

# Methods of Inquiry Based Learning exemplified with the GLOBE database and atmosphere protocols

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# Outline of this training

## 1. Introduction and motivation

- Discuss IBL and data analysis in the context of GLOBE
- Make use of the vast GLOBE database

## 2. Methods and materials

- Formulate a research question and a hypothesis
- Decide which data is needed
- Check if the data is available in the GLOBE database
  - If so: Retrieve the data from the GLOBE database
  - If not: Take the appropriate measurements
- Discuss some general data analysis procedures
- Utilize the EXCEL Workbook DataEv to analyze the data

## 3. Discussion and conclusion from the analysis

- Interpret the data and the data analysis in terms of understanding how the underlying processes work and what this means (e.g. for decision making)

## 4. Outlook

- What are the next steps needed to expand the merit of your finding?

## 5. General discussion

- What is needed by the GLOBE community to fully utilize the potential of IBL in our classrooms?

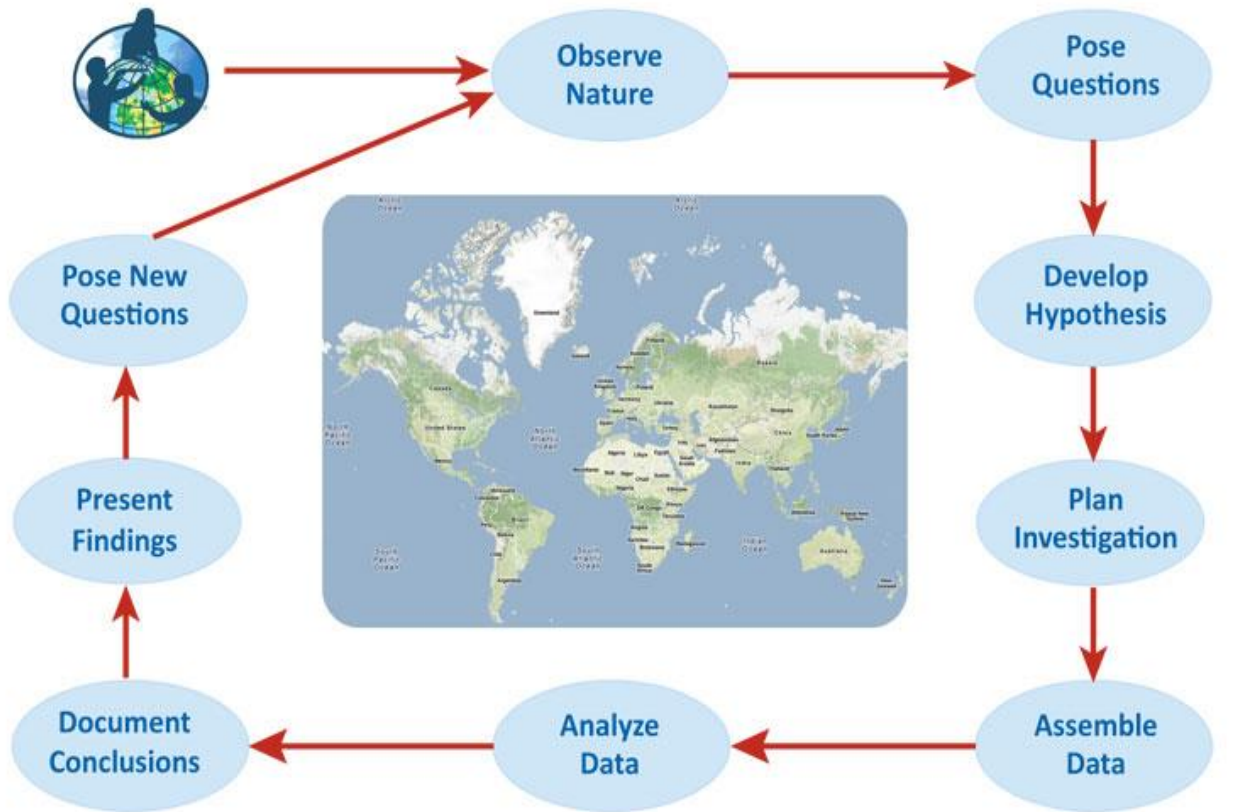
# 1. Introduction and Motivation

Schools/Members	Data	Projects	Training
Name	Data Entered	Citizen Science Data Entered	Total Data Entered
Africa	942,189	6	942,195
Asia and Pacific	1,315,950	52	1,316,002
Europe and Eurasia	46,255,415	245	46,255,660
Latin America and Caribbean	1,020,372	27	1,020,399
Near East and North Africa	787,546	6	787,552
North America	86,228,027	675	86,228,702

Schools/Members	Data	Projects	Training			
Name	Schools	Teachers	Pre-Service	Students	Alumni	Citizen Scientists
Africa	770	487	45	9,817	24	41
Asia and Pacific	2,999	1,233	350	22,861	20	431
Europe and Eurasia	4,312	2,936	220	65,020	24	996
Latin America and Caribbean	989	1,133	514	19,554	24	242
Near East and North Africa	559	501	108	33,229	8	89
North America	19,899	19,981	2,515	433,523	16	1,818

## 2. Methods and Materials

### Scientific Research Process

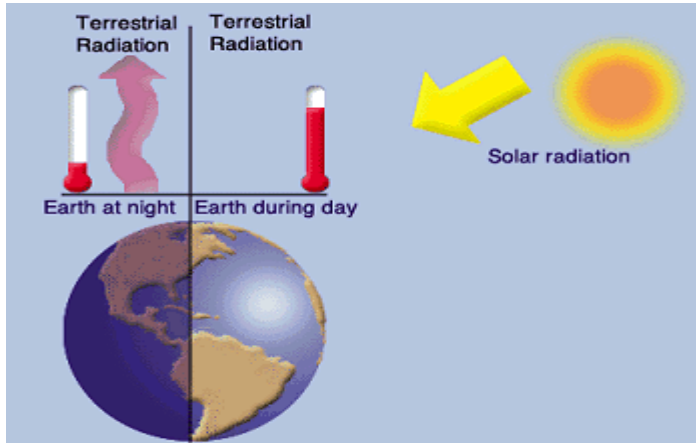


*What is the difference between surface temperature and air temperature?*

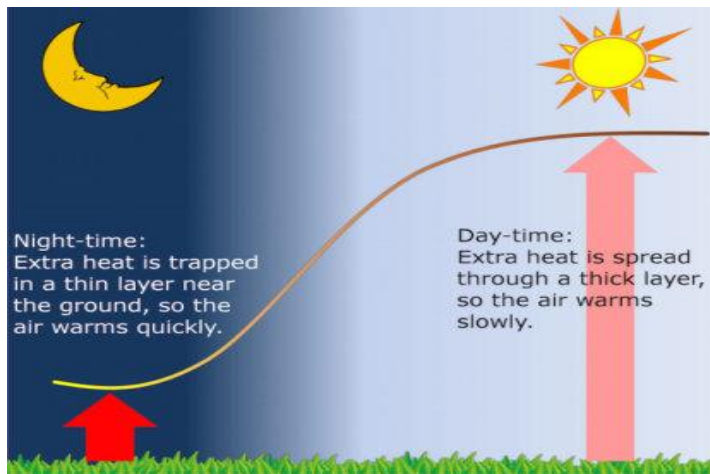
*Surface temperature has a larger annual amplitude*

*Measure surface temperature and air temperature or search GLOBE database*

# Why do we need to understand surface and air temperatures?



They both relate to the energy budget of the earth.



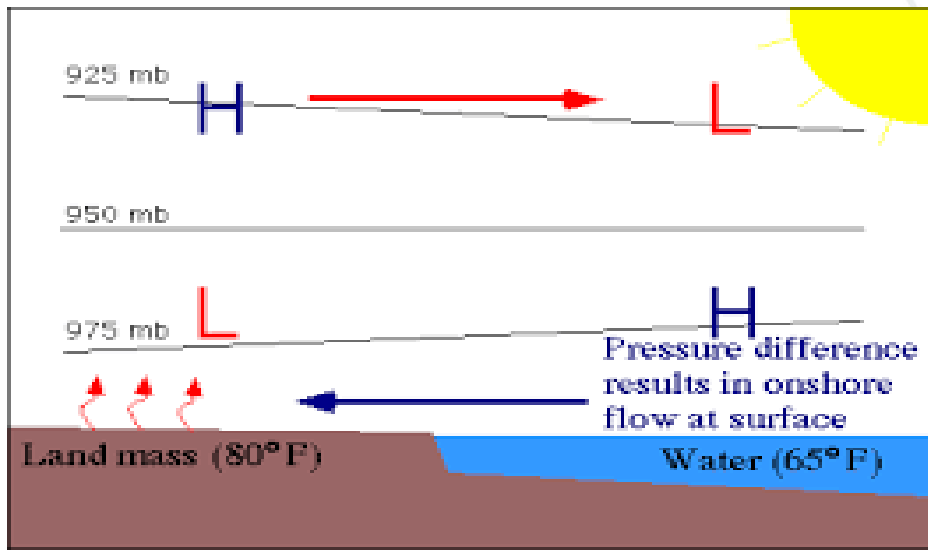
Surface temperature influences air temperature.



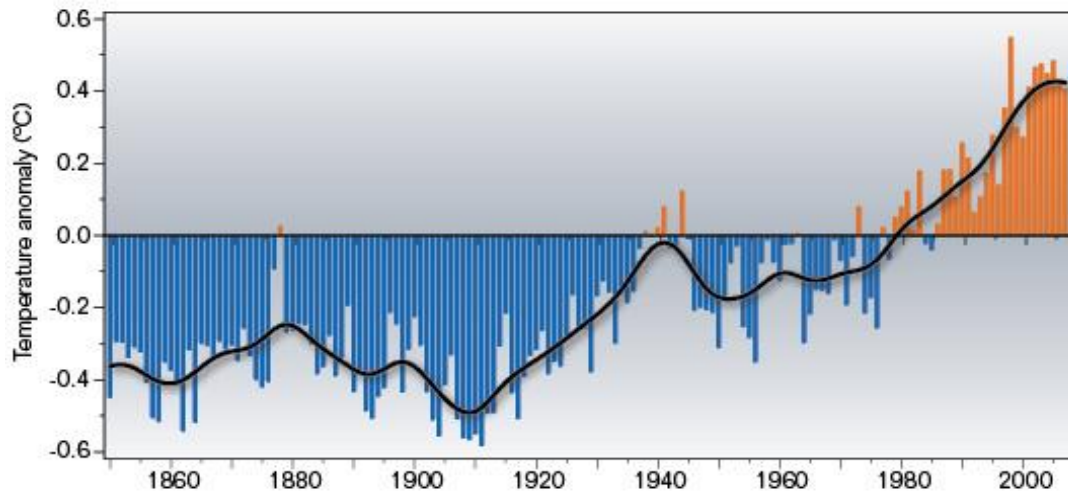
## Driving forces of air movement

- Spatial variation of **heating** on the earth's surface
  - Difference in temperature → Temp. gradient
  - Difference in pressure → Pressure gradient
- ↓
- wind systems  
(global, regional, local)

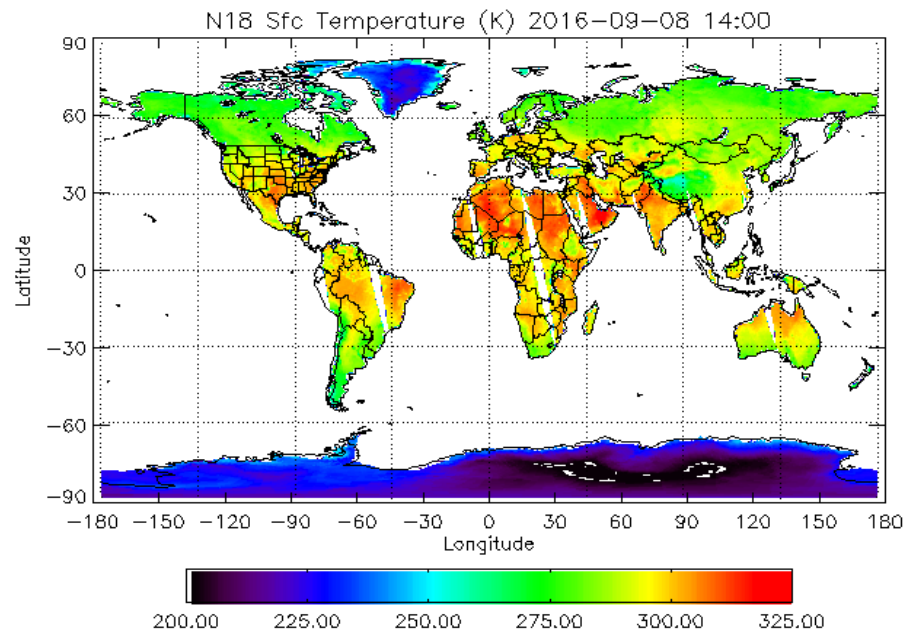
Temperature heating  
leads to wind systems



and to local circulation  
systems, e.g., sea breeze.



Air temperature is an important climate parameter

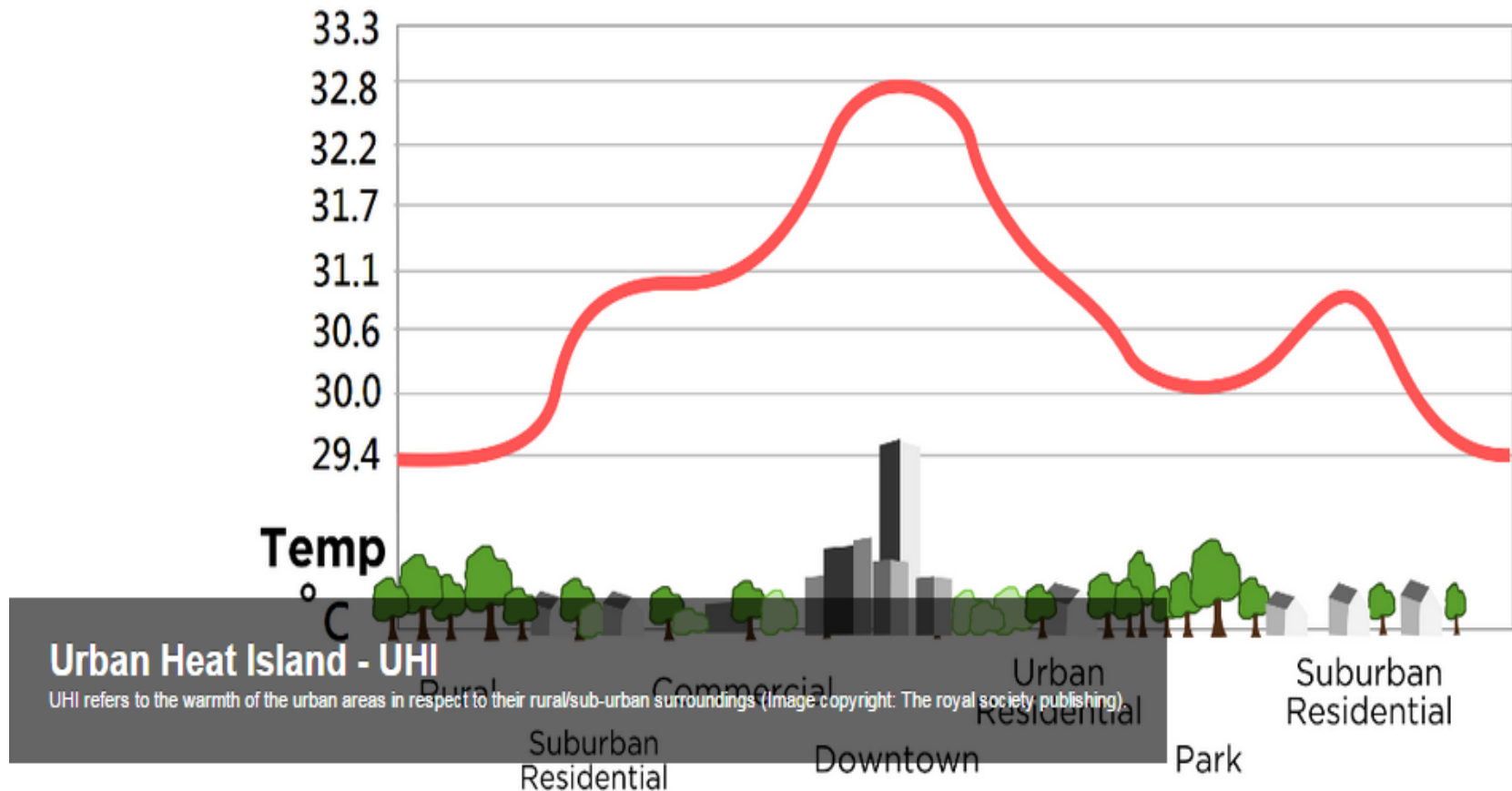


Surface temperature depends, among others, on geographic latitude and land use / land cover.

Land surface temperature 8 September 2016 (degrees K = degrees C + 273.15), at 02 and 14 hr (UTM-time), respectively. White areas are oceans or land areas without data. Map source: [NOAA](#). Please use [this](#) and [this](#) link if you want to see the original diagrams ([NOAA 18](#)) or want to check for more recent updates than shown above.

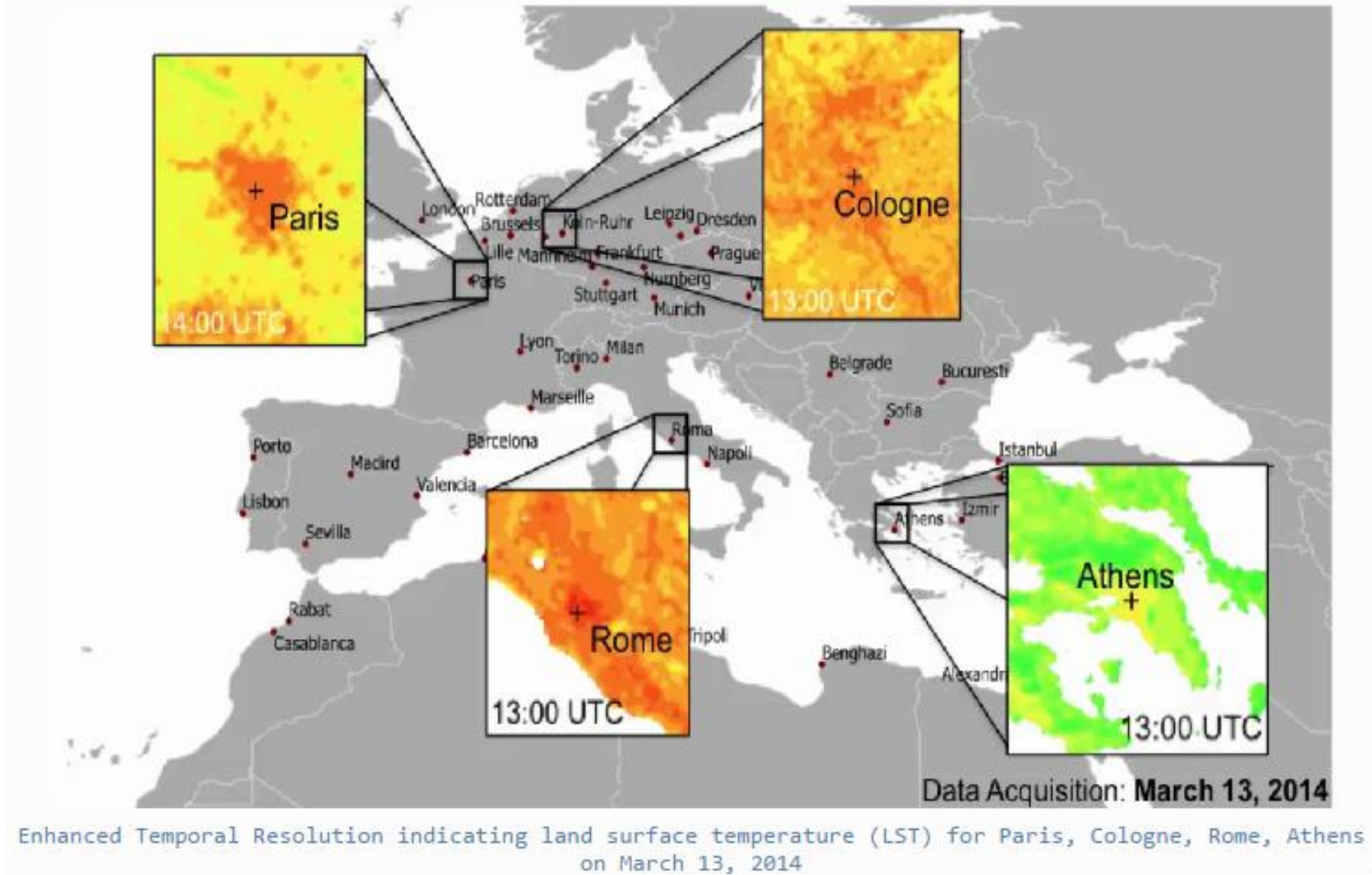
**Due to the building stock, city centers become warmer**

## URBAN HEAT ISLAND PROFILE

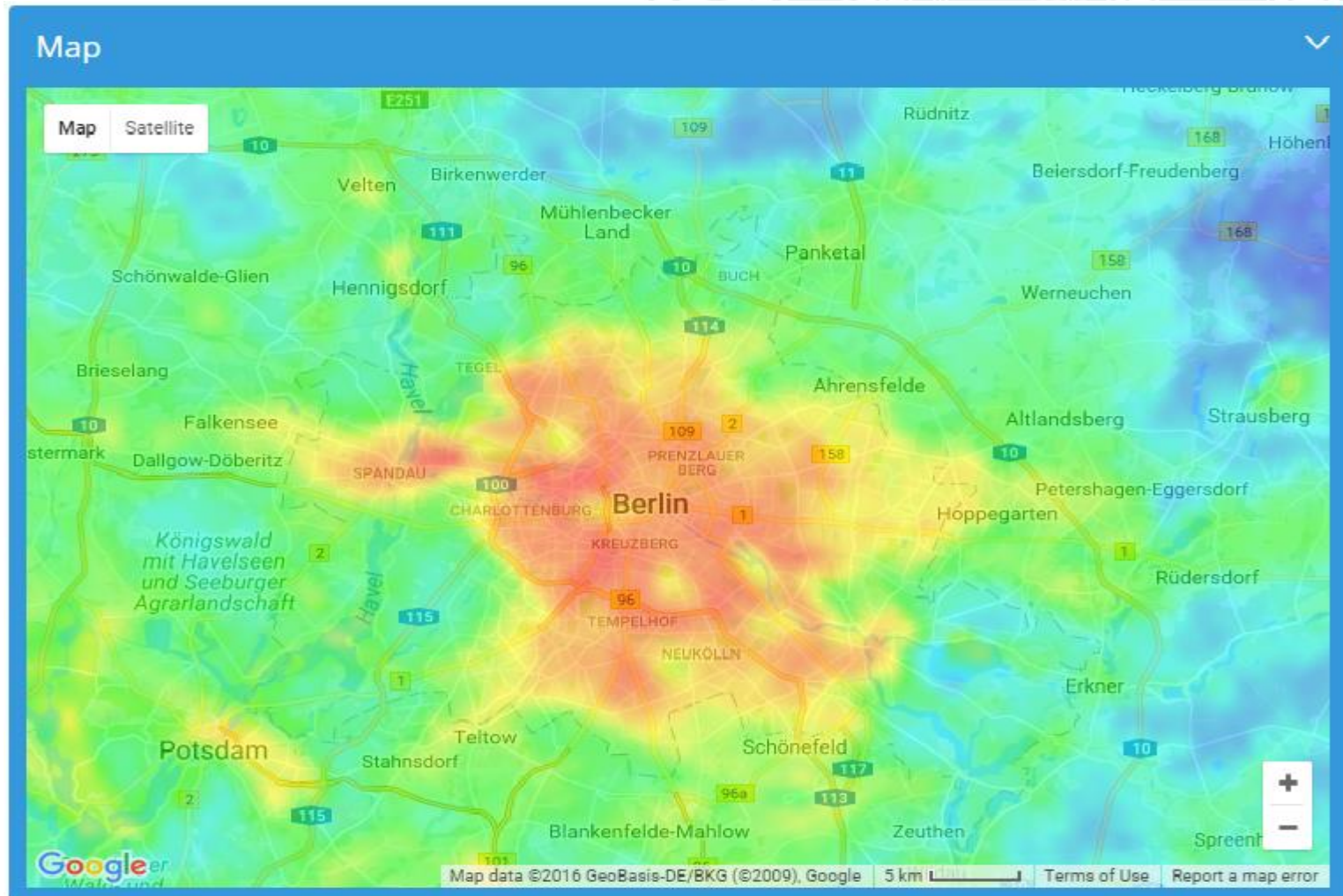




# Surface temperature maps obtained from satellite measurements show the urban heat island effect



# Surface temperature influences the urban microclimate



**To address a hypothesis, appropriate data are needed. Searching the GLOBE database is a good starting point.**

1. Which data are needed to address the hypothesis?
  - *Air temperature and surface temperature measured at the same location and time*
2. For which time frame are data needed?
  - *Sufficient measurements for each month*
3. How many measurements are needed?
  - *As many as possible but at least 5 per month*
4. From which location?
  - *No specific requirement can be drawn from the hypothesis*



# LOBE database



Q

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## Support

[◀ Home](#)

### Science Honor Roll

This tool allows you to find and retrieve GLOBE data using several different search parameters. You will be presented a summary of sites that have data available based on your search parameters. From those sites you can further refine your search and or download the data into a CSV file for detailed analysis. A summary CSV file is also available that summarizes the amount of data available for each site.

## Enter the Data Access Tool

[illegible]

# Search the GLOBE database

Browser window showing the GLOBE database search interface. The address bar displays `http://datasearch.globe.gov/`. The page title is "THE GLOBE PROGRAM Advanced Data Access Tool". The search bar contains the text "Suchen".

Navigation links: Datei, Bearbeiten, Ansicht, Chronik, Lesezeichen, Extras, Hilfe.

Language selection: Sprache auswählen.

Clear Filters | Data Last Updated: 2016-09-17 | Instructions

### Select a Filter:

**Data Filters**

- Select Protocols
- Date Range
- Data Count Range

**Site Filters**

- Site Name
- Country or State/Territory
- In proximity of a lake or river
- School or Teacher
- Elevation Range
- Lat/Long Range
- Proximity to Lat/Long

### Instructions


This tool allows you to find and retrieve GLOBE data using several different search parameters. You will be presented a summary of sites that have data available based on your search parameters. From those sites you can further refine your search and or download the data into a CSV file for detailed analysis. A summary CSV file is also available that summarizes the amount of data available for each site.

General guidelines:

- At least 1 protocol must be selected but no more than 5.
- Multiple filters are encouraged.
- Each filter type can have multiple parameters.
- The default is that all data for all sites in the site list will be included in the measurement data CSV file.
- The ability to download data for specific sites within the site list is only available when the number of sites shown is 50 or less.
- The "-" must be used for southern hemisphere latitudes and western hemisphere longitudes.

Coming soon will be abilities to save your searches.

To begin, select a filter item on the left.





# Search the GLOBE database: Select Protocols

Retrieval Data - GLOBE.gov | http://datasearch.globe.gov/ | aha-effekt - Englisch - De... | GLOBE Data Explorations | ... | 3 Ways to Take a Screensh... | +

datasearch.globe.gov

Meistbesucht | G | W | LEO | Ohi | SD | MNF | Uzk | TR | SHD | OTRS | KIS2 | BSCW | KLI | Soc | EOSDIS | LehrRM | KSTA | SOS | GK | Exk16 | UCAR

THE GLOBE PROGRAM Advanced Data Access Tool

Sprache auswählen

Clear Filters | Data Last Updated: 2016-09-17 | Instructions

Select a Filter:

- Data Filters
  - Select Protocols
  - Date Range
  - Data Count Range
- Site Filters
  - Site Name
  - Country or State/Territory
  - In proximity of a lake or river:
  - School or Teacher
  - Elevation Range
  - Lat/Long Range
  - Proximity to Lat/Long


Filter by Protocol:

(Select up to 5 protocols)

- ☒ Air Temperature Noons
- ☐ Air Temperature
- ☐ Aerosols
- ☐ Barometric Pressure Noons
- ☐ Barometric Pressures
- ☐ Clouds Noons
- ☐ Clouds
- ☐ Precipitation
- ☐ Snow Pack
- ☐ Relative Humidities Noons
- ☐ Relative Humidities
- ☒ Surface Temperature Noons
- ☐ Conductivity
- ☐ Dissolved Oxygen
- ☐ Freshwater Macroinvertebrates
- ☐ Mosquitoes
- ☐ Nitrates
- ☐ pH
- ☐ Salinity
- ☐ Water Temperature
- ☐ Water Transparency
- Pedosphere (Soil) – Soil Temperature and Moisture
  - ☐ Soil Temperature Dailies
  - ☐ Soil Temperature Noons

Add Protocols

# Search the GLOBE database: Download Summary Data

 THE GLOBE PROGRAM Advanced Data Access Tool Sprache auswählen Powered by Google Google Übersetzer

[Clear Filters](#) Data Last Updated: 2016-09-17 [Instructions](#)

Select a Filter:

**Data Filters**

- [Select Protocols](#)
- ☒ Air Temperature Noons
- ☒ Surface Temperature Noons

[Date Range](#)

[Data Count Range](#)

**Site Filters**

- [Site Name](#)
- [Country or State/Territory](#)
- [In proximity of a lake or river:](#)
- [School or Teacher](#)


**9196 Sites Found**

[Obtain Measurement Data](#) [Download Summary Data](#)

School Name	Site Name	Location	Latitude	Longitude	Elevation
13th and 21st Primary School of Keratsini	School Location:ATM-01		37.9522	23.6133	35
1st Gymnasium of Preveza	School Location:ATM-01		38.9533	20.752	15
1st Gymnasium of Xanthi	School Location:ATM-01		41.133	24.8847	50
1st Lyceum of Haidari	School Location:ATM-01		38.0098	23.6595	120
2nd Gymnasium of Agia Paraskevi	School Location:ATM-01		38.003	23.8245	210
3rd Gymnasium of Sparti	School Location:ATM-01		37.0677	22.4247	207
3rd Lyceum of Agaleo	School Location (U-tube):ATM-01		37.9915	23.6752	40
3rd Lyceum of Agaleo			37.9915	23.6752	40
3rd Lyceum of Agaleo			37.59214	23.4056	-1.3
3.zakladni skola			49.683	13.9915	544
4. Zakladni Skola - Ek			50.4387	15.3523	868
56. Mittelschule Leipz			51	11	181
5th Gymnasium of Fa			37.9365	23.696	12
5th Gymnasium of Ni			37.9823	23.6293	100
60. Grundschule			51.164	12.184	86.8
6th Gymnasium of Vo					
#78 Minnie Hartmann					
7th Lyceum of Lariss					
94. Mittelschule					
Abae Thar Secondary					
Abbas El Akkad					
Abbott Loop Elemen					
ABC Elementary Scho					
Abd-Elmaleed Bin Ab					
Abd-Elmaleed Bin Abd-Alaziz Secondary School at Al-M Mohand Al Sarani:ATM-02					

Öffnen von GlobeSummaryData.csv

Sie möchten folgende Datei öffnen:

 **GlobeSummaryData.csv**

Vom Typ: Text Document  
Von: http://vis.globe.gov

Wie soll Firefox mit dieser Datei verfahren?

☐ Öffnen mit UltraEdit Professional Text/Hex Editor (Stand...)

☒ Datei speichern

☐ Für Dateien dieses Typs immer diese Aktion ausführen

[OK](#) [Abbrechen](#)

**Save file and import to spreadsheet**

# Search the GLOBE database:

## Find the station with the most surface temperature data

The image displays a search for a station in the GLOBE database. On the left, an Excel spreadsheet titled 'Data Summay SST Airtemp.xlsx' is open, showing a table with columns 'Site Id' and 'School N'. The table lists several schools, with 'Kilingi-Nõmme Gümnaasium' (Site Id 3363) highlighted in row 1145. On the right, a Google Maps interface shows a map of Europe with a red pin marking 'Kilingi-Nõmme Gümnaasium' in Estonia. A sidebar on the left of the map provides details about the school, including a photo, name, and contact information.

Site Id	School N
1145	3363 Kilingi-Nõmme Gümnaasium
1188	3386 Kilingi-Nõmme Gümnaasium
1210	5098 OS Hugo
1421	11378 Gimnazium
1436	11377 Gimnazium
1549	11379 Gimnazium
1576	11376 Gimnazium
1667	13749 Waterloo
1824	27841 Main Street
1828	33279 Chia-Yi G
1888	13111 As-Siddiq
2073	27403 Rockhill E
2101	27404 Rockhill E
2205	27840 Main Street
2225	35139 Houjia Ju
2310	8960 Dr Ibrahim
2369	12483 Shafi'i Ed
2394	5443 XV, Gimn

**Kilingi-Nõmme Gümnaasium**  
3 Berichte  
Weiterführende Schule

Speichern | In der Nähe | An mein Smartphone senden | Teilen

Sambila 18, Kilingi-Nõmme, 86304 Pärnu maakond, Estland  
kilingi.edu.ee  
+372 449 2264  
Als Inhaber eintragen  
Änderung vorschlagen  
Labels hinzufügen

# Search the GLOBE database

THE GLOBE PROGRAM Advanced Data Access Tool

Clear Filters Data Last Updated: 2016-09-17 Instructions

**4356 Sites Found**

Obtain Measurement Data Download Summary Data

Select a Filter:

Data Filters

Select Protocols

X Air Temperature Noons

X Surface Temperature Noons

Date Range

X 2006-01-01 to 2016-09-17

Data Count Range

Site Filters

Site Name

Country or State/Territory

In proximity of a lake or river:

School or Teacher

Elevation Range

Lat/Long Range

Filter by School or Teacher:

School

School Name:

Killing-Nomme Gymnasium

Add to Filter

School Name	Site Name	Location	Latitude	Longitude	Elevation
3rd Lyceum of Aigaleo	School Location (U-tube):ATM-01		37.9915	23.6752	40
3rd Lyceum of Aigaleo	Sportsground:ATM-03		37.59214	23.4056	-1.3
4. Zakladni Skola - Ekolog. Praktikum	School Location:ATM-01		50.4387	15.3523	868
56. Mittelschule Leipzig	Kleiner Schulhof:ATM-01		51	11	181
60. Grundschule	1. Adresse:ATM-01	Leipzig, ST, Germany	51.164	12.184	86.8
94. Mittelschule	94. Mittelschule:ATM-01		51.346	12.387	67.6
Abae Thar Secondary School at Buraydah	1:ATM-01		26.2	44.1	628.1
ABC Elementary School	Atmosphere shelter:ATM-02	Alberta, AL, United States	32.19196	-82.38009	112.8
Abd-Elmajeed Bin Abd-Alaziz Secondary School at Al-M ALI:ATM-01			24.2434	39.3141	666
Abd-Elmajeed Bin Abd-Alaziz Secondary School at Al-M Mohand AL Sarani:ATM-02			24.604	39.408	630.6
Abd-Elmajeed Bin Abd-Alaziz Secondary School at Al-M ALI1:SMS-01			24.2434	39.3141	666
Abd-Elmajeed Bin Abd-Alaziz Secondary School at Al-M mohand:SMS-02			24.2434	39.3141	666
Abd-Elmajeed Bin Abd-Alaziz Secondary School at Al-M ????:SMS-03			24.2499	39.3334	630.9
Abdullah Bin Salam Secondary School at Al-Ahsa	مدرسة عبدالله بن سلام دراسة الغلاف الجوي		25.4524	49.59444	150
Abdullah Bin Massud Secondary School at Sabt Al Alay: Abdullah Bin Massud Secondary School:ATM-01			19.58186	41.96425	1983.5
Abdullah Bin Omar Intermediate School at Al-Namas	namas		19.07	42.07	2500
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.47	46.36	625.2
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			31.19	34.51	406
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			33.49	-88.32	95
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			-35.0783	138.5951	241
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			36.7126	-82.0174	640
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			36.7126	-82.0174	672.1
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.2728	39.3937	635
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.263	39.3858	631
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.285	39.3754	635
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.277	39.3945	635
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.2856	39.373	635
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.2728	39.3658	619
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.2728	39.3937	627
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			24.46667	39.6	608
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			18.4651	-66.0876	0
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			25	84	153.3
Abdulrahman Bin Alharith Intermediate School at Riyac 111:ATM-01			28.618	77.1048	316.1



THE GLOBE PROGRAM Advanced Data Access Tool

Clear Filters Data Last Updated: 2016-09-17

3 Sites Found

<input checked="" type="checkbox"/>	School Name	Site Name	Location	Latitude	Longitude
<input checked="" type="checkbox"/>	Kilingi-Nomme Gymnasium	School Location:ATM-01		58.1432	24.9428
<input checked="" type="checkbox"/>	Kilingi-Nomme Gymnasium	-KohaNimi:ATM-02		58.1333	24.9428
<input checked="" type="checkbox"/>	Kilingi-Nomme Gymnasium	School Location:SMS-01		58.1432	24.9428

Download Measurement Data (4907) Download Summary Data

Select a Filter:

Data Filters

Select Protocols

X Air Temperature Noons

X Surface Temperature Noons

Date Range

X 2006-01-01 to 2016-09-17

Data Count Range

Site Filters

Site Name

Country or State/Territory

In proximity of a lake or river:

School or Teacher

X Kilingi-Nomme Gymnasium

Elevation Range

Lat/Long Range

Ready for Download

Öffnen von GLOBEMeasurementData-1424.zip

Sie möchten folgende Datei öffnen:

**GLOBEMeasurementData-1424.zip**

Vom Typ: Compressed (zipped) Folder

Von: http://assets.globe.gov

Wie soll Firefox mit dieser Datei verfahren?

☐ Öffnen mit Windows-Explorer (Standard)

☒ Datei speichern

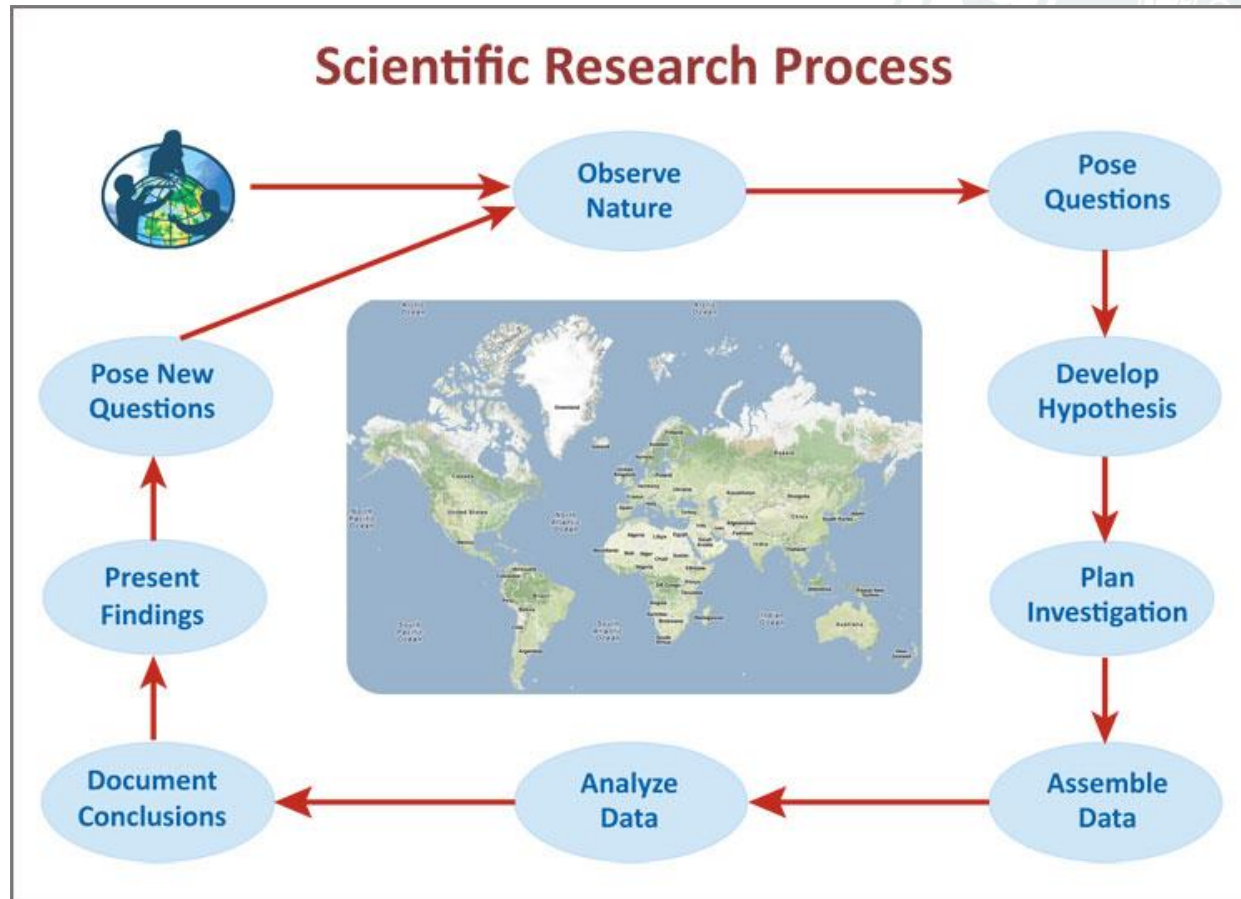
☐ Für Dateien dieses Typs immer diese Aktion ausführen

OK Abbrechen



# 2. Methods and Materials:

## Step 1: Retrieve data



*What is the difference between surface temperature and air temperature?*

*The surface temperature has a larger annual amplitude*

*Measure surface temperature and air temperature or search GLOBE database*

*Retrieve the data and transfer them into a form suitable for analysis*

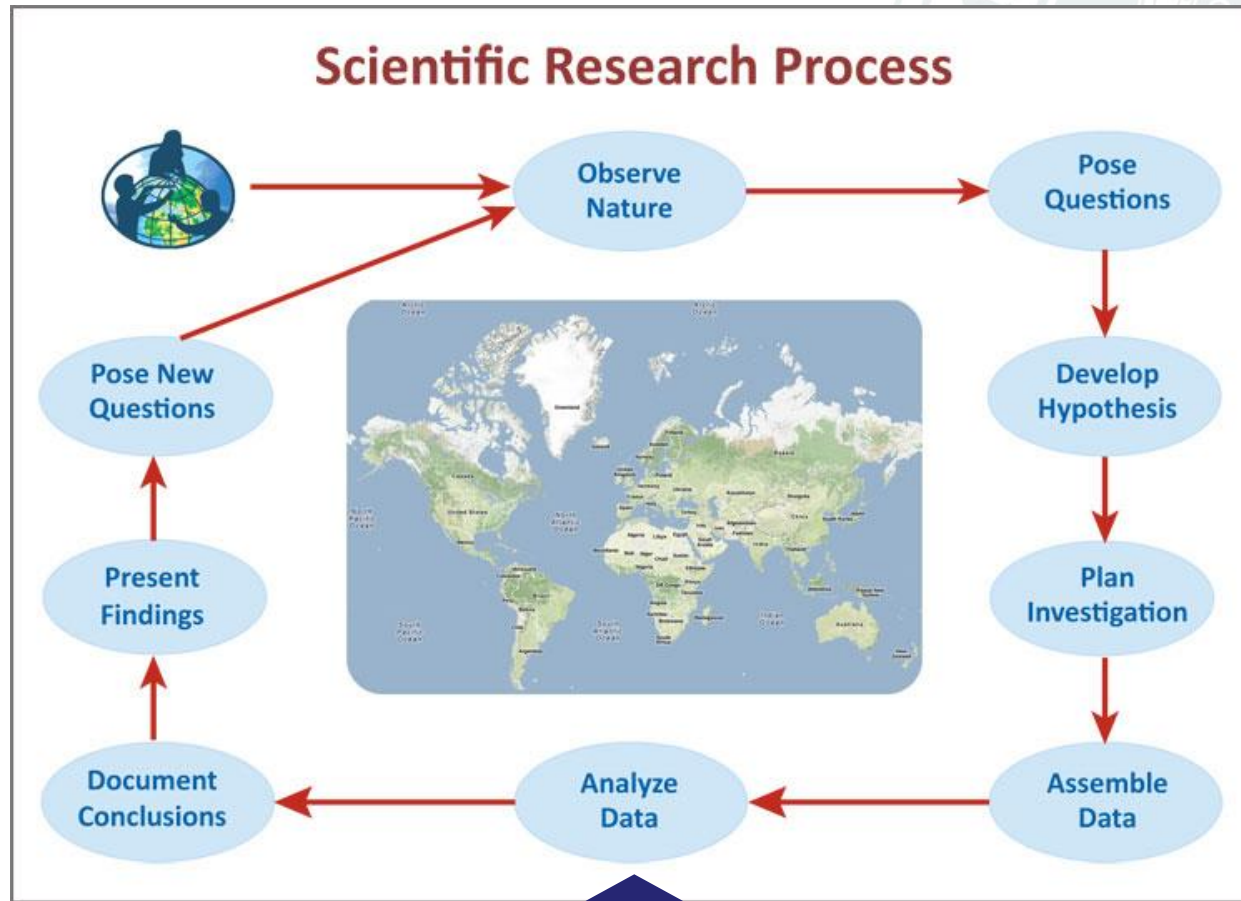
# Unzip the file and import the data to a new workbook

There are several ways to import data to an Excel workbook, a simple method is:

1. Open the data file with an editor (e.g. Editor)
2. Replace all Commas (,) with TAB (Tab is typically the cell delimiter in EXCEL)
3. If needed: Replace all decimal separators according to your country settings (e.g., in English the decimal separator is “.”, in German it is “,”)
4. Select all data: CTRL-a
5. Copy all: CTRL-C
6. Open new Excel workbook
7. Paste all: CTRL-P
8. Save the new workbook

# 2. Methods and Materials

## Step 2: Analyze the data



*What is the difference between surface temperature and air temperature?*

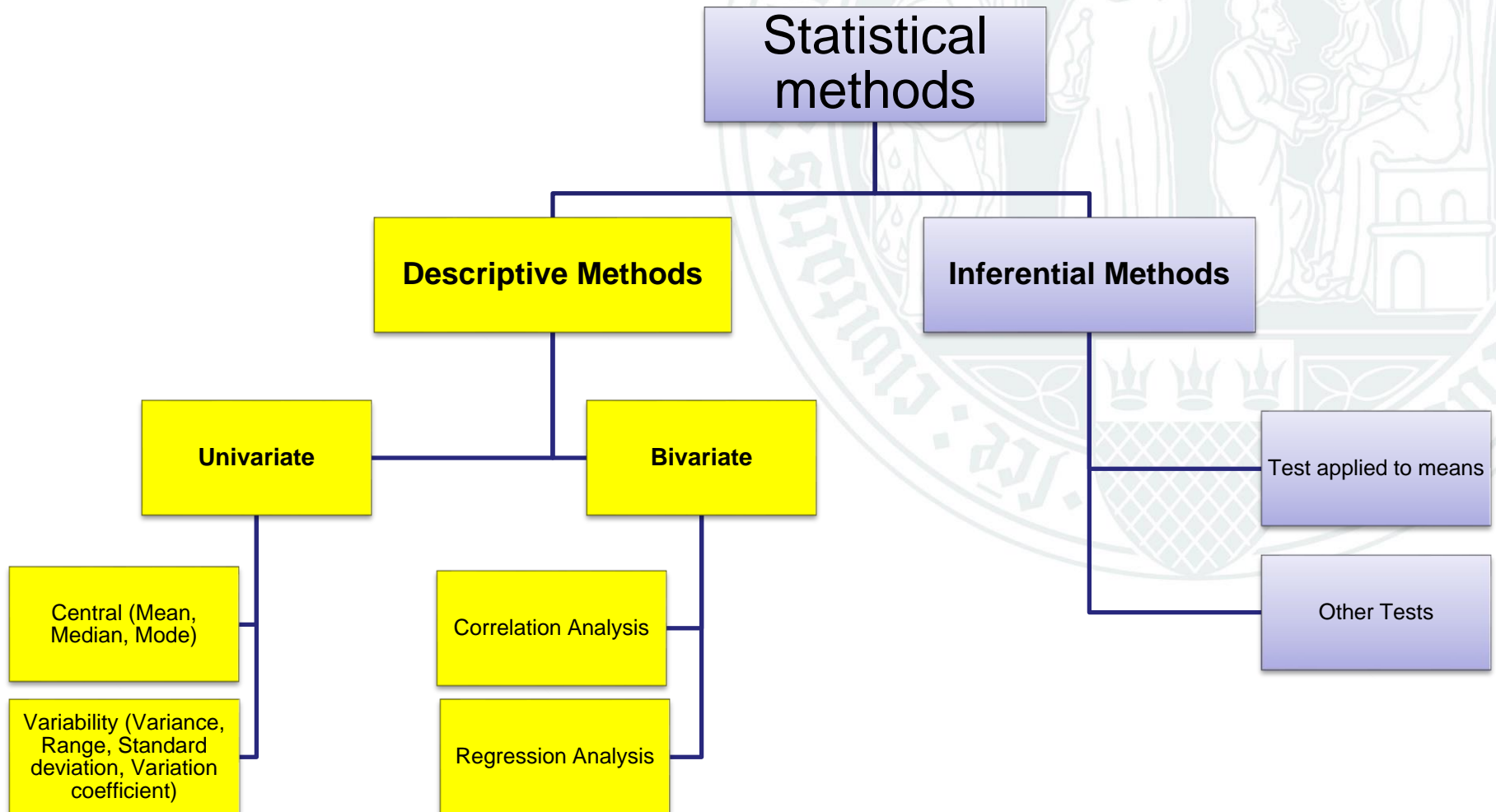
*The surface temperature has a larger annual amplitude*

*Measure surface temperature and air temperature or search GLOBE database*

*Retrieve the data and transfer them into a form suitable for analysis*

*Select the suitable, graphical, tabular, and statistical analyses*

# A short overview about statistical analysis methods





# Types of data

- **Nominal** - Categorical variables with **no inherent order or ranking** sequence such as names or classes (e.g., land use classes). Value may be a numerical, but without numerical value (e.g., I, II, III). The only operation that can be applied to nominal variables is enumeration.
- **Ordinal** - Variables with an inherent rank or order, e.g., mild, moderate, severe (e.g., dry, normal, wet). Can be compared for equality, or greater or less, but not *how much* greater or less.
- **Interval** - Values of the variable are ordered as in ordinal, and additionally, differences between values are meaningful. However, the scale is not absolutely anchored. (e.g., calendar dates or temperatures in Fahrenheit or Celsius). Addition and subtraction, but not multiplication and division are meaningful operations.
- **Ratio** - Variables with all properties of the interval type plus an absolute, non-arbitrary zero point, e.g., age, weight, temperature (Kelvin). Addition, subtraction, multiplication, and division are all meaningful operations.



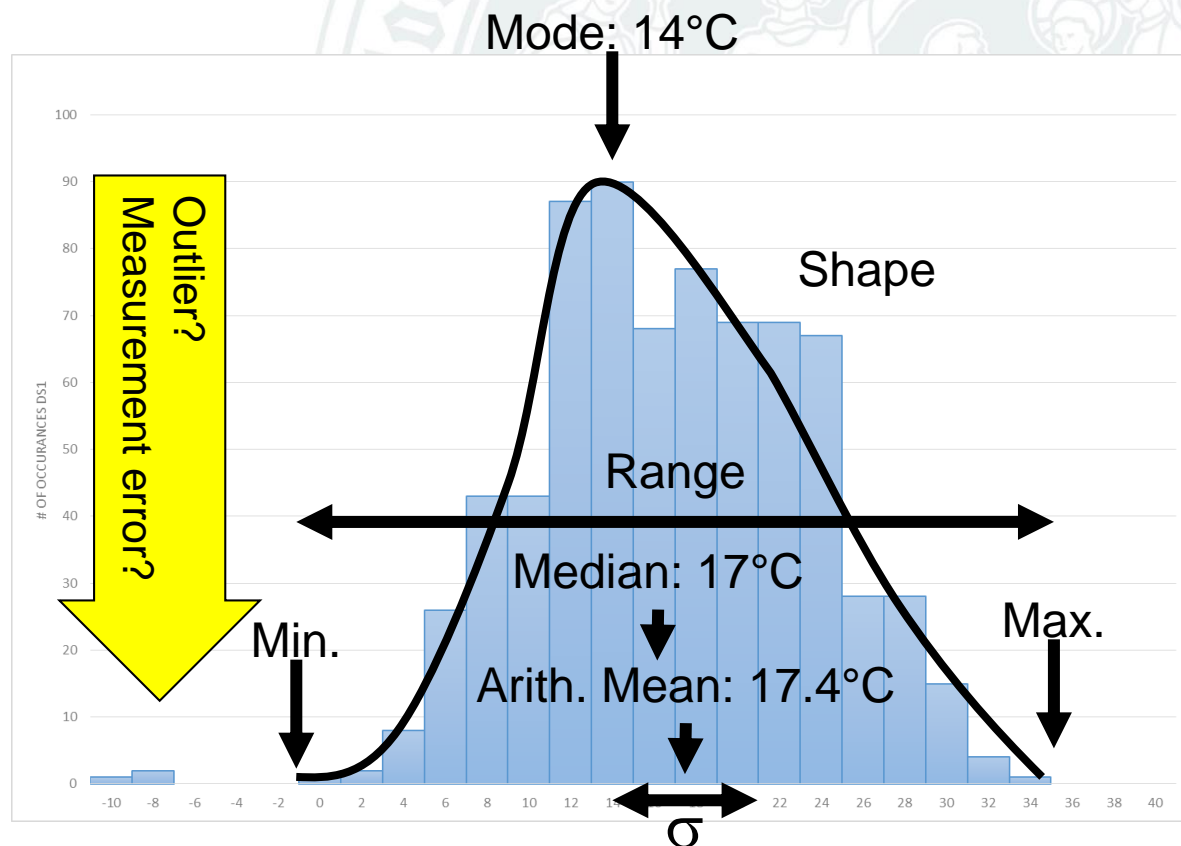
# Basic Data Analyses:

## Univariate Descriptive Statistics

Air Temp [°C] - # of Occurrences

Set 1	DS1
-10	1
-8	2
-6	0
-4	0
-2	0
0	1
2	2
4	8
6	26
8	43
10	43
12	87
14	90
16	68
18	77
20	69
22	69
24	67
26	28
28	28
30	15
32	4
34	1
36	0

Numerical  
presentation



Graphical  
presentation

# Basic Data Analyses:

## Bivariate Descriptive Statistics

Regression analysis basic idea:

- Identify relationships among variables and use these relationships to make predictions.

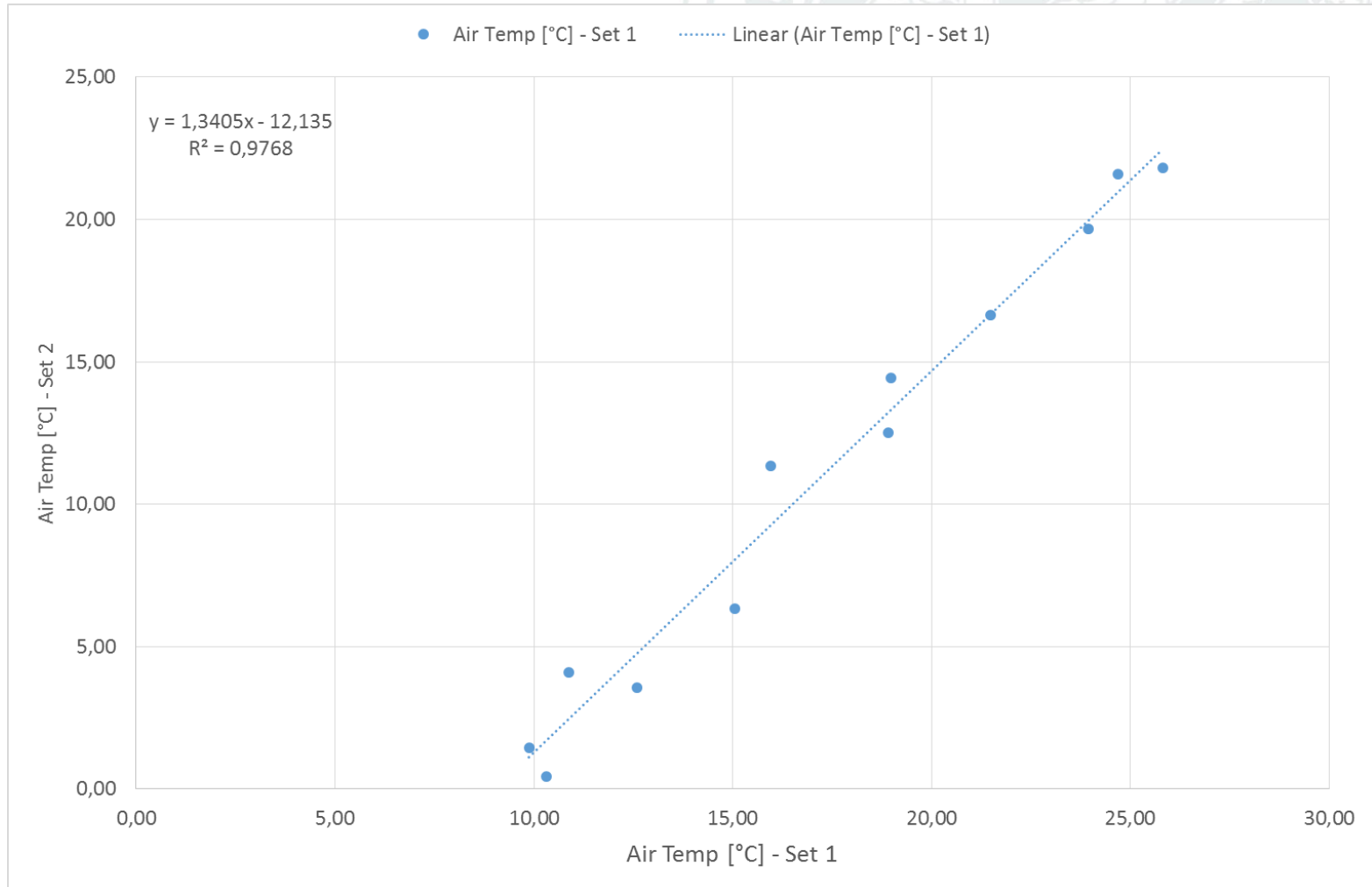
Linear regression:

- Linear dependence: constant rate of increase of one variable with respect to another (as opposed to, e.g., diminishing returns).
- Regression analysis describes the relationship between two (or more) variables.

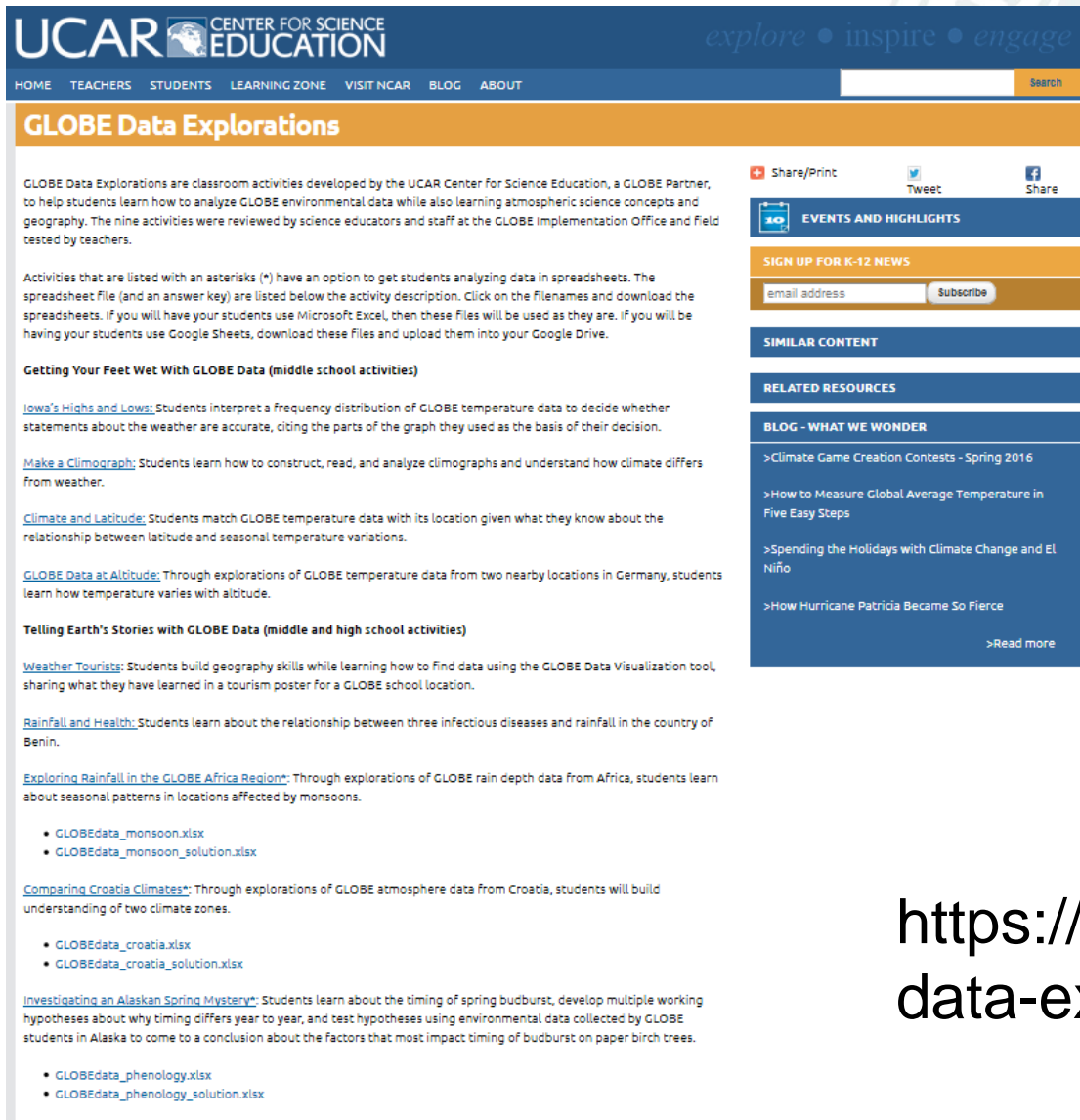
2 main purposes:

- Prediction and Forecasting
- Quantifying causality

# Example of a regression analysis: here linear regression



# Helpful materials for GLOBE data analysis



UCAR CENTER FOR SCIENCE EDUCATION

explore • inspire • engage

HOME TEACHERS STUDENTS LEARNING ZONE VISIT NCAR BLOG ABOUT

**GLOBE Data Explorations**

GLOBE Data Explorations are classroom activities developed by the UCAR Center for Science Education, a GLOBE Partner, to help students learn how to analyze GLOBE environmental data while also learning atmospheric science concepts and geography. The nine activities were reviewed by science educators and staff at the GLOBE Implementation Office and Field tested by teachers.

Activities that are listed with an asterisks (\*) have an option to get students analyzing data in spreadsheets. The spreadsheet file (and an answer key) are listed below the activity description. Click on the filenames and download the spreadsheets. If you will have your students use Microsoft Excel, then these files will be used as they are. If you will be having your students use Google Sheets, download these files and upload them into your Google Drive.

**Getting Your Feet Wet With GLOBE Data (middle school activities)**

Iowa's Highs and Lows: Students interpret a frequency distribution of GLOBE temperature data to decide whether statements about the weather are accurate, citing the parts of the graph they used as the basis of their decision.

Make a Climograph: Students learn how to construct, read, and analyze climographs and understand how climate differs from weather.

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

GLOBE Data at Altitude: Through explorations of GLOBE temperature data from two nearby locations in Germany, students learn how temperature varies with altitude.

**Telling Earth's Stories with GLOBE Data (middle and high school activities)**

Weather Tourists: Students build geography skills while learning how to find data using the GLOBE Data Visualization tool, sharing what they have learned in a tourism poster for a GLOBE school location.

Rainfall and Health: Students learn about the relationship between three infectious diseases and rainfall in the country of Benin.

Exploring Rainfall in the GLOBE Africa Region: Through explorations of GLOBE rain depth data from Africa, students learn about seasonal patterns in locations affected by monsoons.

- GLOBEdata\_monsoon.xlsx
- GLOBEdata\_monsoon\_solution.xlsx

Comparing Croatia Climates: Through explorations of GLOBE atmosphere data from Croatia, students will build understanding of two climate zones.

- GLOBEdata\_croatia.xlsx
- GLOBEdata\_croatia\_solution.xlsx

Investigating an Alaskan Spring Mystery: Students learn about the timing of spring budburst, develop multiple working hypotheses about why timing differs year to year, and test hypotheses using environmental data collected by GLOBE students in Alaska to come to a conclusion about the factors that most impact timing of budburst on paper birch trees.

- GLOBEdata\_phenology.xlsx
- GLOBEdata\_phenology\_solution.xlsx

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- >Climate Game Creation Contests - Spring 2016
- >How to Measure Global Average Temperature in Five Easy Steps
- >Spending the Holidays with Climate Change and El Niño
- >How Hurricane Patricia Became So Fierce

>Read more

<https://scied.ucar.edu/globe-data-explorations>

# Helpful materials for GLOBE data analysis

## Comparing Croatia Climates: A GLOBE Data Exploration



Comparing Croatia Climates  
Student Activity Sheet A

Name \_\_\_\_\_



Comparing Croatia Climates  
Student Activity Sheet E



Comparing Croatia Climates  
Climate Zone Chart

### Purpose

Through explorations of GLOBE atmosphere data from Croatia, students will build an understanding of two climate zones.

### Overview

Students compare data from a coastal location in Croatia to explore the relationship between climate and location. Then they explore the world map of Köppen-Geiger climate classification to see what other regions have similar climate locations.

### Student Outcomes

Students will be able to:

- Summarize different climate zones with summary data.
- Classify the climate based on the climate evidence.
- Compare the climate data to see why two locations have different climates.

### Science Concepts

- Earth System
- Weather and Climate
- Seasons
- Weather can be measured quantitatively
- Weather changes over time

### Prerequisites

Students with some experience with computer-based data analysis will have a greater ease with the software.

GLOBE® 2016



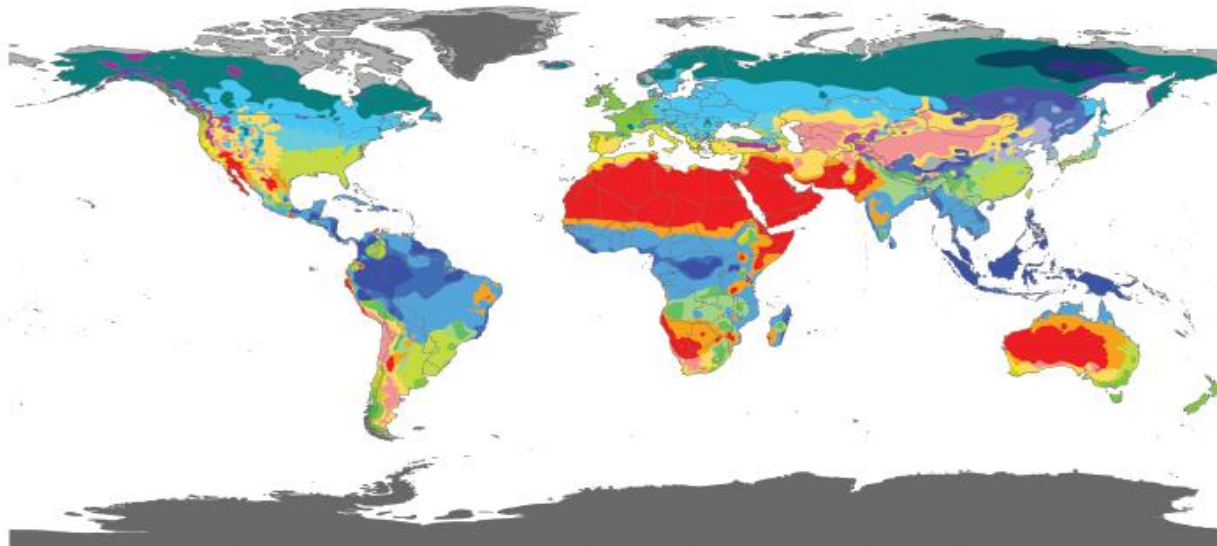
In this activity you will classify the climate based on five years (2002-2006) in two locations. Note that climate zones are based upon temperature and mean precipitation for both locations over five years.

Location 1 \_\_\_\_\_

What's the climate? \_\_\_\_\_

What's the Climate Zone? \_\_\_\_\_

World map of Köppen-Geiger climate classification



Tropical (A)			Dry (B)			Temperate (C)			Continental (D)			Polar Alpine (E)	
Af	BWh	Csa	BWk	Csb	Cwa	Dsa	Dsb	Dwa	Dfa	ET	EF		
Am	BSh	Cwb	BSk	Cwc	Cfb	Dsb	Dwb	Dwb	Dfb				
Aw		Cfc			Cfc	Dsc	Dwc	Dwc	Dfc				
						Dsd	Dwd	Dwd	Dfd				

Contact : Murray C. Peel (mpeel@unimelb.edu.au) for further information

DATA SOURCE : GHCN v2.0 station data  
Temperature (N = 4,844) and  
Precipitation (N = 12,396)

PERIOD OF RECORD : All available

MIN LENGTH : ≥30 for each month.

RESOLUTION : 0.1 degree lat/long

START

Does the location have an average temperature of more than 18°C?

YES

The region has a Tropical Climate (A).

Is the precipitation more than 30% of the average precipitation between April and October?

YES

The region has a Temperate Climate (C).

For color version, visit: [scied.ucar.edu/climate\\_classification](http://scied.ucar.edu/climate_classification)

Courtesy of Peel et al (2007)



# Prepare your data evaluation workbook DataEv.xlsx

## Step 1: Import the data

1. Open the workbook “DataEv”
2. Activate worksheet “DS1” by clicking on the tab in the lower left
3. Delete all data in this worksheet by clicking on Cell A1 and select all cells with CTRL-A, and DEL
4. Open the new workbook containing your data
5. Select all data in your new workbook: CTRL-a
6. Copy the data: CTRL-c
7. Activate cell A1 in worksheet “DS1”
8. Copy the your data into worksheet “DS1”: CTRL-v
9. If you need data from another station repeat the same for worksheet “DS2”

# Prepare your data evaluation workbook DataEv.xlsx

## Step 2: Select your data and adjust the settings

1. Activate worksheet “Main”
2. Enter in cell B1 the worksheet name containing your first dataset (this is “DS1” or “DS2”)
3. Enter in cell C1 the worksheet name containing your second dataset (this is “DS1” or “DS2”). If both data sets are in one sheet, enter the same name twice
4. Enter the column indicator (cell B6 and C6) containing the **date** in “DS1” and/or “DS2”. Typically this is column F
5. Enter the column indicator (cell B7 and C7) containing the **data** in “DS1” and/or “DS2”.
6. Enter the start date for data set 1 and data set 2 (Cells B8 / C8)
7. Enter the end date for data set 1 and data set 2 (Cells B9 / C9) and check if the number of day in cells E10 and E11 is correct
8. Enter the y-axis titles describing your data set 1 and your data set 2 (Cells B10 / C10)

Note: The worksheets “Main”, “Stat” and “Hist” are protected to avoid accidental changes to the equations. You can remove the protection of the workbook by using the password “GLOBE”

# Prepare your data evaluation workbook DataEv.xlsx

## Step 3: Select setting for the histograms

1. Select the start value, step width and end value for the histograms
2. Enter the appropriate data in cells F3 to G5 resp.
3. To enter suitable data, take note of the minimum and maximum values for data set 1 and data set 2 as shown in cells F7 to G8 resp.
4. Enter in cell C1 the worksheet name containing your second dataset (this is “DS1” or “DS2”). If both data sets are in one sheet, enter the same name twice
5. Enter the column indicator (cell B6 and C6) containing the **date** in “DS1” and/or “DS2”. Typically this is column F
6. Enter the column indicator (cell B7 and C7) containing the **data** in “DS1” and/or “DS2”.
7. Enter the start date for data set 1 and data set 2 (Cells B8 / C8)
8. Enter the end date for data set 1 and data set 2 (Cells B9 / C9)
9. Enter the y-axis titles describing your data set 1 and your data set 2 (Cells B10 / C10)

# Look at the data analysis and diagrams

## Step 4a: Statistics, histograms and diagrams

1. Check the mean monthly statistics provided in worksheet “Stat”
2. Cells A5 to E16 contain monthly mean values for the whole period and each month and for all data
3. Cells A20 and down contain mean monthly statistics for each month of each year (The time range can be extended by selecting the last few rows and dragging them downward using the lower right corner of your selection as a handle)
4. Interpret the statistics
5. The Histogram values for the two data sets are give in worksheet “Hist”. These data are used to produce the graphs in Histogram1, Histogram2 and Histo-Comp (for histogram comparison)
6. Diagram CompareDay shows data set 1 and data set 2 as a time series plotted to two Y-Axes. Here the daily values from the sheet “Main” are plotted

Note: The scale of all axes is set automatically. Thus both Y-Axes might be scaled differently although they may contain the same type of data.

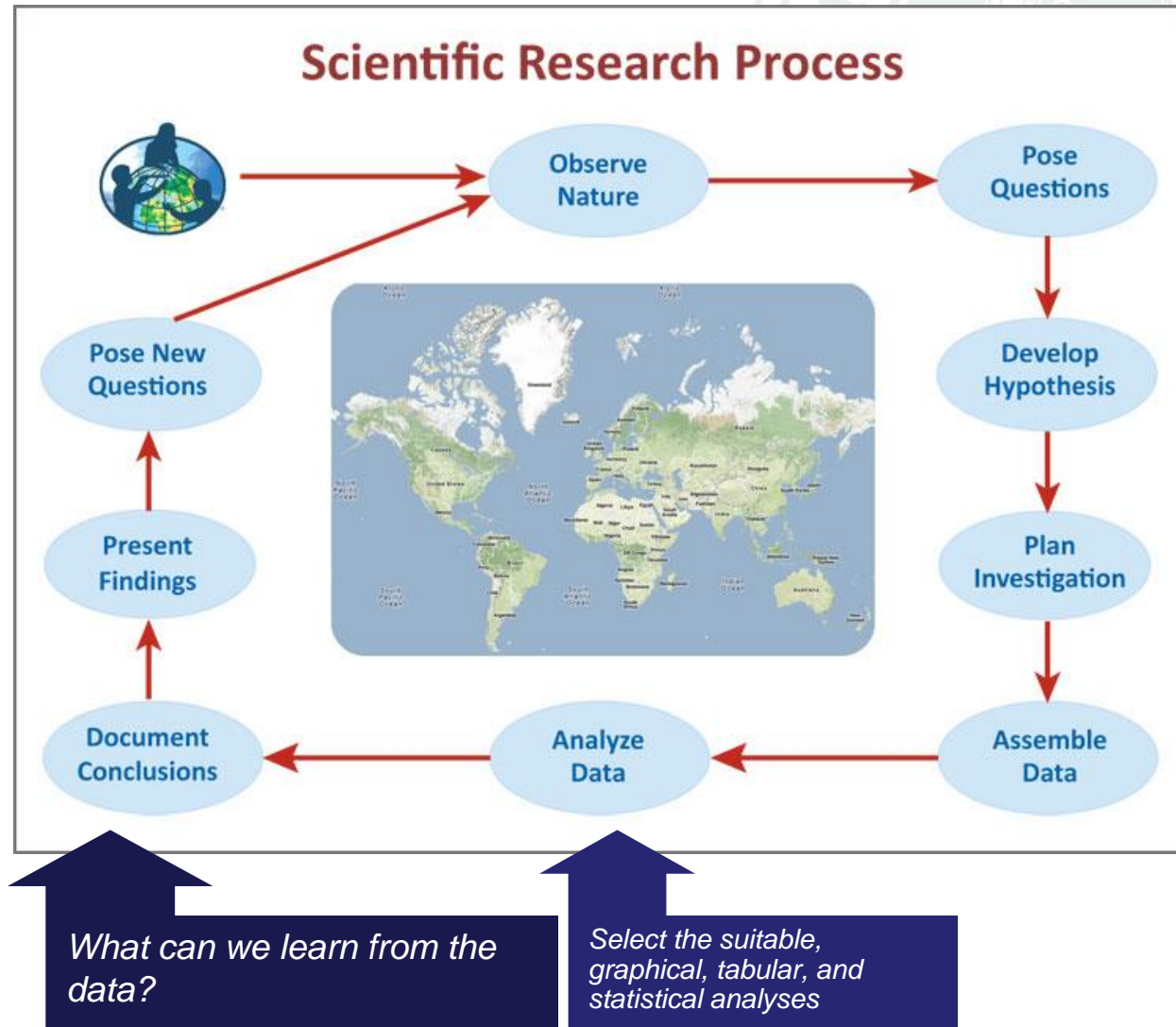


# Look at the data analysis and diagrams

## Step 4b: Statistics, histograms and diagrams

7. Diagram CompareMon is the same as CompareDay only that the monthly means taken from “Stat” range D4:E15 are used.
8. Diagram RelateDay shows a relationship between data set 1 and data set 2 by plotting data set 1 on the x-axis and data set 2 on the y-axis. A linear regression is added to this plot. You might want to change the type of the regression line by double clicking on the regression line and selecting a different type.
9. Diagram RelateMon is the same as RelateDay only that the monthly means taken from “Stat” range D4:E15 are used.
10. The diagrams “Histogram1”, “Histogram2” “Histo-Comp” show the histogram

# 3. Discussion and Conclusion



*What is the difference between surface temperature and air temperature?*

*The surface temperature has a larger annual amplitude*

*Measure surface temperature and air temperature or search GLOBE database*

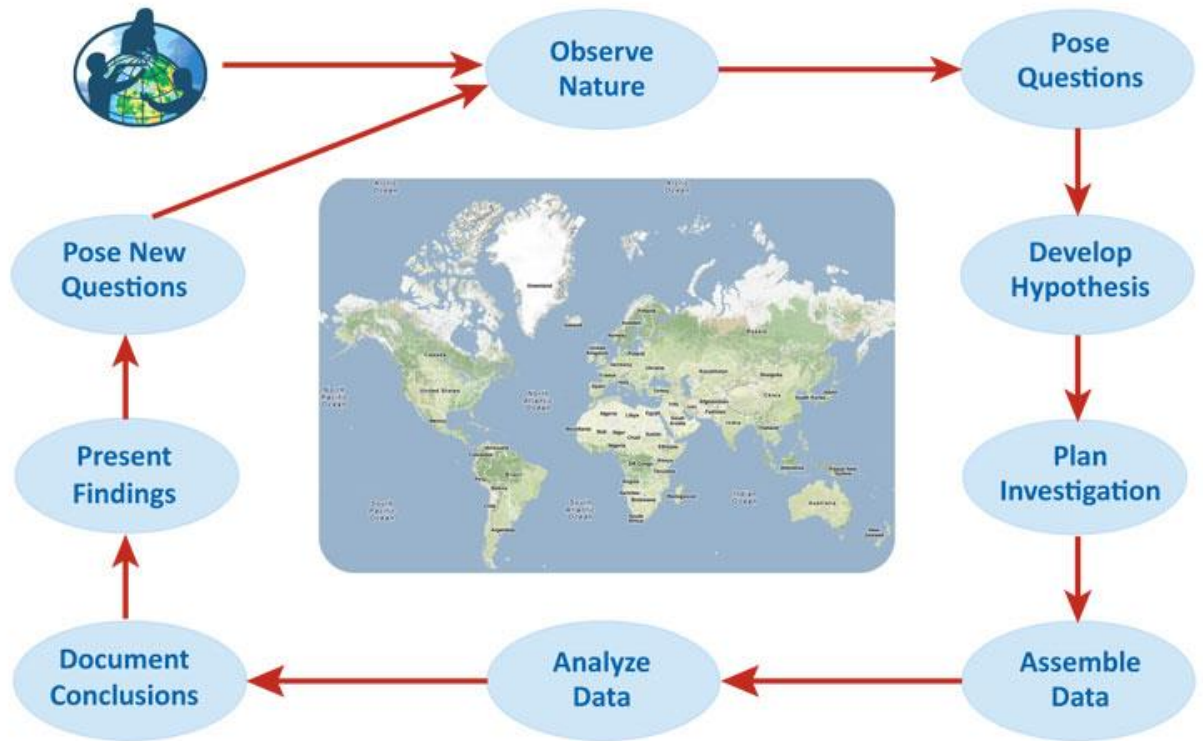
*Retrieve the data and transfer them into a form suitable for analysis*

# 3. Discussion and Conclusion

- What can we learn from the analysis of the data?
- Can the conclusions drawn from this analysis be transferred elsewhere?
- What may be the use of the results in class? In which disciplines in particular?
- How can we further exploit surface and air temperatures?
- What errors have to be taken into account?
- Which analysis tool should be used in which context?
- Are there any other tools (e.g., on the web) to compare and analyze the measured data?
- ....
- ....

# 4. Outlook

## Scientific Research Process



*What is next? How can we expand the merit of our findings?*

*What can we learn from the data?*



# 5. General Discussion

What else do we need to make better use of

- a) The IBL method
- b) GLOBE data
- c) Other data (e.g. NASA or ESA/Sentinel satellite data)
- d) The competence of our community (e.g., through training)
- e) ....

Other issues for discussion and further development of GLOBE

- a) ....
- b) .....

# Where can this Excel workbook and presentation be downloaded?

## On the Globe-Website

- Select “Community”
- Go to “GLOBE Countries and Member's Map”
- Select “Europe and Eurasia” located below the map
  - Select “Documents”
  - Search for “2016 Regional Meeting in Germany”
  - Select this folder and go to “Atmosphere and Climate Workshop”