

# Climate Instrumentation

NATURE Sunday Academy 2015-2016



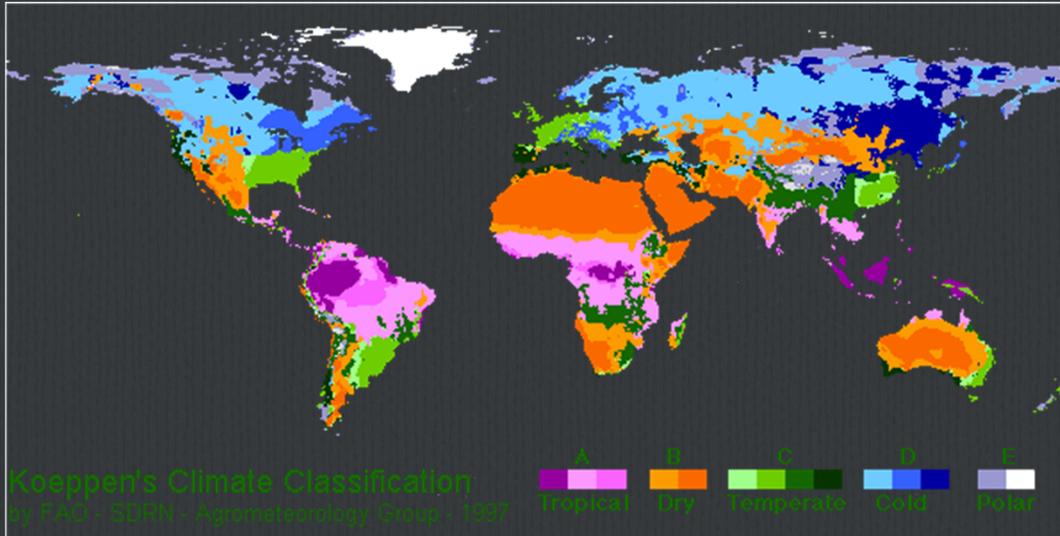
# Ice-Breaker Activity

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- Build a solar cooker with the materials provided
- Write down the reasons for specific materials used and we will discuss at the end of the day
- Most cooked hot dog wins a prize

# What is Climate?

- Long-term weather patterns of an area



- Climate is what you expect, while weather is what you get
- Climate change occurs over decades or centuries

# Climate System

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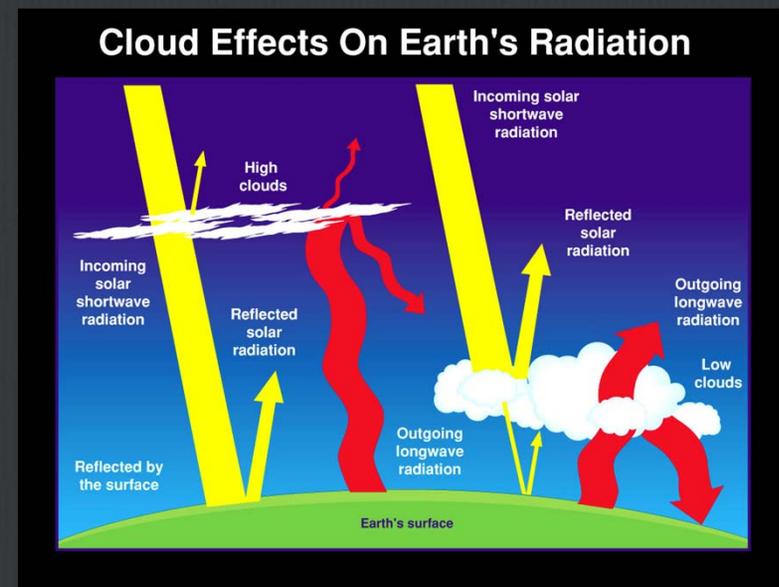
- What is Earth's Climate System and how does it work?
- Watch the following video and answer the questions on your worksheet



**LUNCH BREAK!!!!**

# Climate System

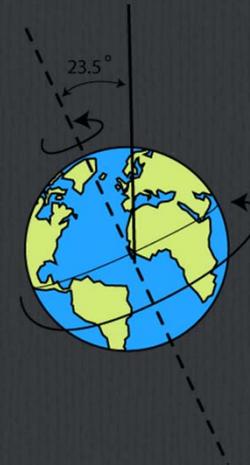
- The sun is the main driver of the climate system
- Clouds can both absorb and reflect some of the energy that reaches the atmosphere
- Some energy reaches the surface while some is absorbed by greenhouse gases such as carbon dioxide, water vapor, and ozone (more on these soon!)



# Climate System

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- The intensity of the Sun's energy at the surface changes due to the tilt of the Earth
  - The reason for the seasons!
- Heat is transferred from the equator to the poles in an attempt to correct the energy imbalance.
  - Atmospheric transport (rising and falling air)
  - Oceanic currents (caused by differences in salinity and ocean temperatures)



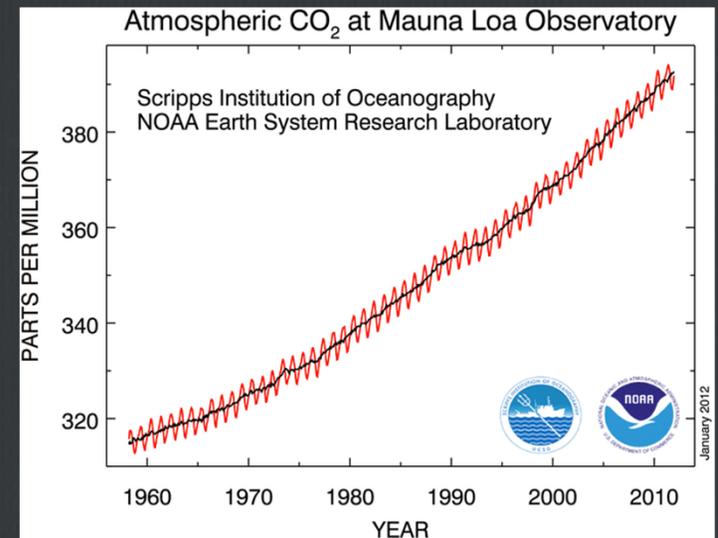
# What is Climate Change?

- Sometimes (but incorrectly) referred to as global warming
- Includes global warming, but refers to more changes that are happening to our planet
  - Rising or lowering sea levels
  - Shrinking or expanding glaciers
  - Accelerating ice melt in Arctic/Antarctica
  - Shifts in flower/plant blooming times
- Caused by heat-trapping greenhouse gasses being put into the atmosphere

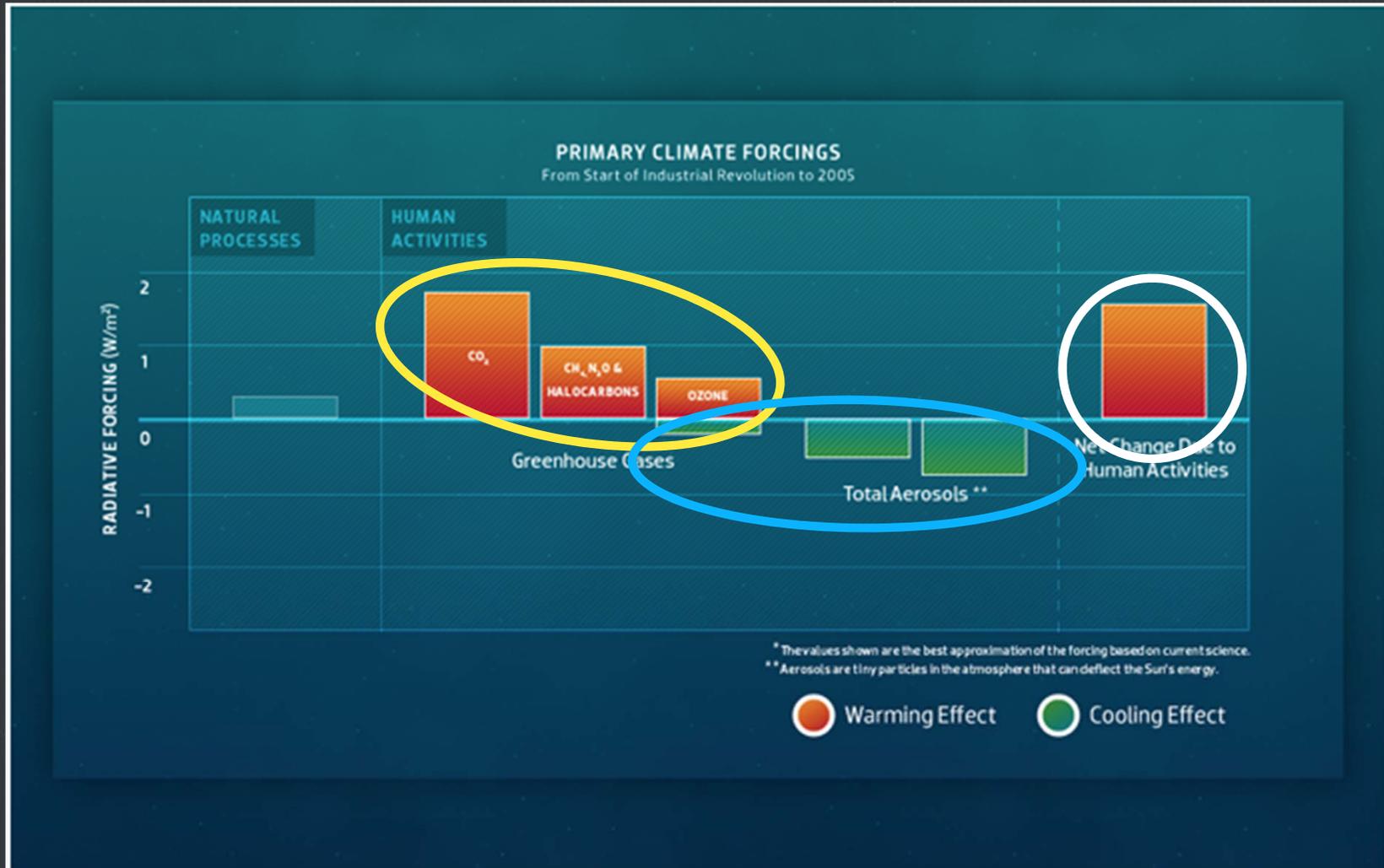


# What Are Greenhouse Gases?

- Gases that trap heat in the atmosphere
  - Natural sources (volcanoes, plants, animals)
  - Man-made (burning of fossil fuels, industrial processes)
- Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), Fluorocarbons (F-gases)
- Greenhouse gases cause positive (heating) or negative (cooling) effects on the climate

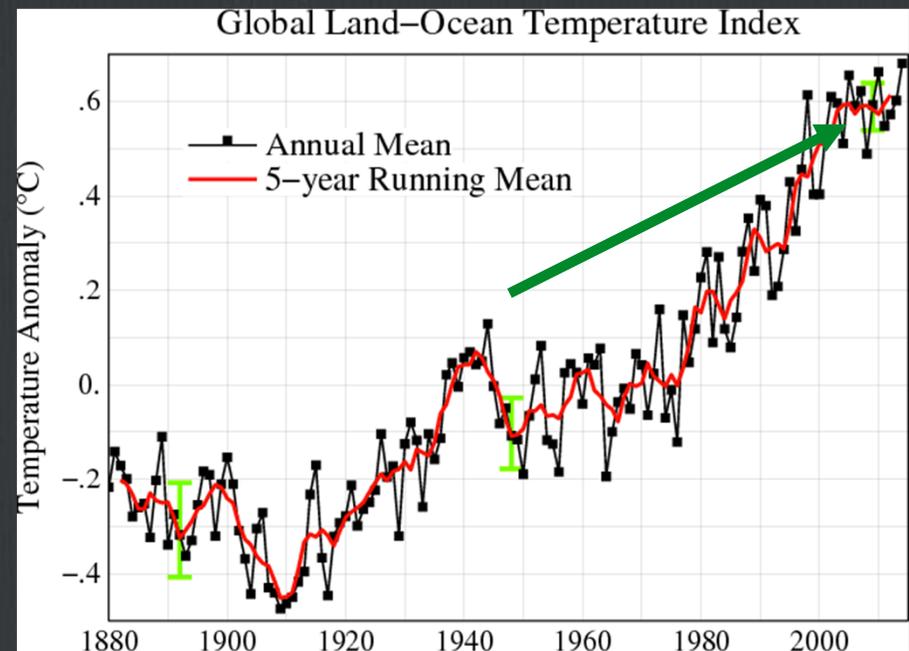


# What Are Greenhouse Gases?



# Climate Change Hiatus?

- Simply put, it is a slowdown of global warming.
- Relatively small changes in the average temperature of the Earth over a period of time
- WHY?
  - Natural variability
  - Uncertainty in measurements
  - Volcanoes
  - Banning of certain gasses



# How do we Measure Climate and Weather?

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- Meteorologists and climate scientists use a variety of instruments to measure many different things
- Watch the following video and fill in the blanks on your worksheet

[Weather and Climate Instruments](#)



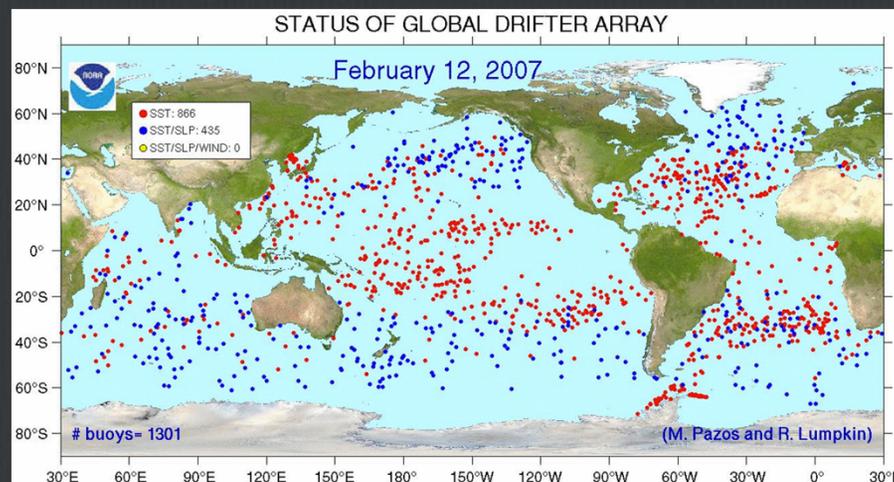
# What do we Measure?

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- Temperature and Dewpoint (°C, °F, Kelvin)
- Air Pressure (millibar, inches, Pascal)
- Relative Humidity (%)
- Wind Direction (degrees, compass direction)
- Wind Speed (knots, mph, km/h)
- Rainfall/Snowfall (inches, millimeters)
- In the United States, there are thousands of weather stations measuring these variables

# What About Over the Ocean?

- Sea-surface temperature: satellites, ships, buoys
- Sub-surface temperature: ships, drifters, buoys
- Ocean currents: satellites, buoys



# Activity 2

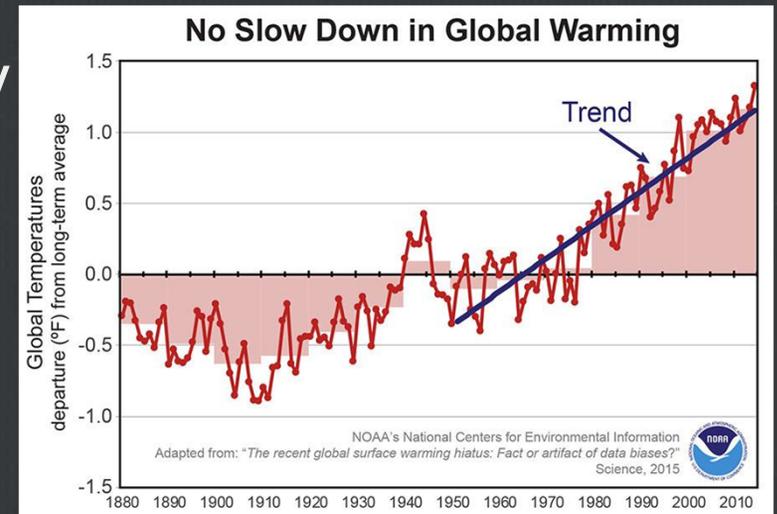
# Back to the Climate “Hiatus”

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- The instruments we use are constantly changing and improving
- Over the ocean, more and more buoys are being used to measure temperature
- Buoys tend to be more accurate than ship measurements.
- In areas where buoys were lacking, ship measurements were used as the truth
- Now that we have more accurate data, correction is needed to adjust the less accurate data

# Is the Climate Hiatus Real?

- Scientists have corrected the temperature data and found that global temperatures are still increasing as much as they were before 1998!
- Climate hiatus is likely caused by errors in instrumentation rather than any physical process like volcanoes, or reduction of certain gasses in the atmosphere



# Activity 3

# Proper Siting of Instruments

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- Temperature:
  - 4-6 feet above ground OR 2 feet above average snow depth
  - Protected from radiation
  
- Wind:
  - 30-33 feet above average ground height within a radius of 500 feet
  - No objects higher than 18 feet within radius of 500 feet
  - No objects higher than 13 feet within radius of 1000 feet
  
- Pressure:
  - Installed in weatherproof facility
  - Avoid areas of direct sunlight, drafts from windows, or air currents (if indoors)
  - 3 feet above ground or 1 foot above average snow depth (if outside)