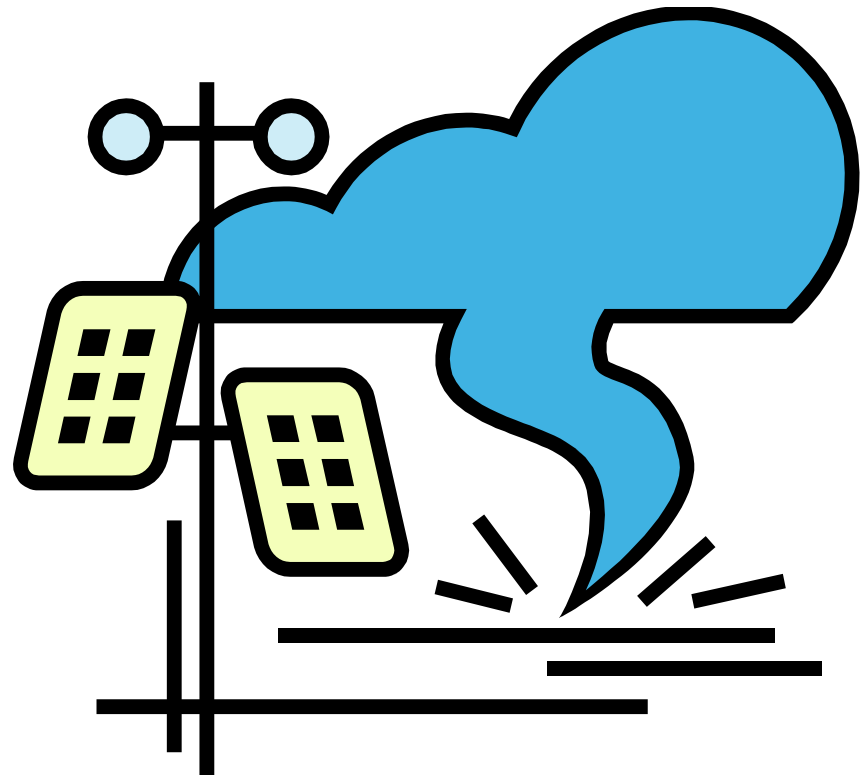


# Meteorology

Presented by Geneva Baker

AZ Science Olympiad

Coaches Clinic



# Disclaimer

- **This presentation was prepared using draft rules. There may be some changes in the final copy of the rules.**
- **The rules which will be in your Coaches Manual and Student Manuals will be the official rules.**

# Event Description

- Study Event
- 50 minutes
- Team of 2
- May Bring:
  - One 2-sided page of notes from any source
  - Non-graphing Calculator

# Topics Include:

- Composition and evolution of Earth's atmosphere.
  - How can the composition of the atmosphere affect climate
    - Greenhouse gasses
    - Aerosols in atmosphere
      - Volcanic particulates
    - Atmospheric Carbon Variability

# Topics Include:

- Weather vs. Climate
  - Weather is what conditions of the atmosphere are over a short period of time.
  - Climate is how the atmosphere "behaves" over relatively long periods of time

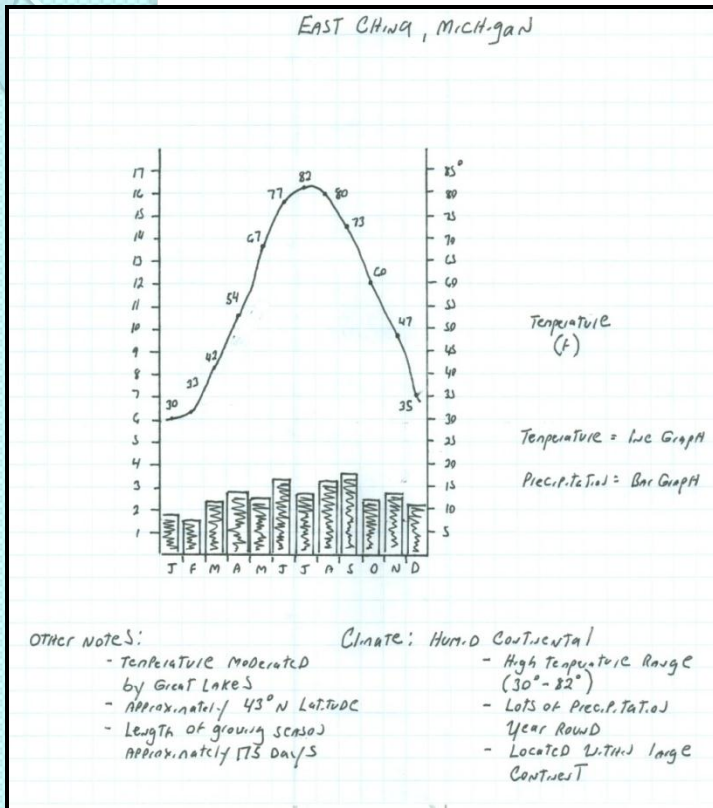
# Topics Include:

- Solar Radiation/Earth's Energy Balance:
  - Albedo,
    - the fraction of the incident sunlight that is reflected. When an object reflects most of the light that hits it, it looks bright and it has a high albedo. When an object absorbs most of the light that hits it, it looks dark. Dark objects have low albedos.
  - Long & shortwave radiation in relation to the (Daisy World Model)  
<http://en.wikipedia.org/wiki/Daisyworld>

# Topics Include:

- Solar Weather & its impact on Earth's Climate
  - Solar Output
  - Sunspots
  - Solar Maximums & minimums
- Daily & Annual maximum/minimum temperature.

# Topics Include:



- Climatic Zones

- How to use the Köppen climate classification system & how it can be used to explain climate change.
- Understand the difference between the Köppen & Thornwaite systems.
- Understand & interpret climographs.

# Topics Include:

- Natural Climatic Variability
  - Effects land masses & water bodies have on climate.
    - This ties into Dynamic Planet – Earth's Freshwaters & Awesome Aquifers
  - Effects of topography on climate
  - Effects of Earth's mean temperature
    - How mean temp may impact Earth's
      - Cryosphere –
        - collectively describes the portions of the Earth's surface where water is in solid form, including sea ice, lake ice, river ice, snow cover, glaciers, ice caps and ice sheets, and frozen ground
      - Hydrosphere
        - describes the combined mass of water found on, under, and over the surface of a planet.
      - Biosphere
      - Atmosphere systems.
  - Effects of plate tectonics on climate

# Topics Include:

- Oceanic & Atmospheric circulation & its impact on climate change.
  - Semi-permanent pressure cells & the 3-cell model of atmospheric circulation
    - Hadley cell, the Ferrell cell, and the Polar cell.
  - El Niño, La Niña, Southern Oscillation/Walker Circulation
  - Thermohaline Circulation & Wind-driven oceanic currents
    - large-scale ocean circulation that is driven by global density gradients created by surface heat and freshwater fluxes
  - Oceanic Circulation

# Topics Include:

- Earth's celestial cycles; their impact on long-term climate change
  - Seasons
  - Milankovich Cycle
    - describes the collective effects of changes in the Earth's movements upon its climate,
    - Eccentricity
    - Axial Tilt
    - Precession

# Topics Include:

- Paleoclimates of Earth's geologic history
- Pleistocene Ice Age
- Younger Dryas Cold Period
- Medieval Warm Period
- Little Ice Age

# Topics Include:

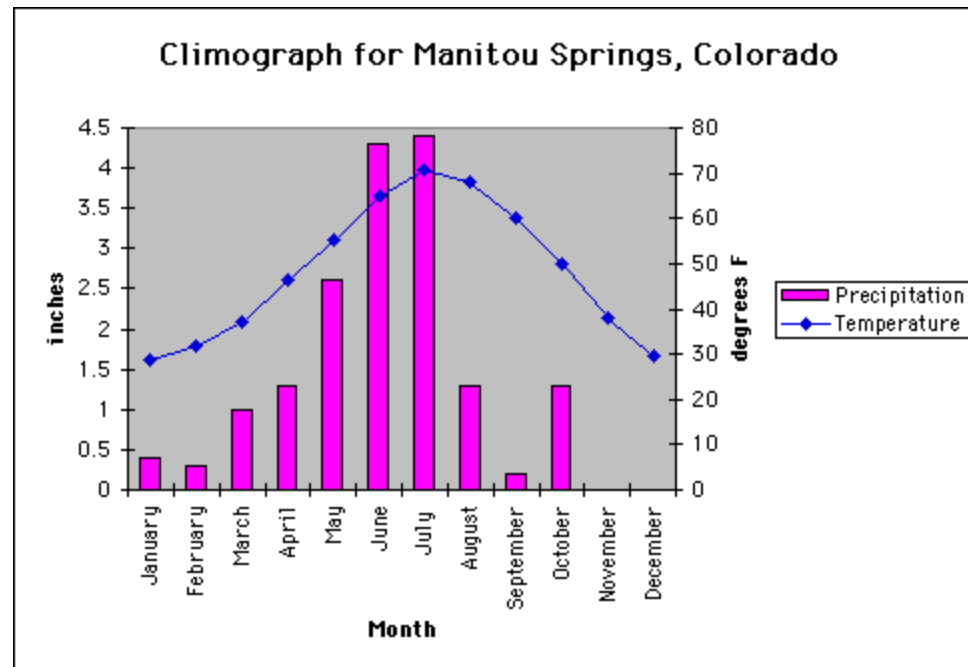
- Paleoproxies – Including but not limited to:
  - Ice Cores
  - Ocean Sediments
  - Lacustrine Sediments (Lake Sediment)
  - Dendrochronology – Tree Ring Dating
  - Coral Bleaching
- What information they are able to provide about ancient climates

# Topics Include:

- Human impact on climate
  - Global warming
  - Greenhouse gasses
  - Ozone depletion
  - Deforestation
  - Desertification
  - Urban Heat Island effect

# Sample Tasks

- Construct and read a simple Climograph

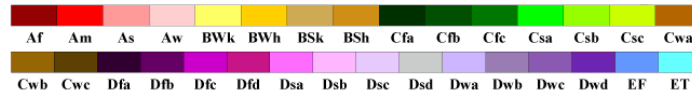


# Sample Tasks

- Read a Köppen Climate Map

## World Map of Köppen–Geiger Climate Classification

updated with CRU TS 2.1 temperature and VASCLimO v1.1 precipitation data 1951 to 2000



### Main climates

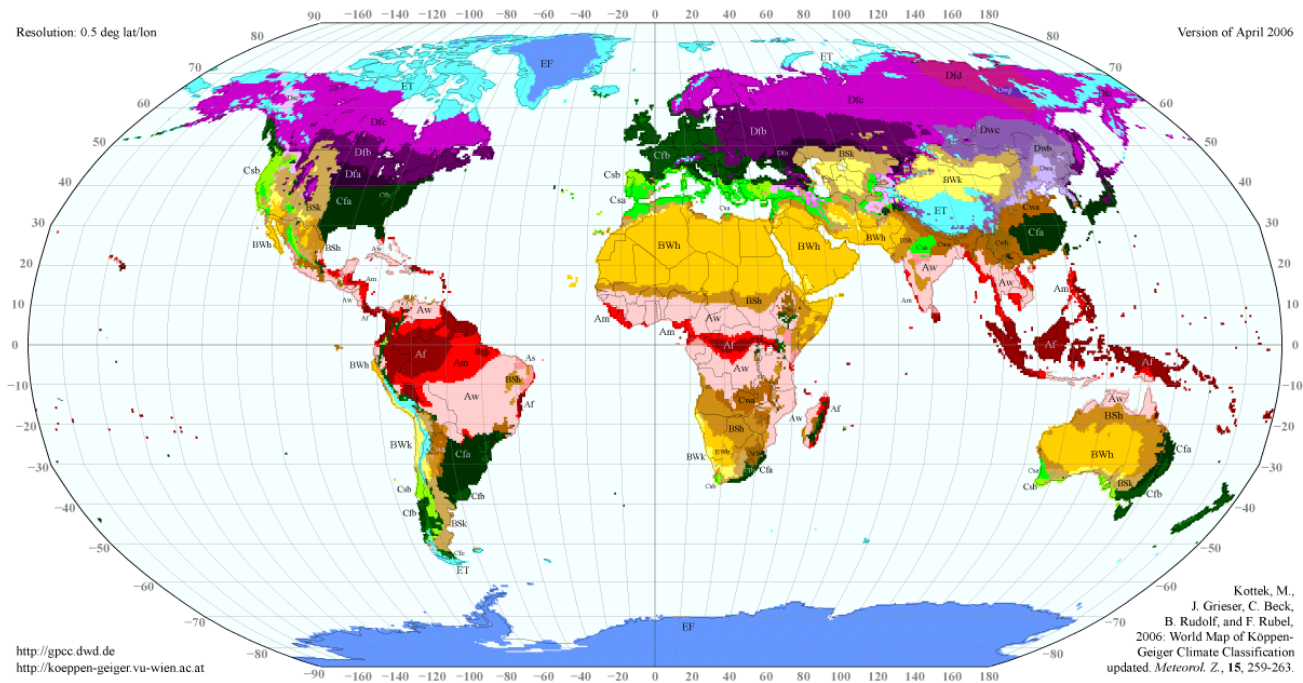
A: equatorial  
 B: arid  
 C: warm temperate  
 D: snow  
 E: polar

### Precipitation

W: desert  
 S: steppe  
 f: fully humid  
 s: summer dry  
 w: winter dry  
 m: monsoonal

### Temperature

h: hot arid  
 a: cold arid  
 k: hot summer  
 b: warm summer  
 c: cool summer  
 d: extremely continental  
 F: polar frost  
 T: polar tundra



# Sample Tasks

- Read and interpret data from a simulated ice core sample



# Resources

- Audubon Weather Guide
- SOINC.org
- Scioly.org
- Any environmental or earth science textbook
- [www.weather.com](http://www.weather.com)
  - The Weather Channel Website-excellent for legacy data for locations throughout the world
- [www.aip.org/history/climate/solar/htm](http://www.aip.org/history/climate/solar/htm)
  - Article relating changing climate conditions to sunspot activity.
- [www.coft.edu/ete/modules/mnsese/earthsysflr/climograph.html](http://www.coft.edu/ete/modules/mnsese/earthsysflr/climograph.html)
  - Describes how to read Climographs and includes many models for different biomes