MiSP WEATHER DATA
Teacher Guide, L1 - L3

Introduction

Using this MiSP unit, students focus their learning during a weather/climate unit on weather variables that have an effect on each other: (1) temperature and saturation mixing ratio (humidity); and (2) altitude and temperature, pressure, and density.

Much of the study of weather focuses on individual weather variables: temperature, cloud cover, barometric pressure, precipitation types and amounts, wind speed and direction, and relative humidity.

The elegance in the study of weather comes in relating or correlating weather variables: the connection between barometric pressure and stormy or fair weather, wind direction and the likelihood of rain, and pressure differences and wind speed (another MiSP unit), to name three.

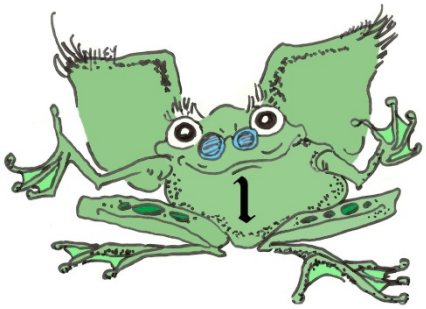
This unit mainly involves data crunching by the students. Teachers will have an opportunity to make the data experiences "elegant" through discussion and relating to local, regional, and national weather.

Standards

ILST Core Curriculum — Major Understandings:
Standard 4 Physical Setting 2.1a, 2.1b, 2.2p
Physical Setting / Earth Science Core Curriculum — Major Understandings:
Standard 4 Physical Setting 2.1c, 2.1d, 2.1e, 2.1f

Lesson Objectives: After completing this unit, students will be able to:

- Describe the relationship between temperature and amount of water vapor in saturated air
- Describe the relationship between altitude and three variables: temperature, pressure, and air density
- Calculate relative humidity, using saturation mixing ratio data
- Graph the relationship between temperature and mass of water in saturated air
- Graph the relationship between altitude and temperature, pressure, and air density



- Determine and compare the unit rate of change (slope) of lines on graphs of air temperature and mass of water vapor and on graphs of altitude and temperature, pressure, and air density (L2)
- Determine and apply the formula for lines on graphs of temperature and mass of water vapor and on graphs of altitude and temperature, pressure, and air density (L3).

Day 1 — Atmosphere and Weather Background, Humidity, Relative Humidity, and Dew Point

Day 1 discussions/review:

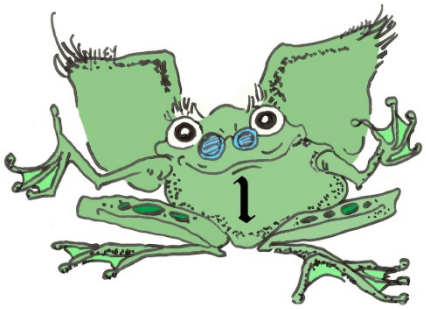
- Weather variables and instruments
- Humans using multiple weather variables; examples include:
    - Old sayings: "Red sky at night, sailor's delight; red sky in morning, sailor's warning" http://www.loc.gov/rr/scitech/mysteries/weather-sailor.html
    - Heat index: http://www.nws.noaa.gov/om/heat/index.shtml
    - Barometric pressure and stormy weather
    - Wind direction and expecting rain
    - Dew point, temperature, and cumulus cloud height:
        - Standard – http://profhorn.aos.wisc.edu/wxwise/thermo/makeCU.html
        - Metric – http://profhorn.aos.wisc.edu/wxwise/thermo/makeCUm.html
- Atmosphere structure: http://earthguide.ucsd.edu/earthguide/diagrams/atmosphere/index.html
- Humidity, measurement of humidity, relative humidity, dew point. Demonstrate finding dew point temperature by cooling down room temperature water until condensation appears on the outside of the container.
  Resource about humidity and measuring humidity:
  http://www.physicalgeography.net/fundamentals/8c.html

Question of the Day

The expression "Red sky at night, sailor's delight; red sky in morning, sailor's warning" has some truth in it. What are other common expressions about the weather —and are they reality or myth?

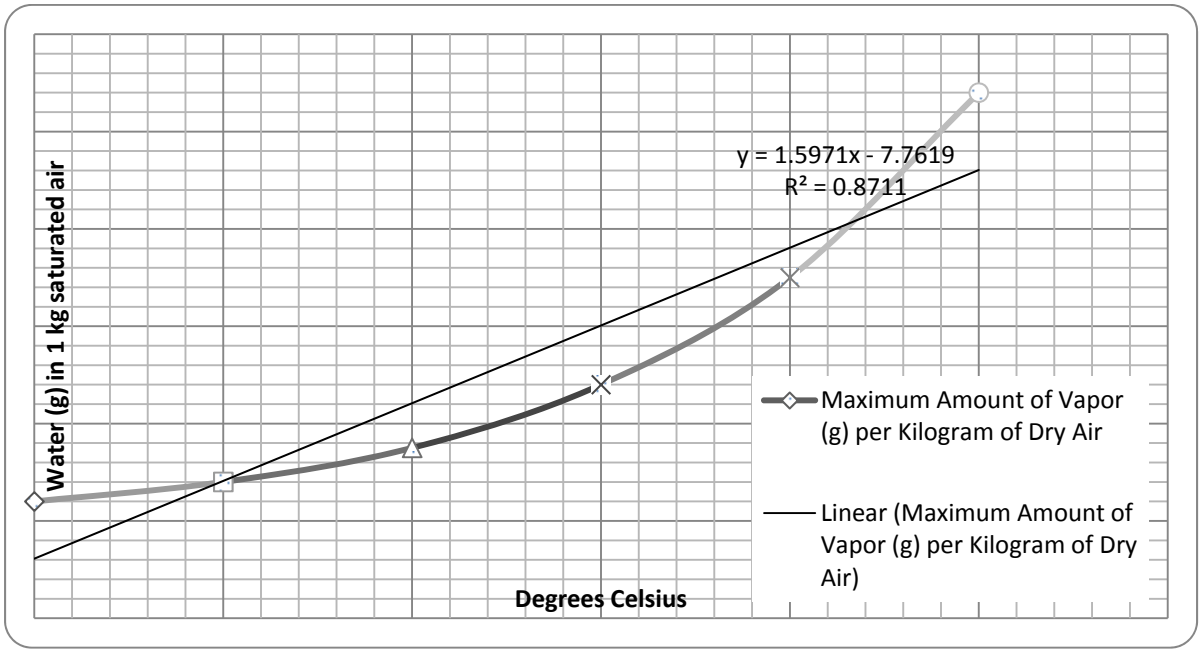
Here are some weather lore resources you may want to use:

http://www.therockerbox.com/weather_lore.htm
http://www.readwritethink.org/files/resources/lesson_images/lesson775/CollectionSayings.pdf



Day 2 — Temperature and Water Vapor (Humidity)

Students will graph temperature and saturation mixing ratio (g/kg) to show that warmer air can "hold" more water vapor than cooler air:

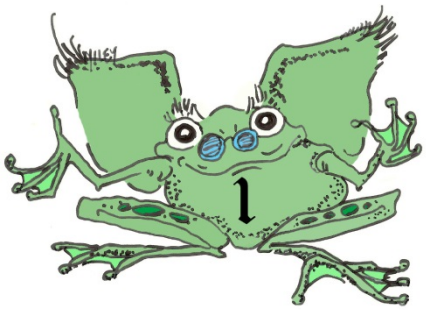


Students will also use the graphed data to calculate relative humidity.

The worksheet directs students to draw a best-fit line, which is not really scientifically or mathematically correct, but the exercise is intended to be fairly simple to get the idea across that temperature affects air's carrying capacity for water vapor. Levels 2 and 3 students will be asked to consider the validity of the best-fit line when they calculate slope.

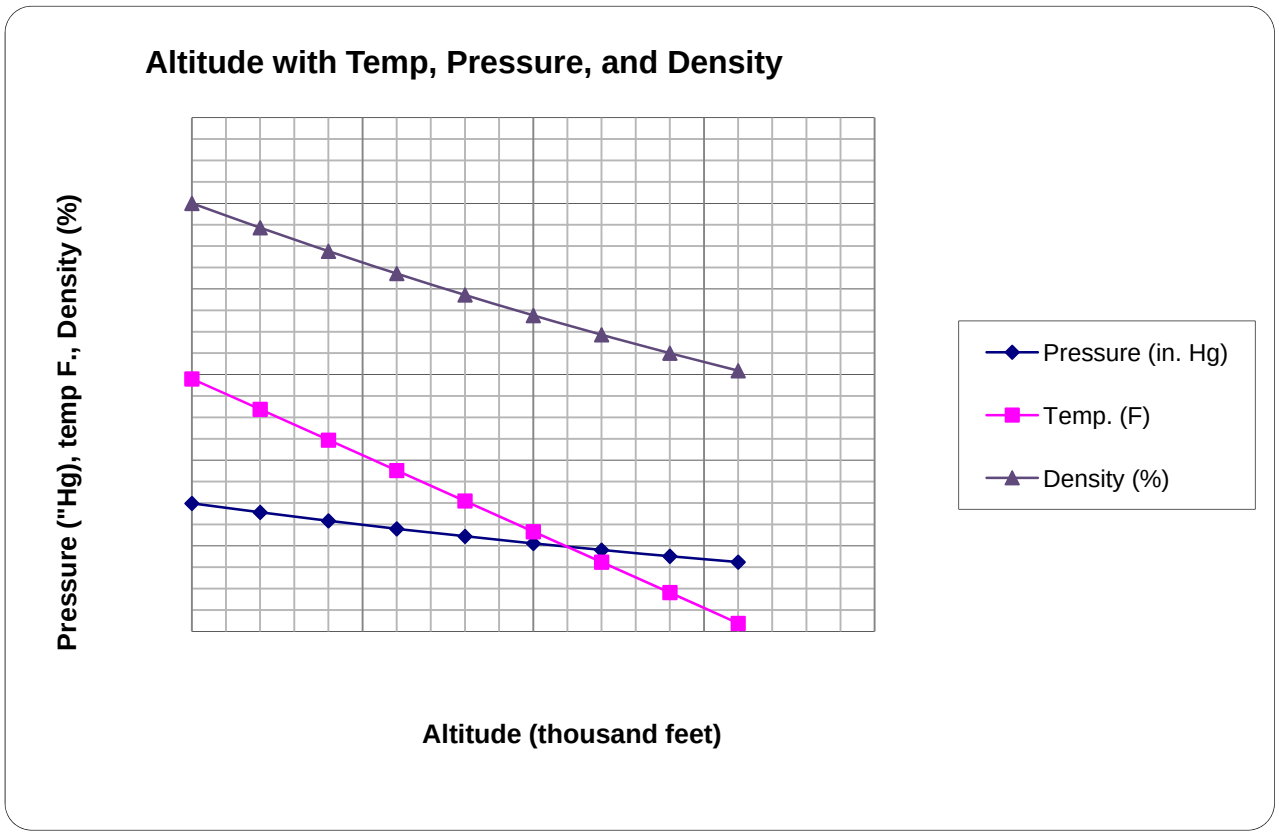
Question of the Day

In late spring a homeowner with a four-foot-deep aboveground pool (still with the winter cover on) noticed condensation, "dew," on the metal wall of the pool from the ground level to about 12" high. The other three feet of the metal wall were dry. What does that tell about the temperatures of the water inside the pool?



Days 3 and 4 — Altitude and Pressure, Temperature, and Density

This worksheet examines three variables at relatively low altitudes. The data uses units of degrees Fahrenheit, inches Hg, and percent (for density). These units allow all three variables to graph nicely on one graph. If teachers want to use other units, conversions are included on the worksheet. The graph or graphs may have to be adjusted. Note that the altitude unit is thousand feet. That will make the unit rate of change (slope) values more reasonable.



The data analysis is standard MiSP fare. The challenge is to help the students understand why each of these variables decreases as altitude increases. Teachers may want to use the websites listed below during discussion. The first is probably more useful than the second for middle school learning.

http://www.grc.nasa.gov/WWW/K-12/airplane/atmosi.html
http://itl.chem.ufl.edu/4411/applets/canonical/canonical.htm

Day 5

Administer the appropriate level assessment.