Climate Instrumentation
NATURE Sunday Academy 2015-2016
Ice-Breaker Activity

- 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

- 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!)

Cloud Effects On Earth’s Radiation

- Incoming solar shortwave radiation
- Reflected solar radiation
- Outgoing longwave radiation
- Earth’s surface
Climate System

- 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 (CO₂), Methane (CH₄), Nitrous oxide (N₂O), 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?

- 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?

- 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”

- 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

- **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)