How does turning on a light bulb in Bremerhaven change the climate in Niger?

Between 2004 and 2006, Bremen-based architect Axel Werner undertook a journey to discover the global climate connections among locations along the 8th meridian, a line of longitude that runs through Bremerhaven, Germany.

Traveling with Israeli-American filmmaker B.Z. Goldberg, Werner talked to people on five continents as Goldberg captured the stories of people living along the 8th meridian. Throughout the journey, Werner and Goldberg focused on local climate and the effects of climate change on the local environment and people. Their documentary captured the unexpected and unintended consequences of human activities that affect climate on a global scale.

Goldberg's 81 documentary film segments are the focal points for exhibits at the Klimahaus, a unique interactive experience on the 8th meridian in Bremerhaven, Germany. Opened in 2009, Klimahaus interactive experiences are constantly updated to reflect the latest scientific findings. To do so, Klimahaus partners with some of the most prestigious climate research organizations in Germany, including the Max Planck Institute for Meteorology, the German Weather Service, and the Alfred Wegener Institute for Polar and Marine Research.

Visitors to the museum explore climate and climate change mechanisms. Although you will not be able to experience the Klimahaus in person, you can take a virtual tour.

As you travel through the virtual tour, take notes. Pay close attention to climate, climate change, human impacts, and global connections. Use the tour as an inspiration for a journey you will be creating for a walk along the your longitude line.

Note that videos are in German and in the native languages of the people who live in the places featured in the videos. As you view the videos, focus on the visual details. Listen carefully. You may be able to understand a few words or discern meaning by careful observation.

Photo credit: Klimahaus

Itinerary

Bremerhaven, Germany
Isenthal, Switzerland
Seneghe, Sardinia, Italy
Kanak, Niger
Ikenge, Cameroon

Queen-Maud-Land, Antarctica
Satitoa, Samoa
Vambell, Alaska, USA
Halligen Langeness, Germany
Date ____________________________

Earth’s Surface Temperatures Changes (°C)

The dark solid line is a running five year average. An anomaly is a variation from normal. Normal is the 0.0 line on the left vertical axis. What questions do you have about Earth’s surface temperature changes? Think like a scientist.

My Questions

Longitudes

8° E 171° W

Explore the locations on the mp to discover how scientists are monitoring Earth’s vital signs, and what’s happening to climates at the local, regional, and global scale.
Describe the climate of Bremerhaven using evidence from the graph.

Analyze:
Evidence of Climate Change in Bremerhaven

Probable Effects of Climate Change in Bremerhaven
Phenomenon Related to Climate

ATMOSPHERIC CARBON DIOXIDE DIRECT MEASUREMENTS: 2005-PRESENT

Atmospheric carbon dioxide is a greenhouse gas monitored by climatologists. Greenhouse gases warm Earth's atmosphere by stopping and absorbing outgoing infrared radiation. Ancient carbon is stored in fossil fuels - coal, gas, oil. Humans release ancient carbon as carbon dioxide through the burning of fossil fuels.

Data source: Monthly measurements (average seasonal cycle removed). Credit: NOAA

What is the trend in atmospheric carbon dioxide? Support your answer with data from the graph.

How do we know this trend is happening? Support your answer with examples from the readings.

How might the trend in atmospheric carbon dioxide be related to changes in surface temperatures? Your answer may be in the form of a diagram or text.

Why would Bremerhaven focus on reducing dependence on fossil fuels as a climate change strategy?

Continue your journey to find more information to help you answer the question: How does turning on a light bulb in Bremerhaven change the climate in Niger? Next stop Isenthal, Switzerland.
Isenthal, Switzerland Climate

Describe the climate of Isenthal using evidence from the graph.

Analyze:
Evidence of Climate Change in Isenthal

Probable Effects of Climate Change in Isenthal
Interpret the Images
Compare the Doldenhorn Glacier in 1960 to the same location in 2007. Describe changes.

Interpret the Images
Compare the Matterhorn Glacier in 1960 to the same location in 2005. Describe changes.

What is the probable cause of the changes in Alpine glaciers?

How do glaciers affect climate?

Describe the effects of glacier changes on climate at the local and global scale.

Continue on your journey. Up next, Seneghe, Sardinia.
Describe the climate of Seneghe using evidence from the graph.

Analyze:
Evidence of Climate Change in Seneghe

Probable Effects of Climate Change in Seneghe
Phenomenon Related to Climate
Use the NASA Time Machine to observe a timeline of change in the Mediterranean.

Winter Precipitation Trends in the Mediterranean Region for the Period 1902 - 2010

The graph shows variations (anomalies) in winter precipitation in the Mediterranean region. The 0-line represents normal precipitation. Years with more than normal rainfall have bars above the normal line. Years with less than normal rainfall have bars below the normal line. The solid line is a running 5-year average.

Describe the trend in winter precipitation since 1990.

Why use a 5-year running average?

How do we know that precipitation is changing?

What might happen if Mediterranean winters continue to be drier than normal? How has climate

How could drier winters affect ecosystems in Seneghe?

continue on your journey. Next up Kanak, Niger.
Describe the climate of Kanak using evidence from the graph.

Analyze:
Evidence of Climate Change in Kanak

Probable Effects of Climate Change in Kanak
Describe the trend in seasonal rainfall in the Sahel region since 1970.

How do we know precipitation is changing?

What geographical factors make Niger prone to desertification?

How has climate change affected water sources in Niger?

Why is precipitation changing?

Why does turning on a light bulb in Bremerhaven affect climate in Niger?

How could reforestaation reverse desertification?

Continue on your journey. Next up Ikenge, Cameroon.
Describe the climate of Ikenge using evidence from the graph.

Analyze:
Evidence of Climate Change in Ikenge

Probable Effects of Climate Change in Ikenge
West African rainforests are being cleared for agriculture. Global demand for palm oil has spurred replacement of rainforests with plantations of palm oil producing trees.

Rainforests make their own rain. Plants take in water and carbon dioxide. Through the process of photosynthesis, plants produce glucose and oxygen. Plants use glucose as a building material and as fuel for cell processes. Excess glucose is stored as starch. Water is produced during the conversion process. Plants maintain their water balance by releasing extra water from their leaves. This process is call evapotranspiration.

At the current rate of deforestation, the African rainforest may not be able to offset carbon dioxide emission from the burning of fossil fuels. How do plants influence climate?

Predict what will happen to climate as the result of deforestation of African rainforests. Support your prediction with scientific reasoning.

Predict the outcome of reforestation efforts. Support your prediction with scientific reasoning.

Continue on your journey. Next stop: Queen Maud Land, Antarctica.
Station 6. Queen Maud Land, Antarctica

Longitude 8° 34' E     Latitude 73° 30' S
Elevation: 141 feet     Population N/A

Climate Type ________________________________

Neumayer Station, Antarctica 8°15'51"W/70°38'42"S

Describe the climate of Queen Maud Land using evidence from the graph.

Analyze:
Evidence of Climate Change in Queen Maude Land

Probable Effects of Climate Change in Queen Mayd Land
Phenomenon Related to Climate
ANTARCTICA MASS VARIATION SINCE 2002

The graph shows changes in the Antarctica ice mass. Data source: Ice mass measurement by NASA's GRACE satellites. Credit: NASA

Describe the trend shown in the graph.

How do we know this is happening?

What is the probable cause of the phenomenon?

How does Antarctic ice mass affect climate on a local and global scale?

How are climate change in Antarctica and climate change in Bremerhaven related? Support your answer with evidence and scientific reasoning.

Continue on your journey. Next stop Satitoa, Samoa
Describe the climate of Satitos using evidence from the graph.

Analyze:
Evidence of Climate Change in Satitos

Probable Effects of Climate Change in Satitos

Phenomenon Related to Climate
The graph shows the changes in sea level as measured by satellites since 1993. Melting land glaciers explain some of the sea level rise. Another contributing factor is seawater expansion. As ocean water becomes warmer, the molecules in seawater spread out increasing the volume and changing the density of the seawater and possibly ocean current circulation. Warmer seawater may also affect the atmosphere because it absorbs less carbon dioxide.

Data source: Satellite sea level observations.

Credit: NASA Goddard Space F

Describe the trend shown in the graph.

How do we know that sea levels are changing?

Use the Explore More links to collect more evidence.

Ise evidence to support or refute predicted impacts of climate change on S
Describe the climate of Gambell using evidence from the graph.

Analyze:
Evidence of Climate Change in Gambell

Probable Effects of Climate Change in Gambell
During the winter, Arctic sea ice increases. During the summer, Arctic sea ice decreases. Arctic sea ice reaches a minimum in September (autumnal equinox). Why does sea ice increase in the winter and decrease in the summer?

Data source: Satellite observations.

Describe the trend in Arctic sea ice since 1990.

How do we know this is happening?

What is causing the change in arctic sea ice?

What are the effects of changing arctic sea ice?

How has changing sea ice affected life in Gamblell?

Continue to Halligen Langeness, Germany to exit the Klimahaus. Next, check your understanding.
Check Your Understanding
Climate is the result of complex interactions among Earth’s atmosphere, land, and water. Turning on a light bulb in Bremerhaven was a metaphor for human activities that contribute carbon dioxide and other greenhouse gases to Earth’s atmosphere. The concentration of greenhouse gases influences climate by changing factors like temperature, precipitation, and sea level.

- Starting with the light bulb, create a diagram that shows interactions and impacts you explored during your journey.
- Focus on cause and effect.
- Include the following keywords:
  atmosphere, land, water, carbon dioxide, greenhouse gases, surface temperatures, sea level rise, glacial retreat (land ice), rainforest deforestation, arctic sea ice, antarctic ice mass, seawater expansion, climate.

Sample Information Organizer for Planning

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
<th>Impact</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions I Still Have

Something I Want to Explore
Date ____________________________

NSTA Engage Spring21
#33329: NMLSTA-Sponsored Session: Inspired by Germany—Understanding Global Climate Change to Take Local Action

**Standard**: Weather and Climate  

**Presenter Contact Information**  
Loris Chen  
[Lchen428@gmail.com](mailto:Lchen428@gmail.com)

**Website Links**

- National Middle Level Science Teachers Association  [https://nmlsta.wildapricot.org/](https://nmlsta.wildapricot.org/)

**Example of a Climate Story**

![Phenomenon Story Diagram](image-url)