



What Does Climate Change Look Like?

**Illinois Lake Management Association
Bloomington, Illinois**

March 23rd, 2018

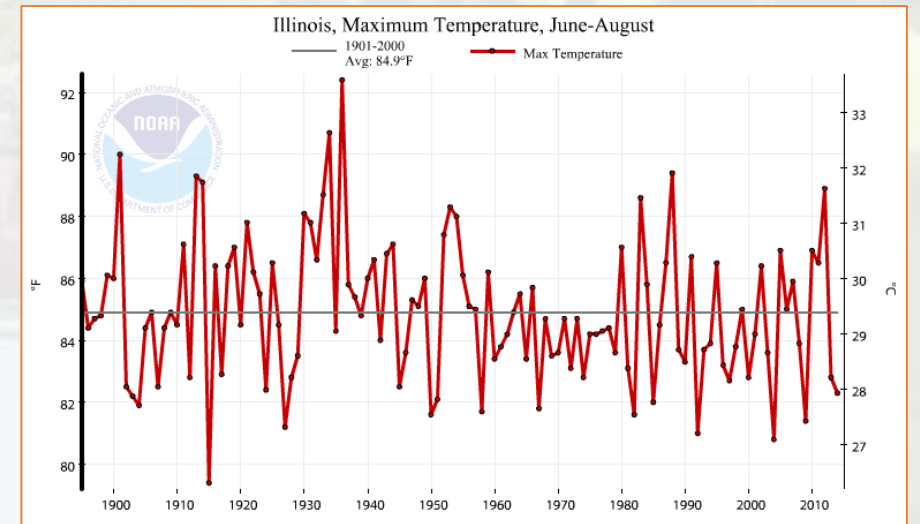
First.... Clarify

What is weather?



Events that can be experienced

What is climate?



Summarizing patterns expected

What Drives Weather



Gravity

Density

Speed

Inertia

Temperature

Pressure

What Drives Weather

Where does weather take place?

Gravity

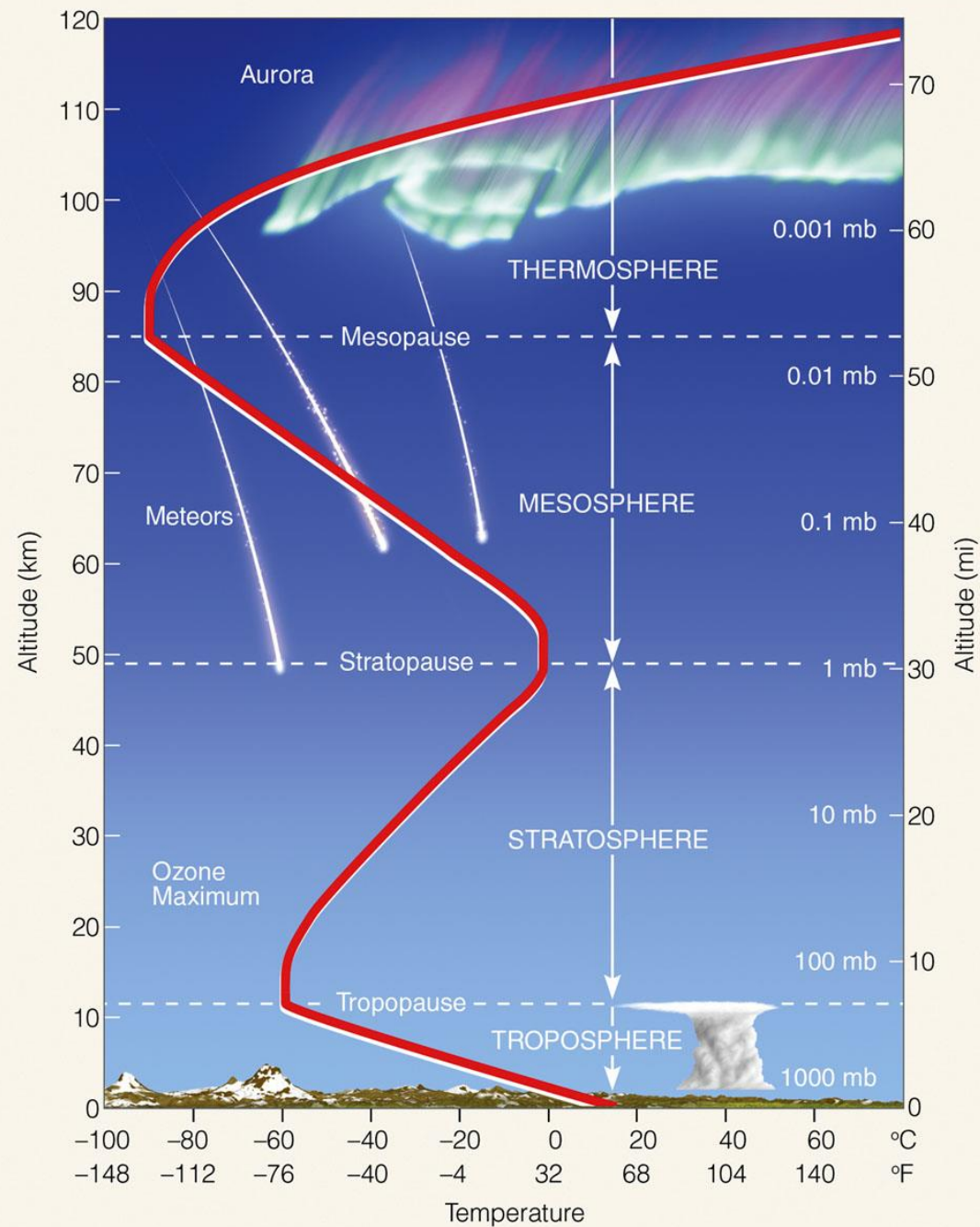
Density

Speed

Inertia

Temperature

Pressure



What Drives Weather

What impacts the mixture?

Gravity

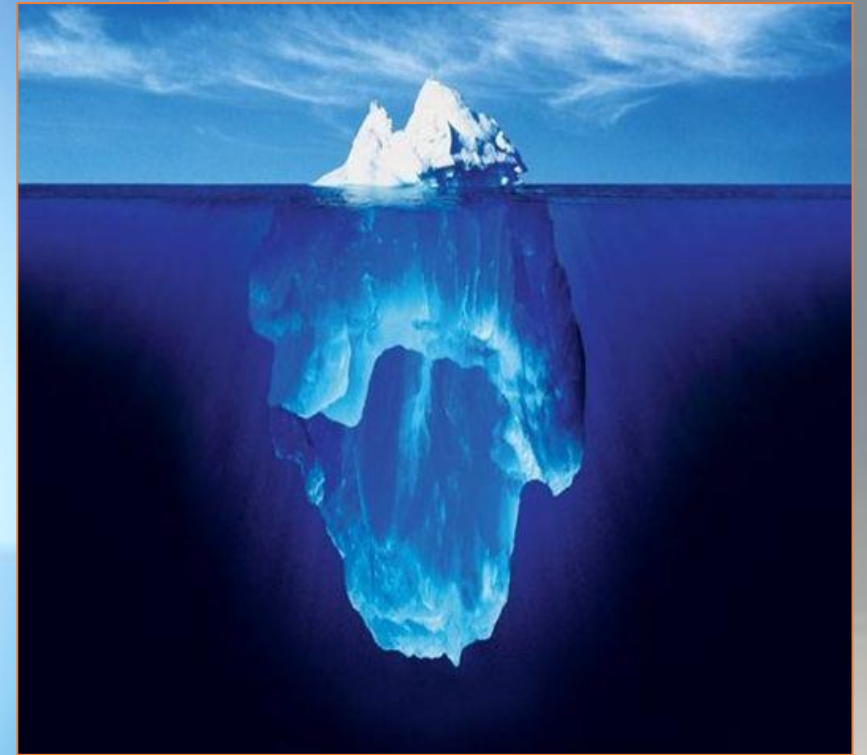
Density

Speed

Inertia

Temperature

Pressure



What Drives Weather

Gravity

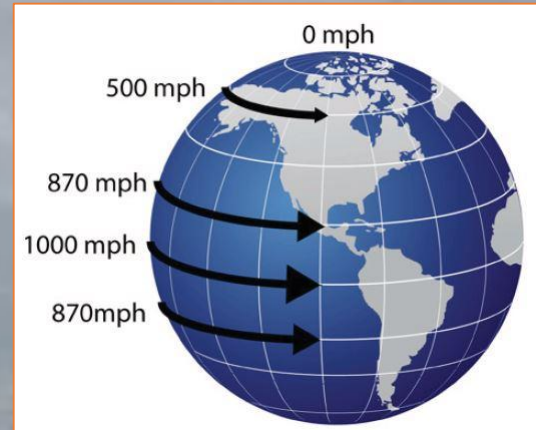
Density

Speed

Inertia

Temperature

Pressure



When the Earth can't drive 55

What Drives Weather

Gravity

Density

Speed

Inertia

Temperature

Pressure



What happens to all that energy?

What Drives Weather

Gravity

Density

Speed

Inertia

Temperature

Pressure

Heat rises, right?



but things would rather be cool

What Drives Weather

Gravity

Density

Speed

Inertia

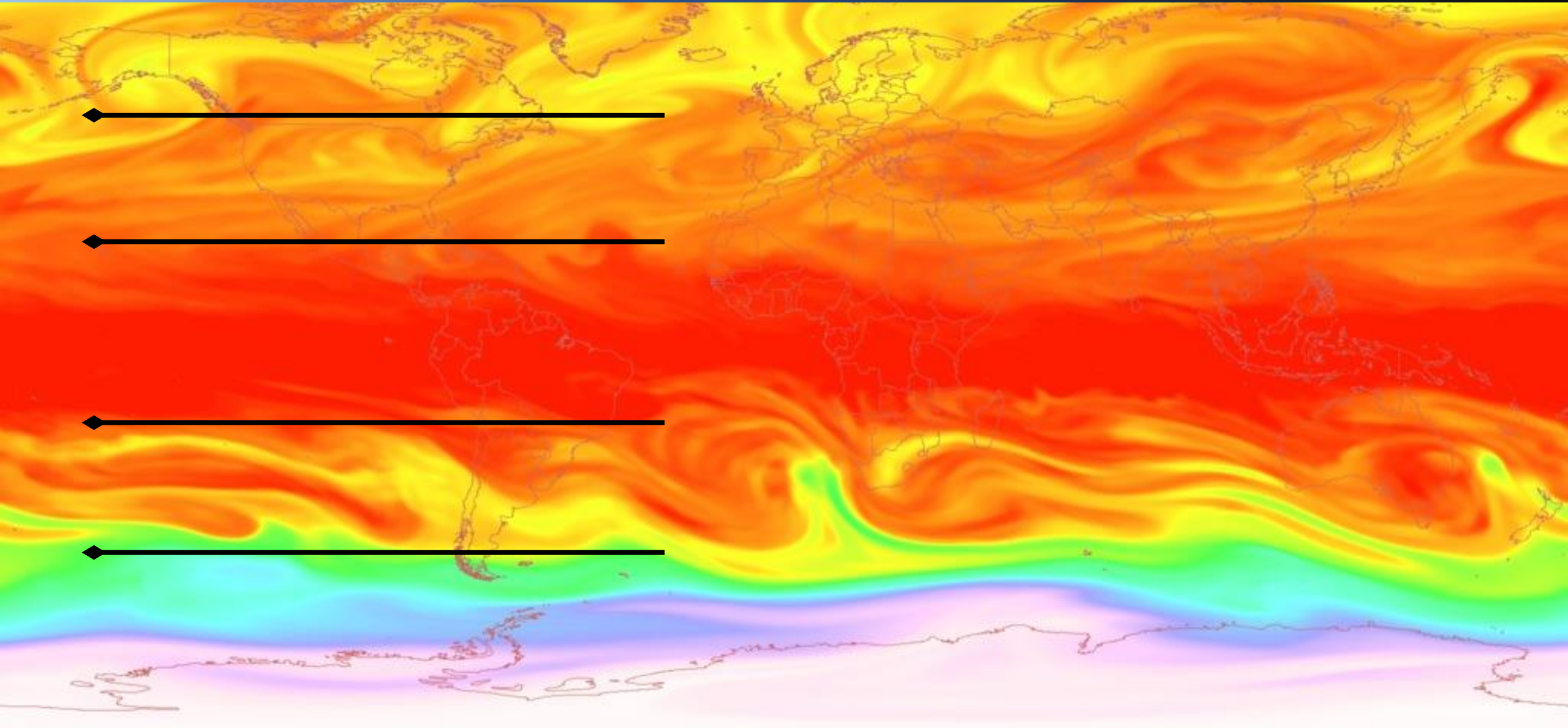
Temperature

Pressure

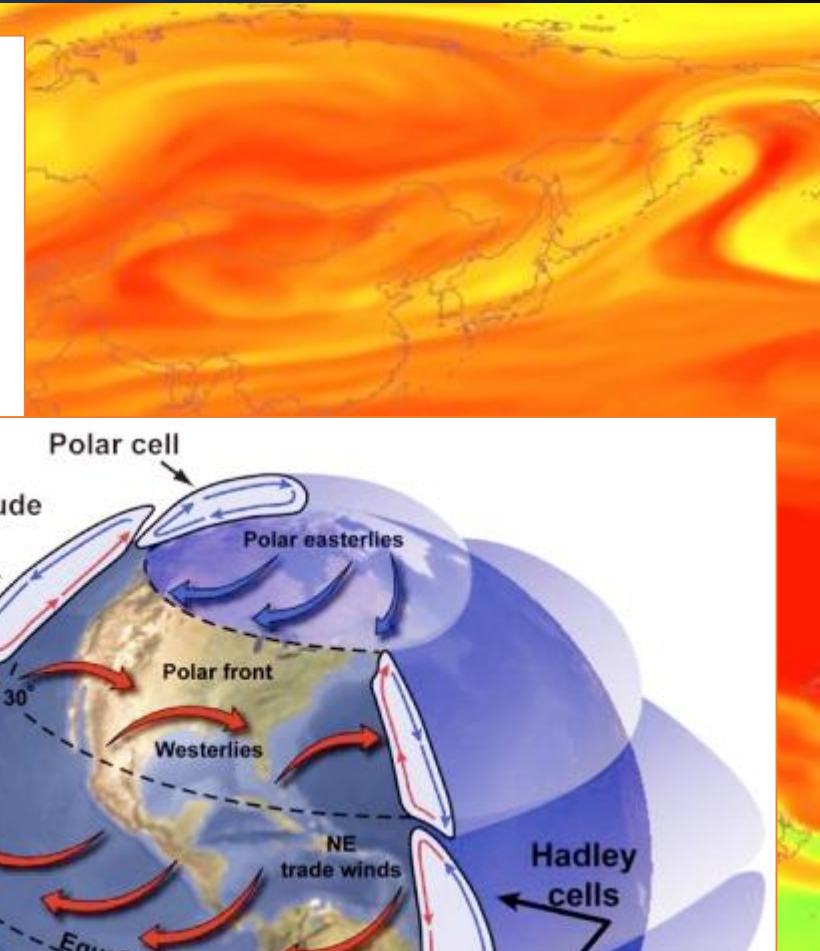
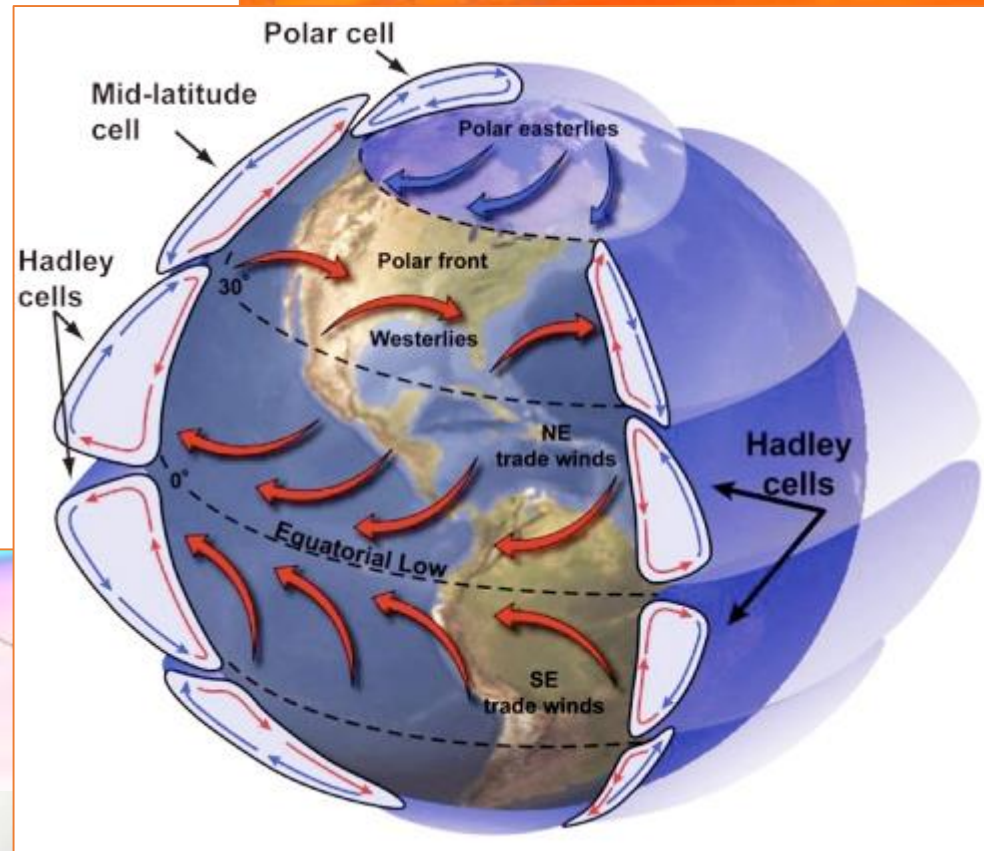
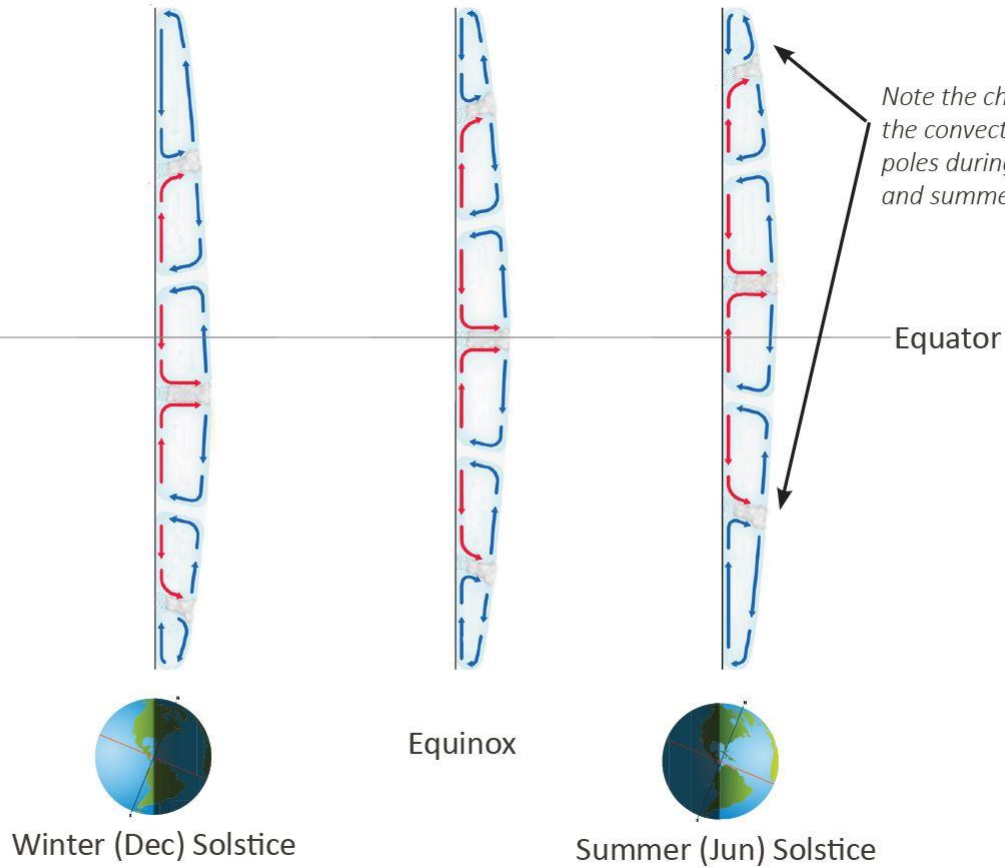
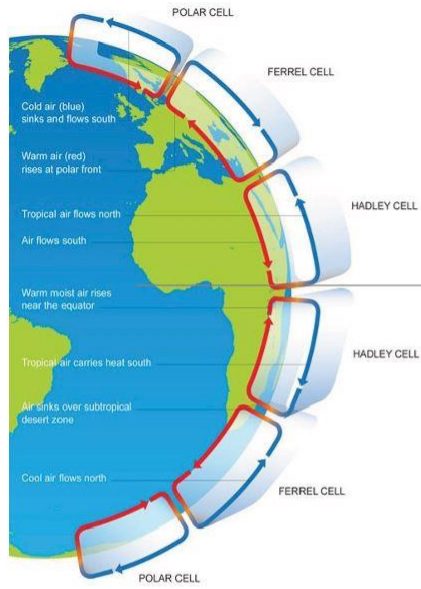
Why does barometric pressure matter?

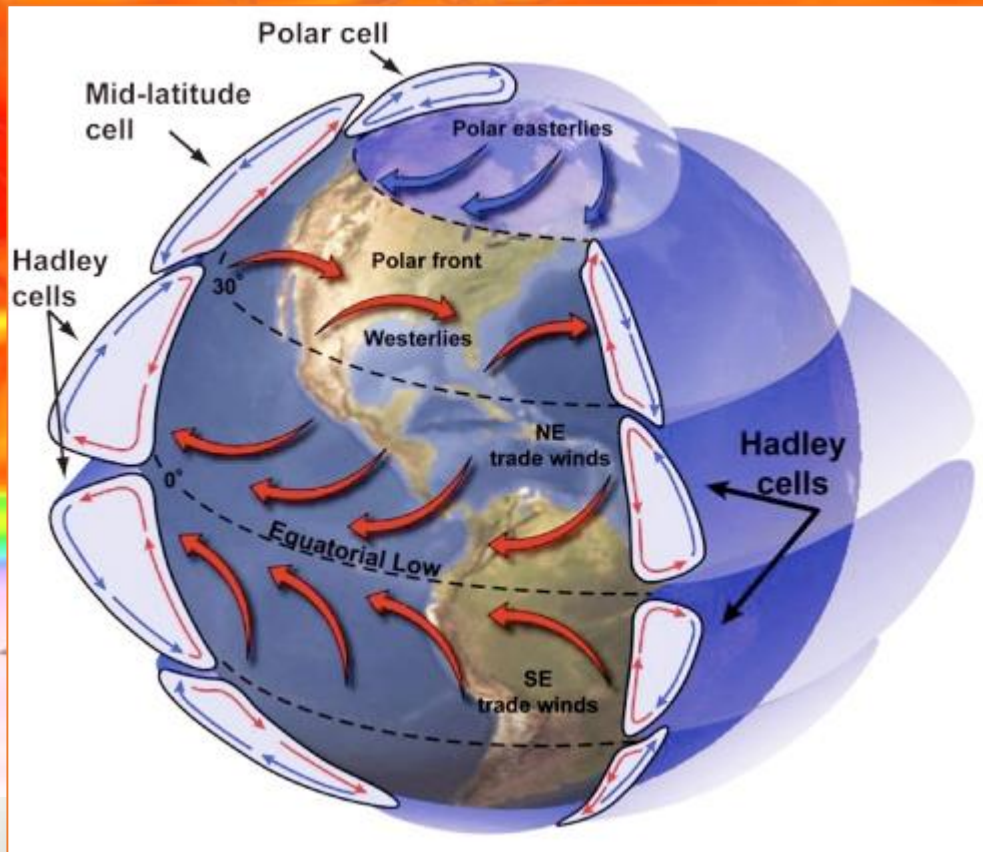
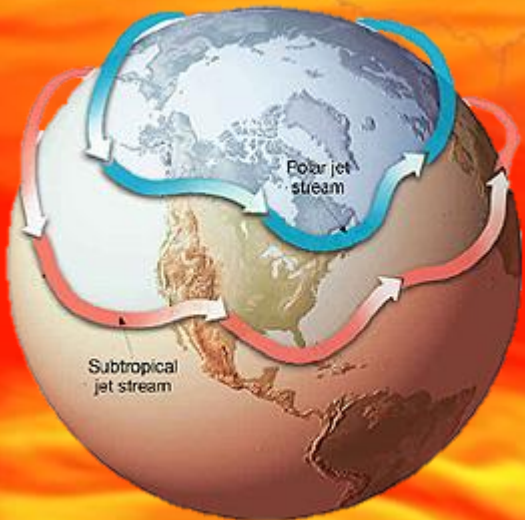
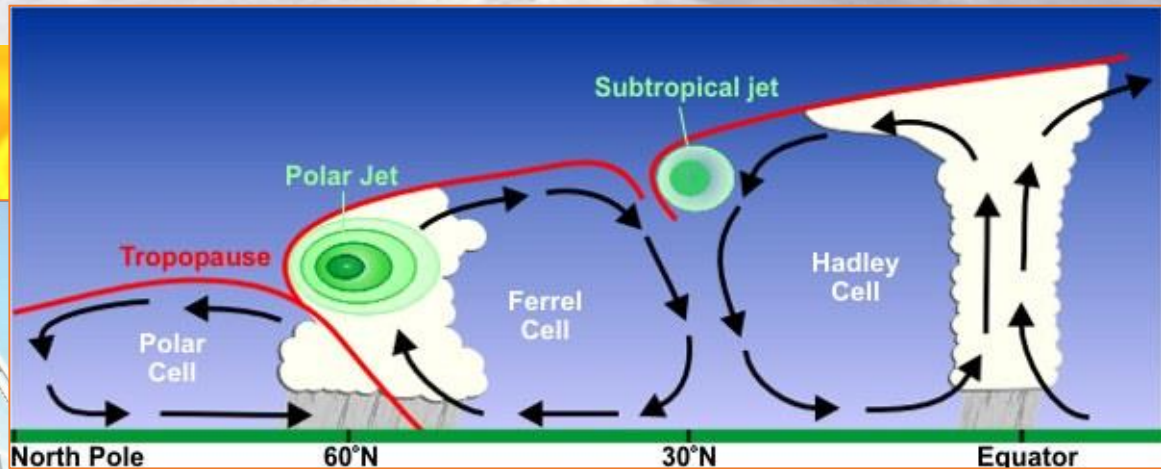
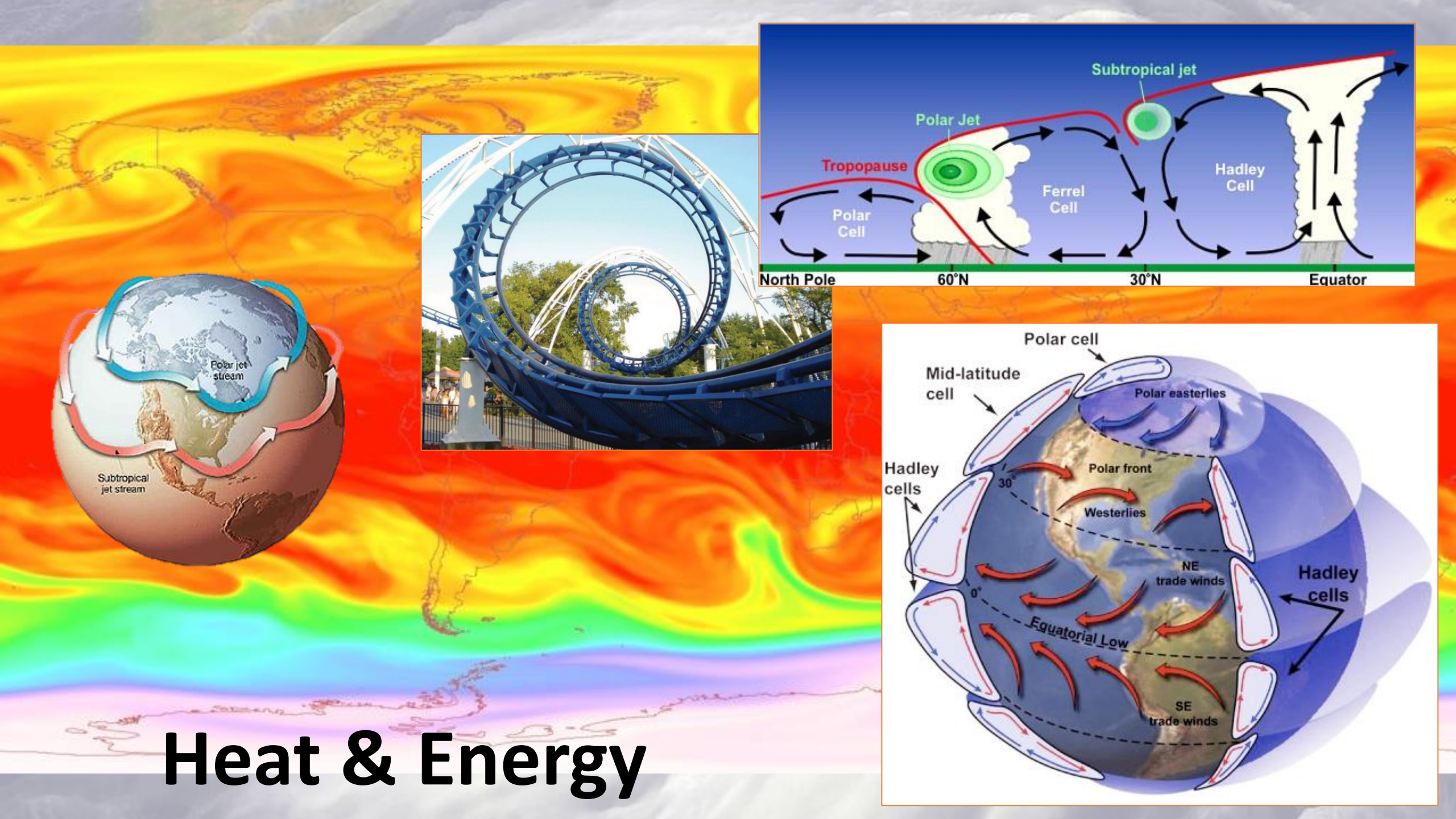


How do all these pieces work together

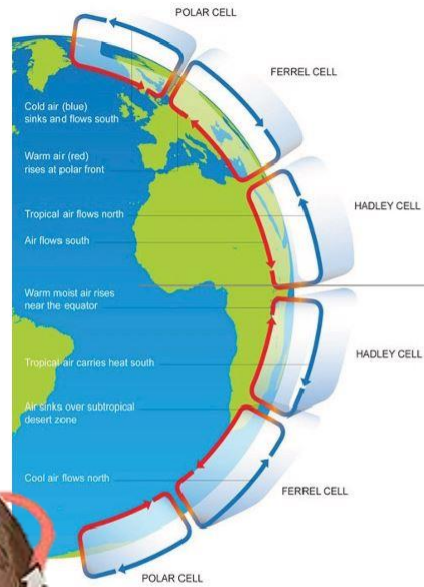
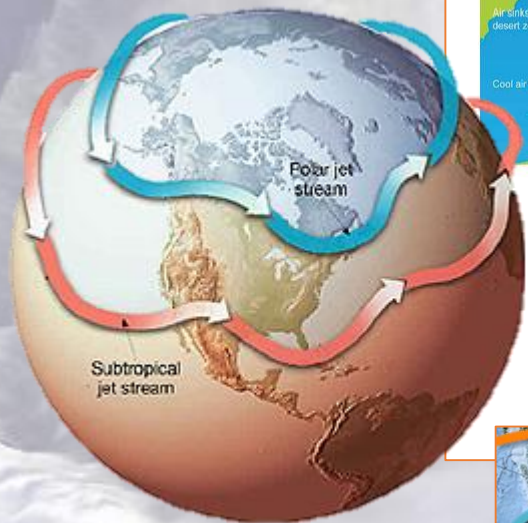


How do all these pieces work together





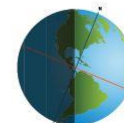
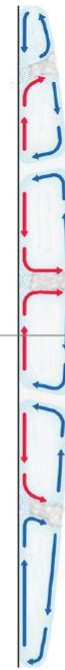
Heat & Energy



Winter (Dec) Solstice



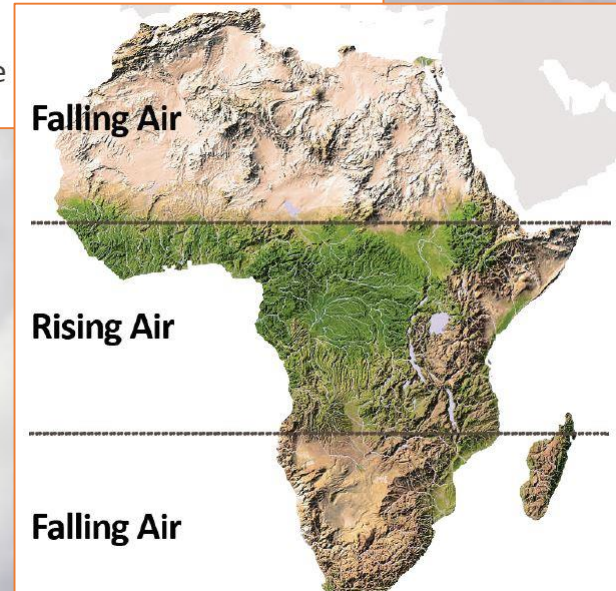
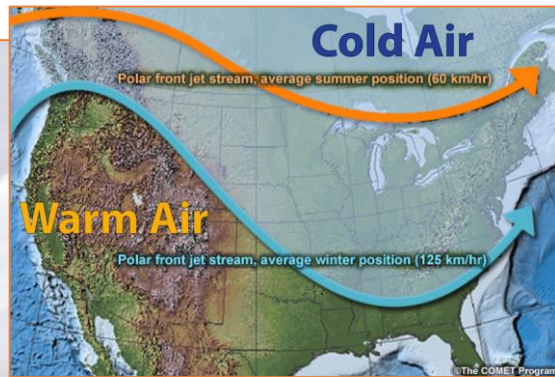
Equinox



Summer (Jun) Solstice

Note the changes in shape of the convection cells near the poles during both the winter and summer solstice

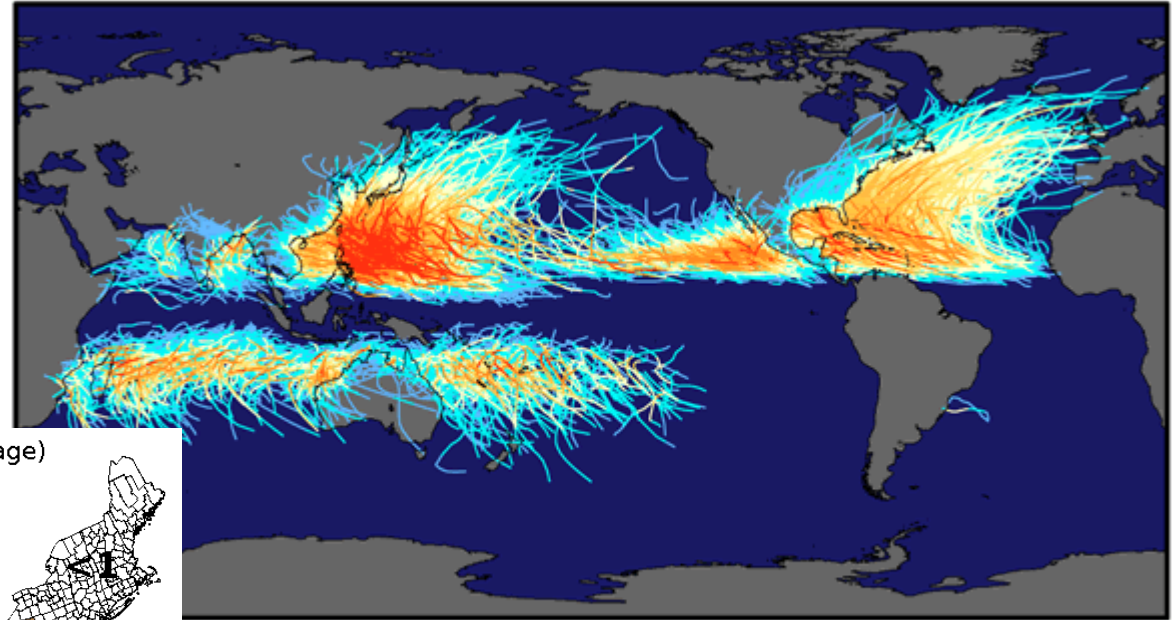
Equator



Heat & Energy

Where do hurricanes occur?

Tracks and Intensity of Tropical Cyclones, 1851-2006

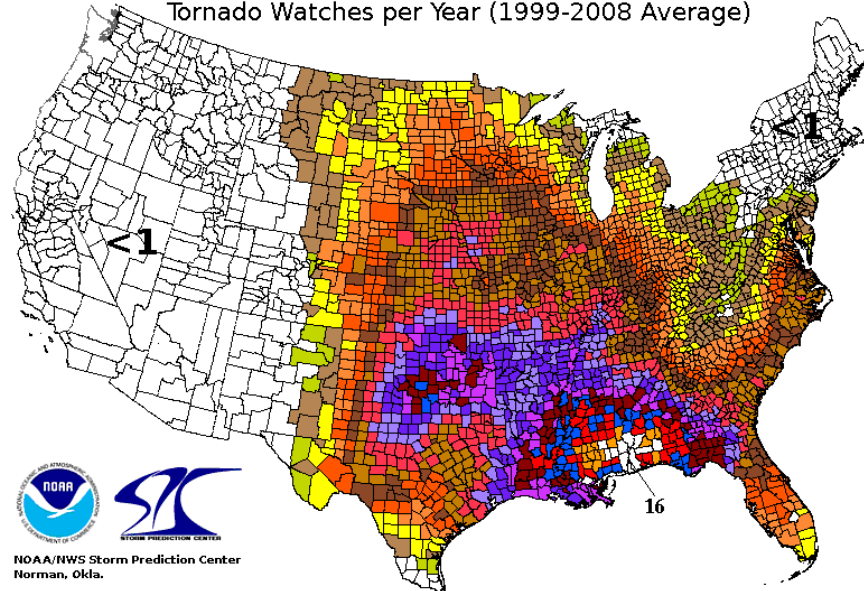


Saffir-Simpson Hurricane Intensity Scale

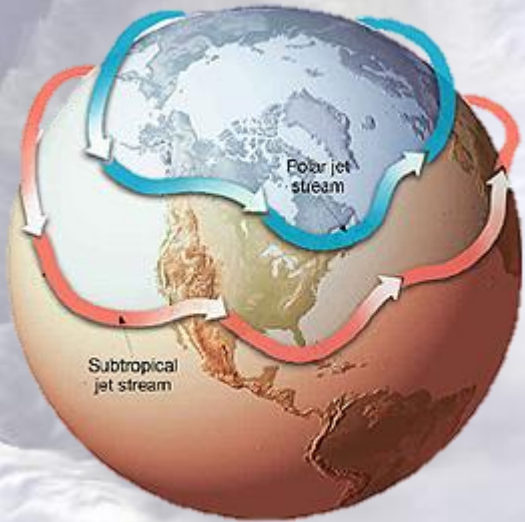
NASA

Where do tornados occur?

Tornado Watches per Year (1999-2008 Average)

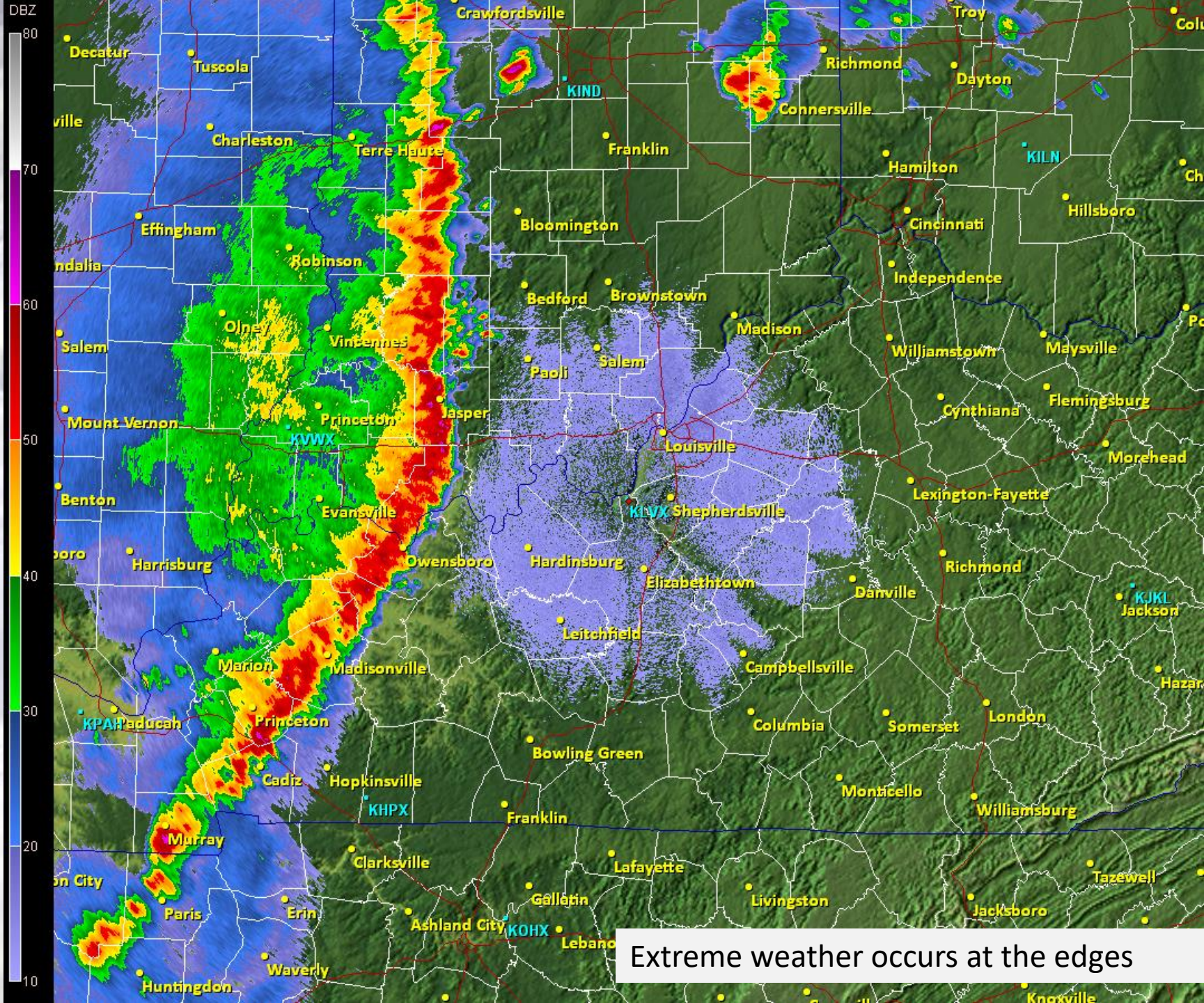


Tornado Watches per Year



When do they occur?

What happens when there is more heat energy in the system?



Extreme weather occurs at the edges



Instability!!

Displaying Last 7-Day Observed Precipitation
Valid on: December 29, 2015 12:00 UTC

Print this map

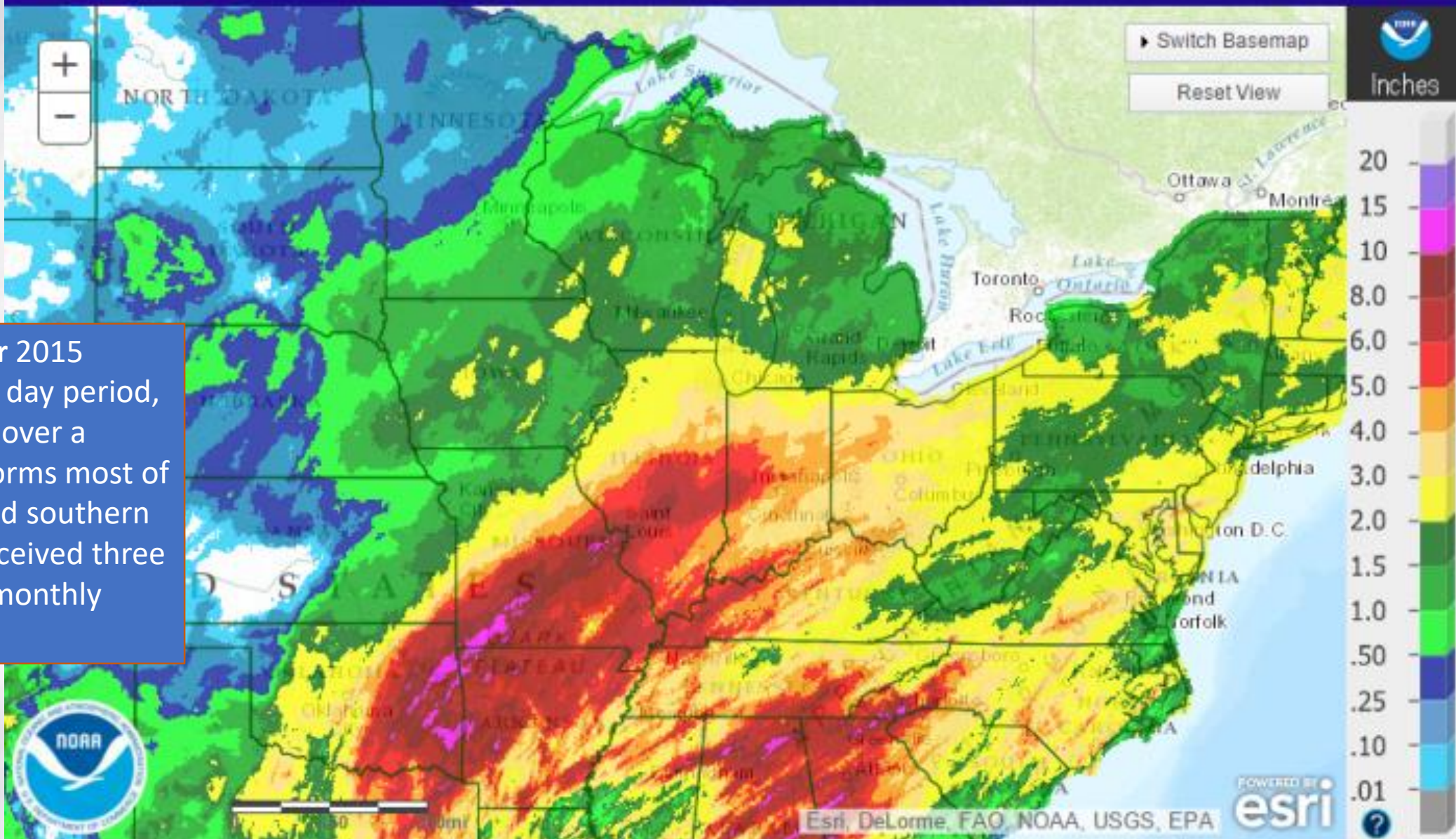
Permalink

BOOK-MARK

What is UTC time?

Map Help

Find address or location



December 2015
Within ~4 day period,
but really over a
couple storms most of
central and southern
Illinois received three
times its monthly
total.

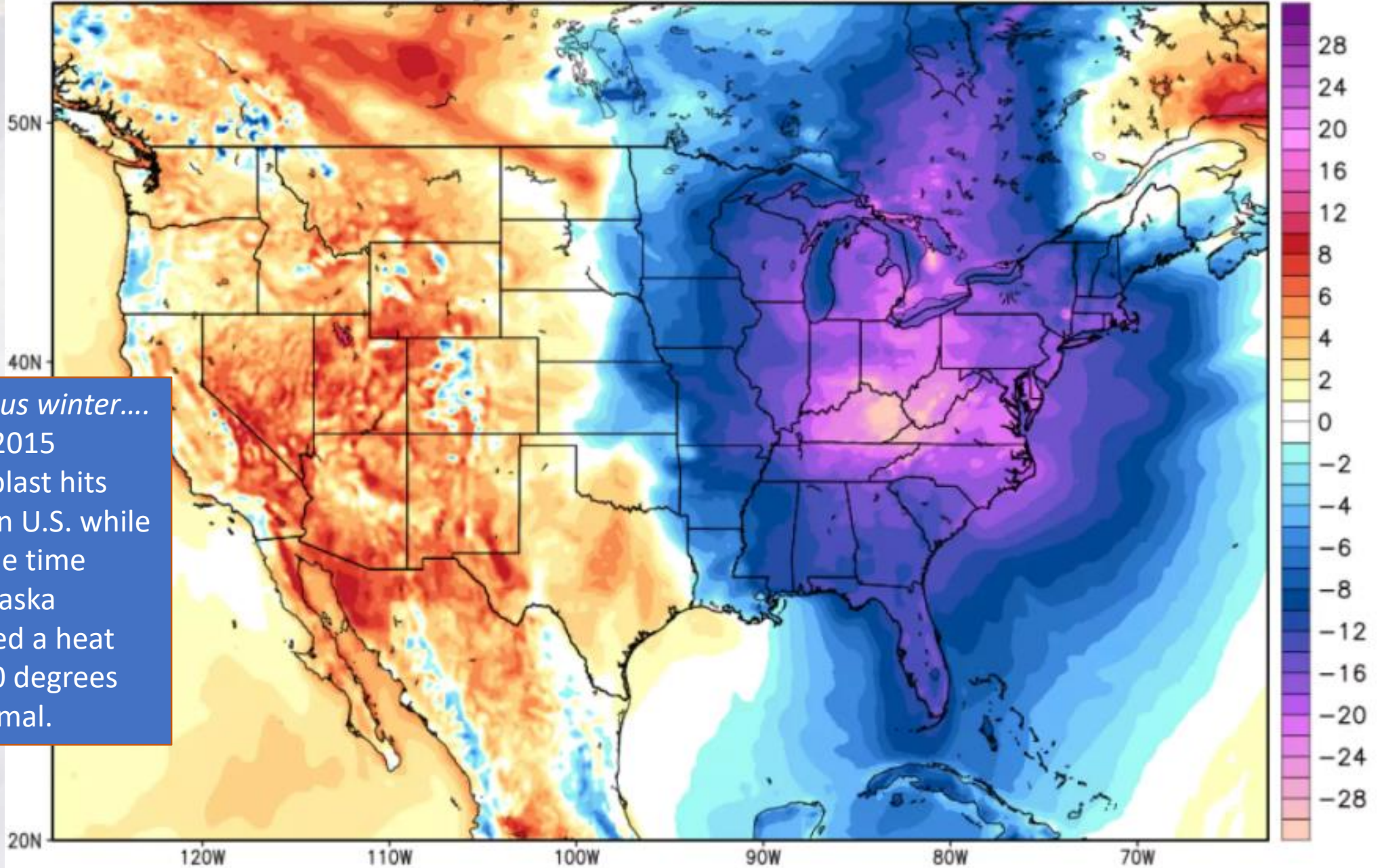
GFS 2-meter Temperature Anomaly (°C) (based on CFSR 1981–2010 Climatology)

Init: 06z Feb 19 2015

Forecast Hour: [30]

valid at 12z Fri, Feb 20 2015

Levi Cowan | tropicaltidbits.com

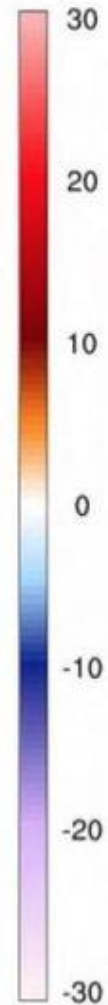
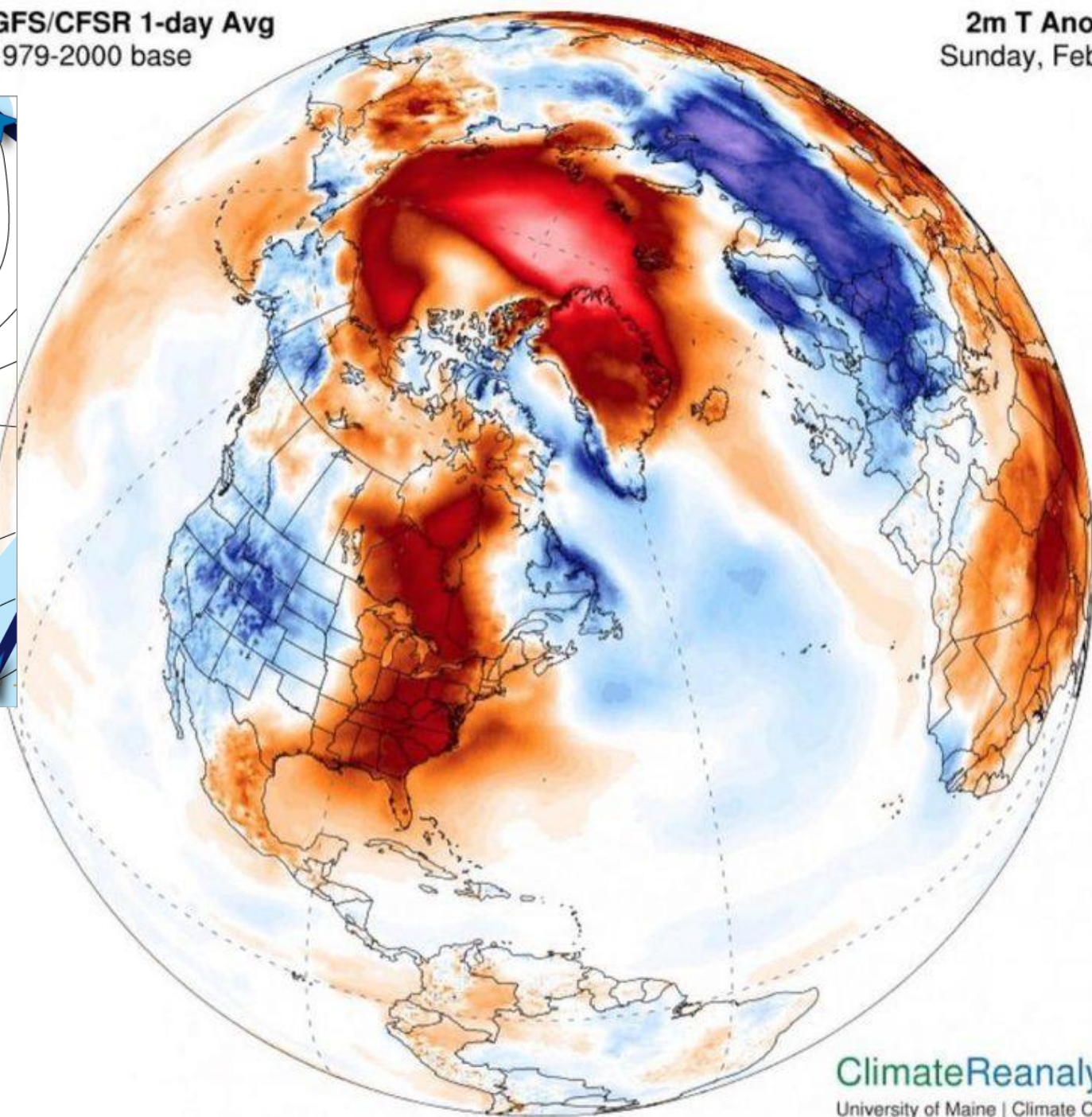
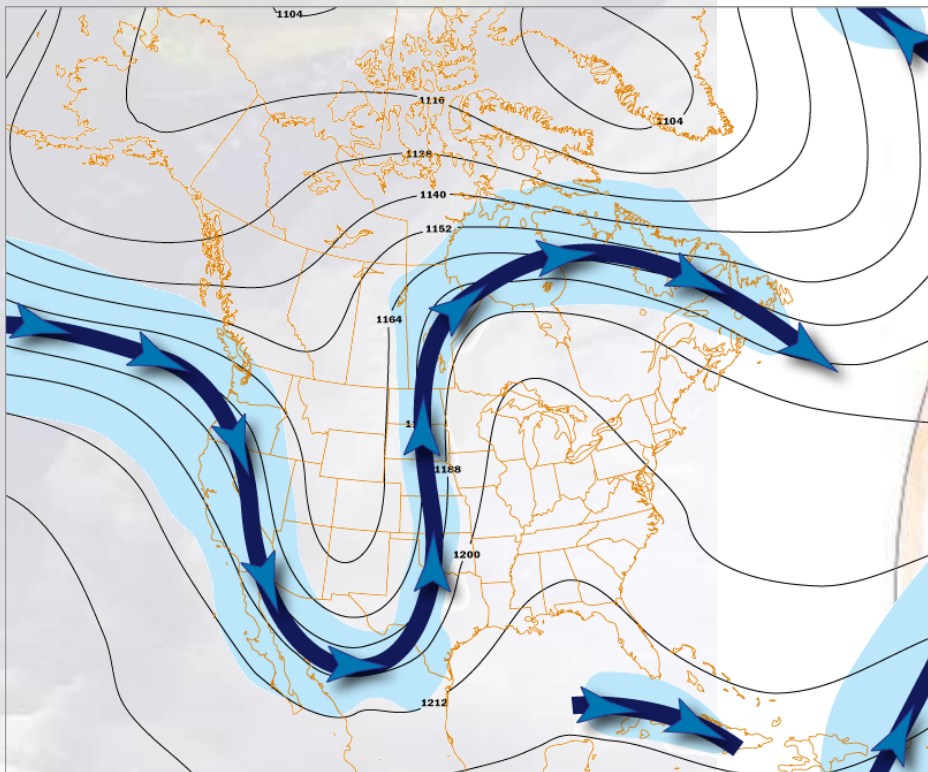


The previous winter...
February 2015
An Arctic blast hits the eastern U.S. while at the same time parts of Alaska experienced a heat wave of 40 degrees above normal.



GFS/CFSR 1-day Avg
1979-2000 base

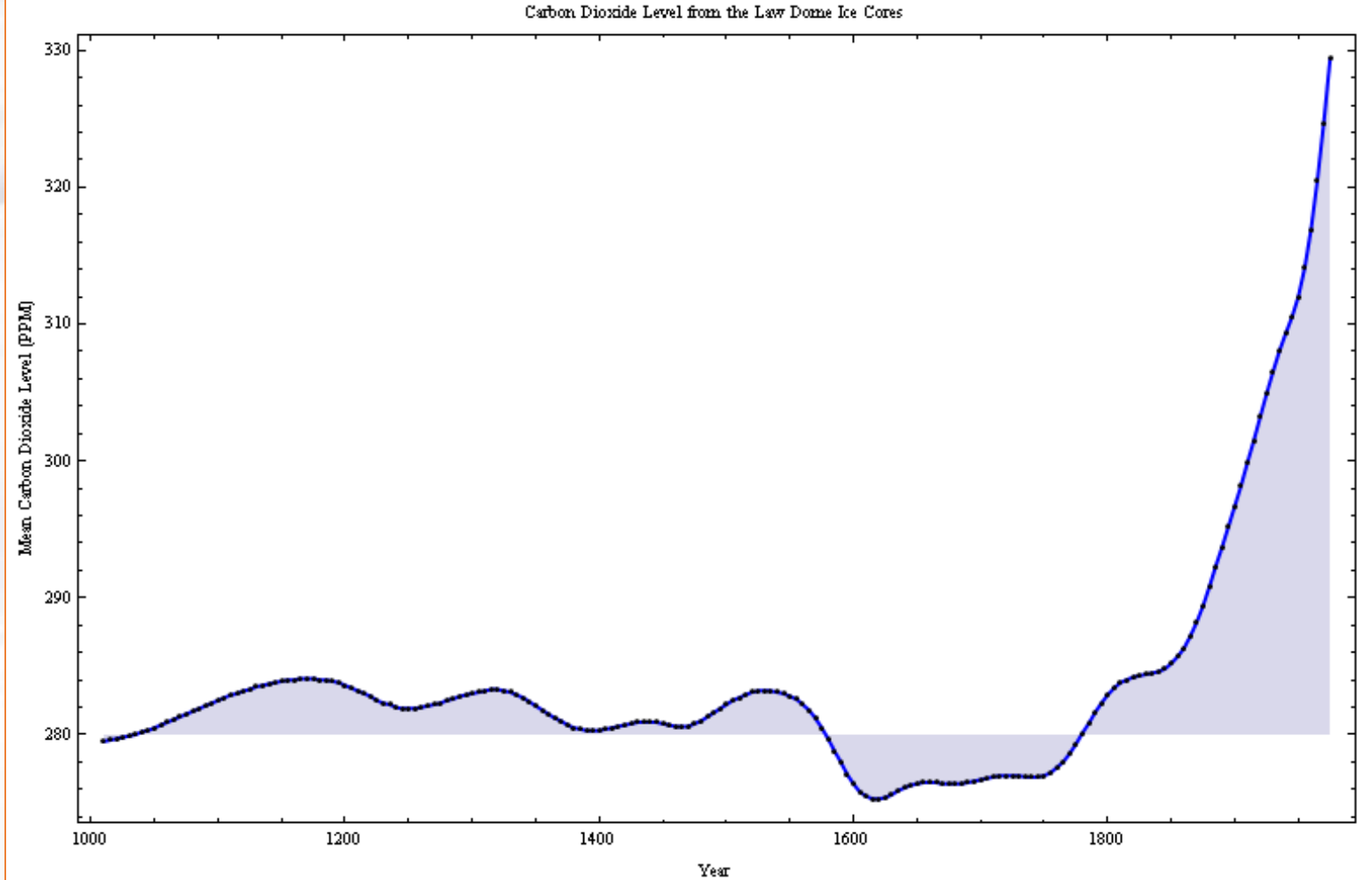
2m T Anomaly (°C)
Sunday, Feb 25, 2018



Is climate change the future or now?

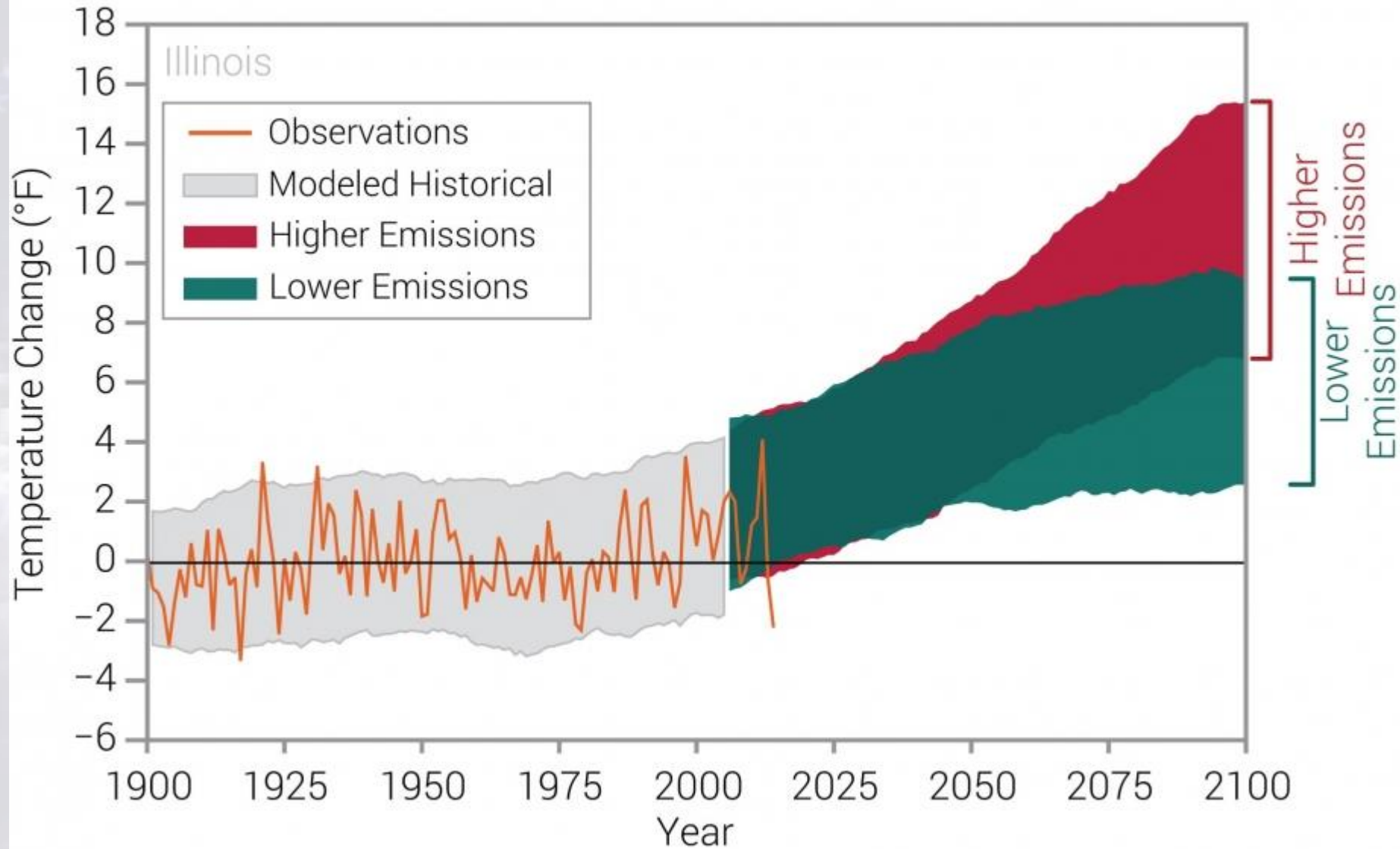
In order of abundance:

1. Water vapor (H_2O)
2. Carbon Dioxide (CO_2)
3. Methane (CH_4)
4. Nitrous Oxide (N_2O)
5. Ozone (O_3)



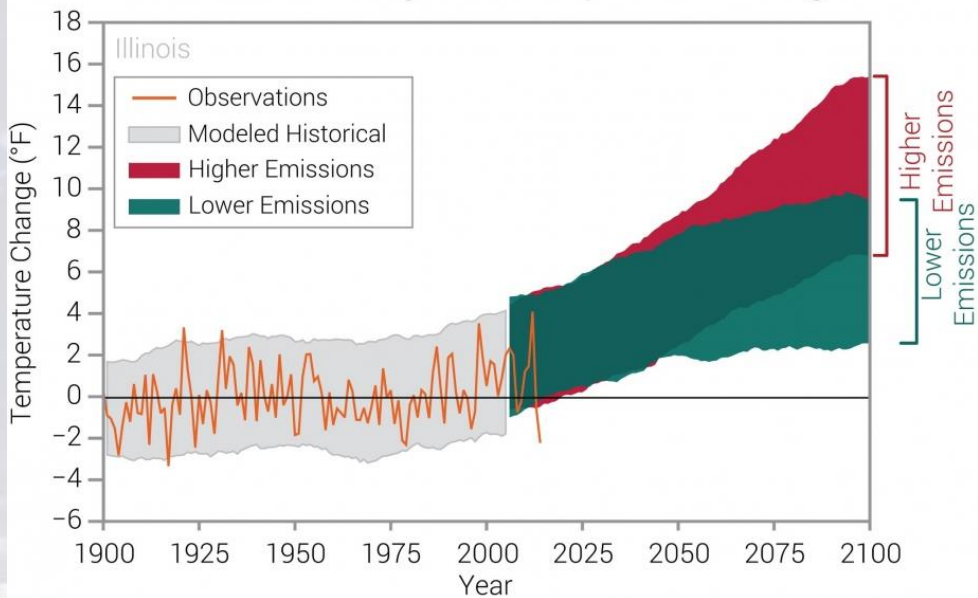
Emissions in the future?

Observed and Projected Temperature Change

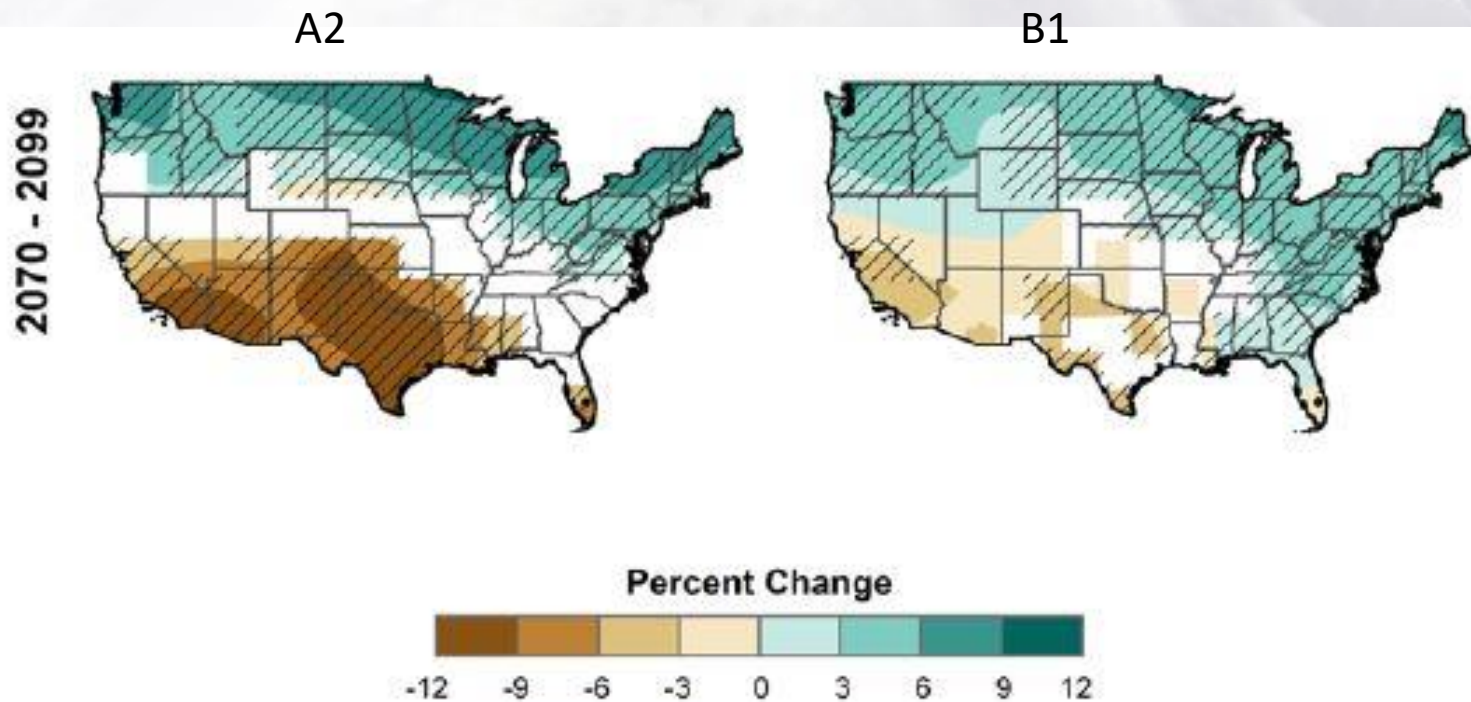


Emissions in the future?

Observed and Projected Temperature Change



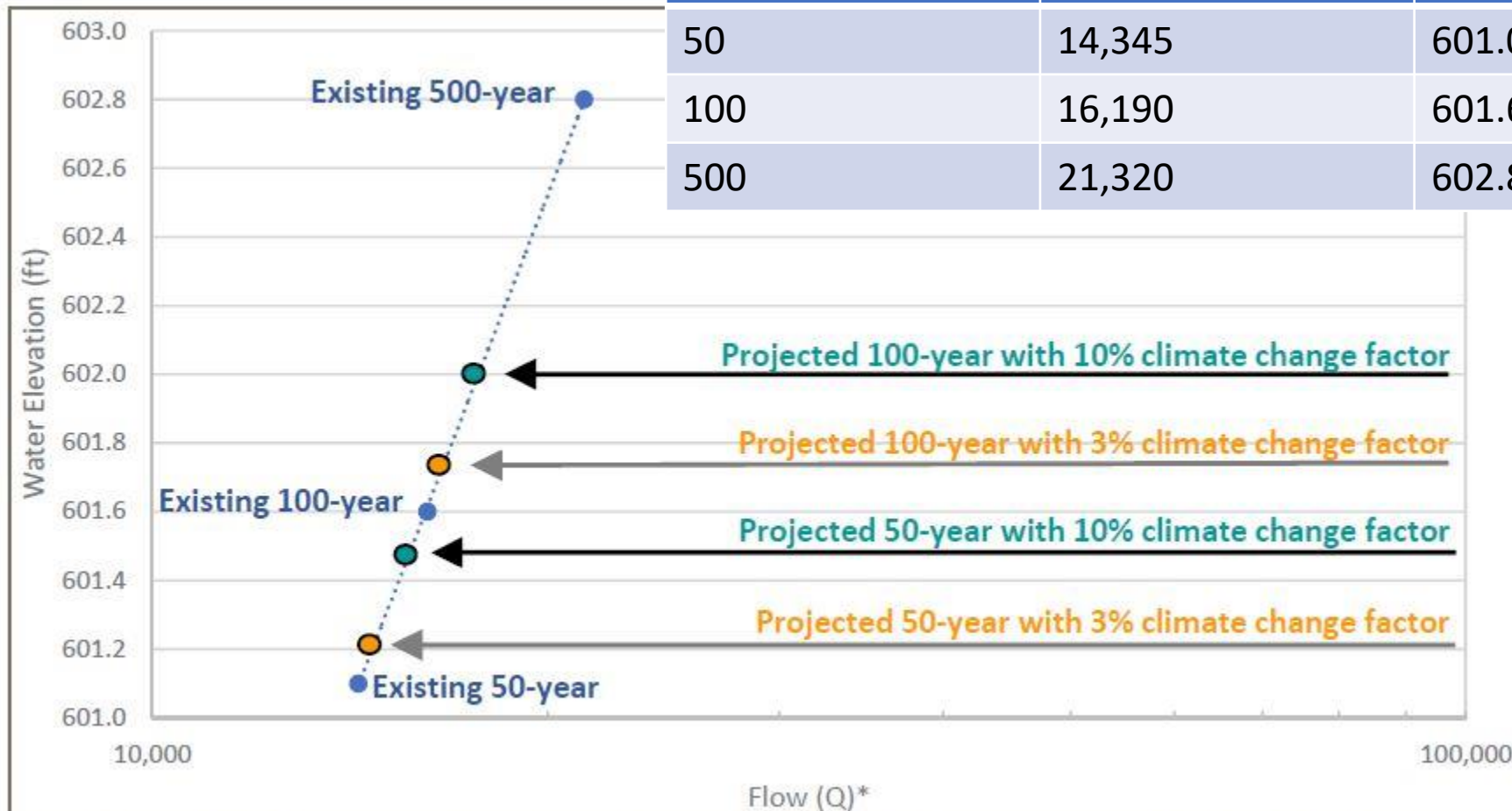
*CMIP, multi-model simulation (2012)
Precip difference from 1971-1999*



Flooding

.....In the Future?

Recurrence Interval	Flow (Q)	Flow Elevation	Stage Elevation
50	14,345	601.0	0.3
100	16,190	601.6	0.9
500	21,320	602.8	2.1



Predict a new flow (Q), the output is an estimate of stage elevation

*Part of the mathematical process converts the flow data into a logarithmic scale, the x-axis represents the flow under the structure

Flooding



0 250 500 Feet

Streams Existing Q100-572.84

.....In the Future?

Flooding



Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Calmapping, AeroGRID, IGN, IGP, and the GIS User Community

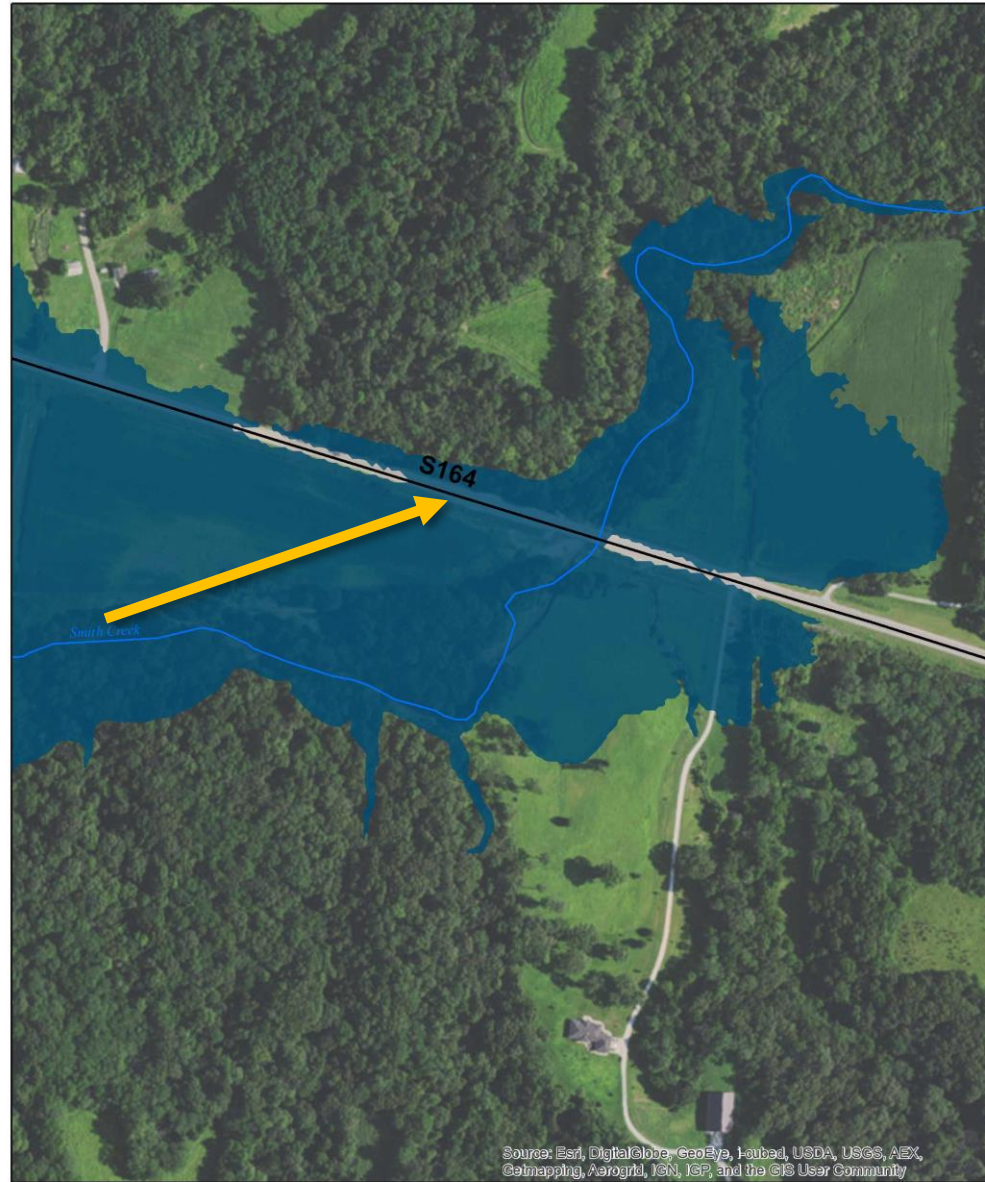


0 250 500 Feet

Streams 3% Q100-573.97

.....In the Future?

Flooding



0 250 500 Feet

Streams
10% Q100-574.26

.....In the Future?

Dec 2004



Thanks for your time today