

Global Weather and Climate: Detailed Outline

THURSDAY: Energy, Radiation & Climate

Morning

8:00 Breakfast

8:30 Introductions and Overview

- Introductions / Teachers / Course presenters (15 minutes)
- Content overview (Scott, Thomas, Brian - 10 minutes)
- Overview of course structure / assignment / credit / instructional approach / mixing / question and suggestion box / practical details: stipends, meals, credit, parking, etc. (All - 5 minutes)

9:00 Engage / Explore

Recap and review principles of energy, radiation and the electromagnetic spectrum. Wave and photon nature of EM waves.

- EM Spectrum Exercises (Rainbow glasses and different bulbs)
- Writing with Light (LEDs / Phosphorescent paper)
- Why Does the Sun Appear Yellow? (Filters)
- Why Is the Sky Purple? (Sunset eggs)
- Why Are Clouds White? (Scattering)
- Color and Cooling (Cylinders)

9:30 Explain: Radiation and Energy

- Recap of the basics
- Waves, photons, spectrum
- Emission & absorption

10:00 Extend

- How Does the Earth Keep Warm, Part II

10:15 Break

10:30 Explain: Greenhouse effect & vertical variations

- Radiation, convection, & temperatures
- Simple layer model of temperatures
- Transmission and weighting

11:15 Extend

- Solar Radiation and Seasons=

11:45 Evaluate

- **Question:** Which has a higher *average* temperature, the earth or the moon? What factors are important to consider?

12:00 Lunch

Afternoon

12:45 Different Voices - Historical Scientists

1:15 Engage / Explore

Introduce concept of feedback.

- Feedback tracks
- Feedback poker

1:30 Explain: Climates of the World

- Tropics, temperate zones, polar caps, Deserts and forests, grasslands
- East vs. West Coast

2:15 Extend

- Climate Zones=

2:30 Break

2:45 Explain: Climate sensitivity & feedback processes

- Effective emissivity and surface temp
- No-feedback calculation
- What we mean by “feedback”
- Water vapor, albedo, & clouds
- What we know from past climates

3:30 Extend & Evaluate

- Simple Climate Model=

4:00 Processing / Planning / Question Time

4:15 Feedback for Presenters, Details, Next Steps

4:30 Adjourn

Evening Fort Collins Foxes

FRIDAY: Forces, horizontal and vertical motion, weather

Morning

8:00 Breakfast

8:30 Engage / Explore

- Launch weather balloon, watch data as it comes in.
- If Hot Air Rises...=
- Why Do Thunderstorms Form in the Afternoon

9:30 Explain: Stability and vertical motion

- Recap of gas laws
- Lapse rates & conditional stability
- Vertical motion & cloud development

10:15 Extend

- Stability and temperature / humidity profiles

10:30 Break

10:45 Explain: Thunderstorms & Severe Weather

- Precipitation processes
- Structure & lifecycle of a thunderstorm
- Hail, gusts, and tornados

11:30 Extend / Evaluate

- Tell the story of a thunderstorm from an energy point of view. Where does it come from? Where does it go?

11:45 Processing / Planning / Question Time

12:00 Lunch

Afternoon

12:45 Different Voices - Historical Scientists

1:15 Engage / Explore

Introduce ideas of angular momentum, coriolis force, forces, force balance.

- Hoberman spheres
- Why do hurricanes rotate counterclockwise?
- Why doesn't the wind blow from high to low pressure

1:45 Explain: Force balances and circulation

- Rotation, angular momentum
- Large-scale weather
- Thermal wind, jet stream, polar vortex

2:30 Break

2:45 Explain: Midlatitude Cyclones, Tropical Cyclones

- Air masses and fronts
- Lifecycle of a midlatitude cyclone
- Tropical Cyclones, Hurricanes

3:30 Extend

- Midlatitude Cyclones

4:00 Evaluate: Clouds in a Glass of Beer, Part II

4:15 Processing / Planning / Question Time

4:30 Adjourn

Evening Density Drinks & Bubbleology

SATURDAY: Models, Weather, Climate & Climate Change

Morning

8:00 Breakfast

8:30 Engage / Explore

- Weather vs. Climate
- What is a Model?

9:00 Explain: Weather & Climate Modeling

- Weather vs climate
- What's in a global weather forecast model?
- Forecast skill & predictability
- Modeling past climates
- 21st Century Projections

9:45 Break

10:00 Extend

- Climate data

10:30 Evaluate

- One minute answer to this question: “If forecasters can’t predict the weather next week, how can they predict the climate 100 years from now?”

10:45 Explain: The Stratosphere & the Ozone Hole

- Ozone & UV radiation
- Dynamics of the ozone layer – why is there no ozone hole over the Arctic?
- Solutions to the ozone hole problem, ozone recovery, lessons learned
- QBO?

11:30 Processing / Planning / Question Time

12:00 Lunch

Afternoon

12:45 Different Voices - Historical Scientists

1:15 Engage / Explore

- What makes a gas a greenhouse gas?
- Energy and efficiency activities
- Measuring CO₂ output of cars

1:45 Explain: Impacts of Climate Change

- Precipitation, hydrology, ecosystems
- Attribution & changes in weather
- Sealevel & ice sheets

2:30 Break

2:45 Explain: Mitigation, Adaptation, & Economics

- Carbon cycle
- Economics of Energy & CO₂

3:30 Extend

- Wedges “light” version

3:45 Evaluate

- Dealing with parents: Role play

4:00 Processing / Planning / Question Time

4:15 Closing / Next Steps

4:30 Adjourn