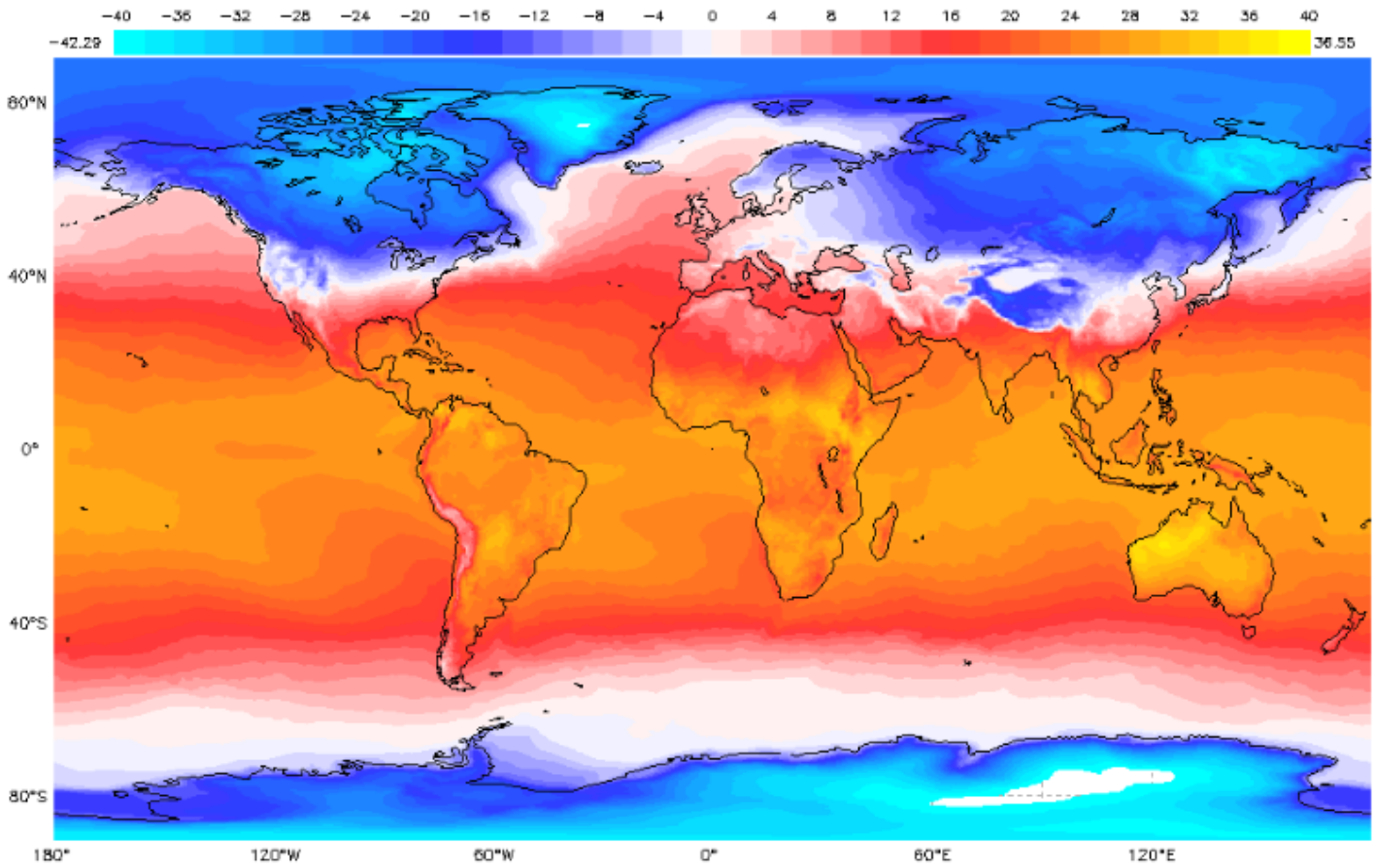
My NASA Data - GLOBE Connections

GLOBE Connections: Changing Air Temperatures



This resource helps to identify and access GLOBE protocols and hands-on learning activities that complement the Changing Air Temperatures phenomenon.

Visit the **GLOBE Atmosphere Protocols & Related ESDE Datasets** page that outlines the datasets available in the Earth System Data Explorer. These data complement student GLOBE investigations using the following protocols.

Changing Air Temperatures

Protocols

GLOBE protocols can be used to collect many types of data to examine changing air temperatures. Students can use the protocols to collect data and share their data with other GLOBE students around the world. As scientists continue their study changing air temperatures, they can use these data.

1. Air Temperature - Students collect current air temperature is measured using a thermometer held in the open air but in the shade for at least 3 minutes.

2. Surface Temperature - Students use an infrared thermometer (IRT) to measure the temperature of the Earth's surface.

Protocol Bundles

These protocol bundles are related to air temperature.

1. ENSO Protocol Bundle - This bundle includes atmosphere, hydrosphere, and pedosphere protocols that are used for the GLOBE ENSO (El Niño Southern Oscillation) Campaign which has been formulated to engage students in determining where and how much El Niño affects local places and to put students in contact with the resulting patterns in their local environment.

2. Mosquito Protocol Bundle - This protocol bundle combines all GLOBE protocols that are related to the Mosquito habitat mapper app and explains how they are related. You can make a difference in tracking and controlling the spread of mosquitoes and help save your loved ones from getting dengue, Zika, and other illnesses.

3. Urban Protocol Bundle - The purpose of the Urban Bundle is to suggest a group of GLOBE protocols that can provide students and teachers with an integrated knowledge of the environment in urban areas, including various processes and their interactions. Given the many small-scale variations caused by the built environment, such citizen science contributions are particularly needed to adequately characterize the urban environment.

4. Weather Bundle - The purpose of the Weather Bundle is to suggest a group of GLOBE protocols that can provide students and teachers with an integrated knowledge of the parameters and processes which control the weather and are responsible through their changes, for weather events.

Learning Activities

Each of the GLOBE protocols has a set of learning activities to help students learn more about the instruments and procedures for the measurements, the content associated with the protocol and ways students and scientists can use the data that is being collected. There is a link for all atmosphere learning activities and those that have been selected for Changing Air Temperatures are detailed below.

1. Atmosphere Learning Activities Introduction (pdf)
2. All GLOBE Atmosphere Learning Activities

Phenomenon-Related Learning Activities:

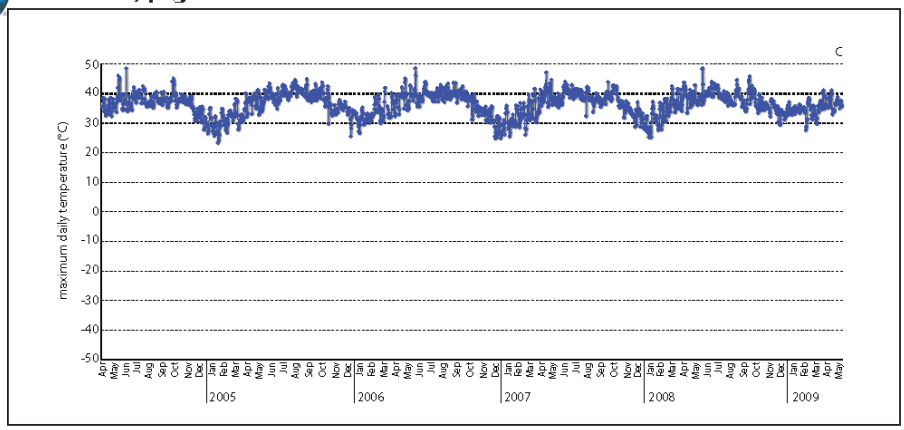
3. Climate and Latitude

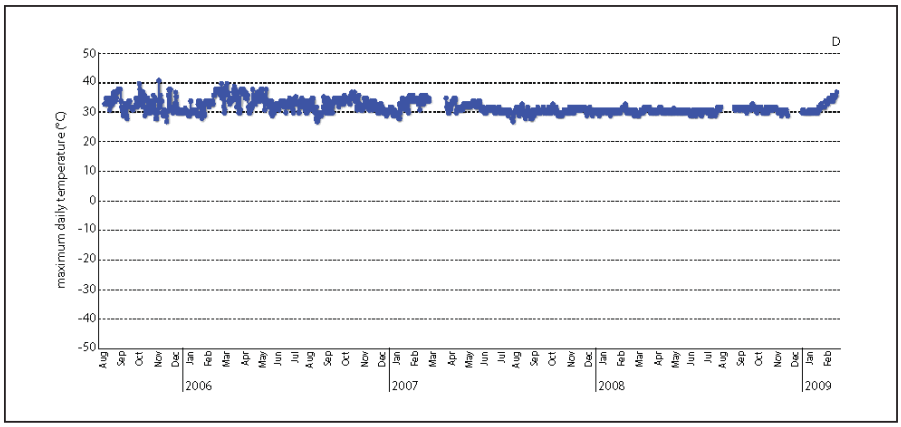
Overview: Students match GLOBE temperature data with its location given what they know about the relationship between latitude and seasonal temperature variations.

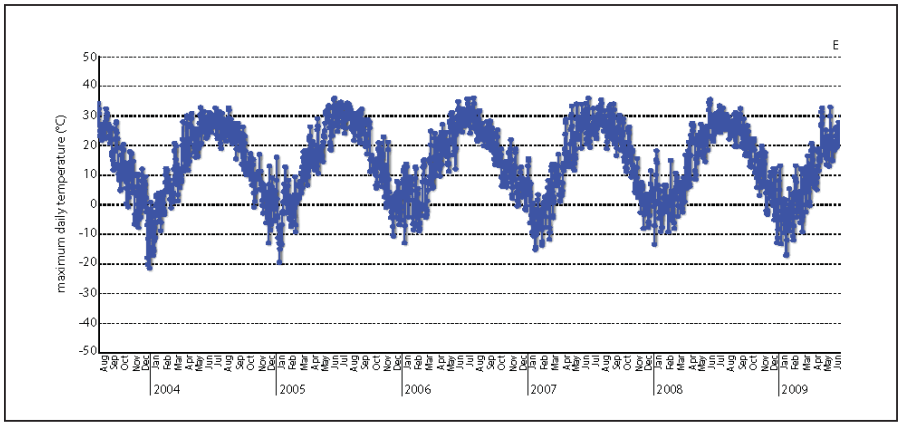
Student Outcomes:

- Match graphs of temperature data with locations given the latitude.
- Explain why they matched each graph to a particular location using the knowledge that seasonal differences are larger further from the equator and temperatures are warmer near the equator.

Climate and Latitude
Data Cards, page 2







4. How Do Seasonal Temperature Patterns Vary Among Different Regions of the World?

Overview: Students use GLOBE visualizations to display student data on maps and to learn about seasonal changes in regional and global temperature patterns.

Student Outcomes:

- Summarize the effect of latitude, elevation, and geography on global temperature patterns;
- Explore local and regional seasonal variations.

Figure AT-STP-9: Maps

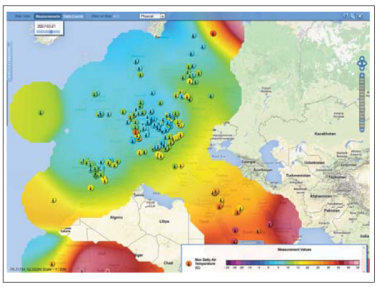


Figure AT-STP-10: Graphs

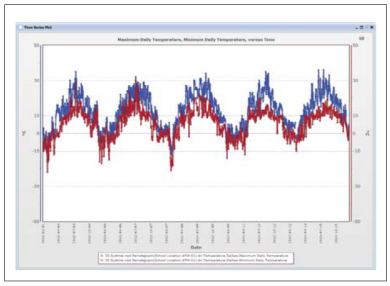


Figure AT-STP-11: Data Table

School Name	Latitude	Longitude	Elevation	Measured Value
Wilhelm-August-Lay-Schule	48.083	7.683	160.8	22.5
Foerderzentrum Erding	48.2977	11.8943	468	26
Stredni Odborne Uciliste Lesnicke a Rybarsk / SOUL a R/	48.9345	17.2934	147.9	23
Zakladni skola Josefa Bublika, Banov	48.9908	17.7203	250	22
ZS a MS Domamil	49	15	495	20
Zakladni skola T.G.Masaryka	49	15	465	23
ZS Brumov Bylnice	49.0818	18.0198	286.9	21.3
Gymnazium Slavicin	49.0905	17.88	363	21
ZS Otrokovice	49.2179	17.5115	135.8	23
Volksschule Petersaurach	49.3117	10.7448	445	21.2
Staatliche Realschule	49.32613	11.01033	301	23
ZS Bystrice nad Pernstejnem	49.519	16.26	570	21
Gymnazium Dr. A. Hrdlicky	49.542	15.3537	518	22.4
Wilhelm-Erb-Gymnasium	49.5673	7.8502	268	22.8
Gimnazjum No 2 in Żywiec	49.6833	19.2002	353	18.3
ZS Pomezi	49.7148	16.3003	565	29.5
Gymnasium an der Heinzenwies	49.7213	7.3092	341	22
Zakladni Skola Opavska	49.7597	17.7845	401	20.7
ZS Golcuv Jenikov	49.8224	15.4836	395	25.1
Darmstadt Elementary School	49.8457	8.6412	217.1	17
VOS a SOST Litomysl	49.8724	16.3041	299.6	19
Offene Schule Babenhausen	49.9	8.84	37	21.6
Gymnazium (CZCZMA4W)	49.9042	16.4432	350	24
ZS Borovskeho Karvina	49.9088	18.4522	279	27
ZS Vrane nad Vltavou	49.9368	14.3792	240	26
Offene Schule Babenhausen	49.96	8.95	37	21
Complex of Schools in Jaroslaw	50.0033	22.6786	212.2	22.6
Gymnazium Voderadska	50.0673	14.4977	185	24
Complex of Schools in Rudna Wielka	50.0874	21.954	174.5	22.5
Gimnazjum No 7 Jana III Sobieskiego in Rzeszów	50.1466	22.1738	179.1	23
Zakladni Skola (CZCZAHJA)	50.2057	16.2367	438	25
DDM	50.2066	15.8347	233.2	26
4. Zakladni Skola - Ekolog. Praktikum	50.4387	15.3523	868	22.2
Mittelschule Elsterberg	50.4433	12.5057	643.5	19.1
Gimnazium in Toszek	50.4514	18.5163	209.1	19
Complex of Schools J. Kilinskiego in Krapkowice	50.4842	17.9581	200	21
Goethe Schule	50.5412	8.522	260	26.3

5. Land, Water, and Air

Overview: Students measure temperature change in soil, water, and air as they are exposed to the heating action of the sun.

Student Outcomes:

- Students gain an understanding of GLOBE specifications for the instrument shelter and perform a guided inquiry project.

Land, Water, and Air

Purpose

To help students understand that land and water heat and cool at different rates and that the properties of soil and water influence the heating of air above them

Overview

Students measure temperature change in soil, water and air as they are exposed to the heating action of the sun.

Student Outcomes

Students gain an understanding of GLOBE specifications for the instrument shelter and perform a guided inquiry project.

Science Concepts

Physical Science

- Heat transfer occurs by radiation, conduction, and convection.

Scientific Inquiry Abilities

- Identify answerable questions
- Design and conduct scientific investigations
- Measuring and recording data
- Develop explanations and predictions using evidence
- Communicate results and explanations
- Organizing data in tables
- Graphing
- Working effectively in groups

Time

Three to four hours total; one to two hours of actual time on task.

Level

Intermediate and advanced

Materials and Tools

(per group of students)

- Two plastic buckets at least 30 cm tall
- Centimeter ruler
- Six Thermometers
- A means to suspend thermometers over the buckets, such as string and dowels

Preparation

Arrange for an outdoor area in which to conduct the experiment. (This activity could be performed indoors by substituting a strong artificial light source for the sunlight.) This experiment gives the best results on a sunny, warm day. Divide the students into small working groups. You may want to demonstrate the activity first so that all students understand how to conduct the experiment.

Prerequisites

None

Background

One of the important reasons why we have different kinds of weather throughout the world is because land and water heat and cool at different rates.

For example, afternoon thunderstorms in Florida are often initiated by the fact that during the day the land heats up faster than the water does. (To understand more about this, students should research what causes sea breezes.) In parts of the world that experience monsoons (wind systems that reverse direction seasonally), the rainy part of the monsoon season is characterized by alternating periods of active (rainy) and non-active (not rainy) weather depending on whether the land is dry or wet.

Students may have observed a difference in the heating and cooling rates of land relative to water if they have ever run barefoot across a beach to the water in the middle of a warm, sunny afternoon. They probably remember how hot the land was and how cool and refreshing the water was. If they were at the beach until after sunset and walked barefoot across the beach to the water, they might remember that at this time of day, it is the beach that feels cool, while the water feels warm. Students can study this land/water difference with a simple experiment.

Source: www.globe.gov