MiSP ASTRONOMY— SEASONS
Teacher Guide

Introduction

This topic is most often included in an astronomy unit or a weather/climate unit. The cause of seasons is a challenging concept for all—children and adults alike. It is much easier to believe that summer is caused by the Earth being closer to the sun. That is our everyday experience with other heat sources.

The unit should be preceded by or started with teaching and learning about the Earth's tilt and its revolution around the sun. The illumination of the Earth at key dates—the equinoxes and solstices—will be highlighted.

The worksheets utilize a simulation to study the changing duration of daylight on Long Island and a comparison of the altitude of the sun and duration of daylight on March 20 at various north latitudes.

Angle of insolation (discussed in another MiSP unit) can be tied to this unit at the teacher's discretion.

The topic in general and the worksheets in particular, will require much teacher facilitation because understanding the topic of seasons is difficult.

During the MiSP training on this unit in the summer of 2010, many participants felt that doing both activities would take too long. Both are valuable teaching and learning experiences, however, so they have been retained in the unit. The second activity, "Where's the Most Sunlight?" is OPTIONAL

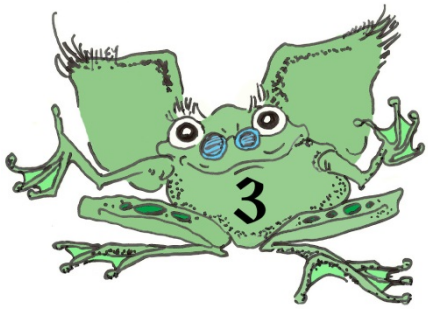
Standards

ILST Core Curriculum — Major Understandings:

Standard 4 Physical Setting 1.1e, 1.1i

Physical Setting / Earth Science Core Curriculum:

Standard 1 Scientific Inquiry Key Idea 3 (optional to this unit)
Standard 4 Physical Setting Major Understanding: 1.1a, 1.1f, 2.2a, 2.2c
Standard 6 Key Idea 5



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

- Describe the positions of the Earth as it travels around the sun and explain how the Earth's tilt affects its illumination
- Use a simulation to show the apparent path of the sun across the day sky at different latitudes and times of the year
- Use the simulation to find azimuth, sunrise and sunset times / duration of daylight, sun's altitude
- Graph day length and sun's altitude data
- Correlate day of the year with length of daylight
- Correlate latitude with length of day and sun altitude
- Correlate the Earth's tilt and revolution around the sun with seasonal changes in daylight duration and sun altitude
- Determine and compare the changing unit rate of change (slope) of selected line segments on the day/daylight graph and on the latitude/altitude graph (L2)
- Determine and apply the formula for lines to selected segments of the day/daylight graph and the latitude/altitude graph (L3).

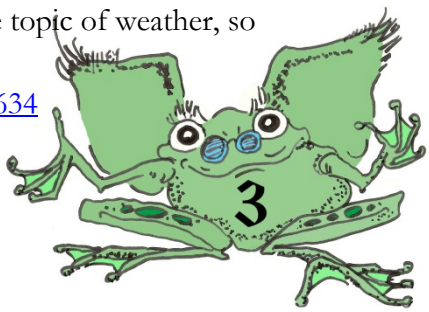
Day 1 — Introduction to Seasons

The challenge of seasons is to enable students to connect the fact that the Earth has a tilt with the fact that it travels around the sun, and to understand that those two things together cause seasons.

There are a variety of useful resources to help you teach this unit:
GEMS/Lawrence Hall of Science, *The Real Reason for Seasons* (Teacher's Guide and CD-ROM), 2000

The following Internet resources may be used:

- Length of day and night visualization
  http://www.cs.sbcc.net/~physics/flash/LengthofDay.swf
- Seasons animations
  http://www.astro.illinois.edu/projects/data/Seasons/index.html
  http://astro.unl.edu/naap/motion1/animations/seasons_ecliptic.swf
  http://esminfo.prenhall.com/science/geoanimations/animations/01_EarthSun_E2.html
- Global climate animations
  http://geography.uoregon.edu/envchange/clim_animations/
- Seasons idea sheet – elementary
  Here is the explanation for changing seasons with two color diagrams illustrating the concept. This is a subscription site, but this particular unit is a sample unit under the topic of weather, so it has free access.
  http://www.exploringnature.org/db/detail.php?dbID=112&detID=2634



Question of the Day

People who fly to Florida and other southern vacation spots during the New York winter comment that the sun is so much brighter in January "down there." Why is that?

Day 2,3 and 3 — Changing Hours of Daylight on Long Island; Where's the Most Sunlight?

As noted in the introduction, the second activity is optional for MiSP classrooms.

Teachers will schedule the time and sequence for the two worksheets used on these days. The simulation is from http://astro.unl.edu/naap/motion3/animations/sunmotions.html.
Ideally the students will work individually or in groups on laptop or desktop computers. If that is not possible, the simulation can be displayed on one computer. If no computers are available, the data will have to be provided to the students.

There are many nuts-and-bolts challenges: using time, subtracting times to find daylight duration, and manipulating the controls on the simulation.

The procedures are outlined on the worksheets. Teachers may want to build in times for discussion, clarification, and remediation. The discussion questions are challenging, especially when the students are asked to relate the worksheet data with the sun–Earth relationships

Slope and line equations focus on the second five minutes of the experiment, when the data will be the most linear. Teachers may use longer or shorter times, depending on the data. Best-fit lines may need to be drawn.

Question of the Day

The northern latitudes get more hours of sunlight on and around June 21 than the latitudes around the equator. Yet the equator's temperatures are still generally much warmer than those of the far north. Why?
There are many places along the same northern latitude as Long Island. They have the same number of hours of daylight as we do, 365 days of the year. Yet some of those places can have very different climates. Why?

Day 5 — Assessment

Administer the assessment: *MiSP Astronomy — Assessment L3*.