The Future of Nordic Skiing

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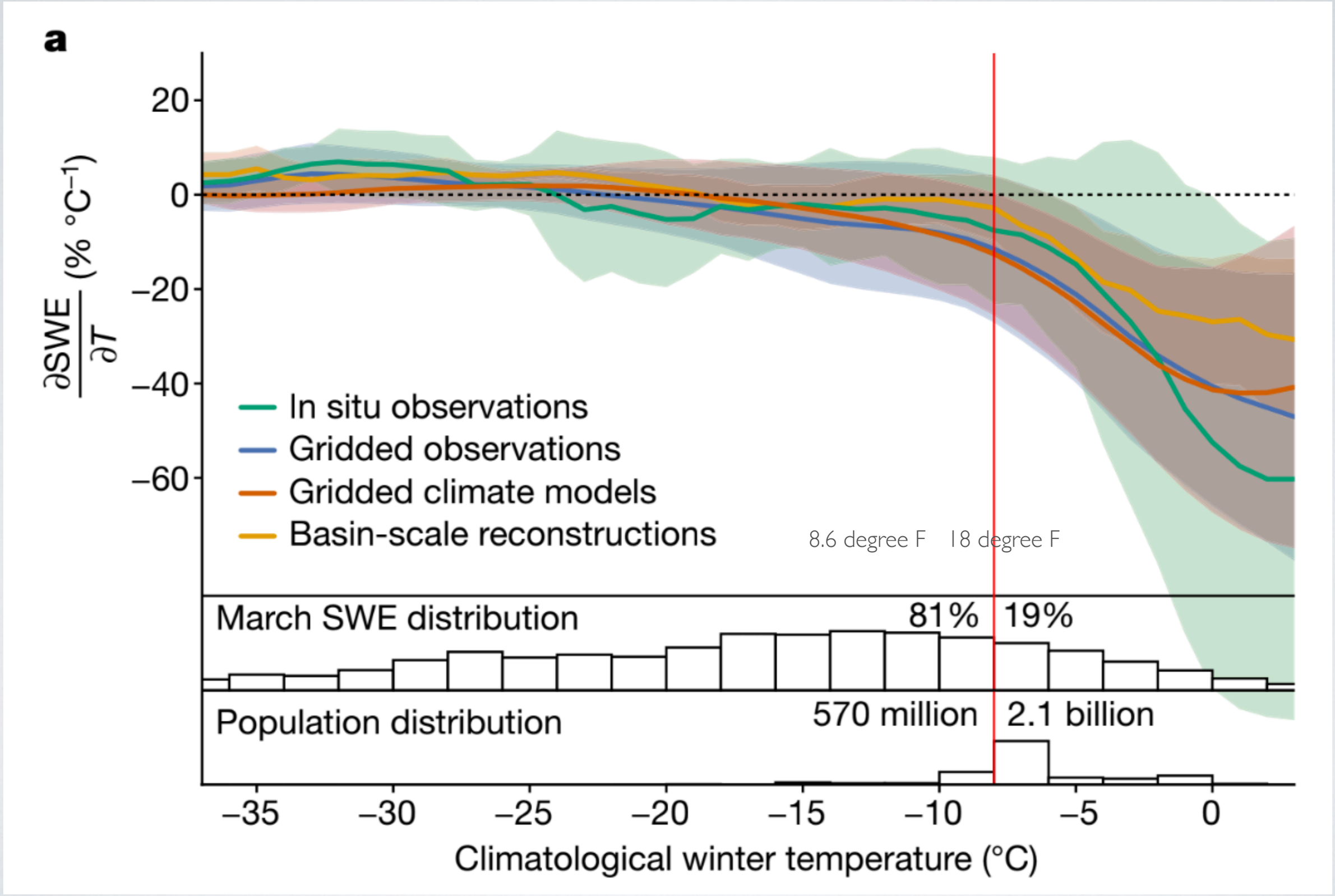
Non-Linear Sensitivity to Snowpack Warming

Evidence of human influence on Northern Hemisphere snow loss
Gottleib et, al; 2024

Non-Linear Sensitivity to Snowpack Warming

Evidence of human influence on Northern Hemisphere snow loss



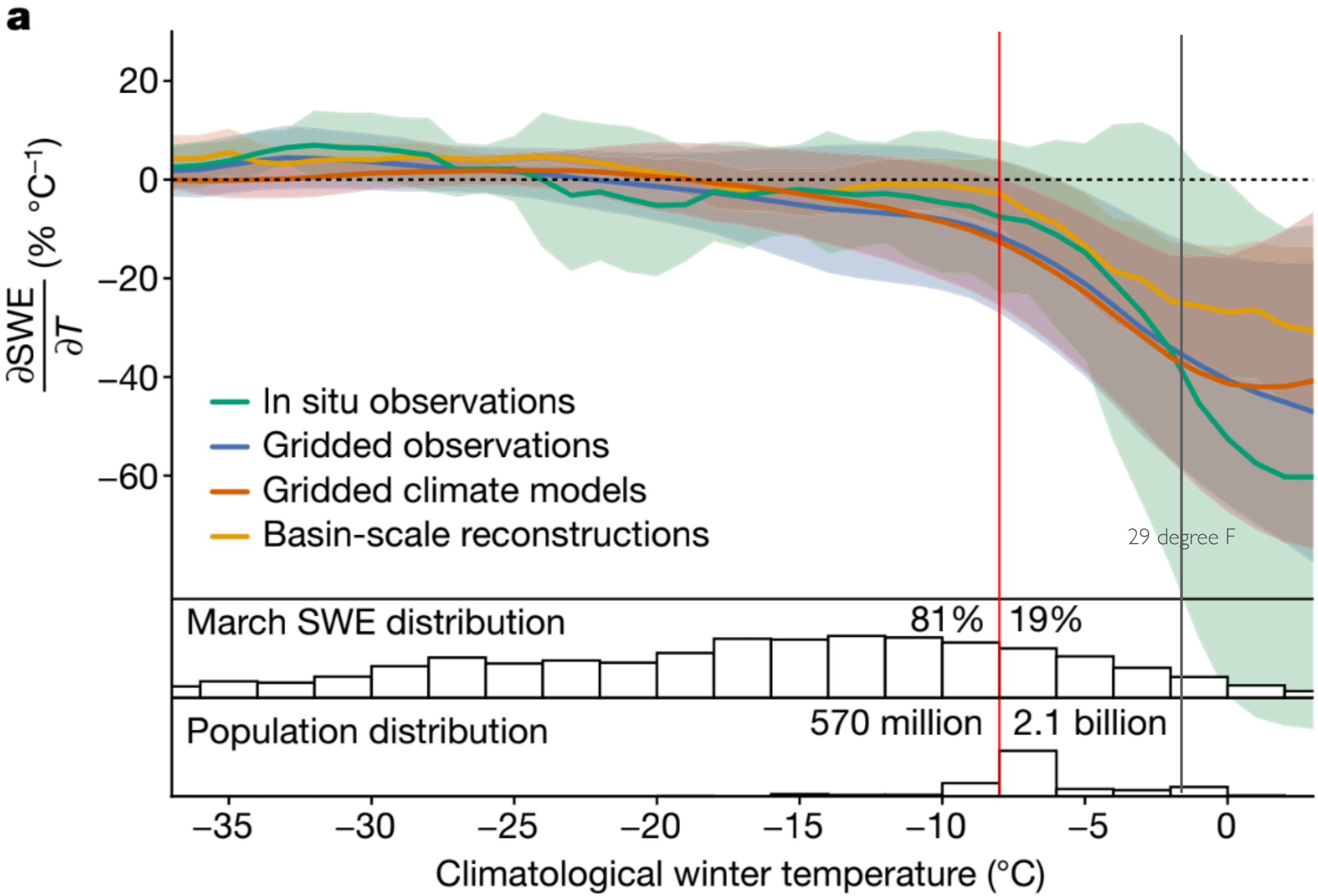
https://doi.org/10.1038/s41586-023-06794-y

Thaynes Canyon Snotel Avg. March Temperature (2004 - 2023)

9230'

29 deg

Nonlinear Sensitivity of Snowpack to Warming



Climate Change Basics

Understanding our planet to benefit humankind

Carbon Dioxide

↑ 420 parts per million +

Global Temperature

↑ 1.1 °C since preindustrial +

Methane

↑ 1923.6 parts per billion +

Arctic Sea Ice Minimum Extent

↓ 12.6 percent per decade since 1979 +

Ice Sheets

↓ 424 billion metric tons per year +

Sea Level

↑ 4 inches since January 1993 +

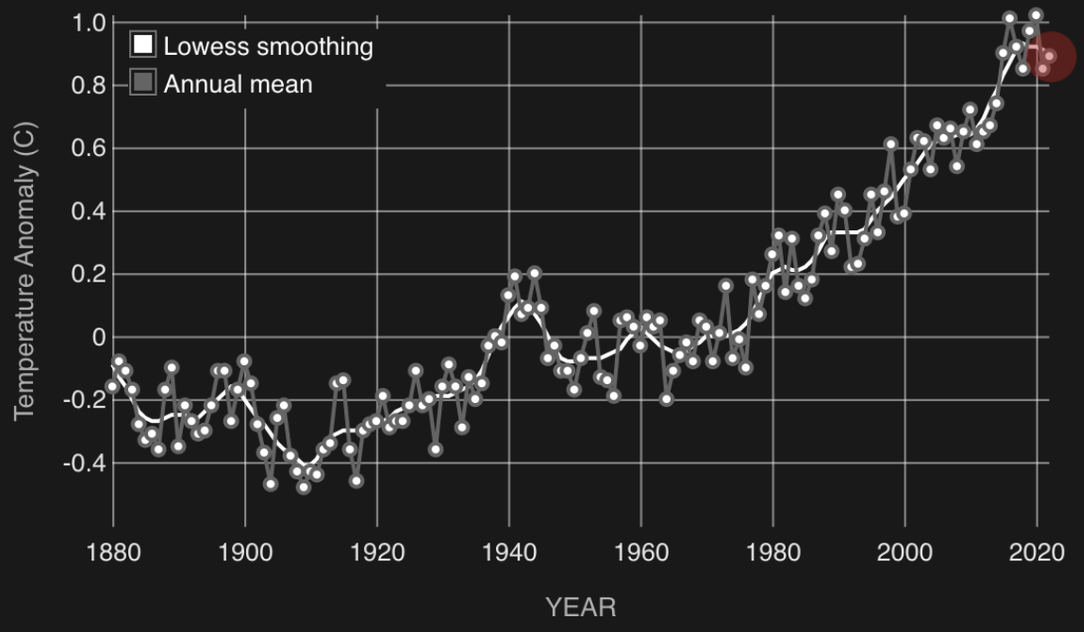
Ocean Warming

↑ 345 zettajoules since 1955 +

Global Temperature

GLOBAL LAND-OCEAN TEMPERATURE INDEX

Data source: NASA's Goddard Institute for Space Studies (GISS). Credit: NASA/GISS



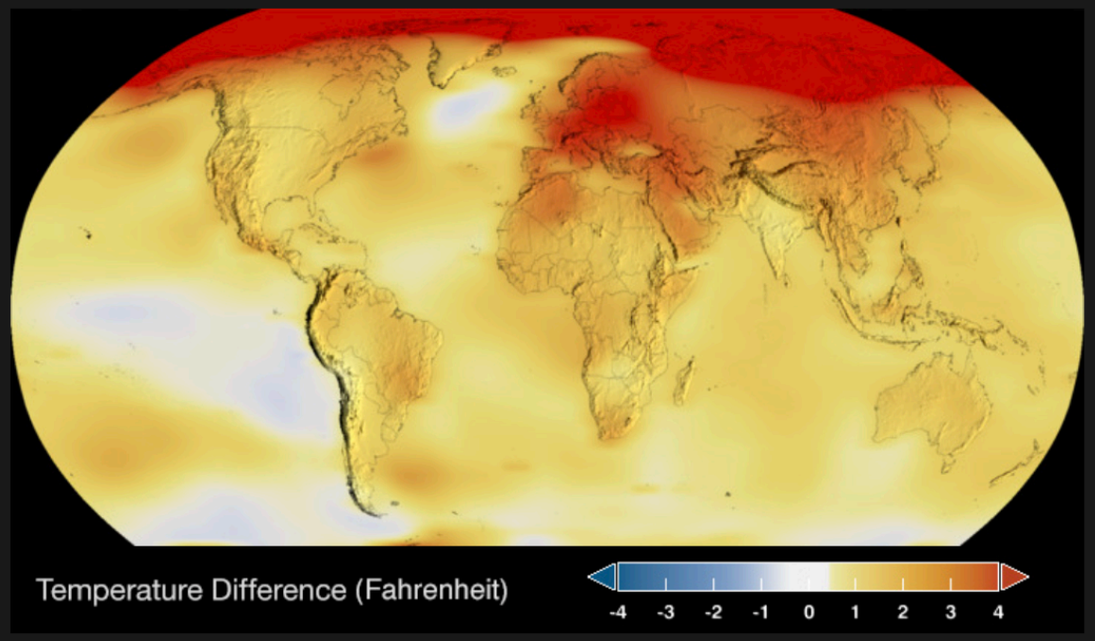
Click+drag to zoom RESET

Get Data: HTTP | Snapshot: PNG

This graph shows the change in global surface temperature compared to the long-term average from 1951 to 1980. The year 2020 statistically tied with 2016 for the hottest year on record since recordkeeping began in 1880 (source: NASA/GISS). NASA's analyses generally matches independent analyses prepared by National Oceanic and Atmospheric Administration (NOAA) and other research groups.

TIME SERIES: 1884 TO 2022

Data source: NASA/GISS
Credit: NASA's Scientific Visualization Studio



1884 2022

The animation above shows the change in global surface temperatures. Dark blue shows areas cooler than average. Dark red shows areas warmer than average. To smooth out variations due to short-term temperature changes (which are considered "noise" in the data), this map shows a 5-year running average.

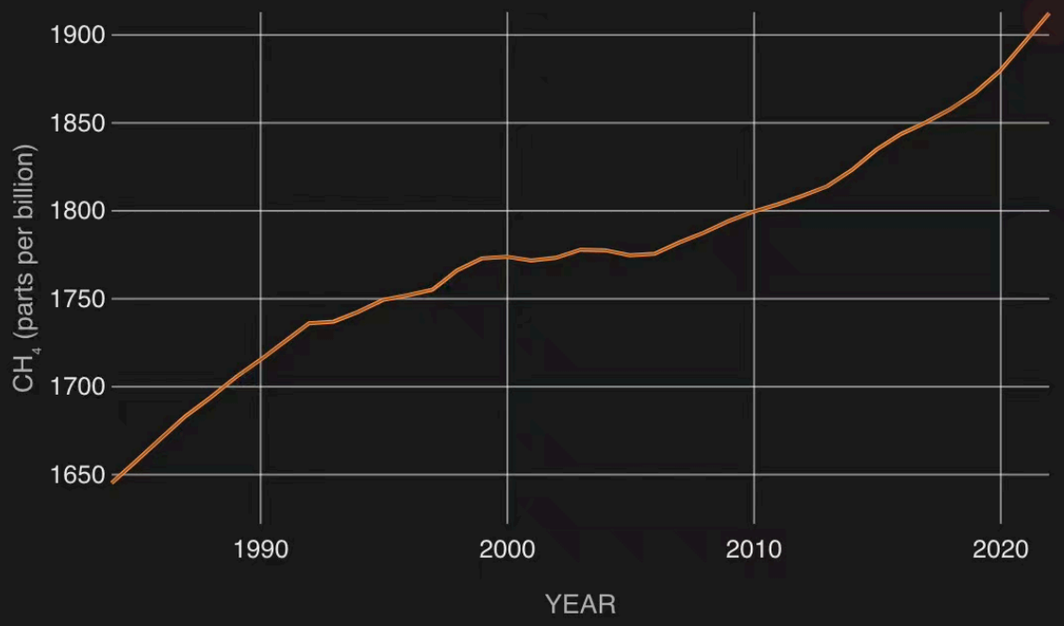
The "Global Temperature" value on the home page dashboard shows global temperature change since 1880, compared to NASA's 1951-1980 baseline.

full vital sign
en español

Methane

ATMOSPHERIC METHANE CONCENTRATIONS SINCE 1984

Data source: Data from NOAA, measured from a global network of air sampling sites

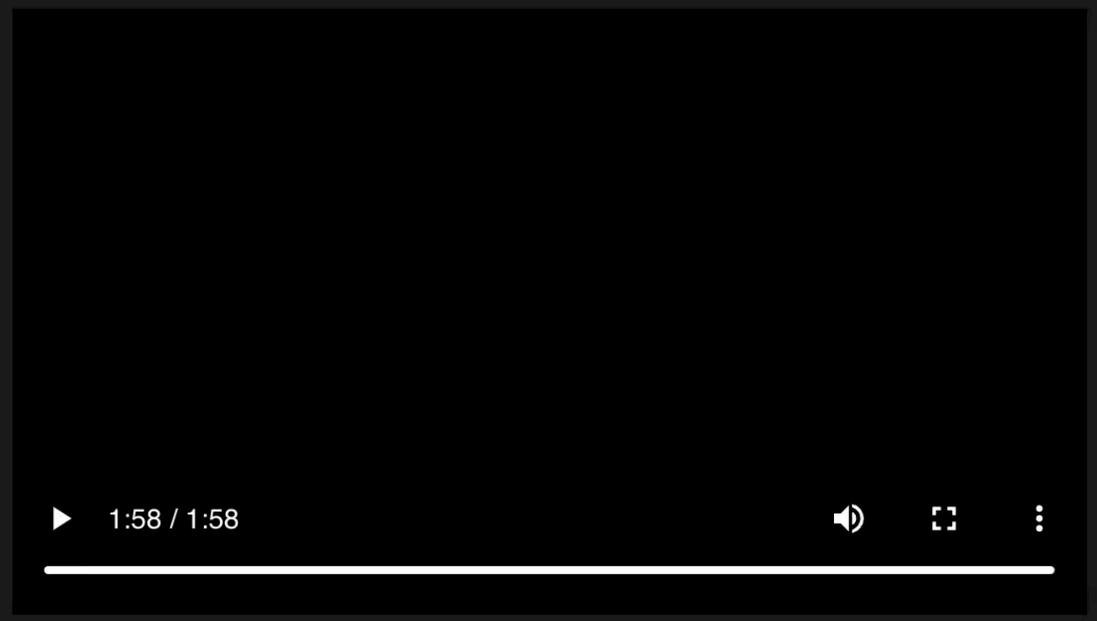


Click+drag to zoom RESET

Get Data: HTTP | Snapshot: PNG

Methane (CH_4) is a powerful greenhouse gas, and is the second-largest contributor to climate warming after carbon dioxide (CO_2). A molecule of methane traps more heat than a molecule of CO_2, but methane has a relatively short lifespan of 7 to 12 years in the atmosphere, while CO_2 can persist for hundreds of years or more.

Methane comes from both natural sources and human activities. An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste. Natural processes account for 40% of methane emissions, with wetlands being the largest natural source. (Learn more about the Global Methane Budget.)



This NASA visualization shows the complex patterns of methane emissions around the globe and throughout the seasons. It shows methane emissions in 2018, based on data from satellites, inventories of human activities, and NASA global computer models. Credit: NASA's Scientific Visualization Studio

The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).

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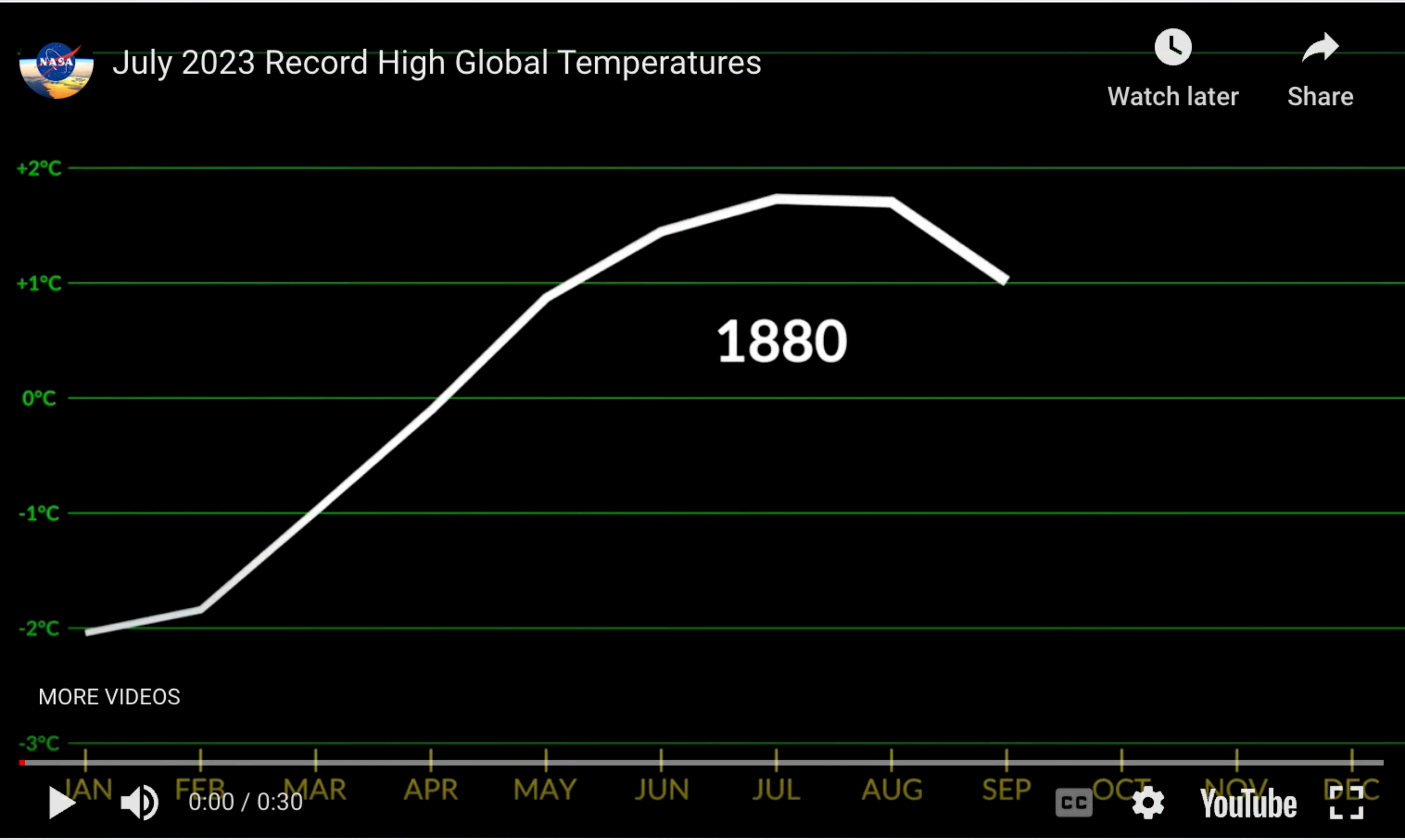
Global Temperatures 1880 - 2023

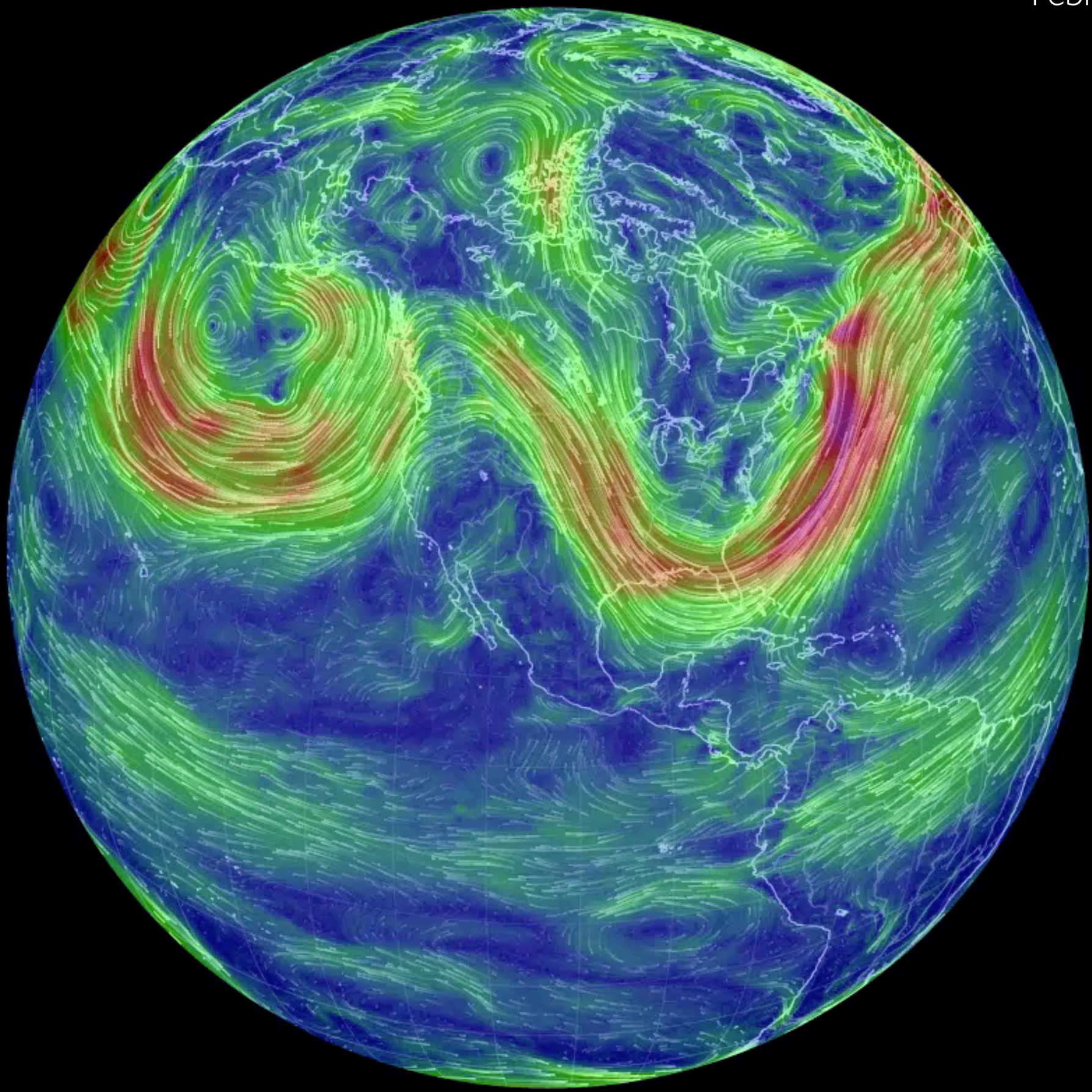


Snow Collection Season

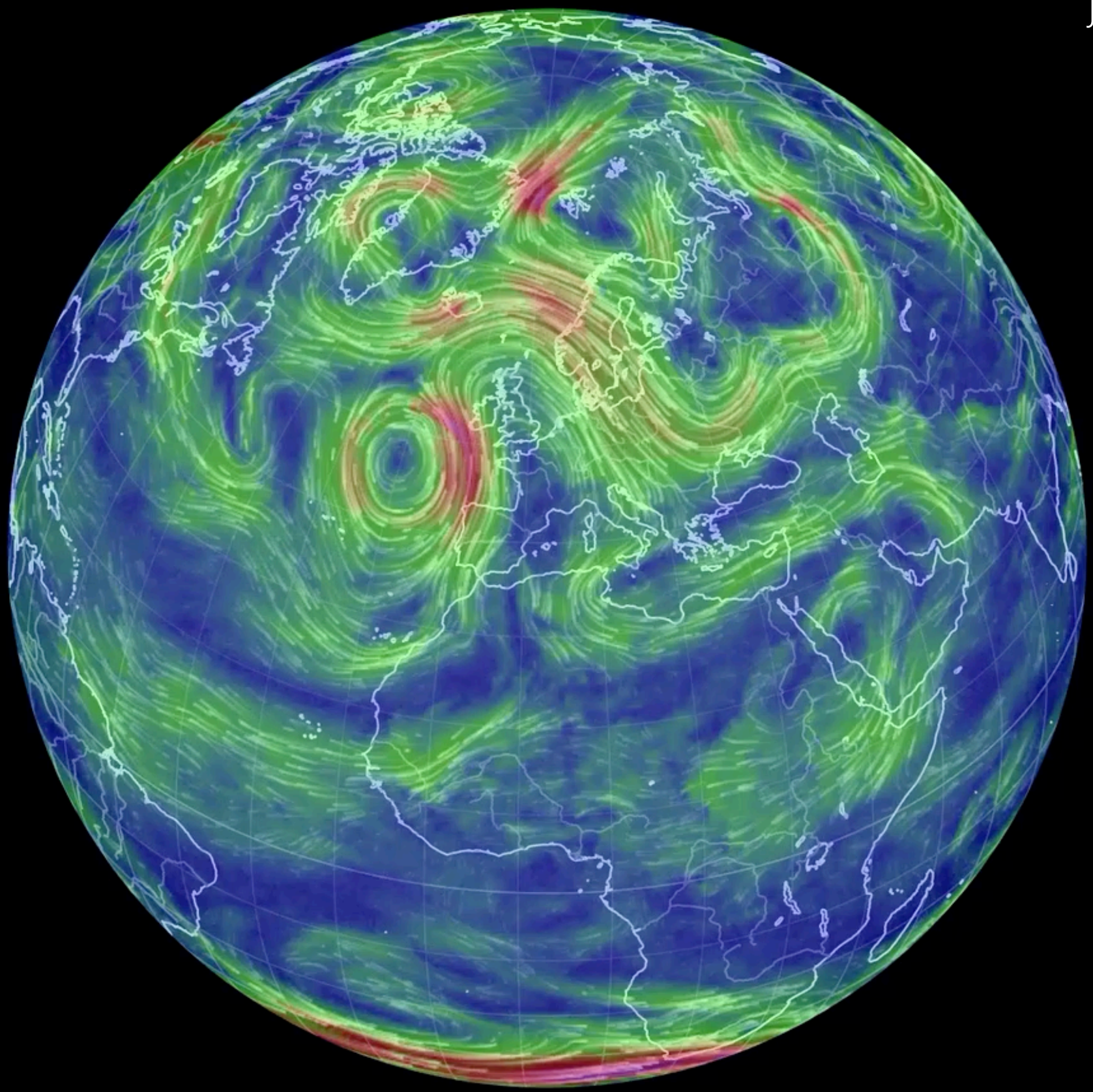
October - April

Quasi Stationary High Amplitude Atmospheric Wave Pattern (High Pressure Ridging)

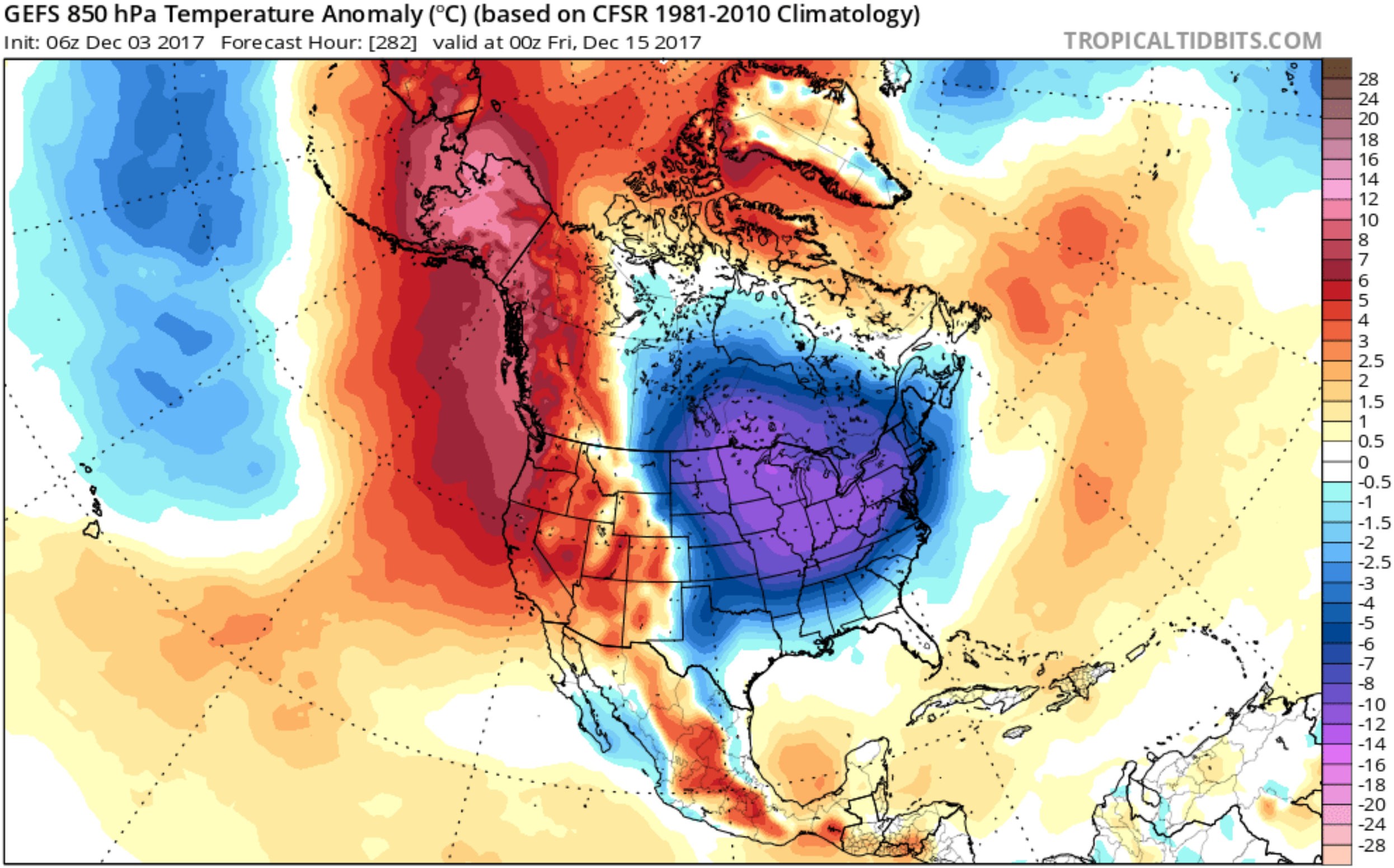
February 10th, 2016



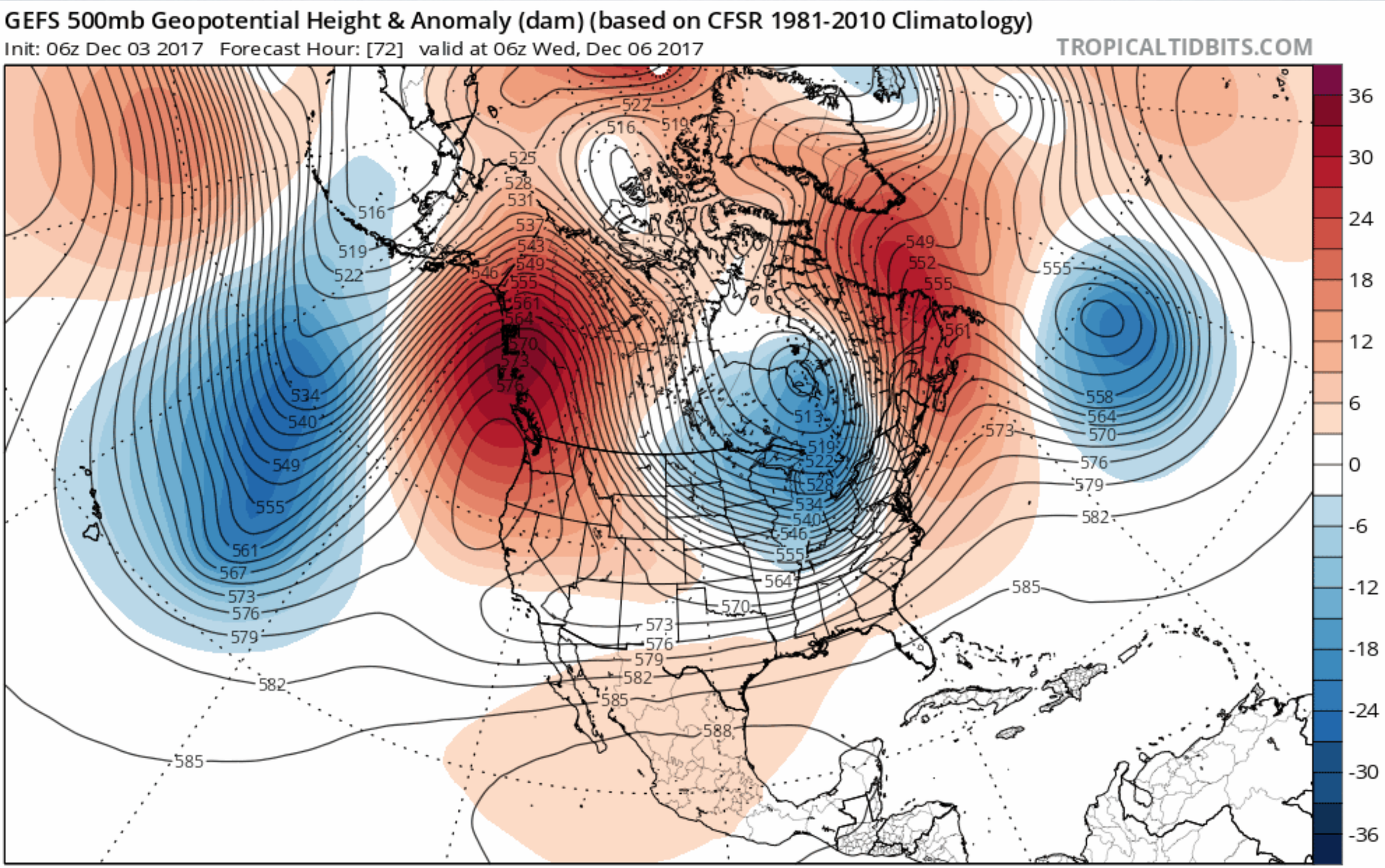
European Heat Wave
June 26th, 2019



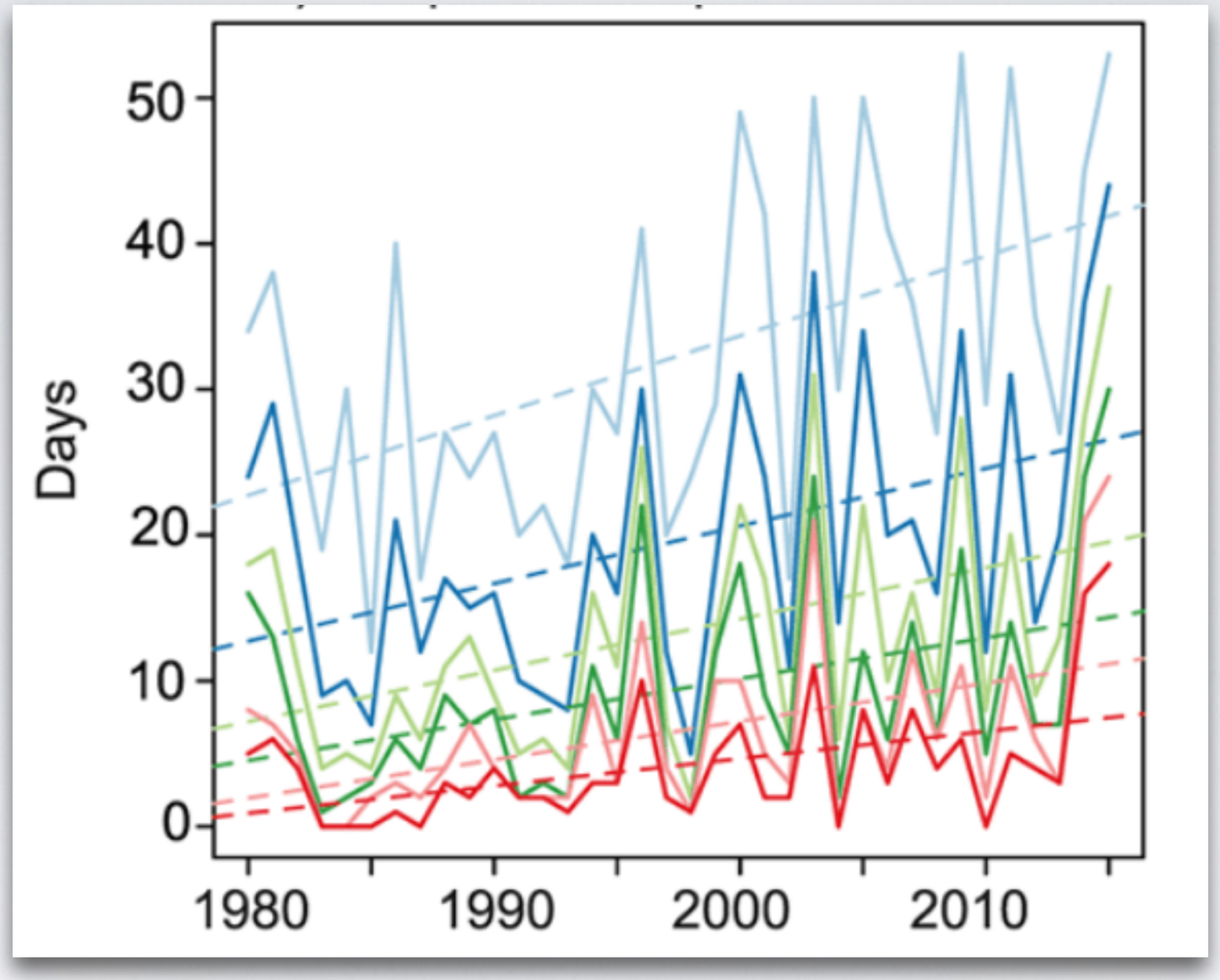
Surface Temperature Anomaly



DiPole Weather Connection



Frequency of Dipole Weather Pattern

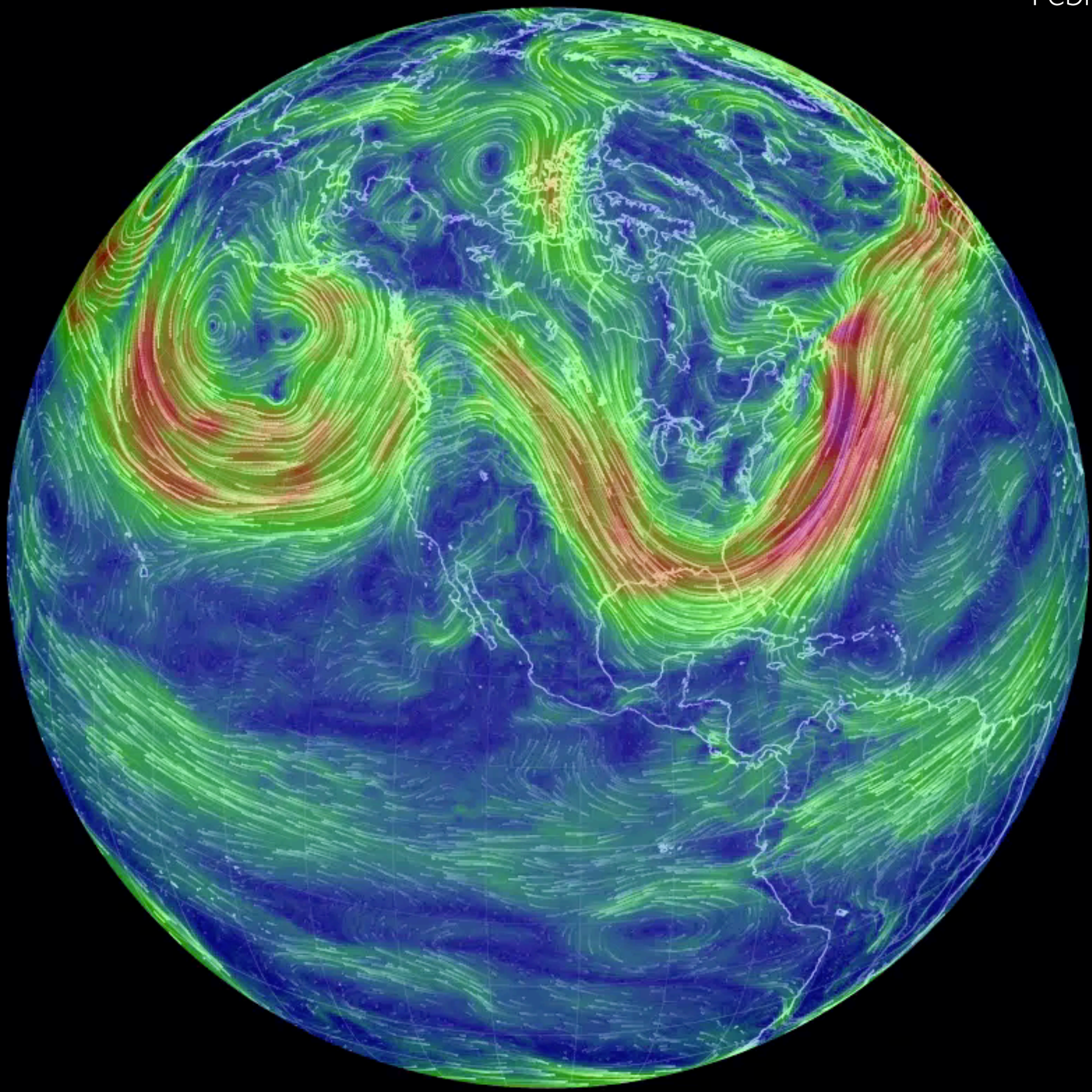


Utah

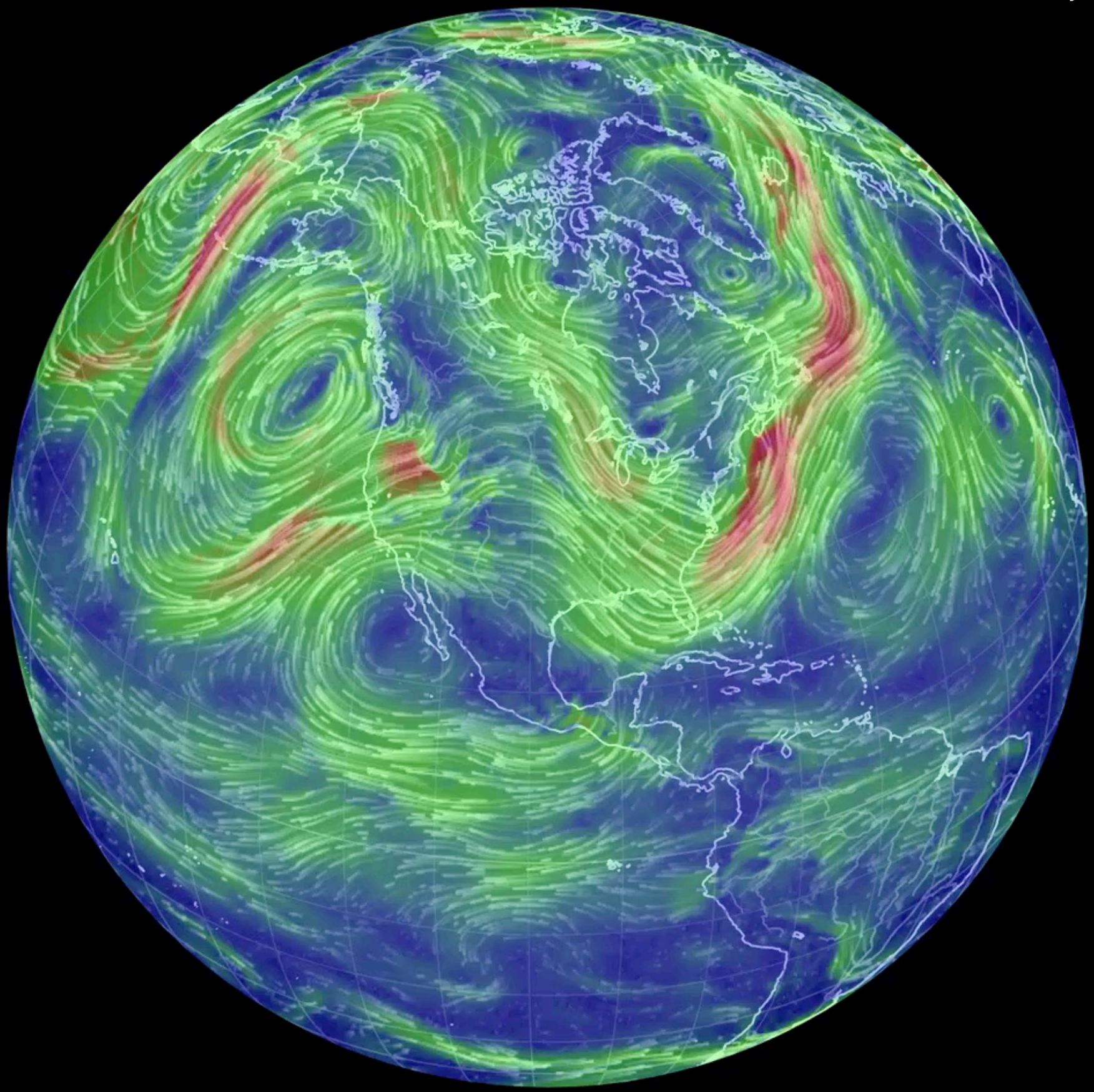
Weather Patterns

Meteorologic Winter

February 10th, 2016



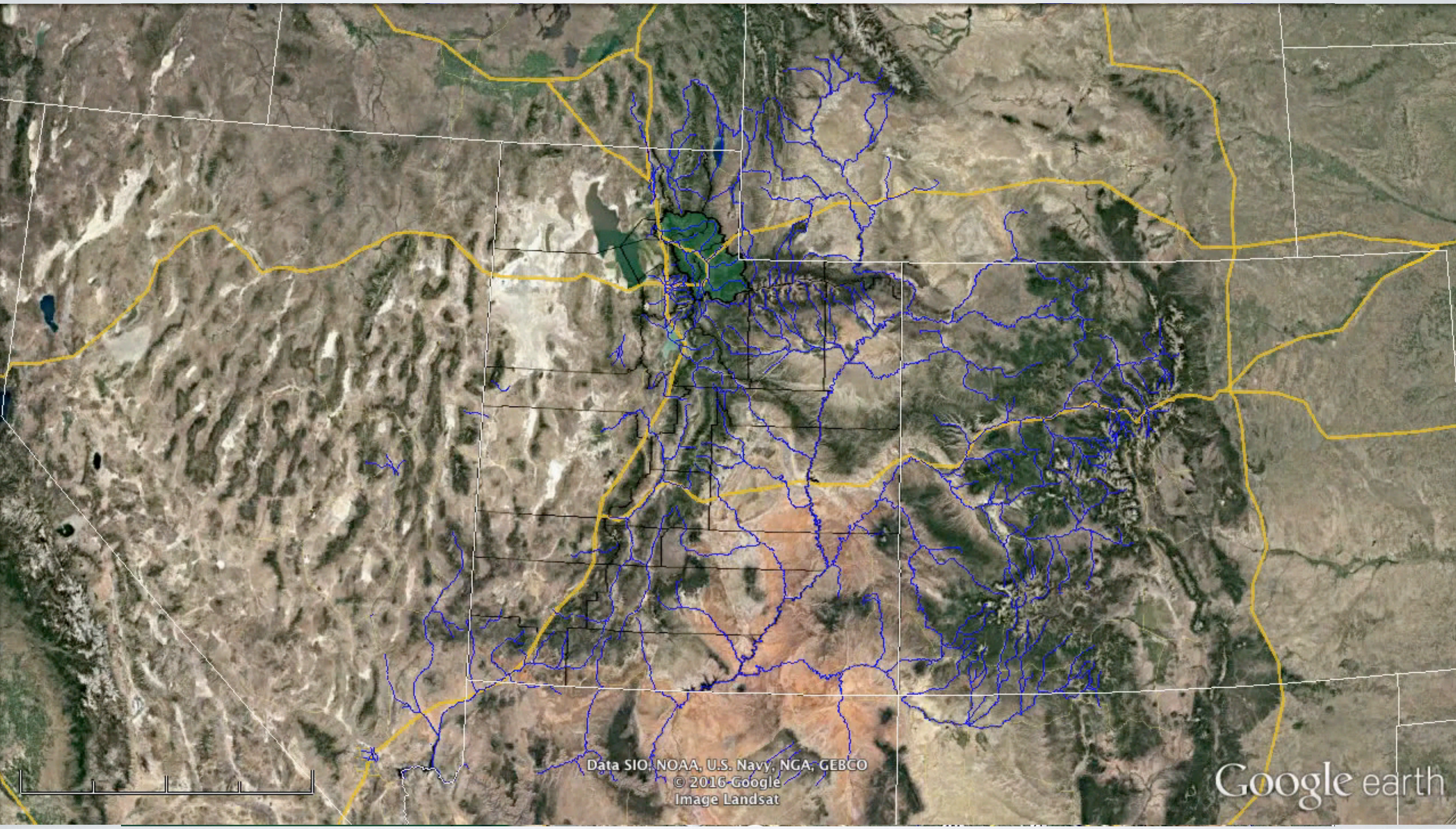
January 7th, 2017



18% to 31% reduction in snow producing storms

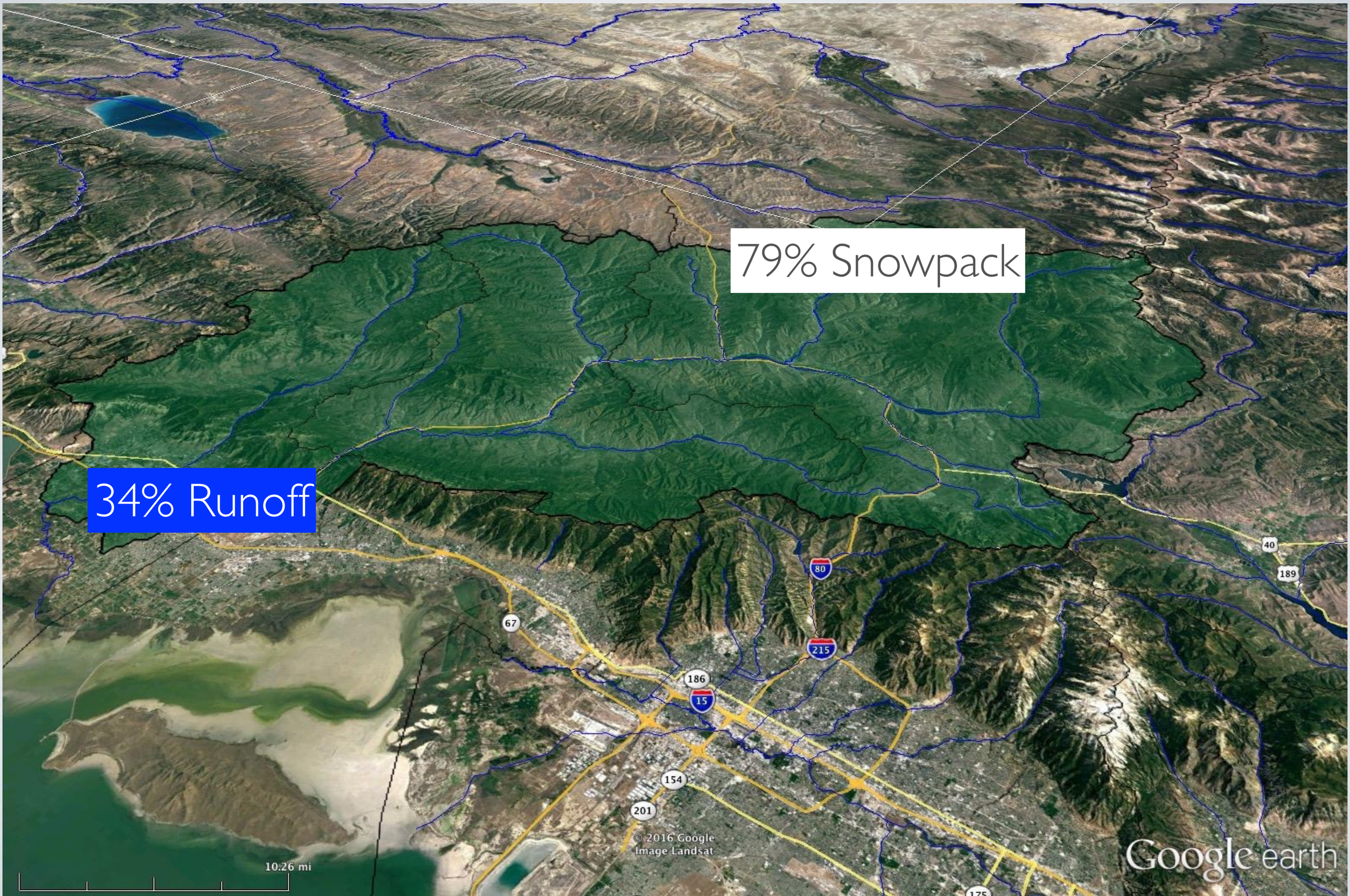
What If Snow Melts Earlier?

Weber River Drainage



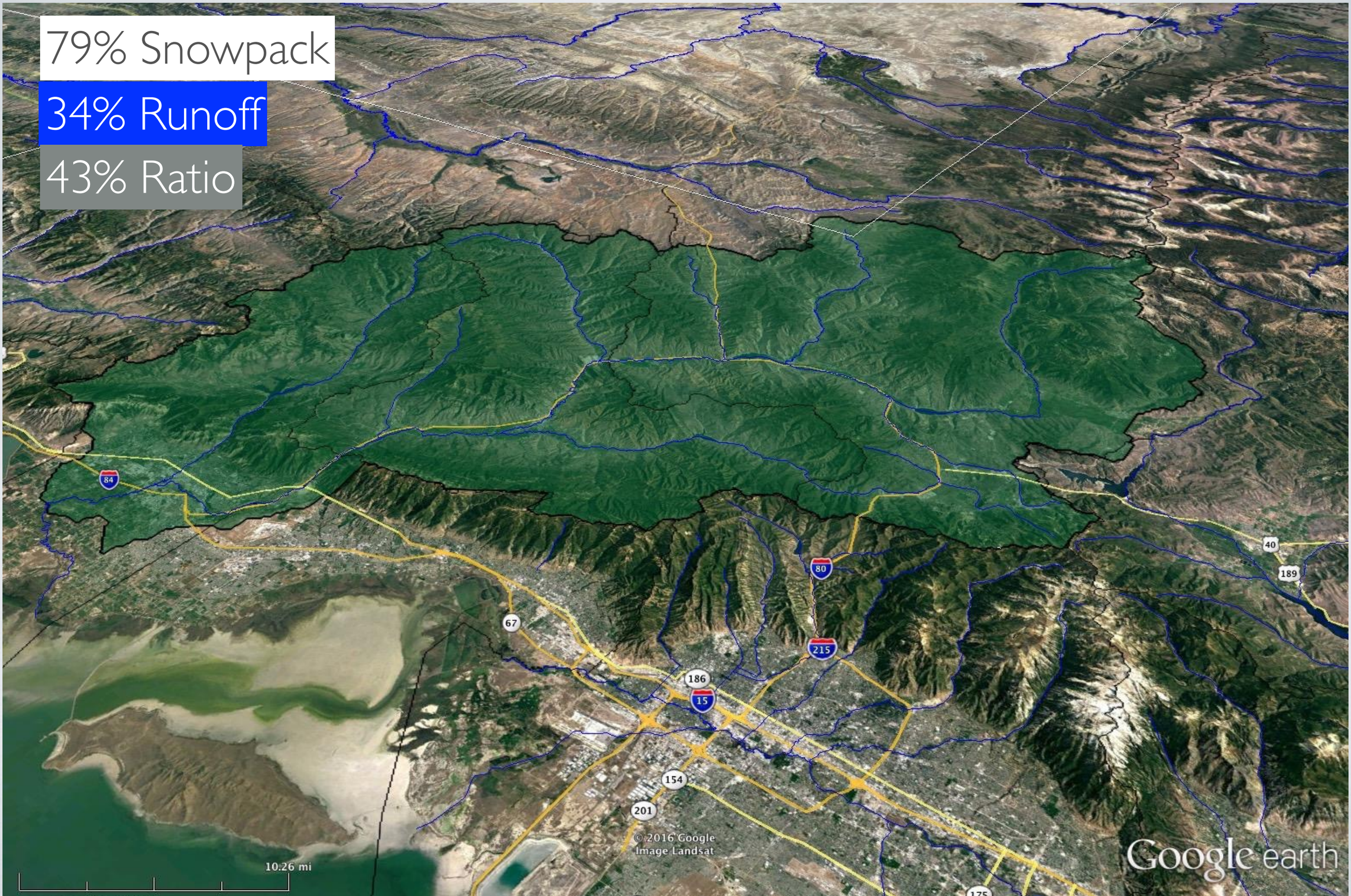
Weber River Drainage

2003 Water Year



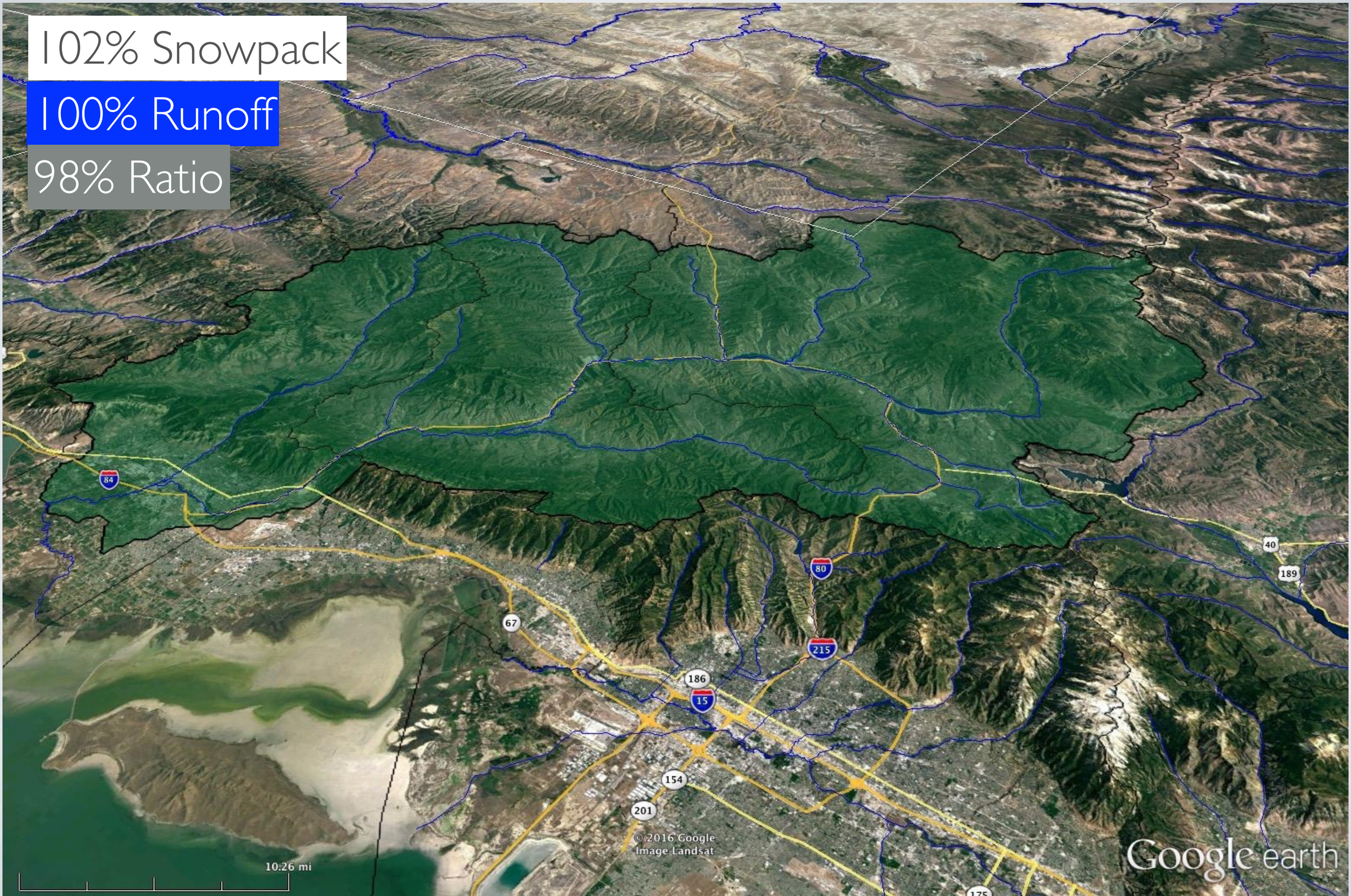
Weber River Drainage

2003 Water Year



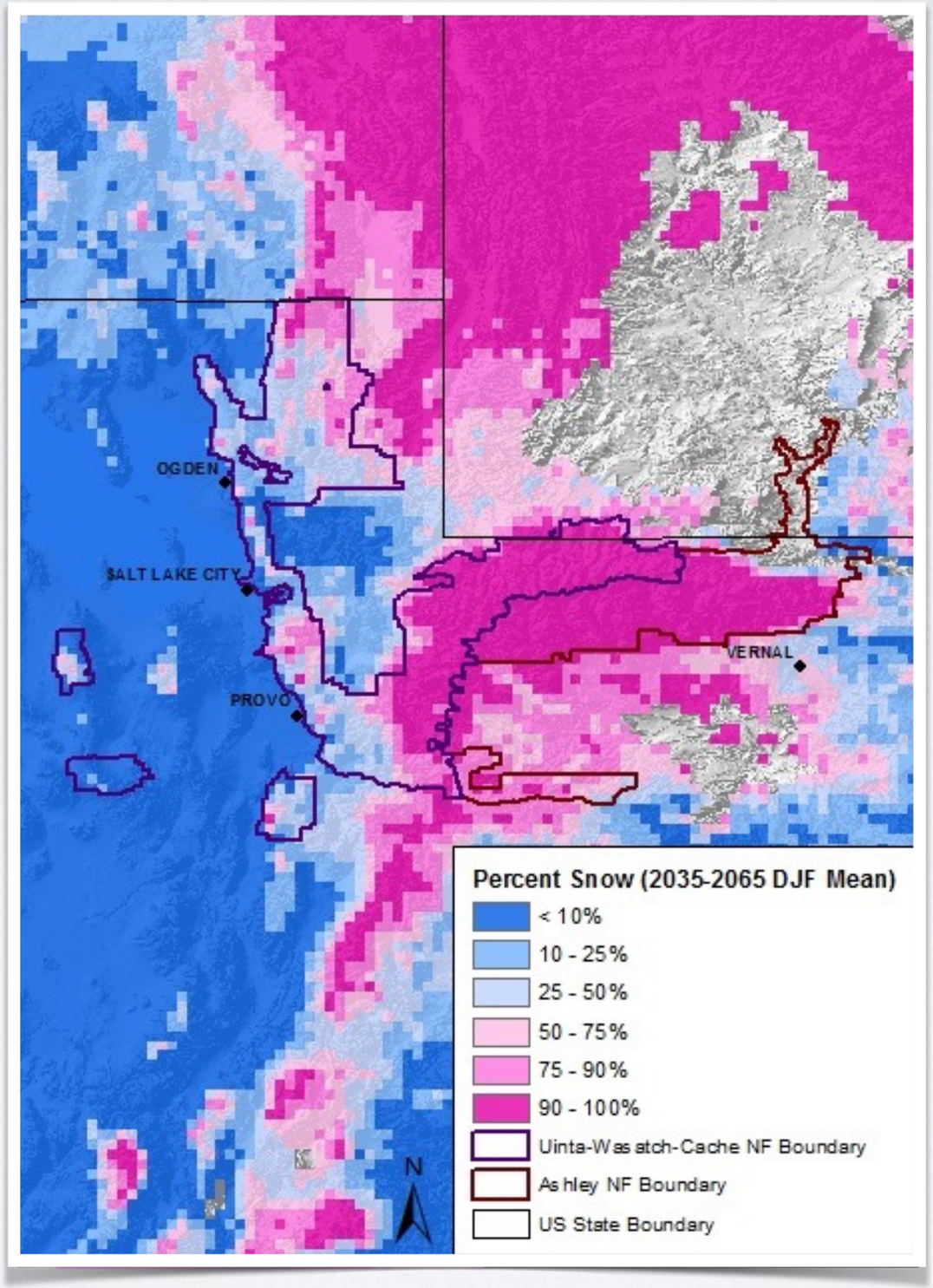
Weber River Drainage

2005 Water Year



Snow Coverage

CHANGE IN SNOW HYDROLOGY TO RAIN



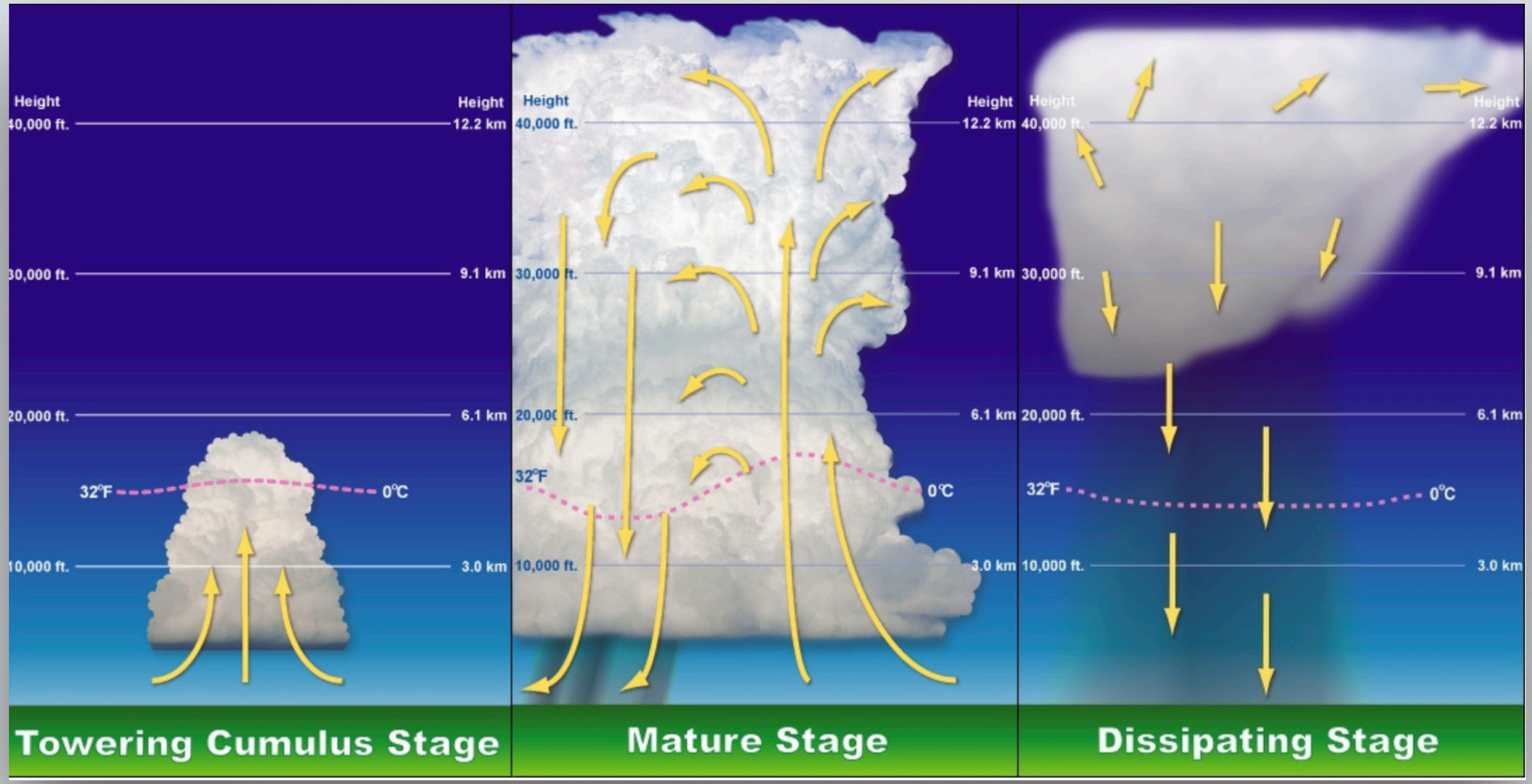
Rice, J.; Bardsley, T.; Joyce, L. A. [and others]. In review. Assessment of watershed vulnerability to climate change for the Uinta-Wasatch-Cache and Ashley National Forests.

Intense Rainfall - Thunderstorm Activity -Flash Flood

For Every 1 Degree C Increase

There is a 7% Increase of Atmospheric Moisture

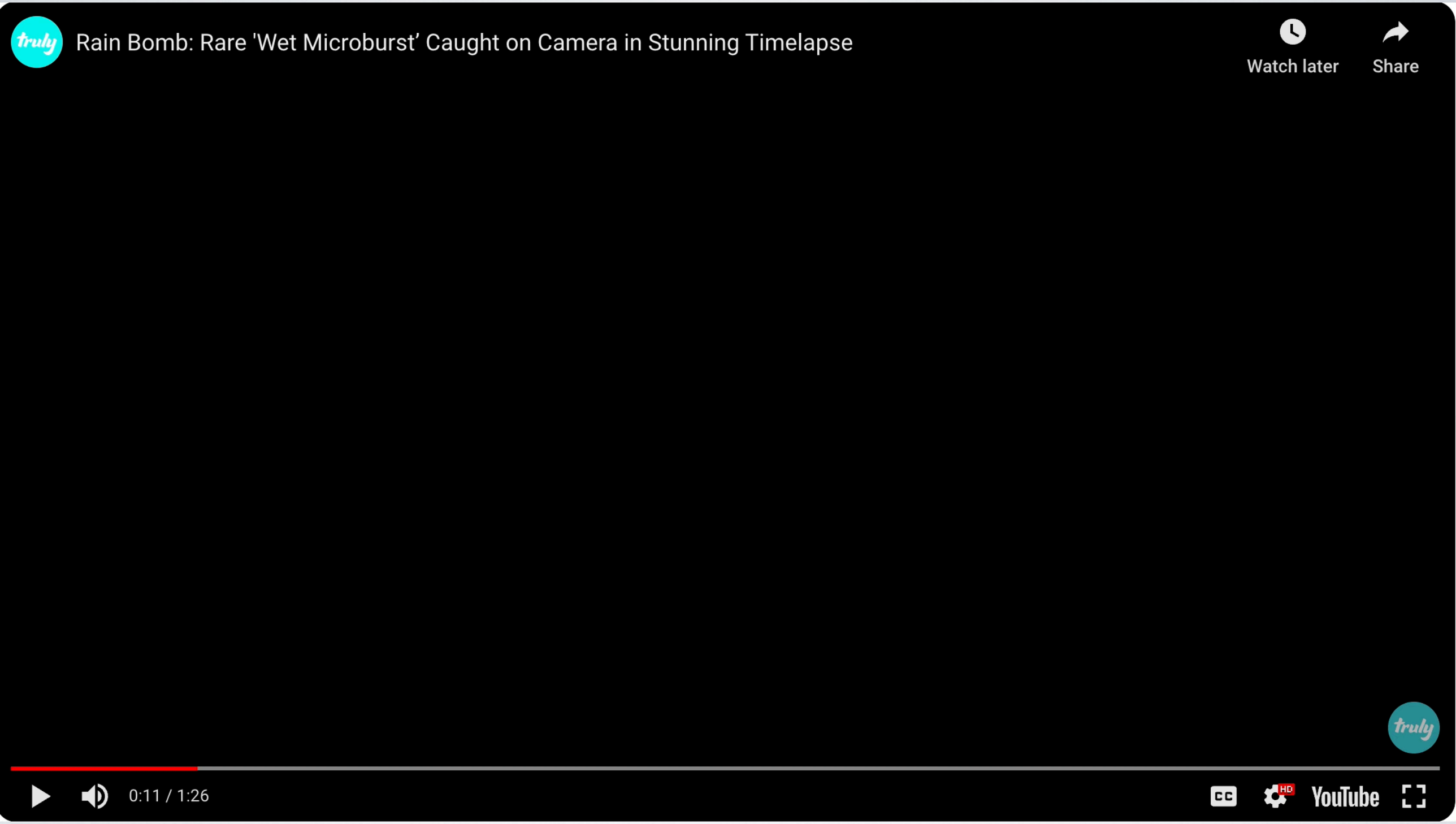
Thunderstorm Formation



Rain Bomb: Rare 'Wet Microburst' Caught on Camera in Stunning Timelapse

Watch later

Share



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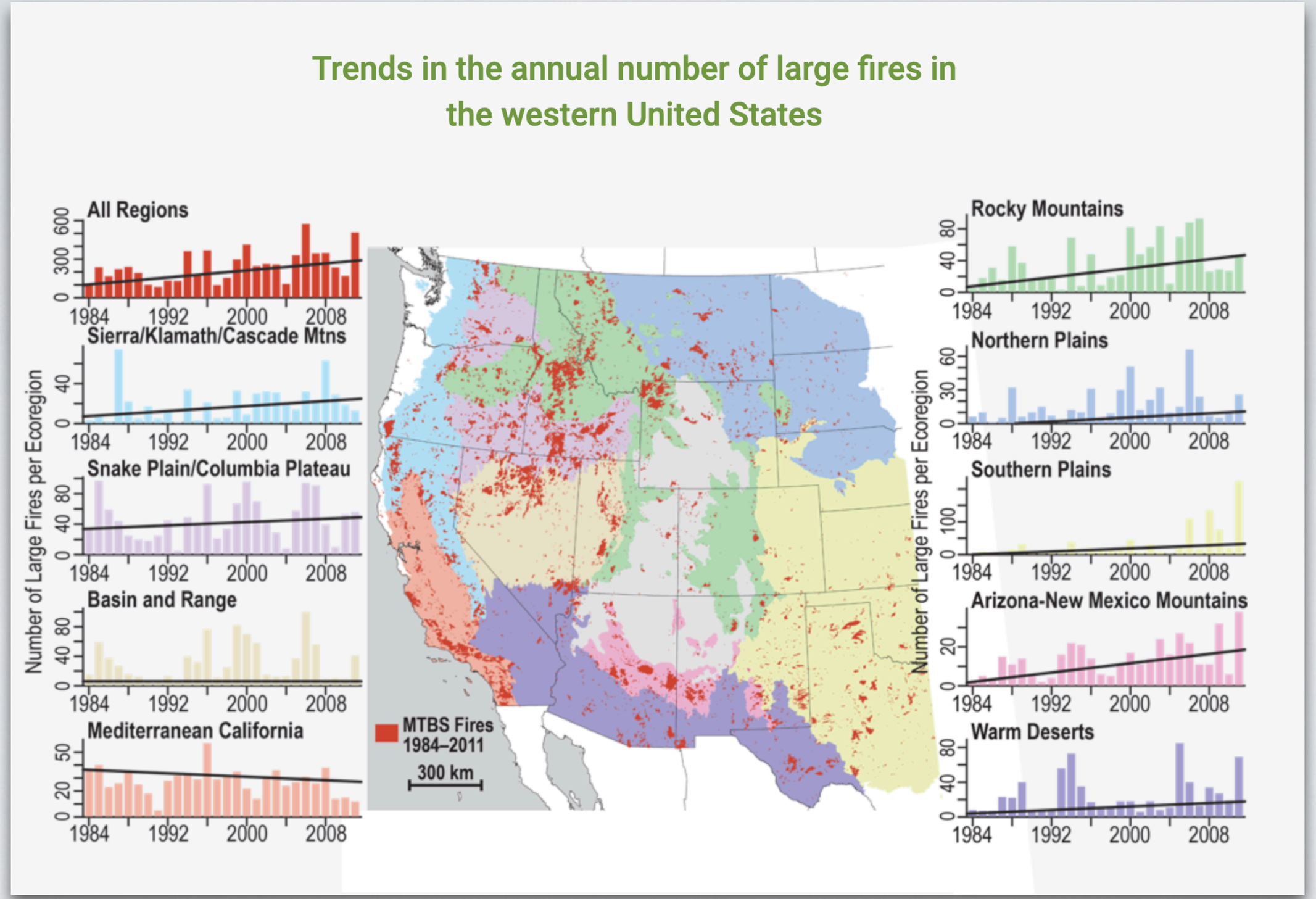
Increased Wildfire Behavior

Increased Wildfire Behavior



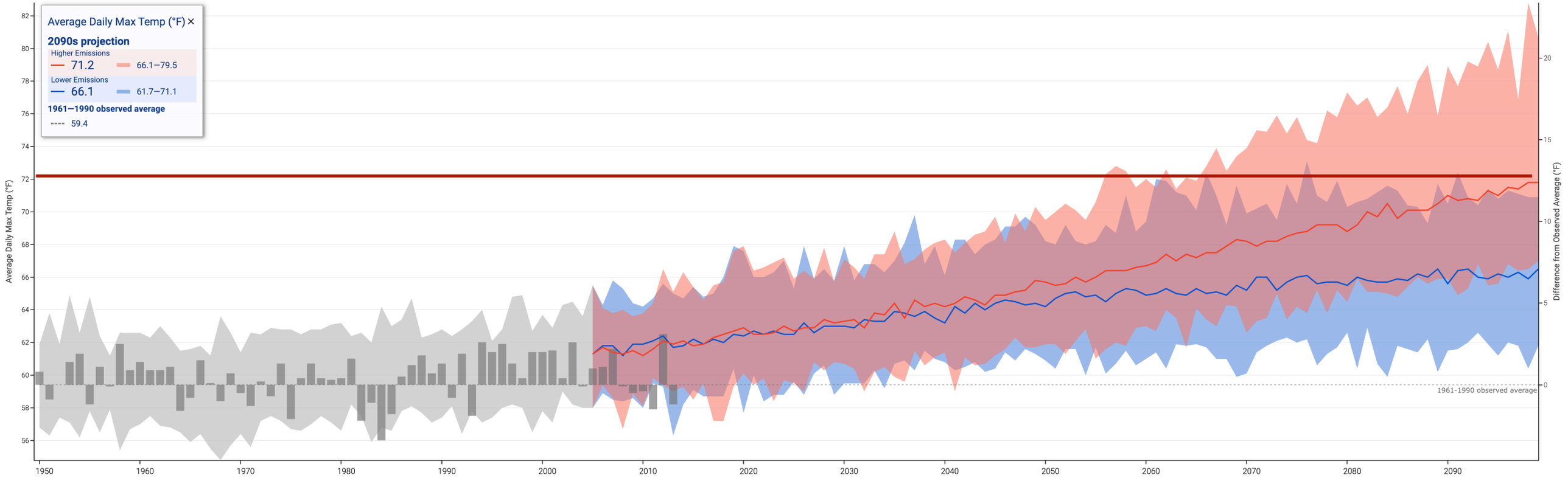
How Hot Will It Get?

Salt Lake City Low/High Emissions Scenario

Projected Temperature Increase Due To Climate Change

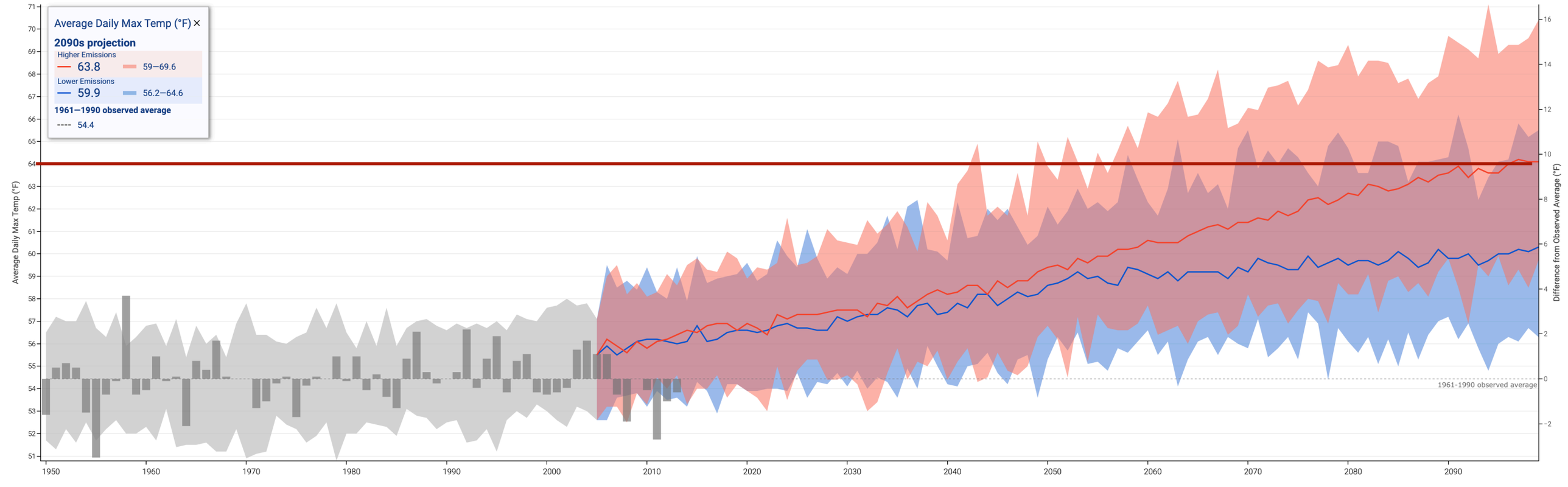
Salt Lake City High Emissions Scenario

Projected Temperature Increase Due To Climate Change



Seattle, WA Emissions Scenario

Projected Temperature Increase Due To Climate Change



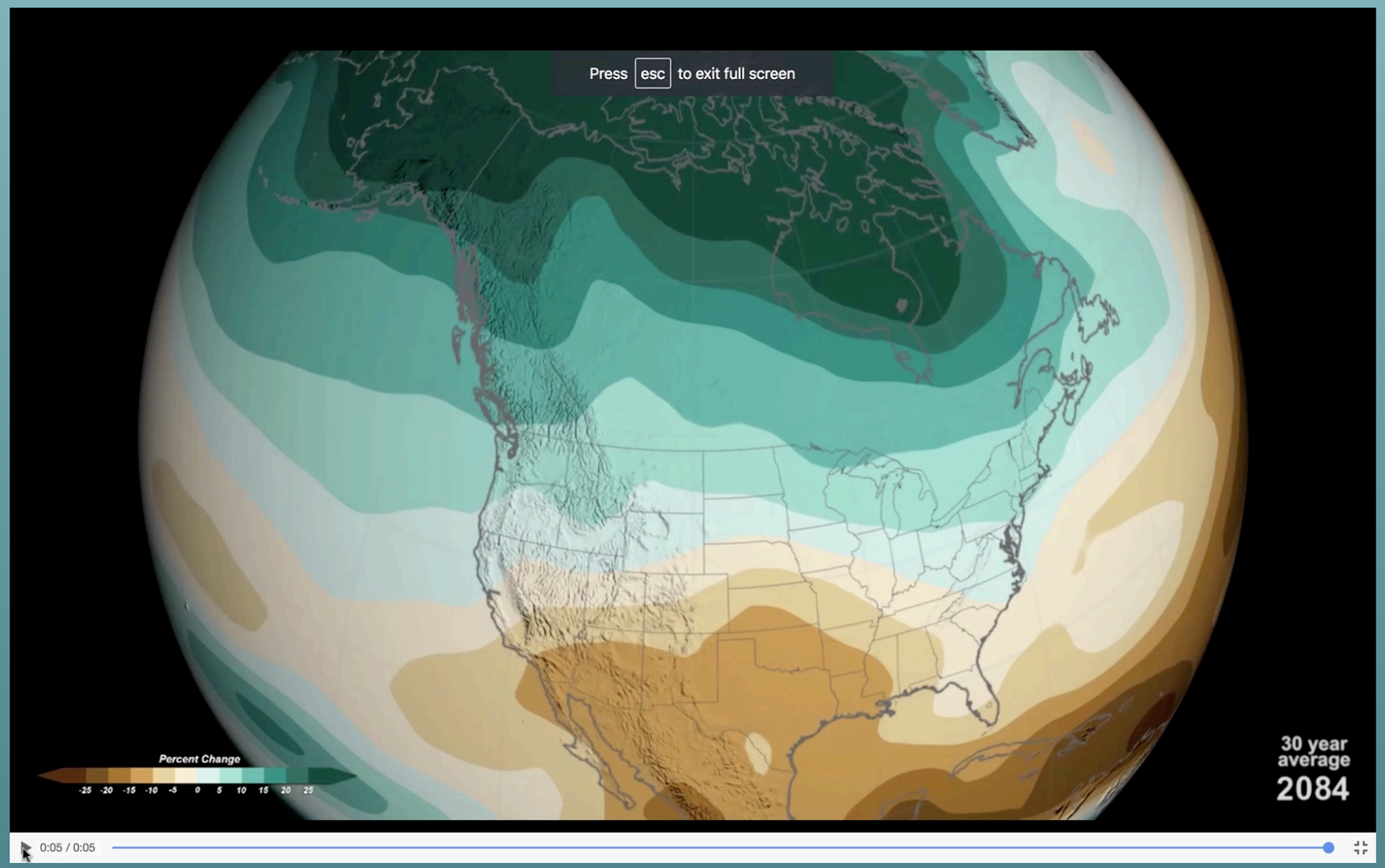
Precipitation Changes

Precipitation Changes

NASA/Goddard Space Flight Center Annual Precipitation Low Emissions

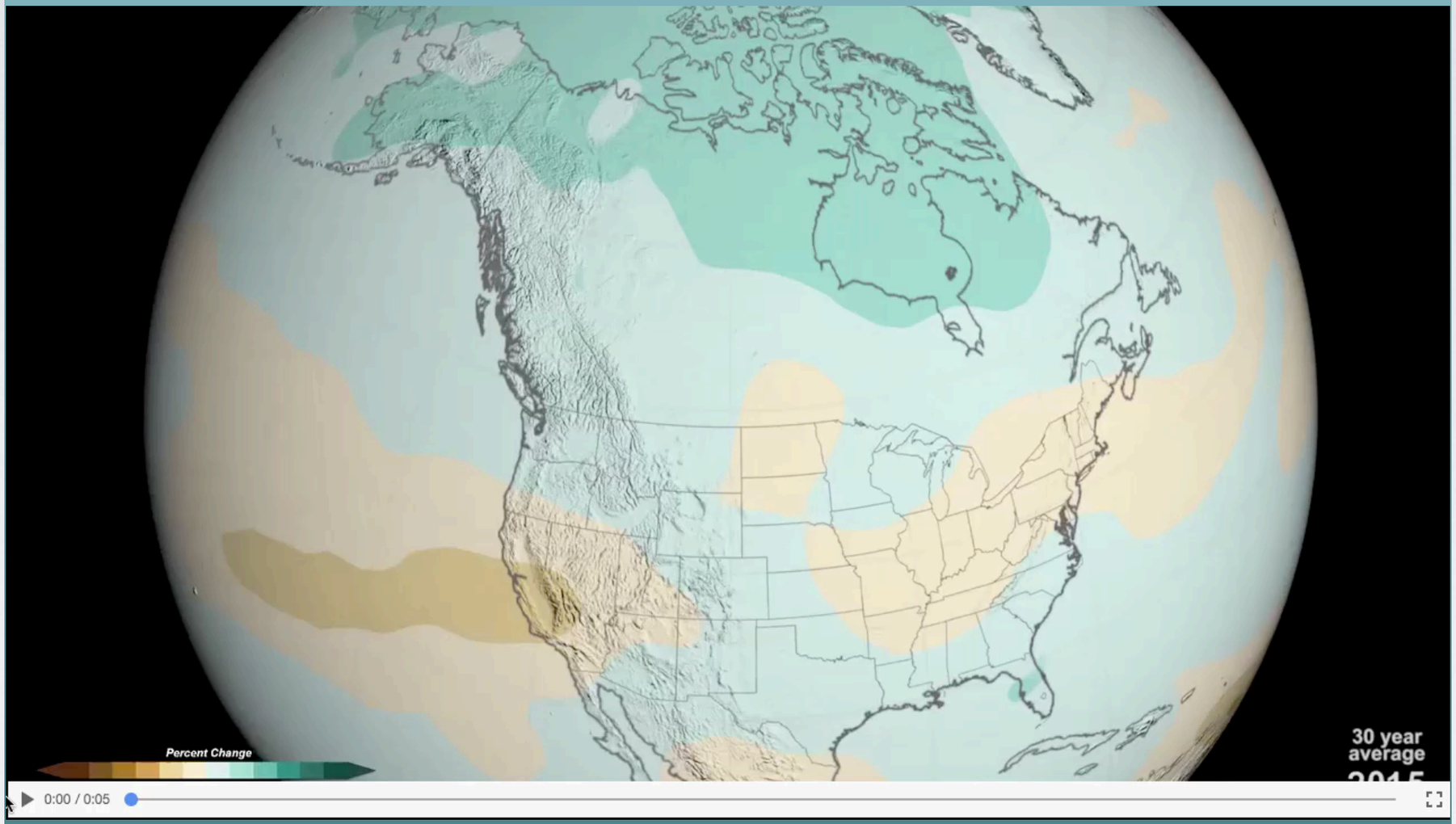
Precipitation Changes

NASA/Goddard Space Flight Center Annual Precipitation High Emissions



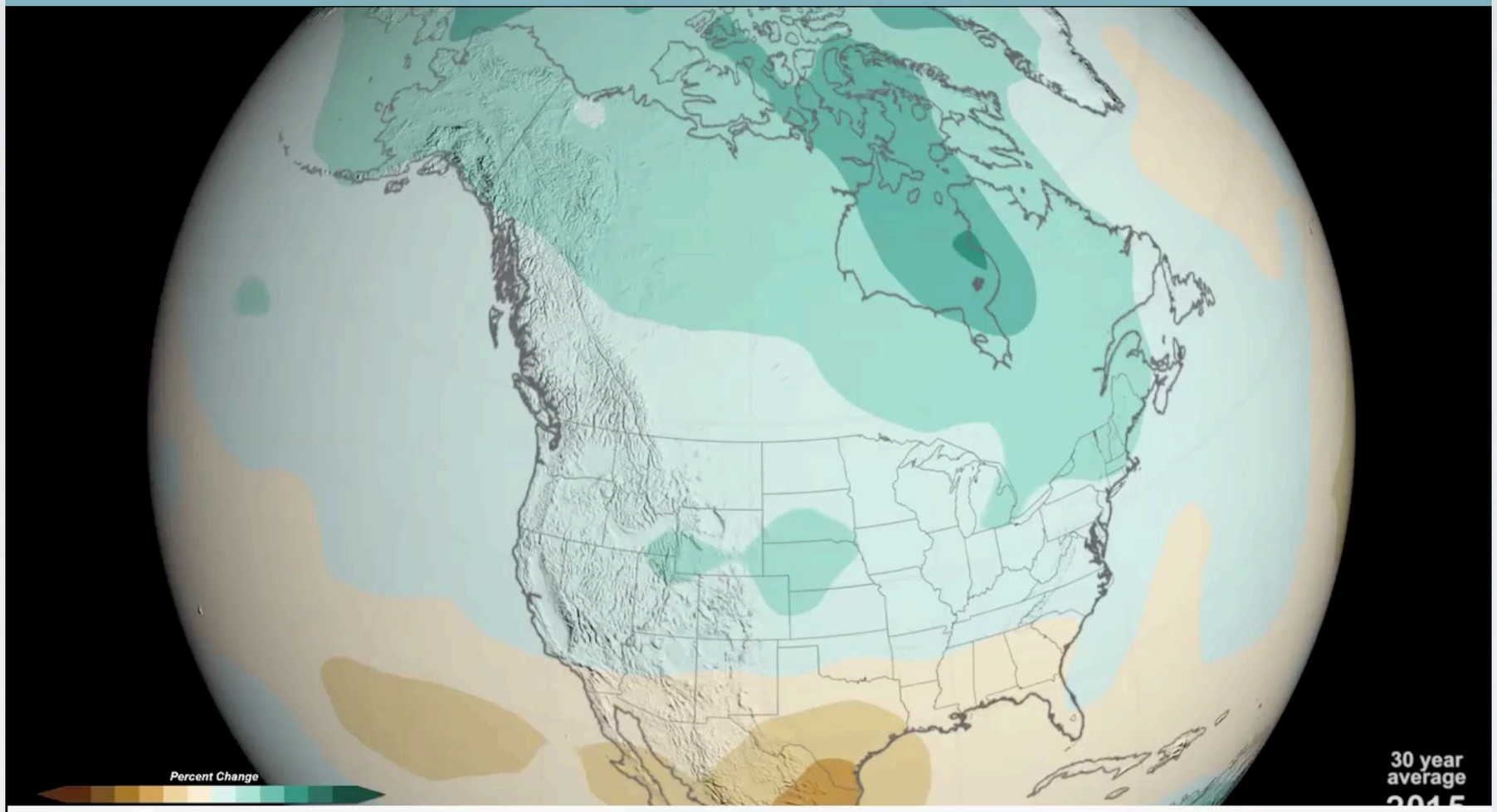
Precipitation Changes

NASA/Goddard Space Flight Center Fall Precipitation High Emissions



Precipitation Changes

NASA/Goddard Space Flight Center Winter Precipitation High Emissions



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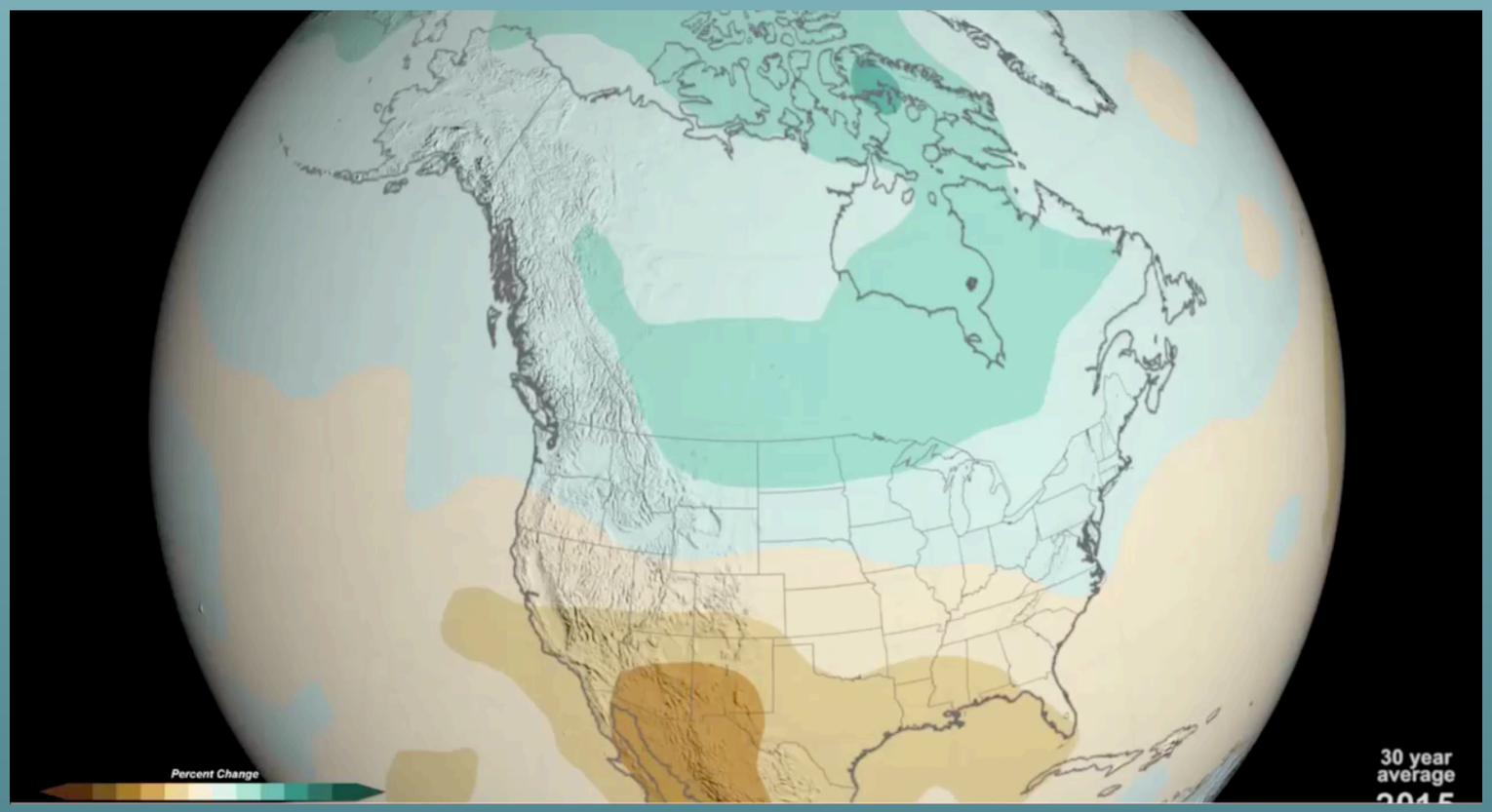
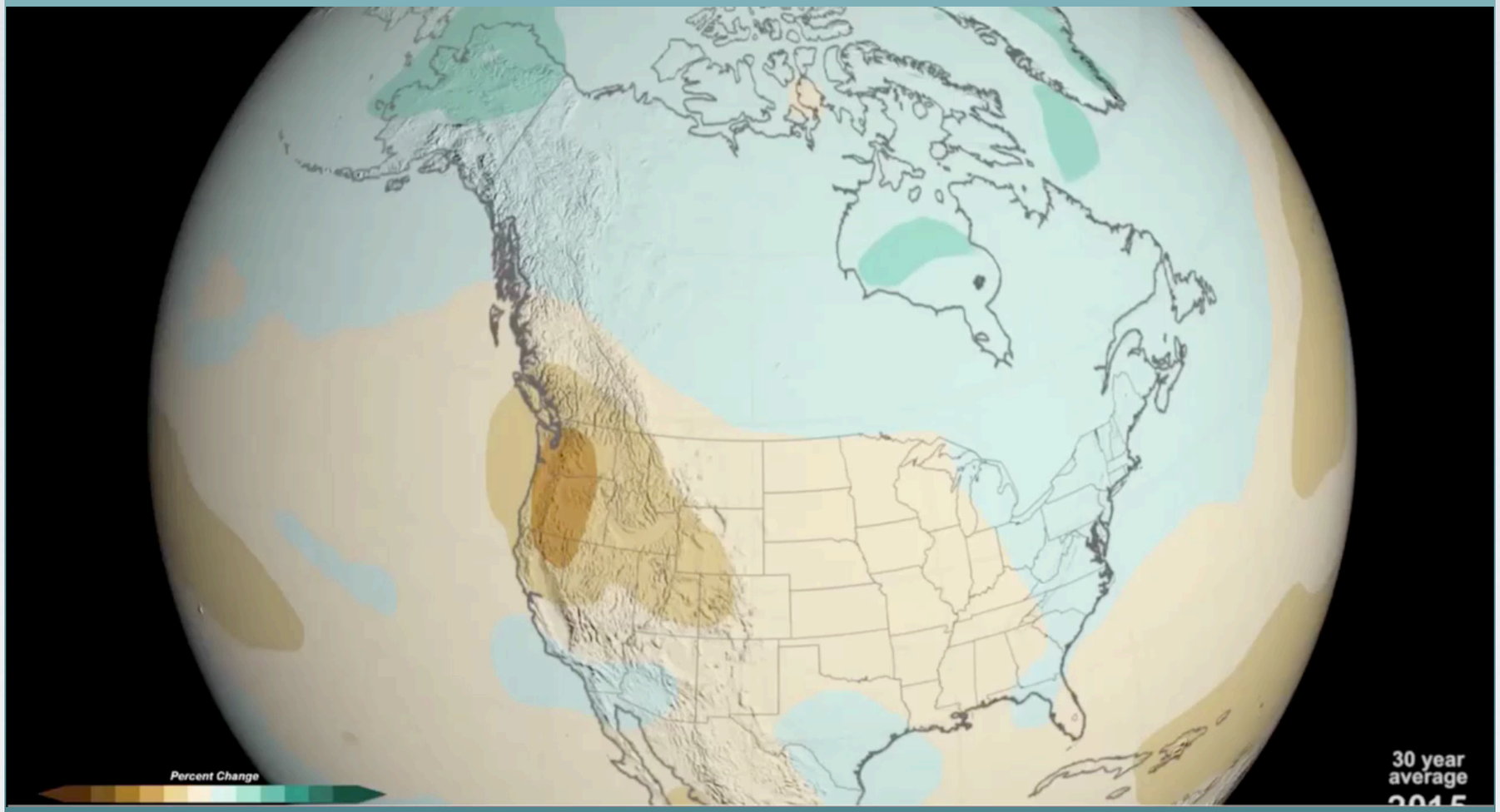
Precipitation Changes

NASA/Goddard Space Flight Center Spring Precipitation High Emissions



Precipitation Changes

NASA/Goddard Space Flight Center Summer Precipitation High Emissions

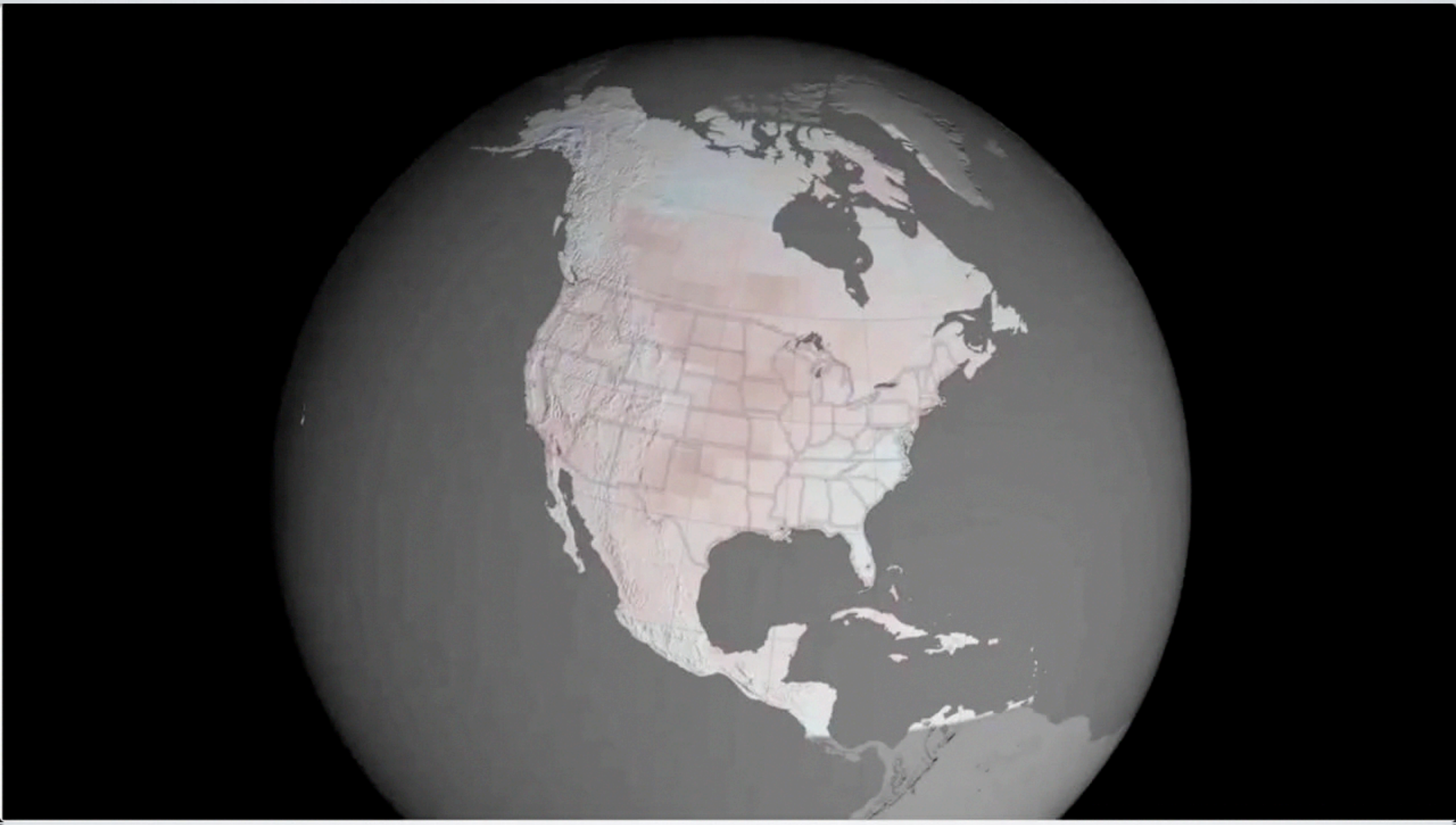


What About Soils?

Projected Soil Moisture Levels Due To Climate Change

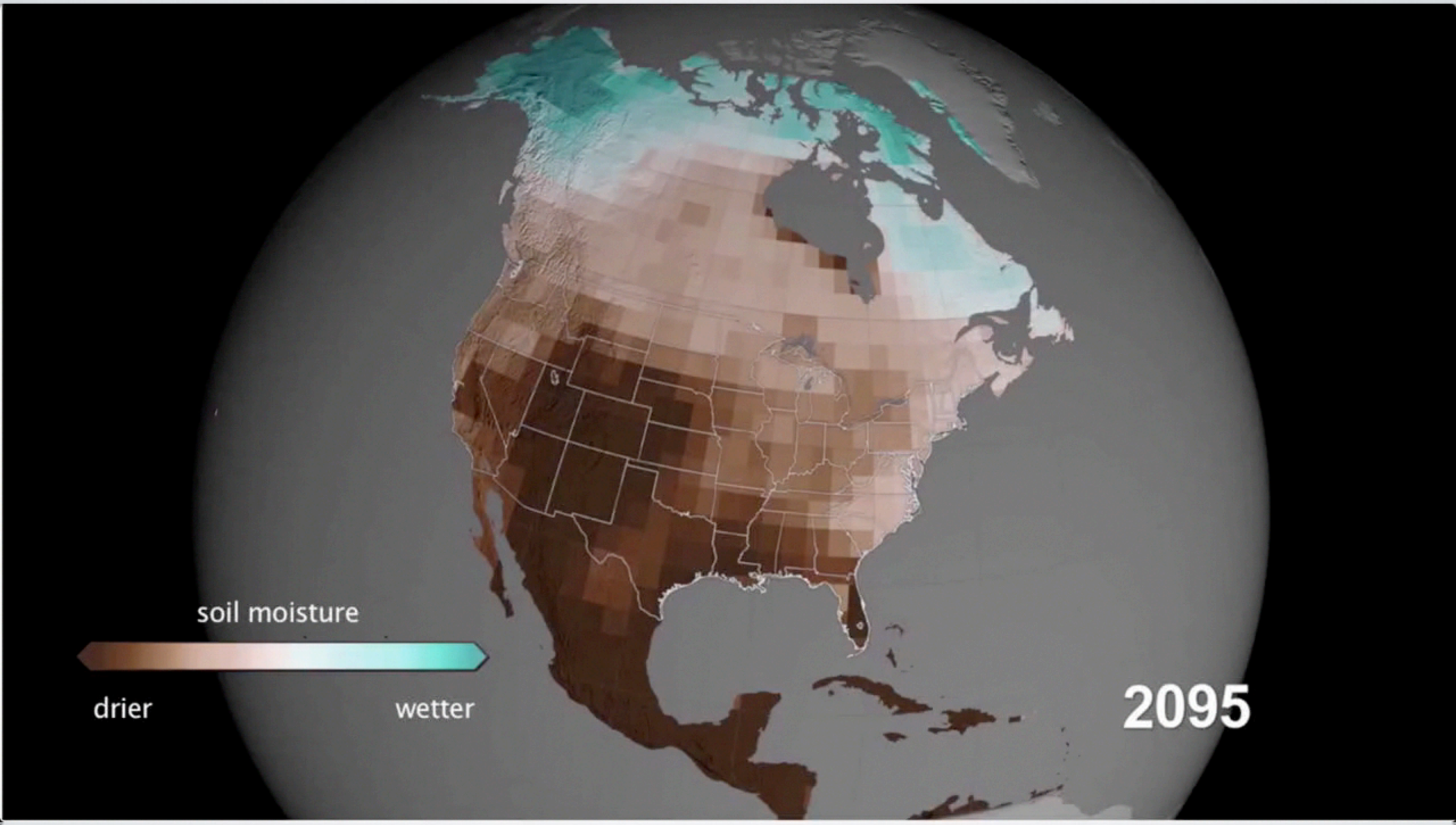
Time Lapse Of Soil Moisture Levels

NASA/GISS Animation High Emission Scenario



Time Lapse Of Soil Moisture Levels

NASA/GISS Animation Low Emission Scenario

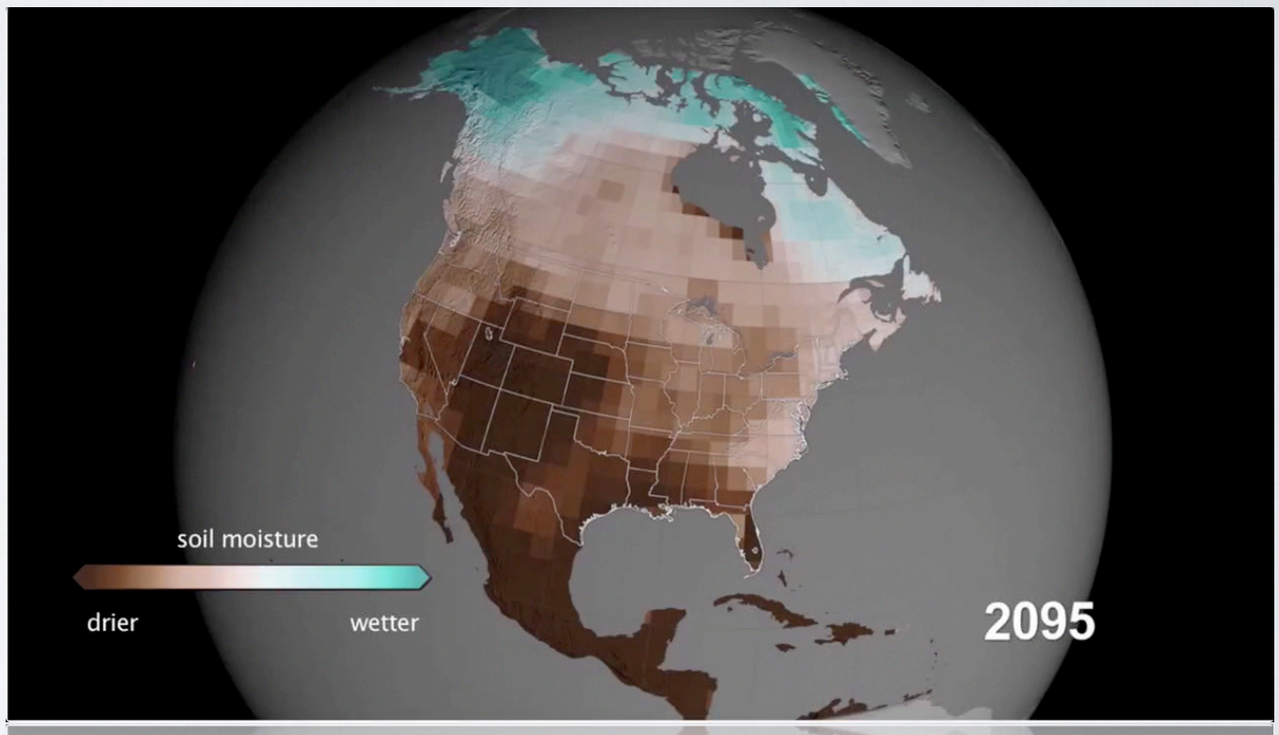


Time Lapse Of Soil Moisture Levels

NASA/GISS Animation High/Low Emission Scenario

High Emission

Low Emission



Questions?

CONTACT INFORMATION

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brian.mcinerney60@gmail.com

Questions?