

Sounding the Alarm: School Solutions to Climate

Subjects and topics:

- Biology: Ecosystems and Climate Change Impacts
- Chemistry: Greenhouse Gases and chemical reactions.
- Physics: Heat Transfer, Energy, Waves.
- Mathematics: Data Analysis and Statistics.
- Information and Communication Technologies: Digital Literacy, Programming, Data Sonification, Multimedia.
- Arts: Sound Design and Storytelling.

Duration: 4 - 8 weeks

Grade level: 6th - 12th

Summary

School Solution to Climate challenges students to understand and address climate change through a multifaceted, interdisciplinary approach. Students will investigate the science behind the greenhouse effect, explore its impact on global climates, research evidence of climate change, and raise community awareness by transforming data into sound using sonification techniques, which will also allow students to represent their findings creatively.

1. FEEL

The Feel phase is the first step in design thinking, focusing on research and understanding a problem's impact on individuals and communities. It encourages empathy, curiosity, and critical thinking while prompting students to generate questions related to their curriculum, such as the importance of environmental protection. By exploring these questions, students engage with various STEAM concepts and conduct research through community surveys, expert visits, and online activities to deepen their understanding of the issue.

The topic of climate change is ubiquitous. We see it every day on the news. However, the causes and consequences are not always well understood, which leads to misconceptions and a lack of effective action.

While the fear of climate change impacts is nowadays widespread, such fear does not contribute to finding effective solutions. Students can play a vital role in climate change research and mitigation by developing and evaluating innovative solutions at the school community level.

The climate change problem

1 - The greenhouse effect is essential for life on Earth. As a starting point, ask your students to investigate why. After this, challenge them with the question “So why do greenhouse gas emissions can harm ecosystems?” There are plenty of resources online, such as [videos](#), podcasts, and interactive digital laboratories, (among others) that they can use to explore such questions.

2 - Engage your Students in a [greenhouse effect experiment](#) and record and discuss their results. Alternatively, students can use [online laboratories](#), however, be sure to guide them through a similar inquiry-based approach.

If the experiments have been carried out correctly, students should conclude that if the Earth system is comparable to that of the experiments, excess greenhouse gases in the atmosphere can lead to global warming.

RESULTS OF THE FEEL PHASE:

By the end of your implementation, you can add here results from this phase, including pictures, aha moments, quotes from students and other people involved, etc. This can inspire others to design projects as amazing as yours.

2. IMAGINE

Data sonification, when the protocol is clearly defined, enhances the intuitive understanding of results for large and diverse audiences. Hence it has great potential for raising awareness of the problem addressed, which is the first step in helping to devise solutions to the problem of local greenhouse gas emissions.

In this phase, the class should **learn about sonification** and its potential. Students can be encouraged to explore several of the sonification methods provided by the [SoundScapes wiki](#), or others that they discover and develop. The aim at this stage is to acquire the techniques and skills to imagine and plan how they can use sonification to understand climate data more intuitively and create a soundtrack that they can use to help raise awareness about climate change, its causes, and/or consequences. **Students can for instance sonify the results of their experiments during the FEEL phase.**

The class should now **choose the target audience** of the sharing phase (e.g. the educational community, including tutors), justify the reason for their choice, and develop a concrete plan for how they will present the results of their project.

Examples of sonification activities that can be planned:

Causes of Climate Change:

- Increase in greenhouse gas emissions over time.
- Increase in deforestation rates over time.

Effects of Climate Change:

- Increase in global average temperatures.
- Increase in sea levels.

RESULTS OF THE IMAGINE PHASE:

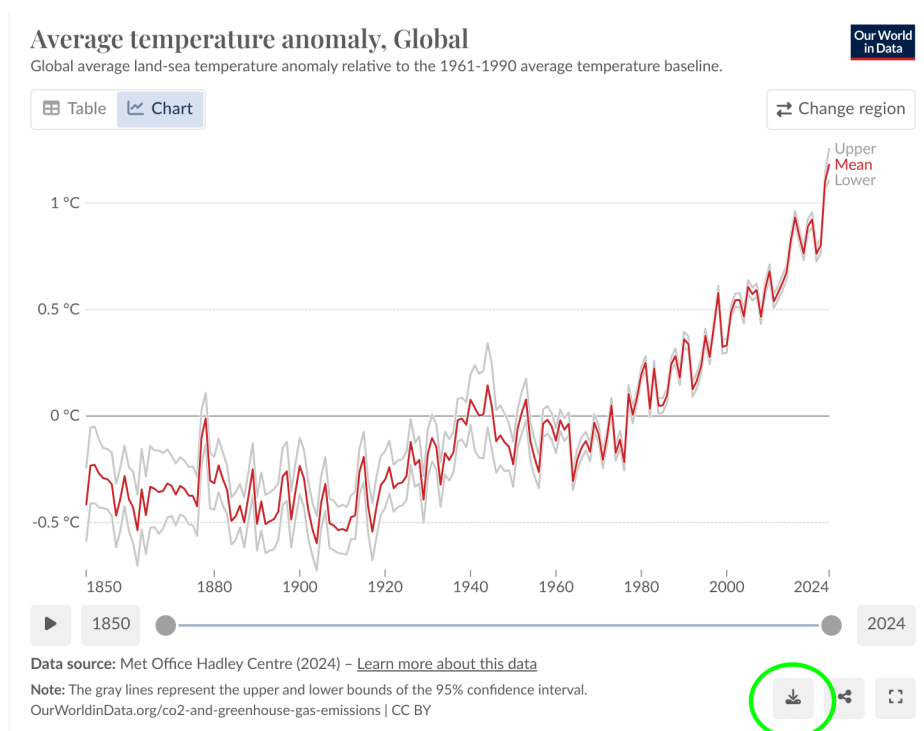
By the end of your implementation, you can add here results from this phase, including pictures, aha moments, quotes from students and other people involved, etc. This can inspire others to design projects as amazing as yours. You can include here all the ideas from your students. This might help others to solve the problem too.

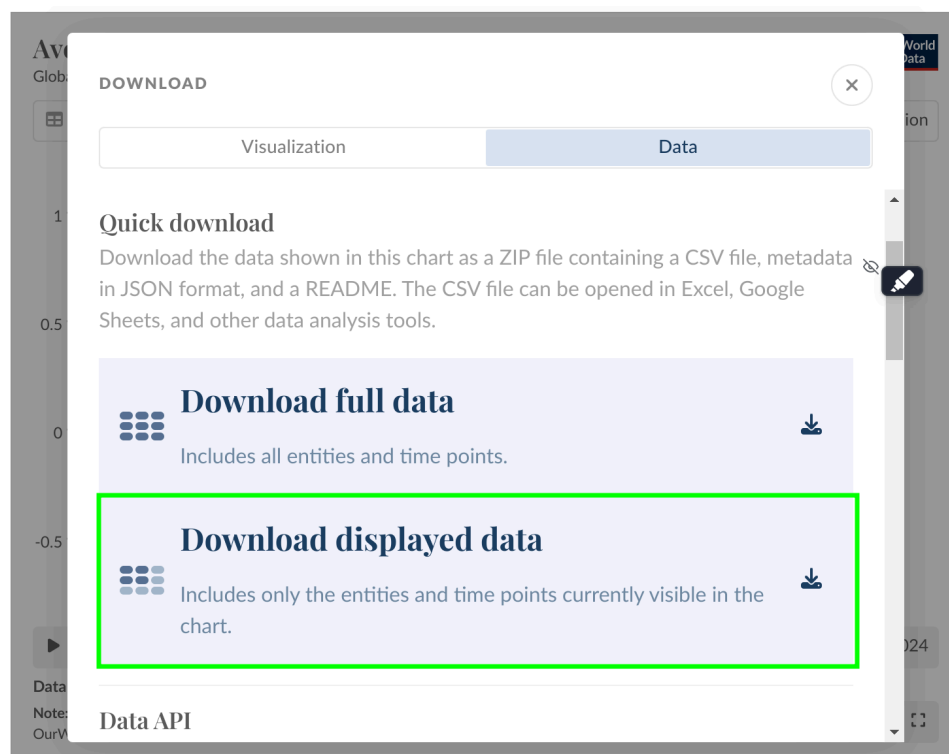
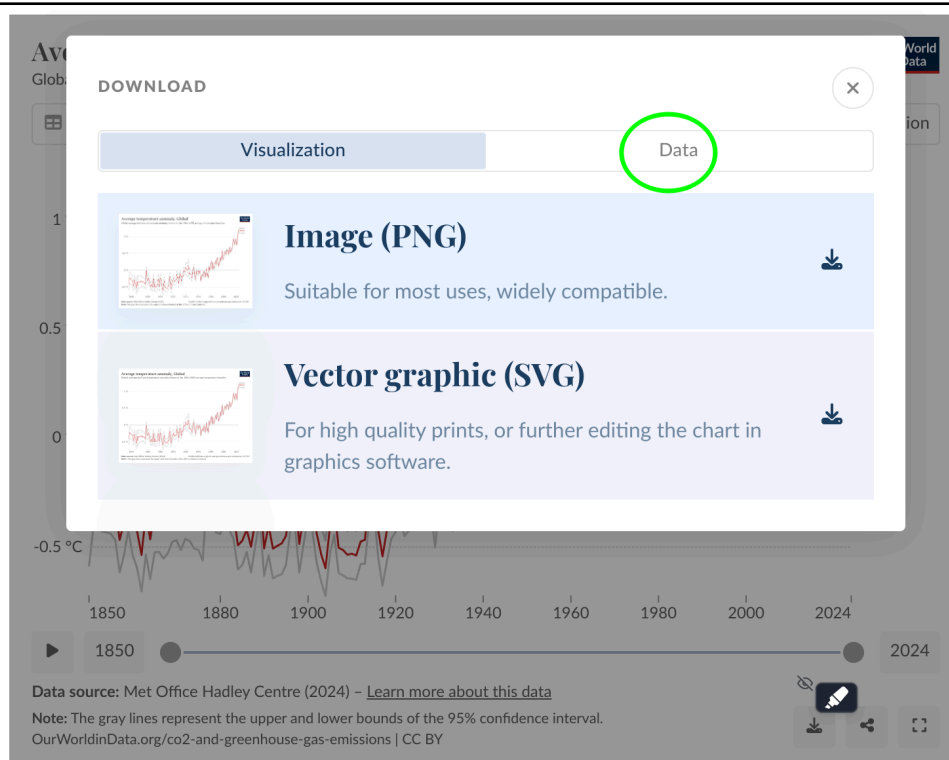
3. CREATE

There are numerous online data sources available for exploring climate change-related information over time, such as [Our World in Data](#). Alternatively, students can contact the local weather station or other relevant entities. The class can be divided into groups and each group can explore different climate change causes or impacts. Data retrieved from such sources can be sonified using data [sonification a posteriori techniques](#).

Example activity:

1. Download data concerning [CO₂ and Greenhouse Gas Emissions](#) between 1850 and today):





2. Go to your "Downloads" folder. Unzip the file "temperature-anomlay.zip". Go to the extracted folder, and drag and drop the file with the extension ".csv" (in this case "temperature-anomlay.csv") to the [Twotone](#) data source selection box.

Select Data Source

Pick a data source by choosing a sample or uploading a spreadsheet of your own.

Basque Country Daily Time Use Data 2013	288 rows
NEW ▶ Declines in abundance of insects in Denmark over 22 years	1449 rows
NEW ▶ ESCH22_SOUND_OF_DATA_B40_Traffic_Data	360 rows
Honey Production in the USA (1998-2012)	15 rows
Mars Weather Report Feb 24-20 2019	7 rows
NYC 311 Call Volume by Agency Feb 1 - 10, 2019	24 rows
Prussian cavalry killed by horse kicks	20 rows
NEW ▶ SimCorp official share history 2003-2023	2000 rows
NEW ▶ SOUND OF DATA Luxembourg COVID time series 08-02-22	1037 rows

Drag and drop files here or click to browse

- ✓ File types supported: .xls, .xlsx, .csv, .ods
- ✓ Column headers are required to detect fields.
- ✓ Maximum file size: 20MB
- ✓ Up to 2000 rows of data

SELECT

3. Look for the uploaded data in the list and select it.

Select Data Source

Pick a data source by choosing a sample or uploading a spreadsheet of your own.

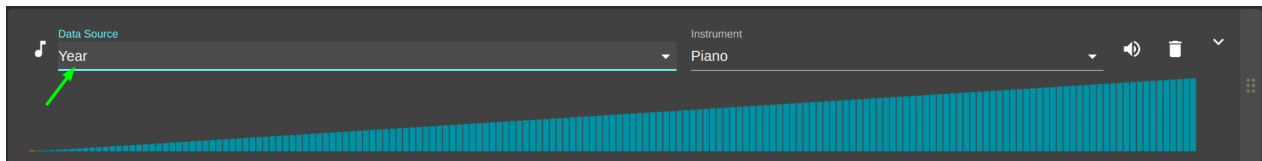
Honey Production in the USA (1998-2012)	15 rows
Mars Weather Report Feb 24-20 2019	7 rows
NYC 311 Call Volume by Agency Feb 1 - 10, 2019	24 rows
Prussian cavalry killed by horse kicks	20 rows
NEW ▶ SimCorp official share history 2003-2023	2000 rows
NEW ▶ SOUND OF DATA Luxembourg COVID time series 08-02-22	1037 rows
temperature-anomaly	525 rows
UN Sustainable Development Goals Index - US Cities	100 rows
US Historical Revenue, Public Debt and GDP	50 rows

Drag and drop files here or click to browse

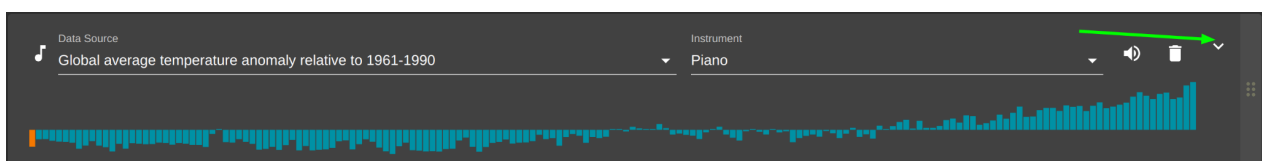
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SELECT

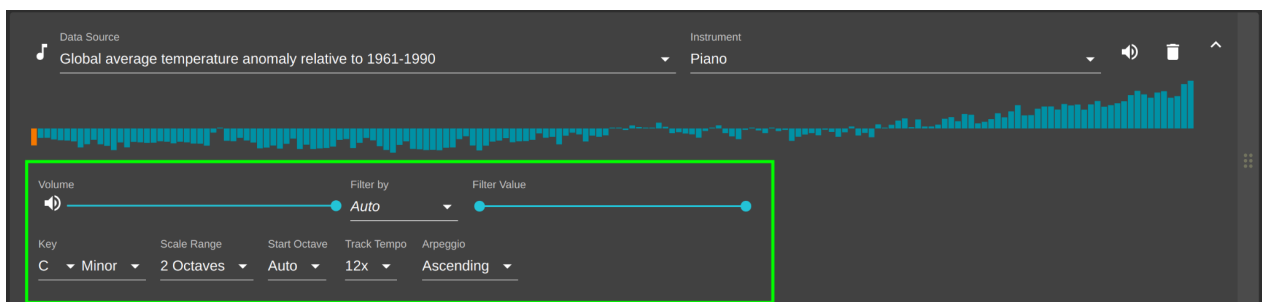
- Click the dropdown menu where it says “Year” and change its value to “Global Average temperature anomaly relative to 1961-1990”. The menu next to it lets you choose the instrument.



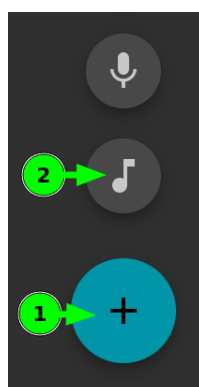
- To manipulate volume, key, and scale range, among other parameters, click the top-right arrow.



- A box will appear that lets you change other parameters.



- From the right-bottom “+” icon you can add more tracks to your sonification project.



8. After completing your project you can export it to an mp3 soundtrack (or another format) by clicking the bottom right button “export”.

Ensure that the data uploaded to Twotone is organized, with each parameter in a separate spreadsheet column and the parameter names listed in the first row as follows. Normally you don't need to do this with data retrieved from [Our World in Data](#). However, it is always important to check, since not everyone organizes data the same way and Twotone requires this format.

C	D
Year	Global average temperature anomaly relative to 1961-1990
1850	-0.4177114
1851	-0.2333498
1852	-0.22939907
1853	-0.27035445
1854	-0.29152083
1855	-0.29691675
1856	-0.32035372
1857	-0.46723005
1858	-0.3887657
1859	-0.28126517
1860	-0.39016518
1861	-0.42011204

All activities should be documented in photo, video, and/or other formats for sharing and demonstrating their impact.

RESULTS OF THE CREATE PHASE:

By the end of your implementation, you can add here results from this phase, including pictures, aha moments, quotes from students and other people involved, etc. This can inspire others to design projects as amazing as yours. You can include here pictures from their creations too.

4. SHARE

A **final event can be organized** at the school where the results of the activities will be presented and discussed. The entire educational community can be invited to this event,

including the students' tutors. Members of the community involved and local decision-makers can also be invited.

The event can begin with a very **brief descriptive presentation of the studies** carried out, followed by the **presentation of the songs created** through sonification applied to the results obtained as a way of raising awareness of the climate change problem. This will be followed by a **presentation of recommendations** for solving the problem of local greenhouse gas emissions into the atmosphere.

A series of workshops can also be held by the students on different sonification techniques to introduce the community to this pedagogical approach and its learning potential.

Alternatively, if it is not possible to organize a final event at school, a webinar can be organized online following a similar program.

All the records, results, documents, etc., of the activities carried out will be uploaded to the [SoundScapes online community](#) to inspire other teachers, students, or others, and to enable replication of what has been done.

RESULTS OF THE SHARE PHASE:

By the end of your implementation, you can add here results from this phase, including pictures, aha moments, quotes from students and other people involved, etc. This can inspire others to design projects as amazing as yours. You can add here pictures of your students sharing their results and write down final considerations.