

Code Red for Humanity?

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AIAA Presentation
OC Section ASAT Conference
October 23, 2021

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The Problem

Our Beautiful Earth



IPCC AR6

It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

Approved Version

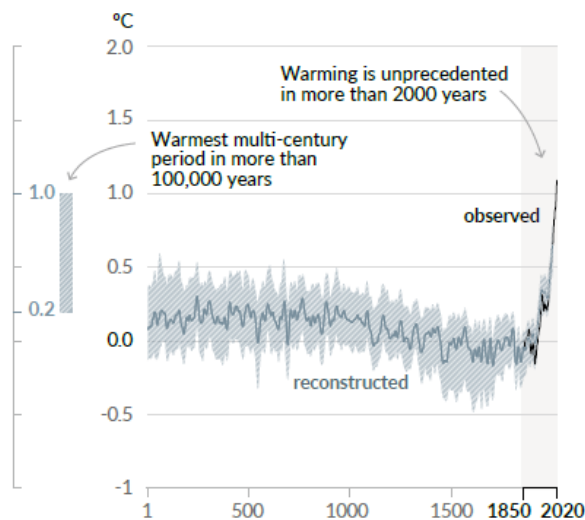
Summary for Policymakers

IPCC AR6 WGI

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Changes in global surface temperature relative to 1850-1900

a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and observed (1850-2020)



b) Change in global surface temperature (annual average) as observed and simulated using human & natural and only natural factors (both 1850-2020)

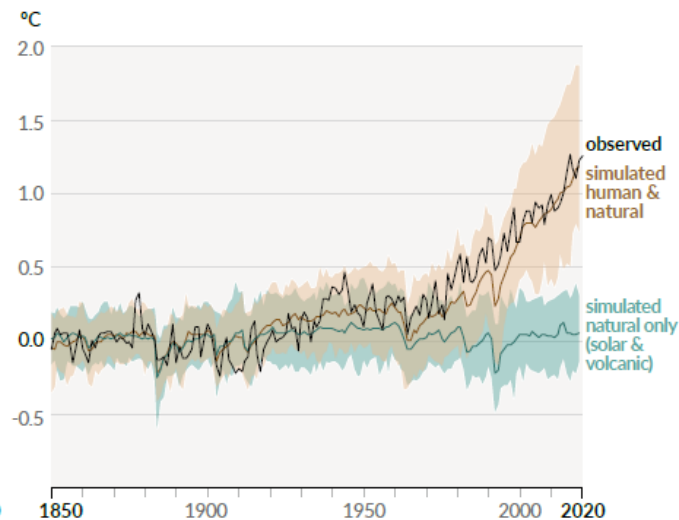


Figure SPM.1: History of global temperature change and causes of recent warming.

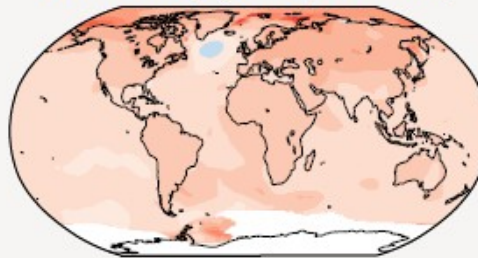
IPCC AR6 Global Changes

With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

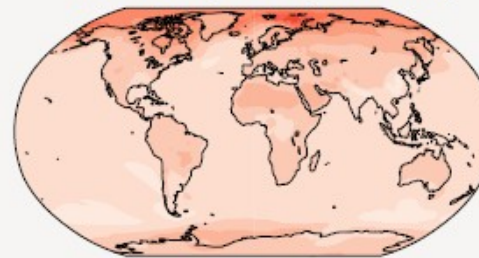
a) Annual mean temperature change (°C) at 1 °C global warming

Warming at 1 °C affects all continents and is generally larger over land than over the oceans in both observations and models. Across most regions, observed and simulated patterns are consistent.

Observed change per 1 °C global warming



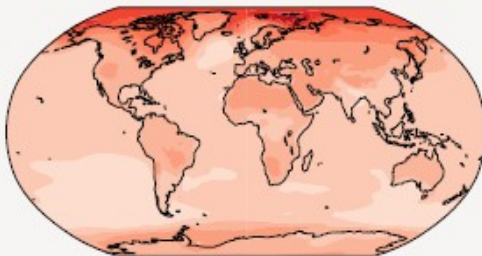
Simulated change at 1 °C global warming



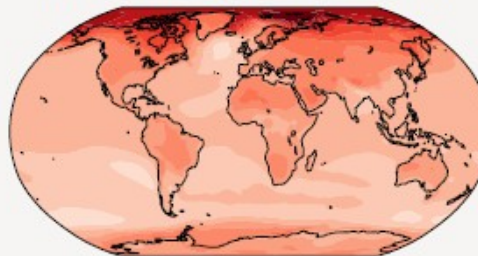
b) Annual mean temperature change (°C) relative to 1850-1900

Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics.

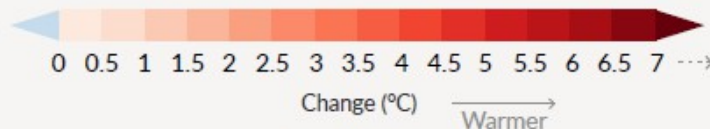
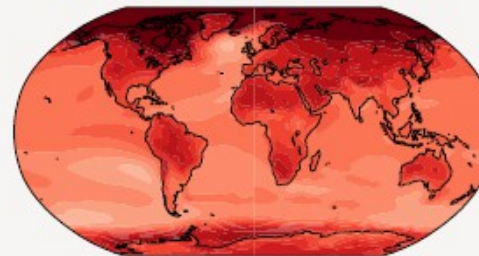
Simulated change at 1.5 °C global warming



Simulated change at 2 °C global warming



Simulated change at 4 °C global warming

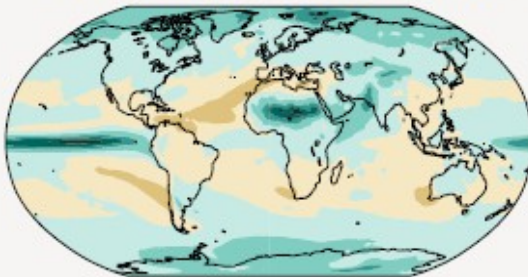


Water Changes

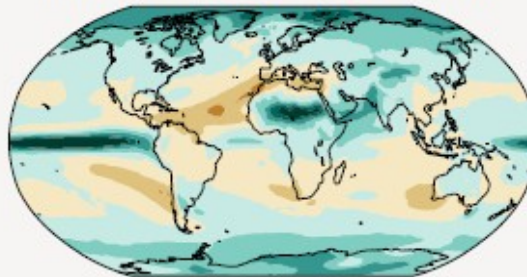
c) Annual mean precipitation change (%) relative to 1850-1900

Precipitation is projected to increase over high latitudes, the equatorial Pacific and parts of the monsoon regions, but decrease over parts of the subtropics and in limited areas of the tropics.

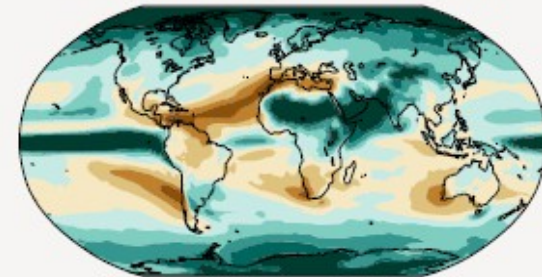
Simulated change at 1.5 °C global warming



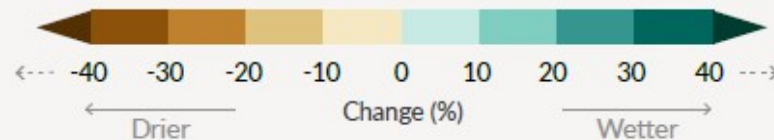
Simulated change at 2 °C global warming



Simulated change at 4 °C global warming



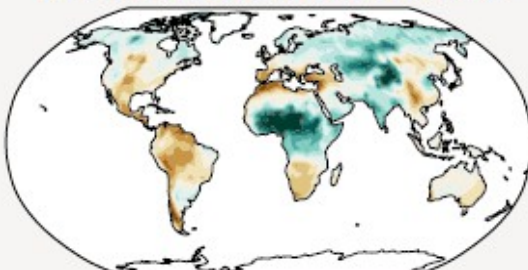
Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions



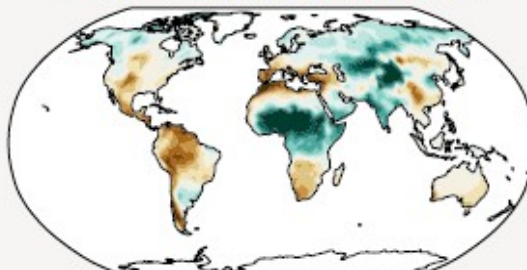
d) Annual mean total column soil moisture change (standard deviation)

Across warming levels, changes in soil moisture largely follow changes in precipitation but also show some differences due to the influence of evapotranspiration.

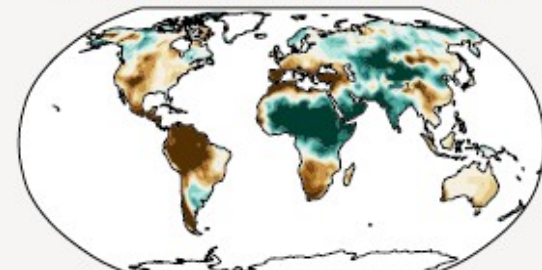
Simulated change at 1.5 °C global warming



Simulated change at 2 °C global warming



Simulated change at 4 °C global warming



Reaction to IPCC AR6

- U.N. Secretary-General António Guterres described the report as a "code red for humanity," also said "This report must sound a death knell for coal and fossil fuels, before they destroy our planet."
- British Prime Minister Boris Johnson: "...wake-up call for the world to take action now.."

N. Y. Times, Sept. 2021

- United Nations Warns of 'Catastrophic Pathway' With Current Climate Pledges
- The global average temperature will rise 2.7 degrees Celsius by century's end even if all countries meet their promised emissions cuts, a rise that is likely to worsen extreme wildfires, droughts and floods, the United Nations said in a report

\$1 Trillion Infrastructure Bill

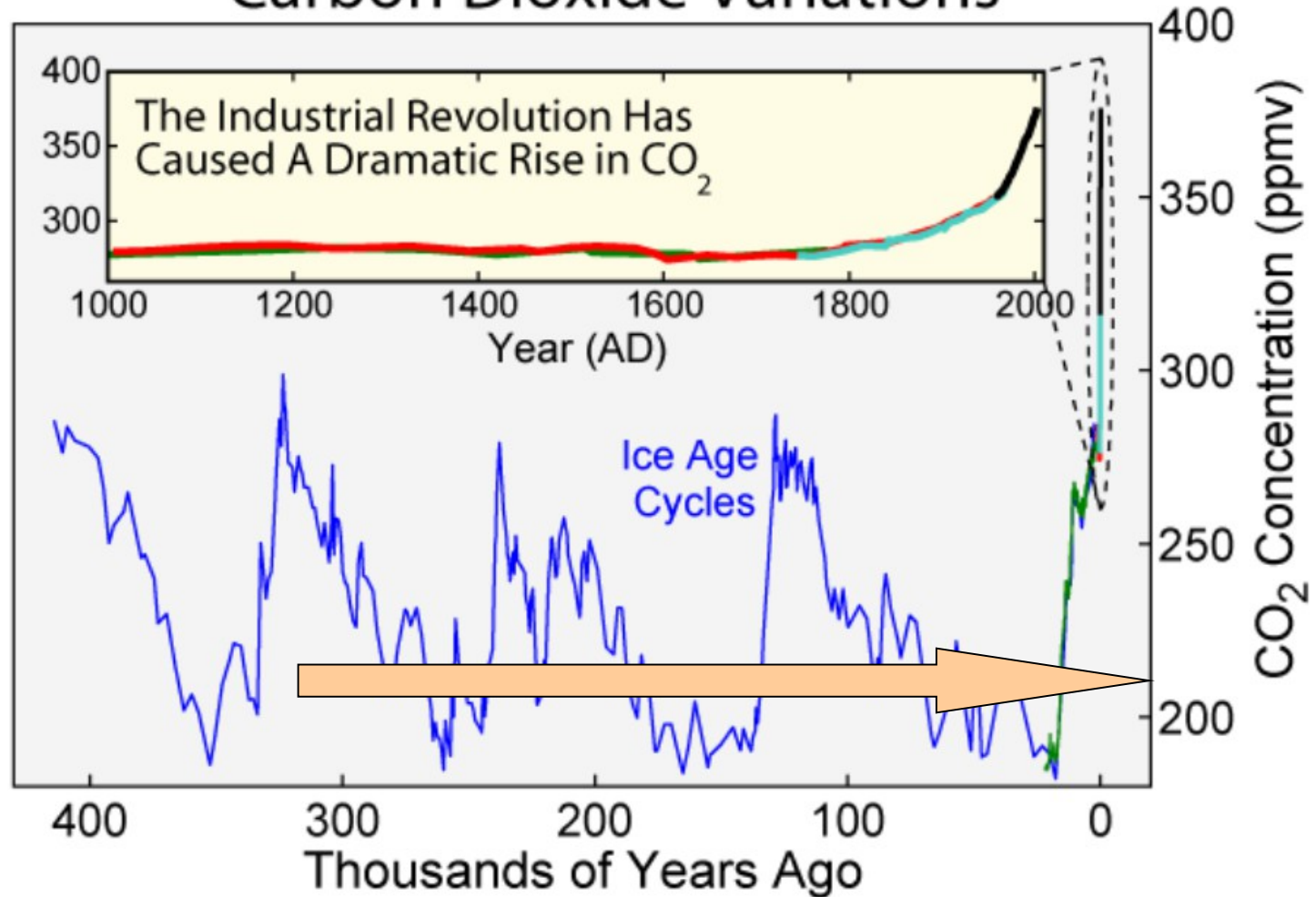
- Passed Senate; delayed in House
- \$73 billion for electric grid and power infrastructure
- \$66 billion for passenger and freight rail
- \$39 billion for public transit
- \$21 billion for environmental remediation projects
- \$15 billion for electric vehicles

Reconciliation Bill

- \$3.5 Trillion
- Clean Electricity Performance Program
 - \$150 billion
 - Rewards for increasing renewable energy 4%/yr
 - 80% of electricity from clean sources by 2030
- Republicans and Manchin will not support

Homo
Sapiens

Carbon Dioxide Variations

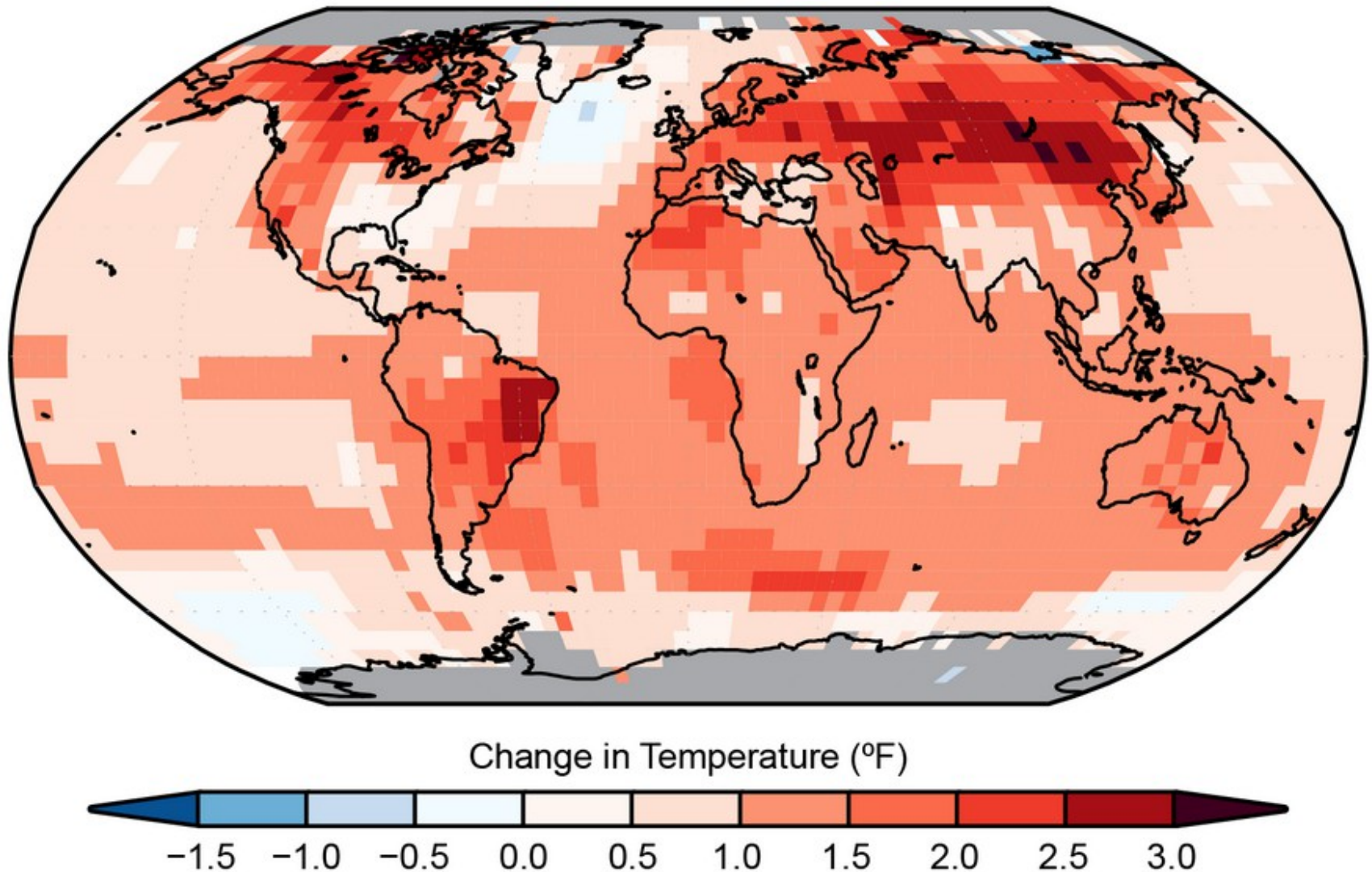


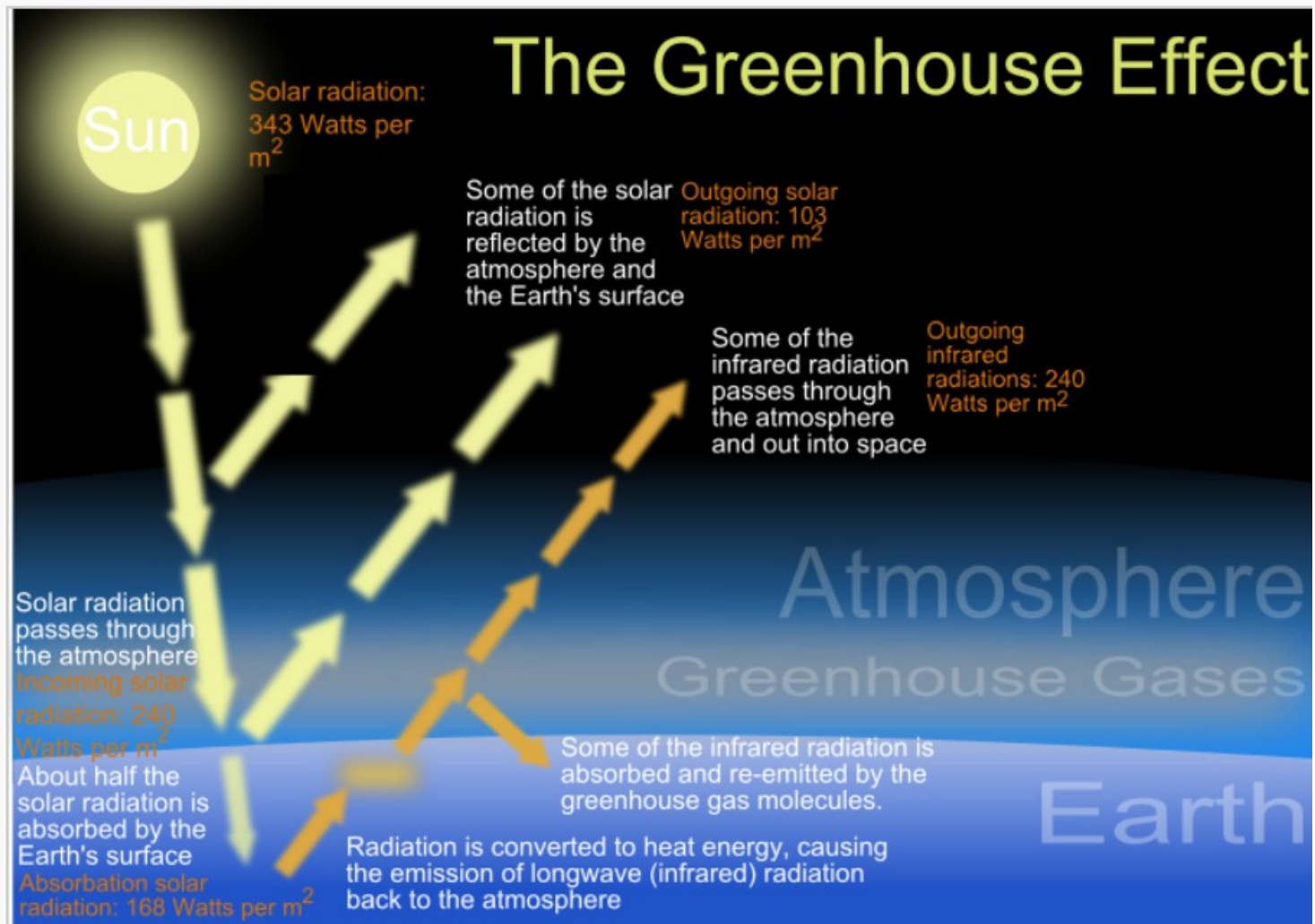
CO₂ concentrations over the last 400,000 years



Surface Temperature Change

Period: 1986-2015 relative to 1901-1960

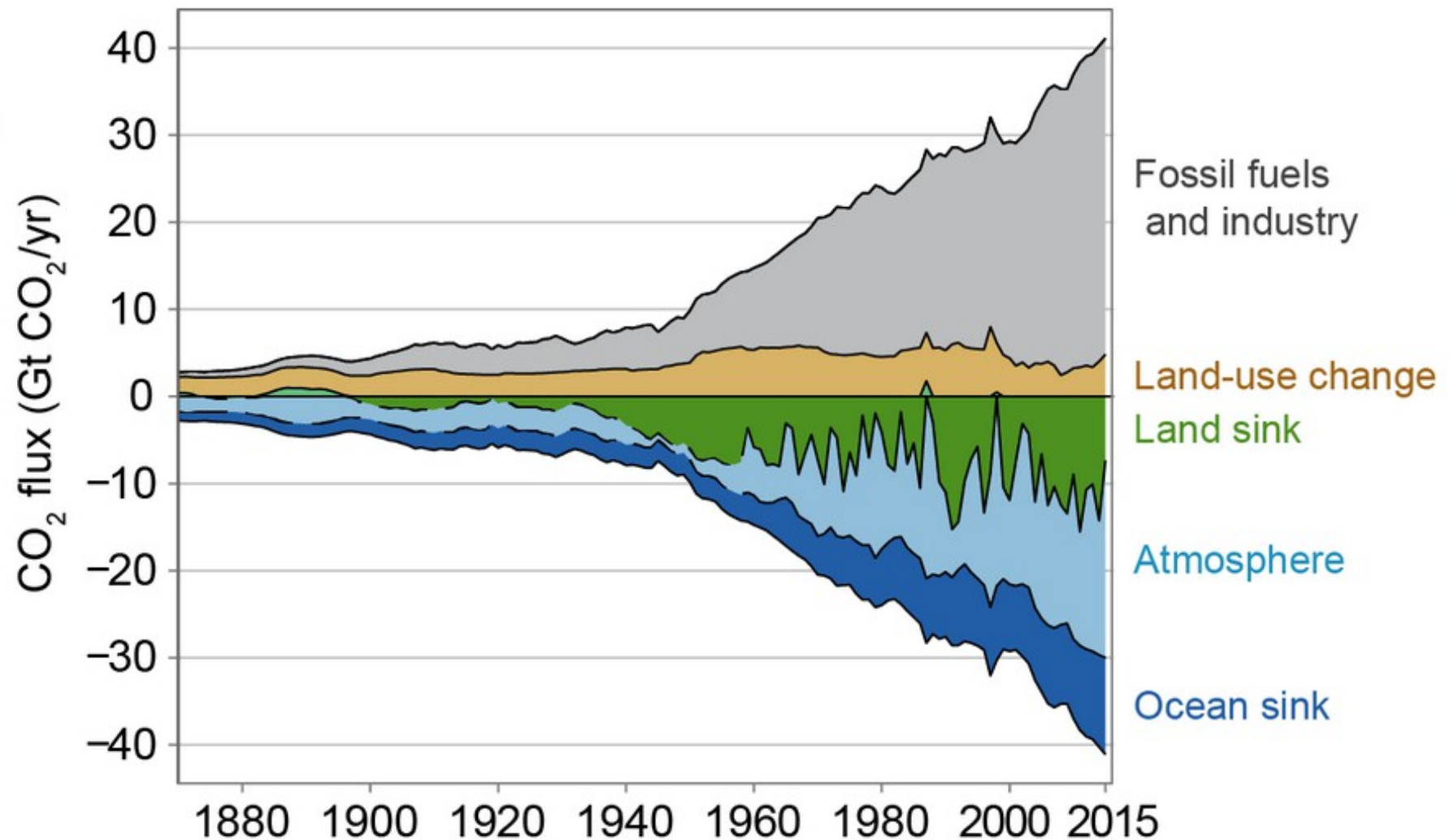




A pictogram of the greenhouse effect

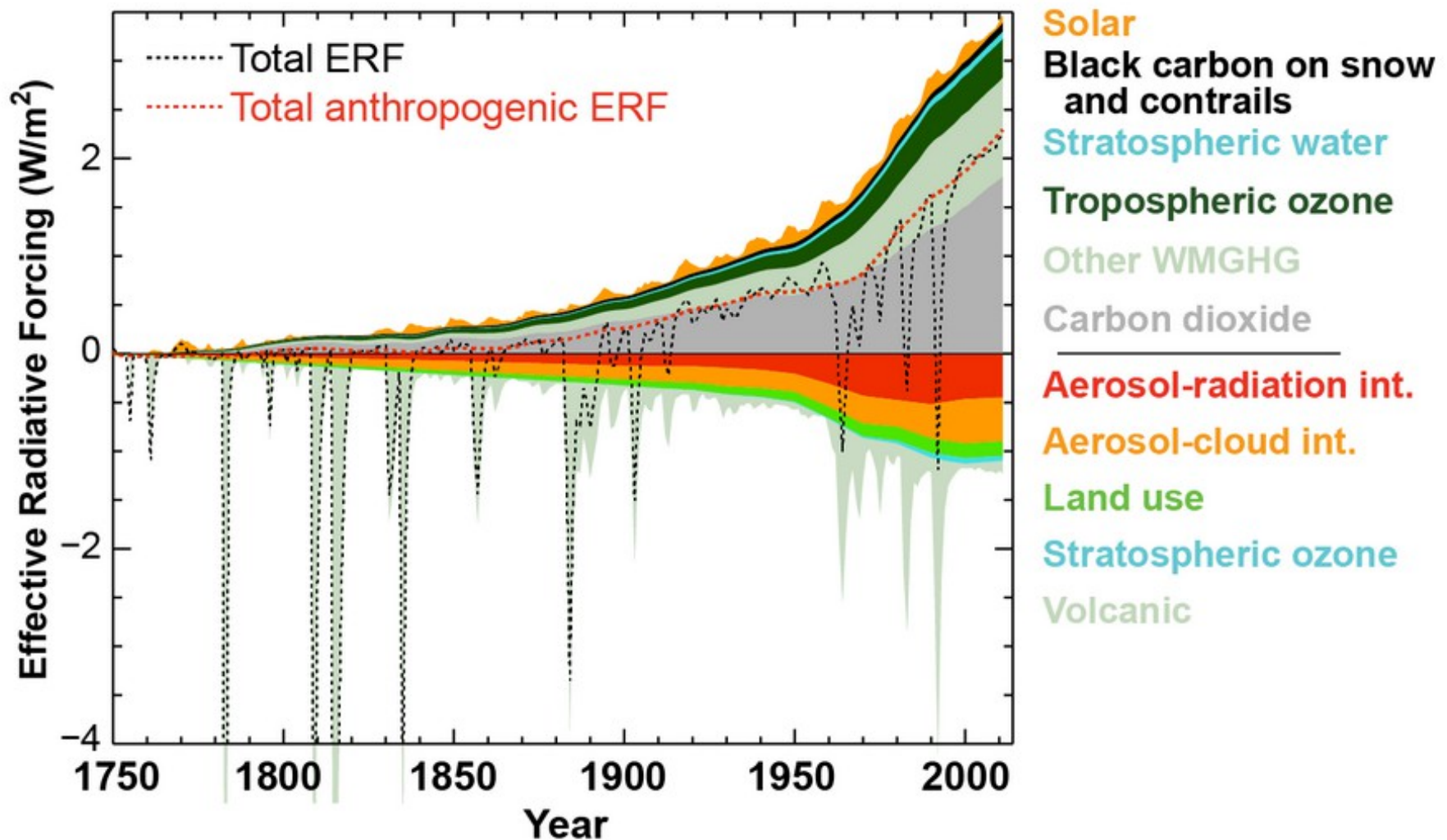


Carbon Dioxide Sources and Sinks

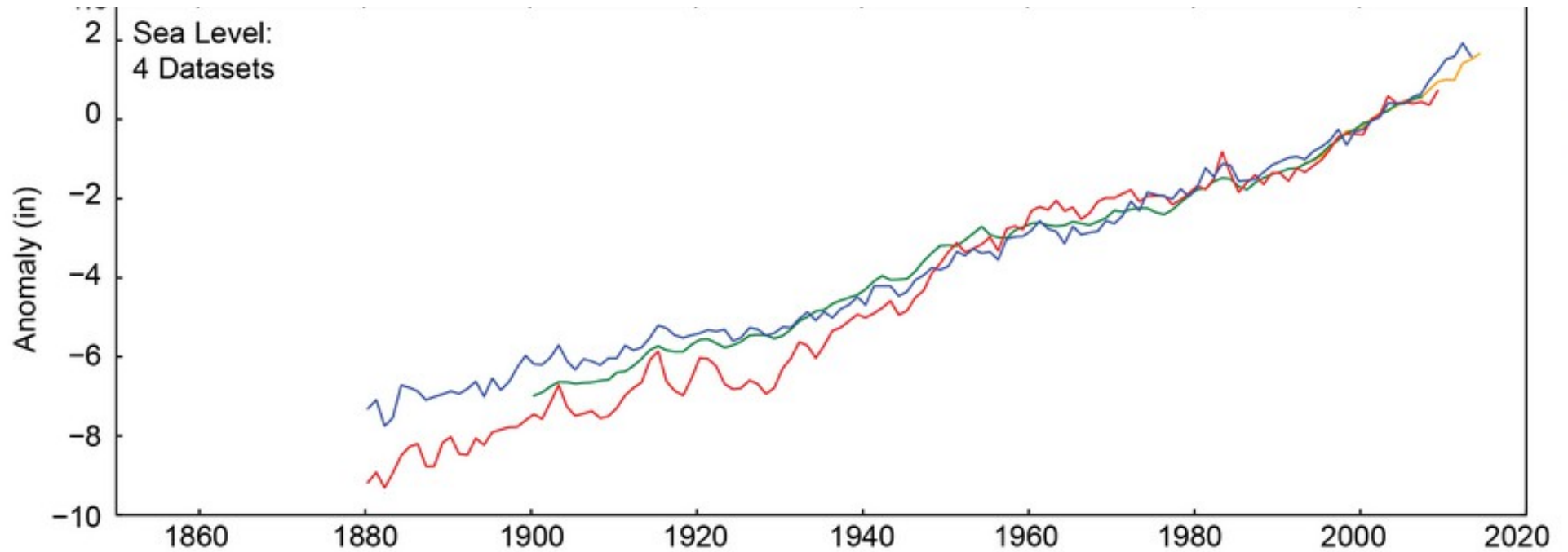


Effect of Various Forcings

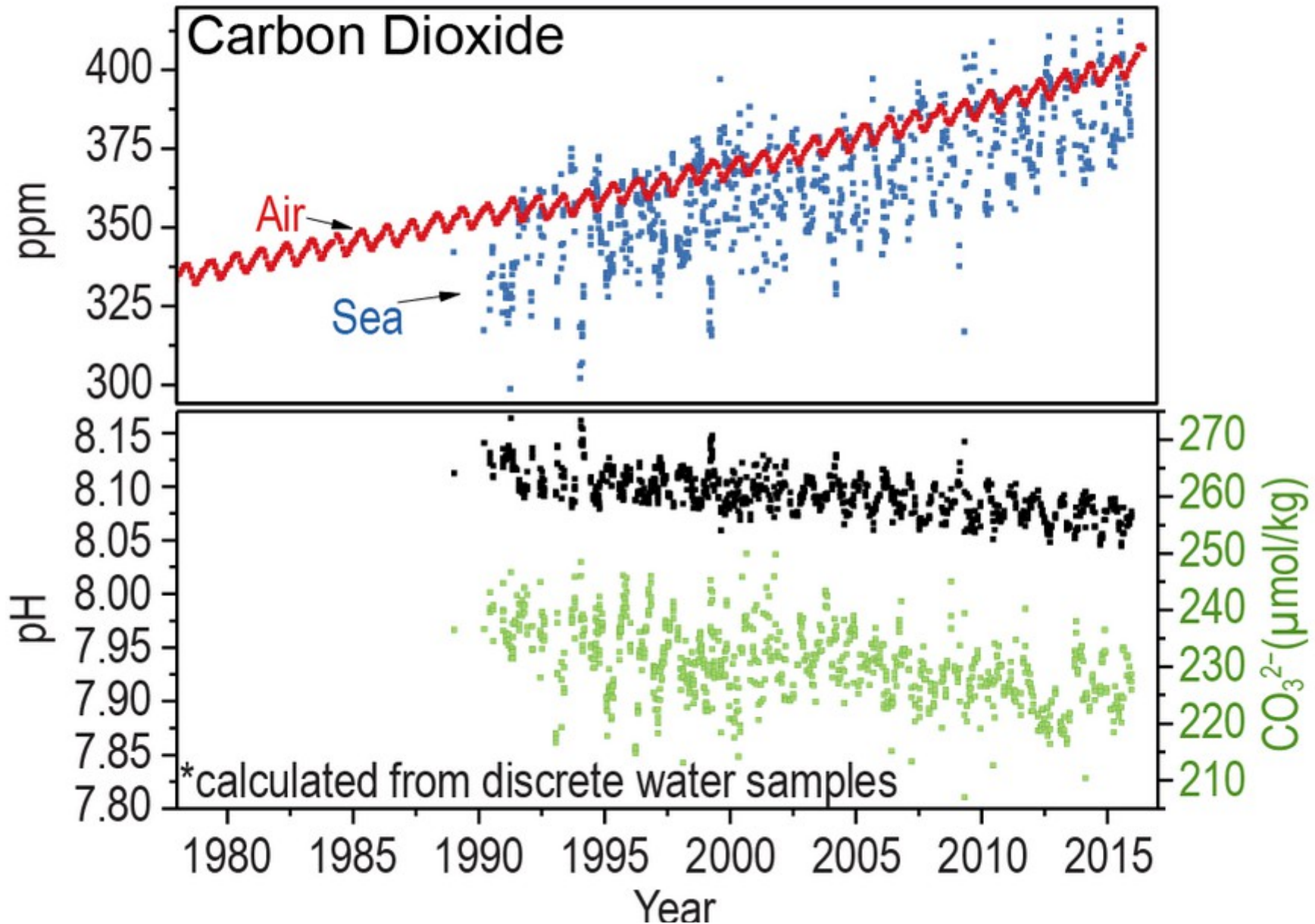
Time Evolution of Forcings



Sea Level Rise

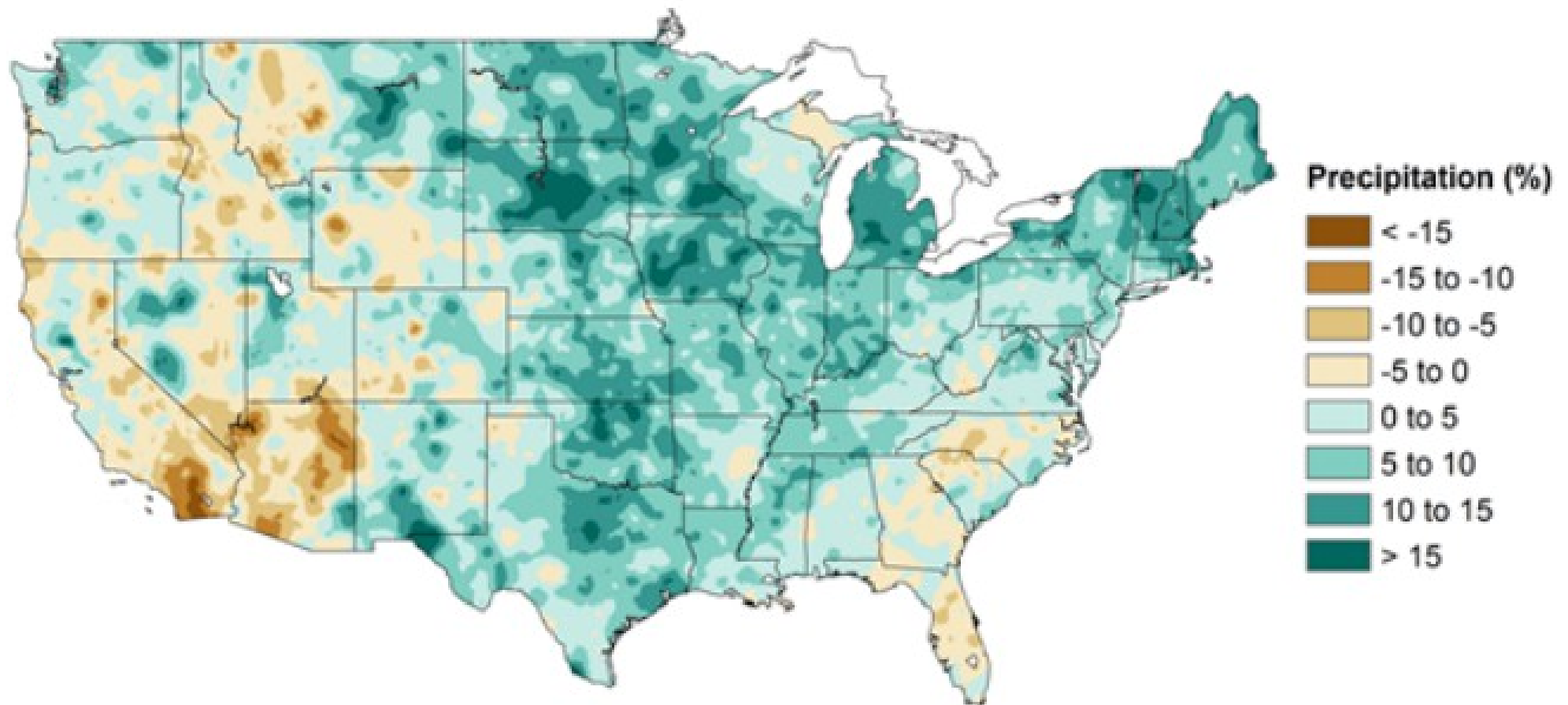


Ocean Acidification



Change in Annual Precipitation

Period: 1986-2015 relative to 1901-1960



Jetstream

Reference:

What is a Jet Stream?

By Kim Ann Zimmermann, Live Science Contributor | March 11, 2013 07:22pm ET

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MORE ▾



The jet stream, in purple, separates cold air over the Rocky Mountains from warm air over the Midwest in this forecast map for the weekend of March 8, 2013.

Credit: AccuWeather.com

Future?

- Increasing CO₂ in air and oceans
 - Can not stop using fossil carbon immediately
 - Increased warming, acidification
 - More intense weather, climate migration
- With no U. S. federal action
 - Hunger
 - Wars
 - Possible reduction of population by 50%
- With U. S. federal action
 - Might control carbon increases in 10 years
 - Still need mitigation spending

How climate models got so accurate they earned a Nobel Prize

- <https://www.nationalgeographic.com/environment/article/how-climate-models-got-so-accurate-they-earned-a-nobel-prize>
- Last month, Time Magazine listed two of them—Friederike Otto and GeertJan van Oldenborg of the World Weather Attribution Project—among the 100 Most Influential People of 2021. And on Tuesday, pioneering climate modelers Syukuro Manabe and Klaus Hasselmann shared the Nobel Prize for Physics