate has shifted to "region by region". I believe the reading would be been easier to comprehend if it was more clear as to the description was for total global climate or regional.

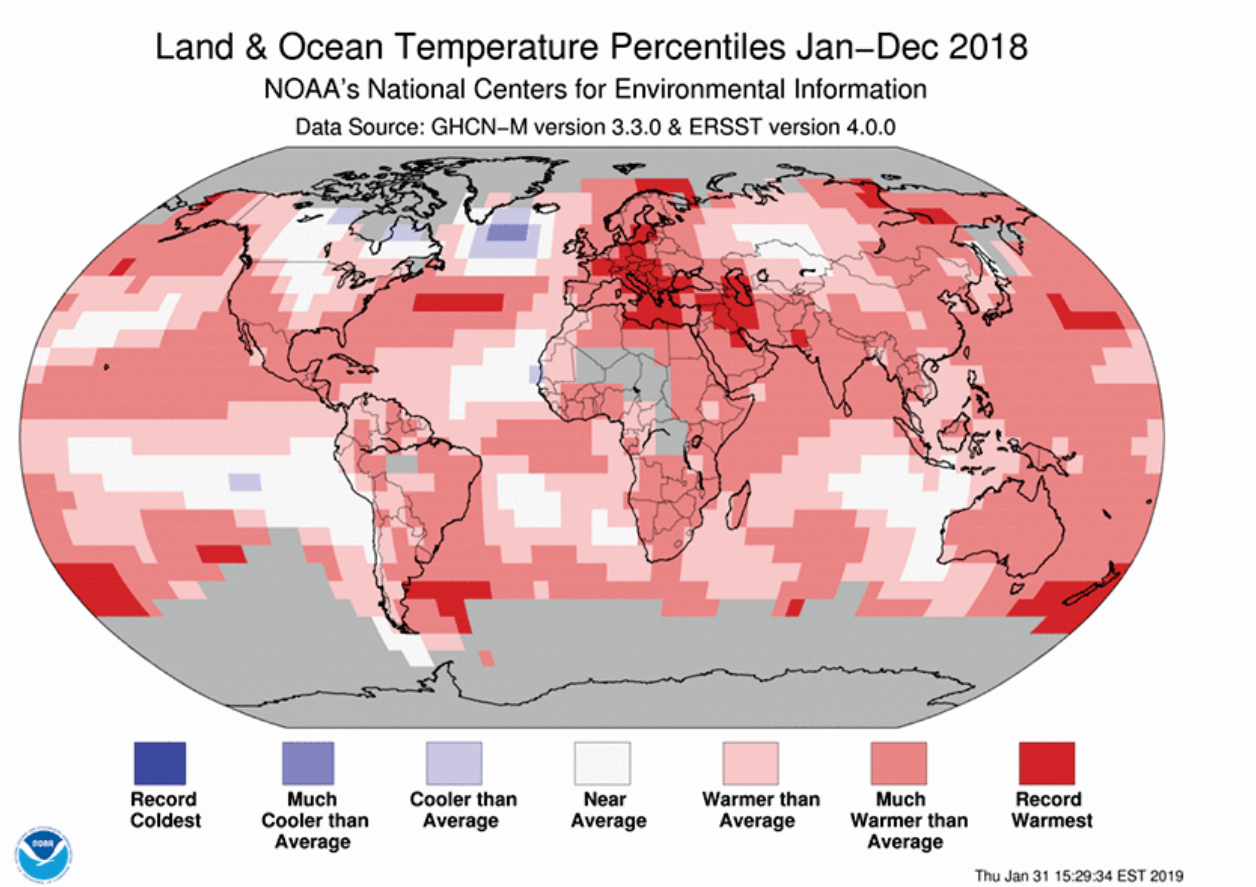


Figure depicts departure of surface temperature from average for the globe during 2018.

https://www.wunderground.com/cat6/Earth-Had-Its-4th-Warmest-Year-Record-2018-Say-NOAA-and-NASA

I remember earlier in the semester you mentioning that aerosols have a cooling effect on the Earth. However, they also cause things like acid rain. My question is would there be a way to utilize the cooling effect of aerosols without side effects or at least severely limit these side effects?

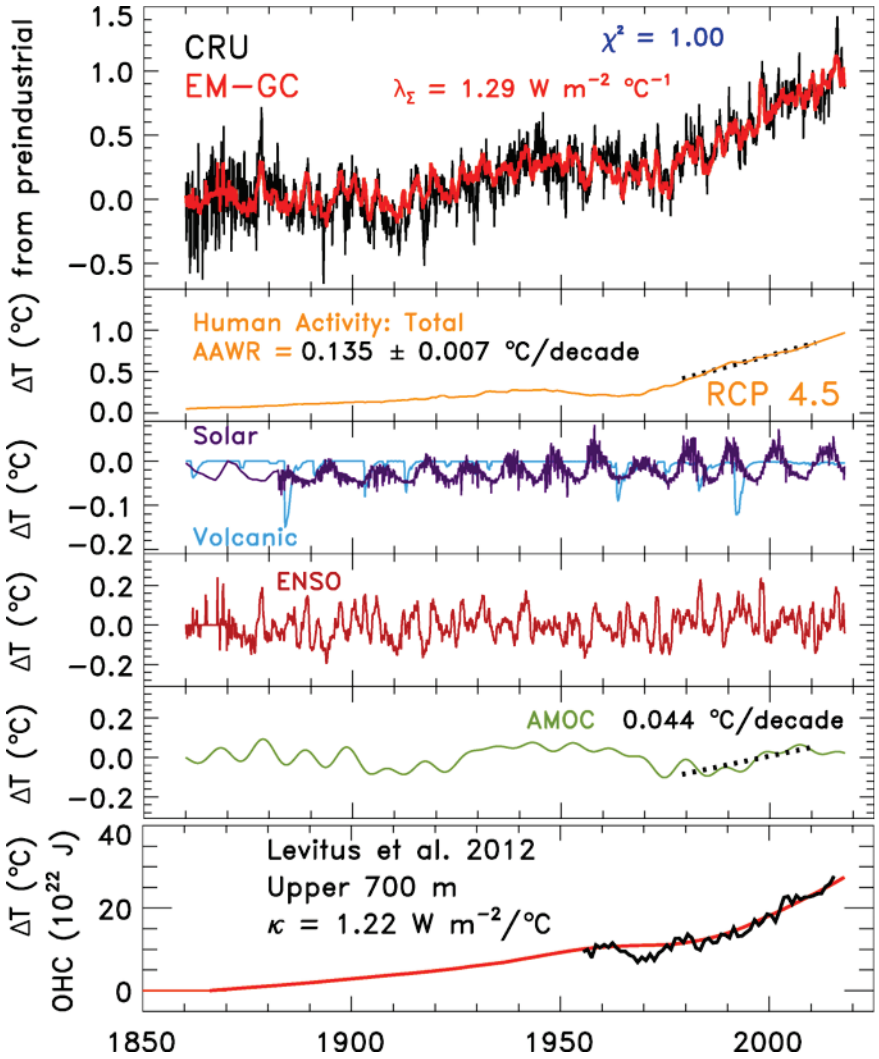
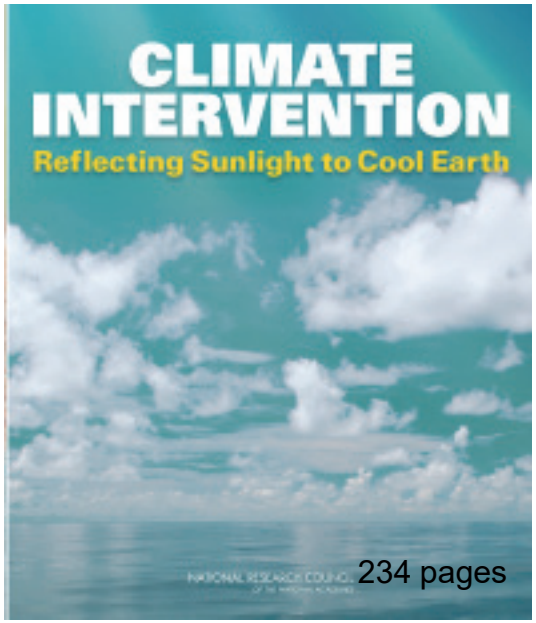


Fig 2.5 (updated) ***Paris Climate Agreement: Beacon of Hope***



Box 3. ***Albedo Modification Strategies Considered in This Study***

- Stratospheric aerosols that help reflect sunlight back into space
- Marine cloud brightening to enhance reflection of sunlight

https://www.nap.edu/catalog/18988/climate-intervention-reflecting-sunlight-to-cool-earth

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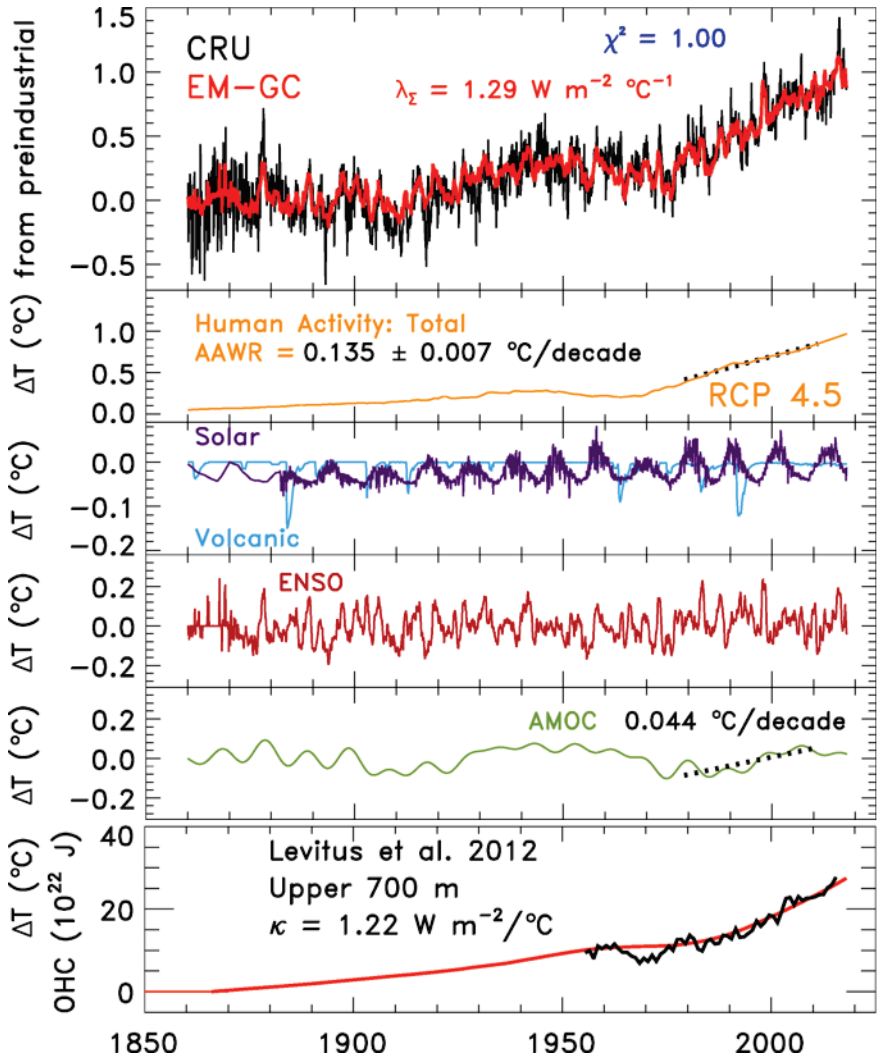
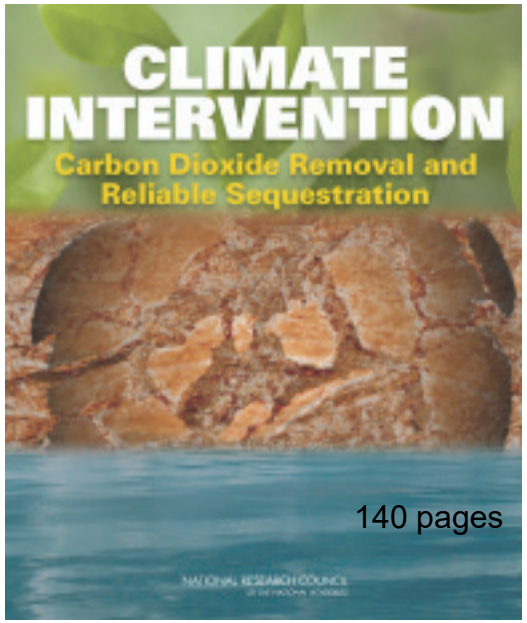




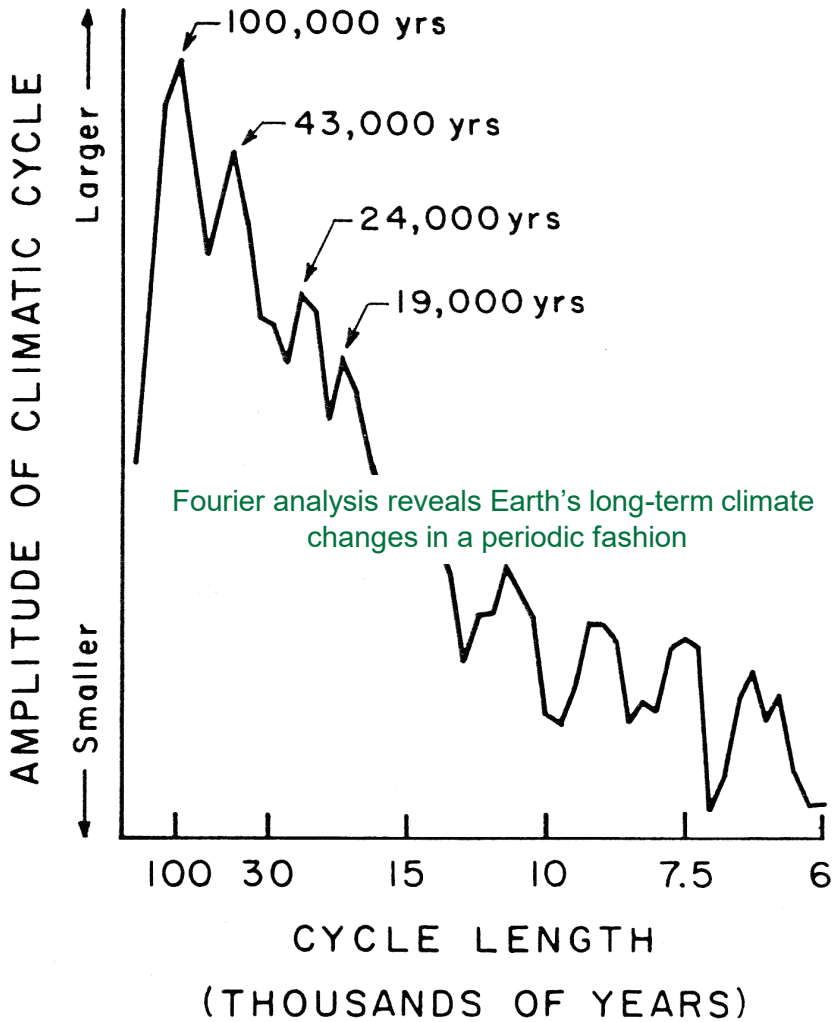
Box 2. *Carbon Dioxide Removal Strategies Considered in This Study*

- Changes in land use management to enhance natural carbon sinks such as forests and agricultural lands
- Accelerated weathering in the ocean and on land to enhance natural processes that remove carbon dioxide from the atmosphere
- Bioenergy with carbon capture and sequestration
- Direct air capture and sequestration of carbon dioxide
- Ocean iron fertilization to boost phytoplankton growth and enhance take-up of carbon dioxide

Fig 2.5 (updated) ***Paris Climate Agreement: Beacon of Hope***

https://www.nap.edu/catalog/18805/climate-intervention-carbon-dioxide-removal-and-reliable-sequestration

I understand that this is more of an astronomy question, but could you elaborate on what exactly Milankovitch cycles are and how they affect the climate?



Fourier analysis reveals Earth's long-term climate changes in a periodic fashion

Figure 42. Spectrum of climatic variation over the past half-million years. This graph—showing the relative importance of different climatic cycles in the isotopic record of two Indian Ocean cores—confirmed many predictions of the Milankovitch theory. (Data from J.D. Hays et al., 1976.)

Ice Ages, Imbrie and Imbrie, Harvard Univ Pres, 1979

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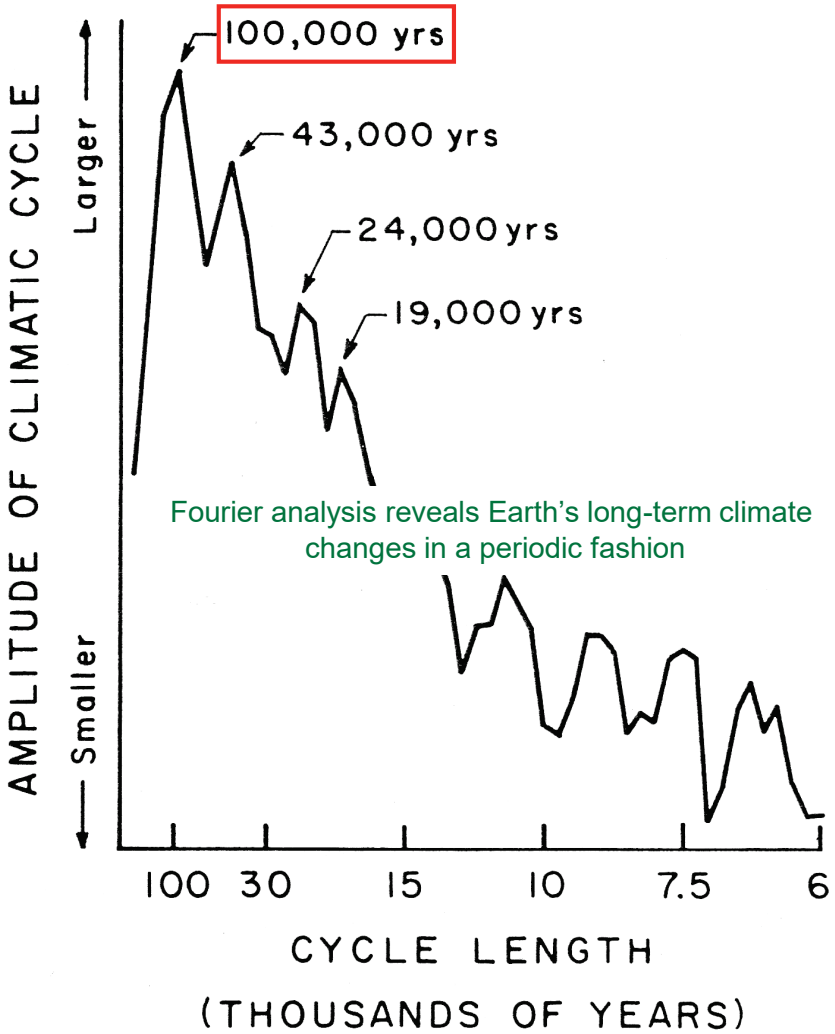

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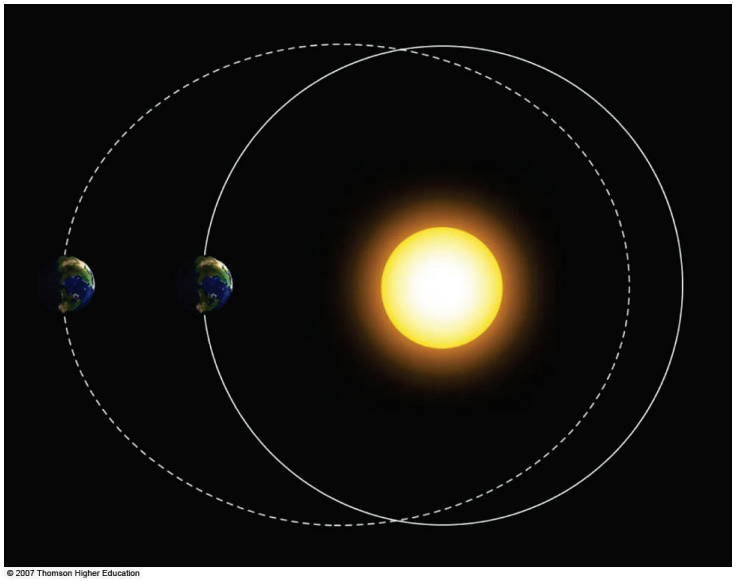
100,000 year cycle due to changes in the eccentricity of Earth's orbit, mainly due to gravitational pull of Jupiter and Saturn.



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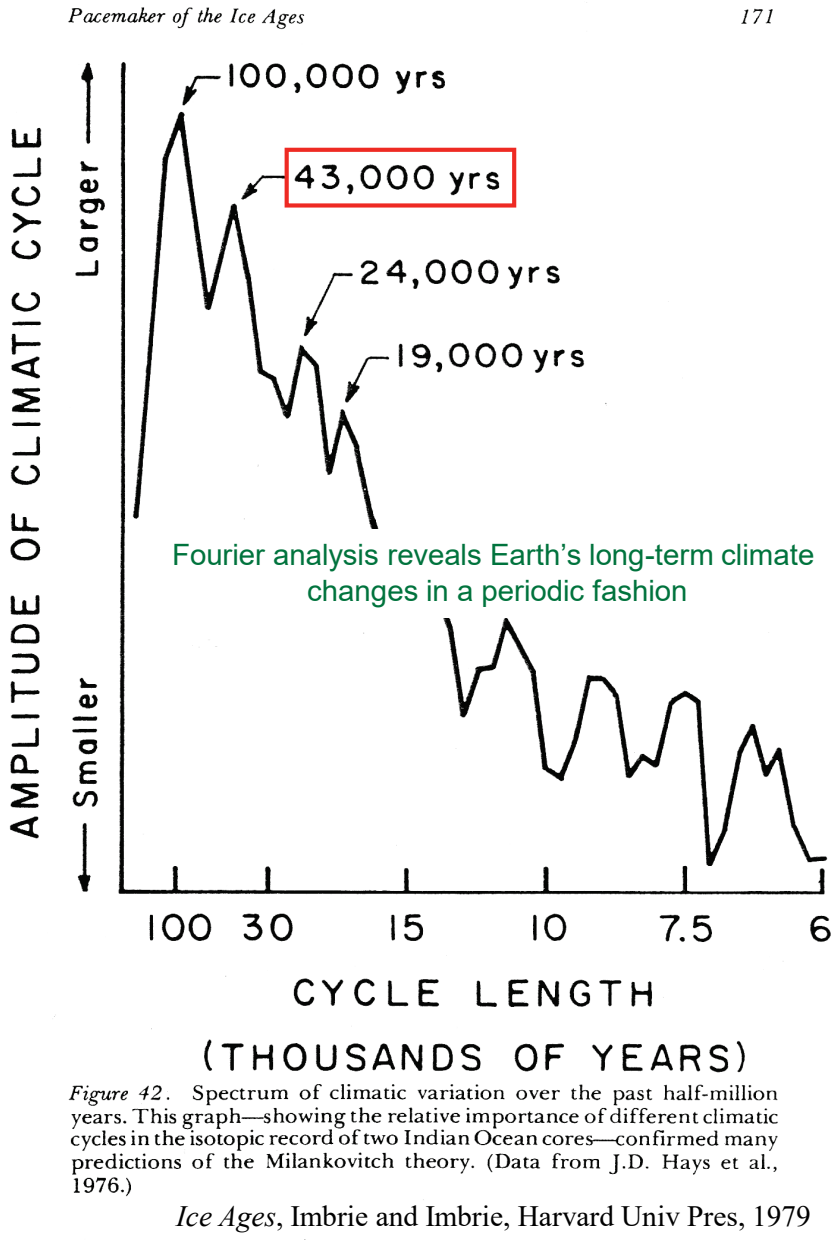
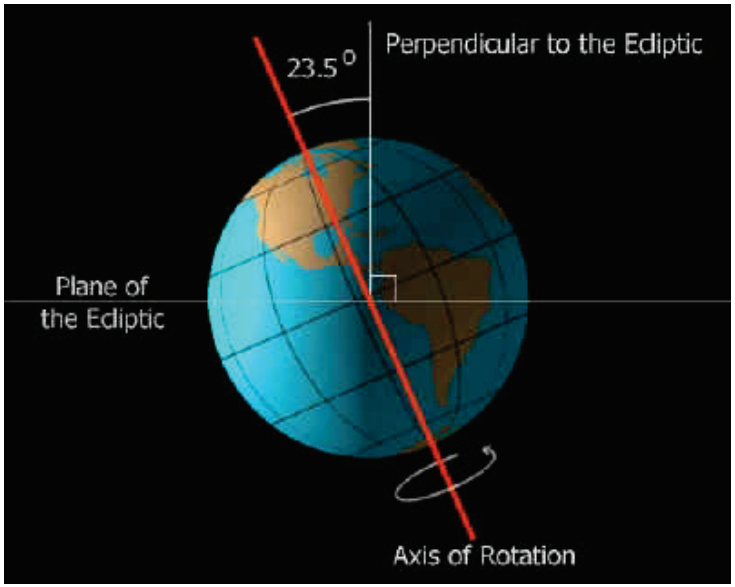


Ice Ages, Imbrie and Imbrie, Harvard Univ Pres, 1979

43,000 year cycle due to changes in tilt of Earth's axis (obliquity).



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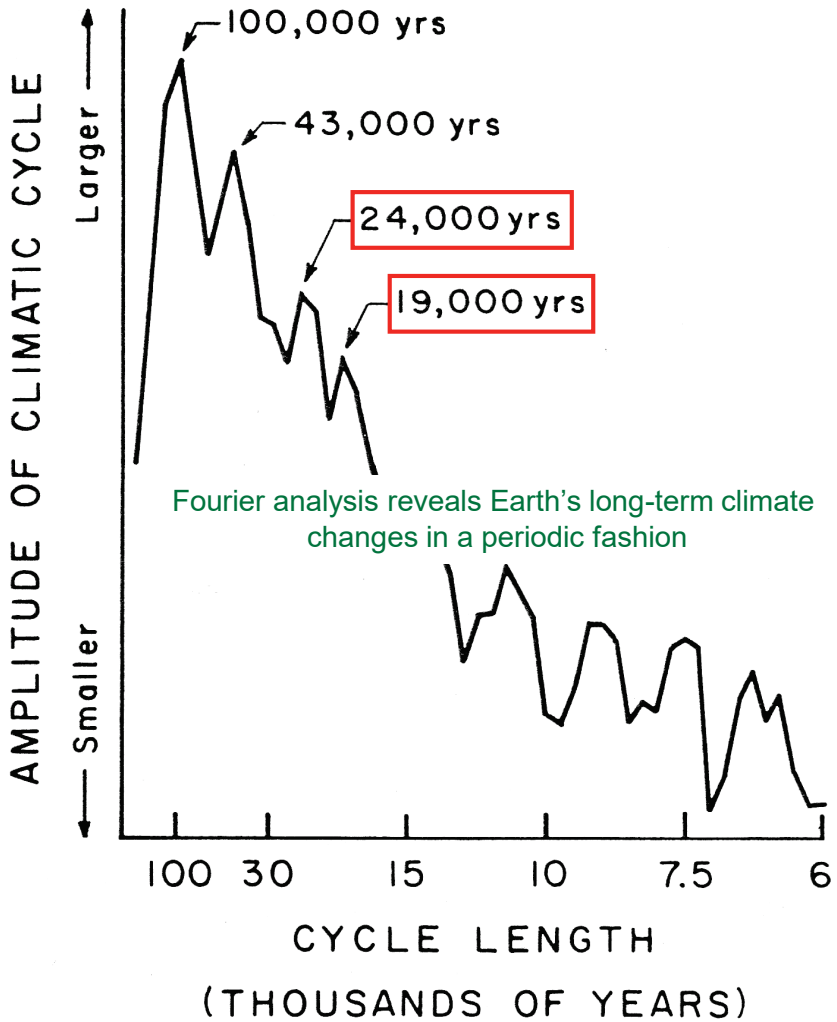

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24,000 and **19,000 year cycles** due to Earth "wobbling" on its axis.