Step 2, Part 1: The ‘then and now’ of Climate Change

Students discuss climate change as an all time, worldwide phenomenon, using the fact sheet about climate change throughout history.
They will also analyse the timeline of conferences and weather events of the last decades to be aware of the consequences that these agreements have had for climate change. This will give them an idea of how policies concerning climate change have changed over time, and what still has to be done.

Introduction
During this lesson, students will learn about historical examples of climate change and identify different types of effects that climate change has had in history. They will then look at conferences and weather events from the last decades in order to draw some conclusions about how political decisions have or have not been implemented, and what the contemporary consequences of those decisions are.

Lesson objectives

- Students will have group discussions about climate change as an all time, worldwide phenomenon, using texts on different types of climate change events throughout history.
- Students will draw some conclusions about similarities and differences between these events throughout history.
- Students will analyse the climate change timeline that includes conferences, treaties and the extreme weather events of the last decades in order to be aware of the intentions and real actions taken by governments, and the real effects on the weather.

Preparation and materials

- Factsheets with information about Climate change in history. There are three documents about this topic.
- Climate change in history (**annex 1**) with explanations for teachers. This information can be used to explain the historical context to students before they start analysing the examples of climate change events in history.
- Climate change events in history (**annex 2**). Various events related to different historical periods are explained briefly.

- Climate change deeper explanations (**annex 3**) . There are three examples of climate change events in history with deeper explanations for higher level students.

  Depending on the level of your students, choose which of the documents you want to use with your students. Give a copy of the document to each group of 3-4 students and tell students to share the events among them.

- Timeline with information about climate change. This timeline gives information about important worldwide conferences and treaties concerning climate change during the last decades, and the annual summary of the most recent extreme weather events. (Climate change digital timeline)
- A handout with different extreme weather newspaper headlines. The overview includes a "?" mark in order to motivate students to think about local/national examples. **(annex 4)**
- Graphs and tables about climate effects and climate change development created by the UN Climate Change Secretariat and WMO. (**annex 5** and **annex 6**)

* Depending on the time you have, you can focus only on some of the aspects (climate change in history, conferences, weather events...)

Planning grid

1) Analysing climate change in history

a) Students should read the short text about climate change in history in small groups and discuss the main differences in causes and effects between different events. How did people cope with climate change in the past?

b) Come to a short conclusion in a whole class procedure. Students might conclude that climate change has happened throughout history worldwide, and that the effects were very important. The main difference is that nowadays, the main cause of change is human action, and the number of effects will multiply in a short time.

2) Analysis of agreements, facts and weather events

a) Organise the class in three groups and tell students to analyse the information in the sources using the given questions as their guideline (model: experts).

1. Some students will analyse the conferences and treaties that appear in the climate change timeline. They can find some recent examples of agreements and disagreements and analyse them:
    - What countries are involved: which countries have signed or agreed with it? Which countries have not?
    - Have the agreements already been implemented?
    - Is it possible to notice the effects of these agreements?

2. Some students will analyse the weather events that appear in the climate change timeline, including the handout with weather events headlines. They can find some recent examples of different events and analyse them:
    - Which are the main weather events?
    - What countries or regions are involved?
    - What are the consequences (social, economic, ...) of these events?
    - What will happen in a few years if things do not change?
    - Add one or two headlines about extreme weather events that have happened recently in your city or country.

3. Some students will analyse the climate change developments that appear in graphs and tables. They can choose some graphs or tables and analyse them:
    - What are the main consequences of climate change?
    - What countries and/or regions are involved?
    - Which economic sectors are involved?

- What are the consequences (social, economic, …) of climate change?
- What will happen in a few years if things do not change?

b) Reorganise the class in groups of three or six, with one or two experts on each topic in each group. Tell them to inform each other about the main ideas that have appeared in each group and reflect on the consequences that climate change will bring if we do not take actions to mitigate them.

3) Final discussion

Put the whole class together and discuss the solutions that politicians have or want to implement. Discuss with the students whether they think that the way politicians are dealing with climate change will make a real difference, and if not, what should be done.

Annex 1 (teachers)

Climate change in history

The climate is always changing. There were ice ages and warmer periods when alligators were found in Spitsbergen. Ice ages have occurred in a 100,000-year cycle for the last 700,000 years, and there have been previous periods that appear to have been warmer than the present despite CO2 levels being lower than they are now. More recently, we have had the medieval warm period and the little ice age.

Greenhouse gases, mainly CO2 but also methane, were involved in most of the climate changes in the past. When they were reduced, the global climate became cooler. When they were increased, the global climate became warmer. Volcanic eruptions have caused strong cooling following a period of unusually heavy activity.

When CO2 levels jumped rapidly, the global warming that resulted was highly disruptive and sometimes caused mass extinctions. Symptoms from those events include big, rapid jumps in global temperatures, rising sea levels and ocean acidification. Humans today are emitting prodigious quantities of CO2 at a rate faster than even the most destructive climate changes in the planet's past.

The concentration of carbon dioxide has been increasing since the beginning of the Industrial Revolution. From 289 ppm of carbon dioxide in the atmosphere in 1750, to 380 ppm by 2005 and to 407 ppm in 2018. Most of the increase has occurred since 1959, as world energy usage has expanded dramatically.

Source: Skeptical science

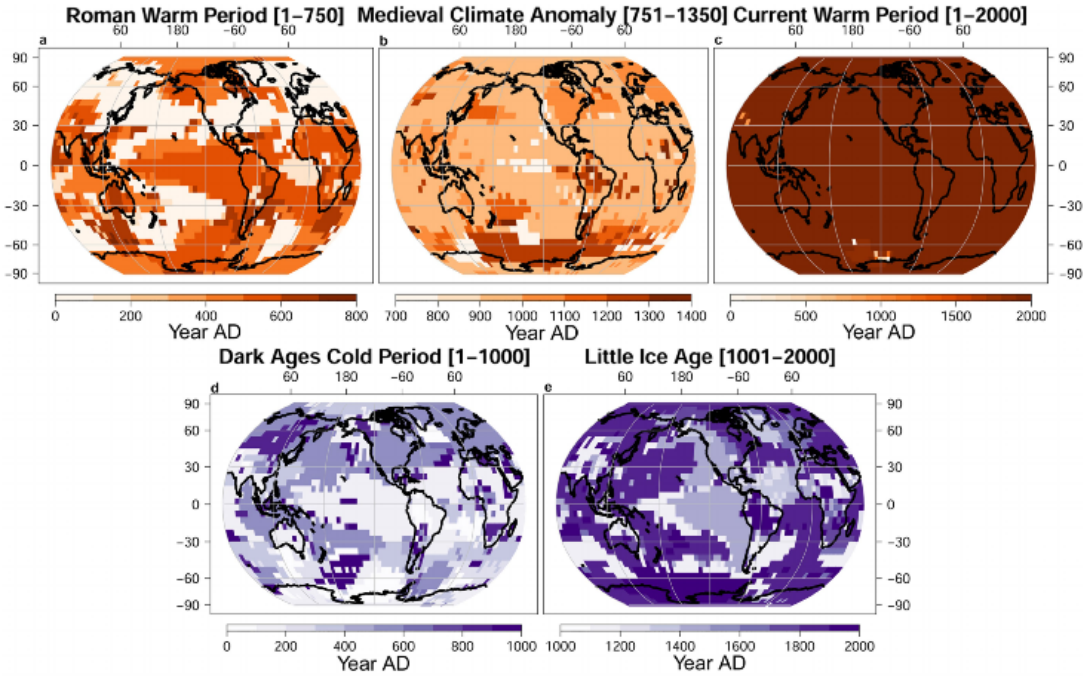


Fig. 3 | Timing of peak warm and cold periods. a–e, Centuries with the highest ensemble probability of containing the warmest (**a–c**) and coldest (**d**, **e**) 51-year period within each putative climatic epoch (see Methods). The full time ranges over which the search was performed for each epoch are indicated in parentheses. The numbers on the *y* axis and upper *x* axis are degrees latitude and longitude.

Maps: Raphael Neukom1, Nathan Steiger2, Juan José Gómez-Navarro3, Jianghao Wang4 & Johannes P. Werner, *No evidence for globally coherent warm and cold periods over the preindustrial Common Era , Nature July 2019, page 3*

Annex 2
Some examples of climate change in history:

*__Early Bronze Age__. The climate was warm in Europe at altitudes now beyond cultivation, such as Dartmoor, Exmoor, the Lake district and the Pennines in Great Britain. The climate appears to have deteriorated towards the Late Bronze Age, with a period of unusually cold climate in the North Atlantic region 1800-1500 BC.

Source: BROWN Tony, _The Bronze Age climate and environment of Britain_, 2008

*__Prehistoric Central North Africa.__ Climate cooler and wetter, some parts of the present Saharan desert may have been populated, judging by cave art and other signs of settlement in the area.

Source: _Historical climatology,_ Wikipedia

*__Roman Warm Empire.__ The first known global pandemic struck in 451 AD and recurred until 750 AD leading to the premature death of up to a quarter of the human population in the Eastern Mediterranean region. The plague of Justinian (536-750 AD) coincided with a period of major climate change in the Eastern Mediterranean. The largest dry to wet climatic shift of the last 11,000 years occurred in the 6th century AD. This was briefly interrupted (535-536 AD) by a climatic reversal and failure of harvests which may have been caused by a major volcanic eruption. The climatic instability created the environmental condition to allow the plague to spread exceptionally quickly with devastating consequences for human mortality.

The Justinian plague era came to an end when the climate became drier once again. The wetter climate would have increased the number of rats and other rodents which carry fleas, which in turn carry the plague bacterium.

Source: _Climate change and the Plague of Justinian_, University of Plymouth

*__Warm Period in Middle Ages.__ There was a warm period between about 800-1300 AD. During this period some parts of the globe may have been warmer than they are today, such as the North Atlantic. The effects of the warm period were particularly evident in Europe, where grain crops flourished, many new cities arose, and the population more than doubled. During this period, the Vikings colonised southern Greenland because the milder climates allowed favourable open-ocean conditions for navigating. The Greenland settlement lasted until 1300 AD when the little Ice Age ended the possibility of farming.

Source: _Why Greenland Viking vanished_, Smithsonian, 2019, _Medieval warm period_, Skeptical Science

*__1046 Cold winter__ in the middle of the Warm Period. As it appears in the Anglo-Saxon Chronicle (1046): "And in this same year after the 2nd of February came the severe winter with frost and snow and with all kinds of bad weather, so that there was no man alive who could remember so severe winter as that, both through mortality of men and disease of cattle; both birds and fishes perished through the great cold and hunger."

Source: *The Little Ice Age Was Not So Little*, Alternate history, ASB-Environmental

*__Medieval Little Ice Age.__ In 1300, temperatures dropped dramatically in parts of Europe and North America. The Little Ice Age was not a time of continuous cold climate, but rather repeated periods of cooling and warming, each of which occurred during times of solar minima, that lasted until 1800.
With the colder climate, early snows, violent storms, and recurrent flooding massive crop failures occurred, resulting in famine and disease. Glaciers began advancing and pack ice extended southward in the North Atlantic, blocking ports and affecting fishing.
The change from the warm to the cold period was abrupt and devastating, leading to the Great Famine from 1310 to 1322. Continuous rain impeded the sowing of grain crops, and harvests failed once and again. Diseases increased, people died of starvation, and many farms were abandoned. 1316 was the worst year for cereal crops in the entire Middle Ages. Cattle could not be fed, hay wouldn't dry and couldn't be moved so it just rotted.

Sources: *Medieval Warm Period*, Science direct, EASTERBROOK, D, *Evidence Based Climate Science*, HUHTAMAA, H, *Climate and the Crises of the Early Fourteenth Century in Northeastern Europe*

*__Europe's 'bleak midwinter' of 1430-1440__ made dramatic changes in response to food shortages and famine caused by exceptional cold. Crops failed, food and fuel prices rose. Malnutrition and famine struck many parts of Europe. Weakened populations fell prey to disease and pestilence, worsened by environmental and living conditions. Authorities responded by changing trade policy, banning food exports and introducing new approaches to protect people from hunger, such as communal granaries for storage. Norse colonies in Greenland starved and vanished as crops failed and livestock could not be maintained through increasingly harsh winters.

Source: *What can a Medieval Climate crisis teach us about Modern day warming*, The Guardian, 2016

*__17th century Little Ice Age.__ The coldest temperatures in Northwestern Europe and southeastern North America. This Ice Age is well documented by paintings, diaries, and events held on frozen lakes and rivers in the 17th and 18th centuries. The most serious period was from 1645 to 1715, during which sunspots became exceedingly rare. Temperatures in Europe decreased, snow and ground frost became frequent, glaciers in the Swiss Alps reached farms and buried villages. Sea ports were blocked in Iceland and Holland and cereal grain harvests failed, leading to mass famines. The Thames River and canals and rivers of the Netherlands froze over during the winter. The population of Iceland decreased by about half.

Jan Griffier – *The Great Frost* – 1663 (Thames River, London)

In parts of China, warm-weather crops that had been grown for centuries were abandoned. In North America, early European settlers experienced exceptionally severe winters.

Source: *Environmental History Resources*

*__Europe's Little Ice Age in 1790-1830.__ Cold weather, cool temperatures, low sunspot activity; it was a time of intense cooling and great hardship. Widespread famines due to crop failures spread across Europe. Several notable events occurred during this period, including the French Revolution and Napoleon's defeat in Russia because of a bitterly cold winter. The 1794-95 winter was particularly harsh, which concluded in bad harvests and food shortage.

*__1815, the year without a summer,__ due to volcanic dust, happened in the middle of the Little Ice Age from 1790 to 1830. Evidence suggests that this phenomenon was caused by the 1815 eruption of Mount Tambora in April in the Dutch East Indies (now Indonesia). This eruption was the world's largest eruption in at least 1,300 years. The result was a further reduction in solar irradiance that brought record cold to much of the world during the summer. The unusual cold caused crop failure, an increase in food prices, widespread famine, and epidemics of cholera and other diseases.

Source: *Blast of the Past.* Smithsonian magazine

*__Beginning of the Industrial era.__ Some studies reveal that warming in some regions actually began in the 1830s, as an immediate effect of burning fossil fuel. That warming did not develop at the same time across the planet. The tropical oceans and the Arctic were the first regions to begin warming in the 1830s. Europe, North America and Asia followed two decades later.
With the dawn of the Industrial age and the burning of fossil fuels such as coal, natural gas and oil, humans began to significantly add to the amounts of carbon dioxide and other greenhouse gases in the atmosphere, enhancing the planet's natural greenhouse effect and causing higher temperatures.

Source: *The industrial revolution kick started global warming much earlier than we realised*, The conversation.

Annex 3
DEEPER EXPLANATIONS OF SOME HISTORICAL CLIMATE CHANGES

*Warm Period in Middle Ages

There was a warm period between about 800-1300 AD. During this period, some parts of the globe may have been warmer than they are today, such as the North Atlantic. The effects of the warm period were particularly evident in Europe, where grain crops flourished, alpine tree lines rose, many new cities arose, and the population more than doubled.

Excavations have shown the presence of birch trees during the early Viking period. The Vikings took advantage of the climatic amelioration to colonise southern Greenland in 985 AD, when milder climates allowed favourable open-ocean conditions for navigation and fishing. Erik the Red explored Greenland from Iceland and gave it its name. He claimed land in southern Greenland and became a chieftain in about 985 AD. Greenlanders brought grain seed, probably barley, oats and rye, horses, cattle, pigs, sheep and goats. The southern coastal area was forested at the time. Greenland settlements lasted about 500 years before cooling during the Little Ice Age ended the settlements. From 1000 to 1300 AD the settlements thrived under a climate favourable to farming, trade, and exploration. A cooling, steadily deteriorating climate began after 1300 AD and farming became impractical. A bishop who travelled there about 1350 AD found that the settlement was completely abandoned. The church abandoned Greenland in 1378 AD because ships could not get through the sea ice between Iceland and Greenland.

During the Medieval Warm Period, wine grapes were grown as far north as England or North America, where growing grapes is now not feasible, and about 500 km north of present vineyards in France and Germany. Wheat and oats were grown around Trondheim, Norway, suggesting that the climate was about 1°C warmer than it is at present.

Evidence also suggests that some places were very much cooler than today including the tropical pacific. This arid period may have depopulated the Great Plains of North America.

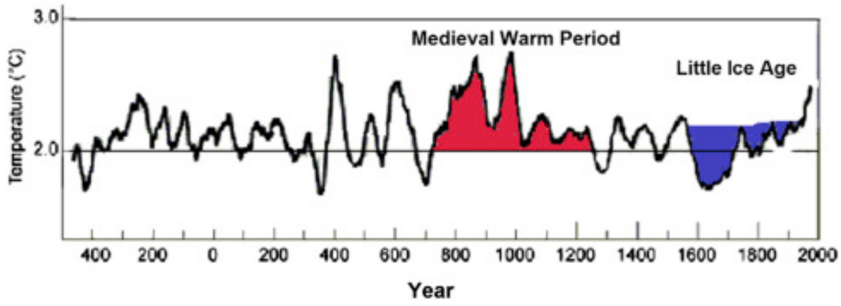


Figure 21.10. Temperature reconstruction from tree rings in China. (Red = warm, blue = cool.)

Graphic source: EASTERBROOK,, _Evidence-Based Climate Science_, Nature, 2016

Source: _Why Greenland Viking vanished_, Smithsonian, 2019, _Medieval warm period_, Skeptical Science

*Medieval Little Ice Age

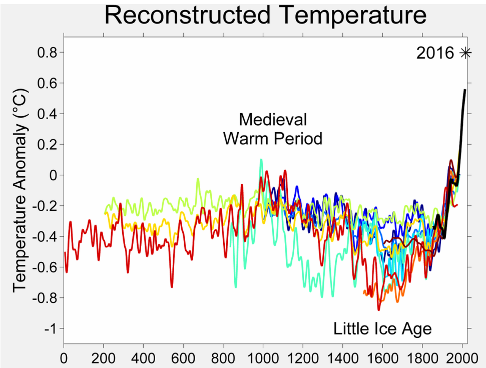
At the end of the Medieval Warm Period, **~1300 AD,** temperatures dropped dramatically in parts of Europe and North America and the cold period that followed is known as the Little Ice Age. The periods of colder climate that ensued for five centuries were devastating. The population of Europe had become dependent on cereal grains as a food supply and with the colder climate, early snows, violent storms, and recurrent flooding that swept Europe, massive crop failures occurred, resulting in widespread famine and disease. Glaciers in Greenland and elsewhere began advancing and pack ice extended southward in the North Atlantic, blocking ports and affecting fishing.

The change from the warm to the cold period was abrupt and devastating, leading to the Great Famine from 1310 to 1322. In the winter of 1309–1310, the Thames River froze over and poor people were especially affected. The year 1315 was particularly bad. Jean Desnouelles wrote at the time: "Exceedingly great rains descended from the heavens and they made huge and deep mud-pools on the land. Throughout nearly all of May, June, and August, the rains did not stop." Corn, oats, and hay crops were beaten to the ground, August and September were cold, and floods swept away entire villages. Crop harvests in 1315 were a disaster, affecting an enormous area in northern Europe. In some places, up to half of farmlands was eroded away. Cold, wet weather prevented grain harvests, and fall plantings failed, triggering famines.

In 1316 AD, spring rain continued, impeding the sowing of grain crops, and harvests failed once again. Diseases increased, newborns and eldery people died of starvation, and multitudes scavenged anything edible. Entire communities disappeared and many farms were abandoned. This year was the worst for cereal crops in the entire Middle Ages. Cattle couldn't be fed, hay wouldn't dry and couldn't be moved so it just rotted.

Thousands of cattle froze during the bitterly cold winter of 1317–1318 and many others starved. The cold immobilised shipping. Rain continued through the summer and people suffered for another seven years.

The Little Ice Age was not a time of continuous cold climate, but rather repeated periods of cooling and warming, each of which occurred during times of solar minima, characterised by low sunspot numbers, low total solar

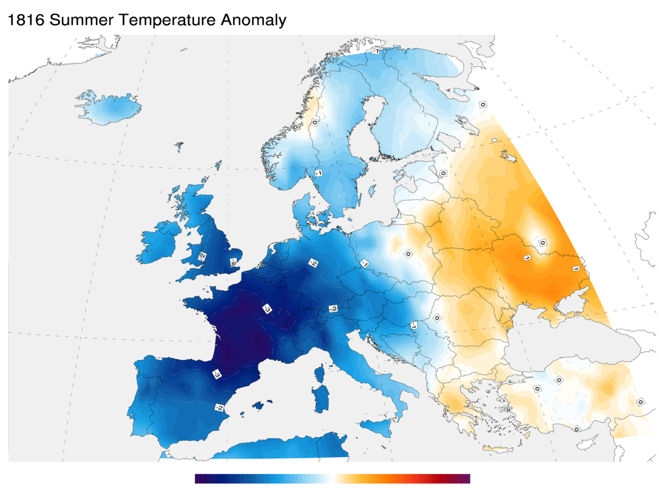


irradiance, decreased solar magnetism, increased cosmic ray intensity, and increased production of radiocarbon and beryllium in the upper atmosphere.

Graphic source: _2000 year temperature comparison_, Wikimedia

Sources: _Medieval Warm Period_, Science direct, EASTERBROOK, D, _Evidence Based Climate Science_, HUHTAMAA, H, _Climate and the Crises of the Early Fourteenth Century in Northeastern Europe_

*1815, the year without a summer,**
happened in the middle of the Little Ice Age from 1790 to 1830 due to volcanic dust. This year was also called the Poverty Year, because of severe climate abnormalities that cause average global temperatures to decrease by 0.4–0.7 °C., which resulted in major food shortages.
Evidence suggests that the anomaly of having the lowest sun sort number to date since record, was predominantly caused by the 1815 eruption of *Mount Tambora* in April in the Dutch East Indies (now Indonesia). This eruption was the world's largest eruption in at least 1,300 years. It ejected immense amounts of volcanic ash into the upper atmosphere, where the jet stream carried it around the world. The result was a further reduction in solar irradiance that brought record cold to much of the world during the summer. The unusual cold played havoc with agricultural production in many parts of the world, resulting in crop failures, dramatic increases in food prices, famine, cultural disruptions, and epidemics of cholera and other diseases. Rapid, dramatic temperature changes occurred frequently, as temperatures sometimes went from above-normal summer levels to near freezing within hours. U.S. grain prices at least quadrupled, and oat prices increased almost eightfold.
Elsewhere around the world, famine, riots, arson, and looting occurred in many European cities, while China suffered from massive crop failures and disastrous floods. A disruption in the Indian summer monsoon spread a cholera outbreak from a region near the River Ganges all the way to Moscow. "The Year Without a Summer" also had cultural effects:



- The lack of oats to feed horses likely inspired German inventor Karl Drais to research new ways of horseless transportation, which led to his invention of the precursor to the bicycle.
- Many Americans left New England for the Midwest, accelerating the westward movement of the American people. Vermont alone had as many as 15,000 people emigrate, including the family of Joseph Smith, who moved from Norwich, Vermont, to Palmyra, New York. This move

may have made possible the publication of the Book of Mormon and the founding of the Church of Jesus Christ of Latter-day Saints.

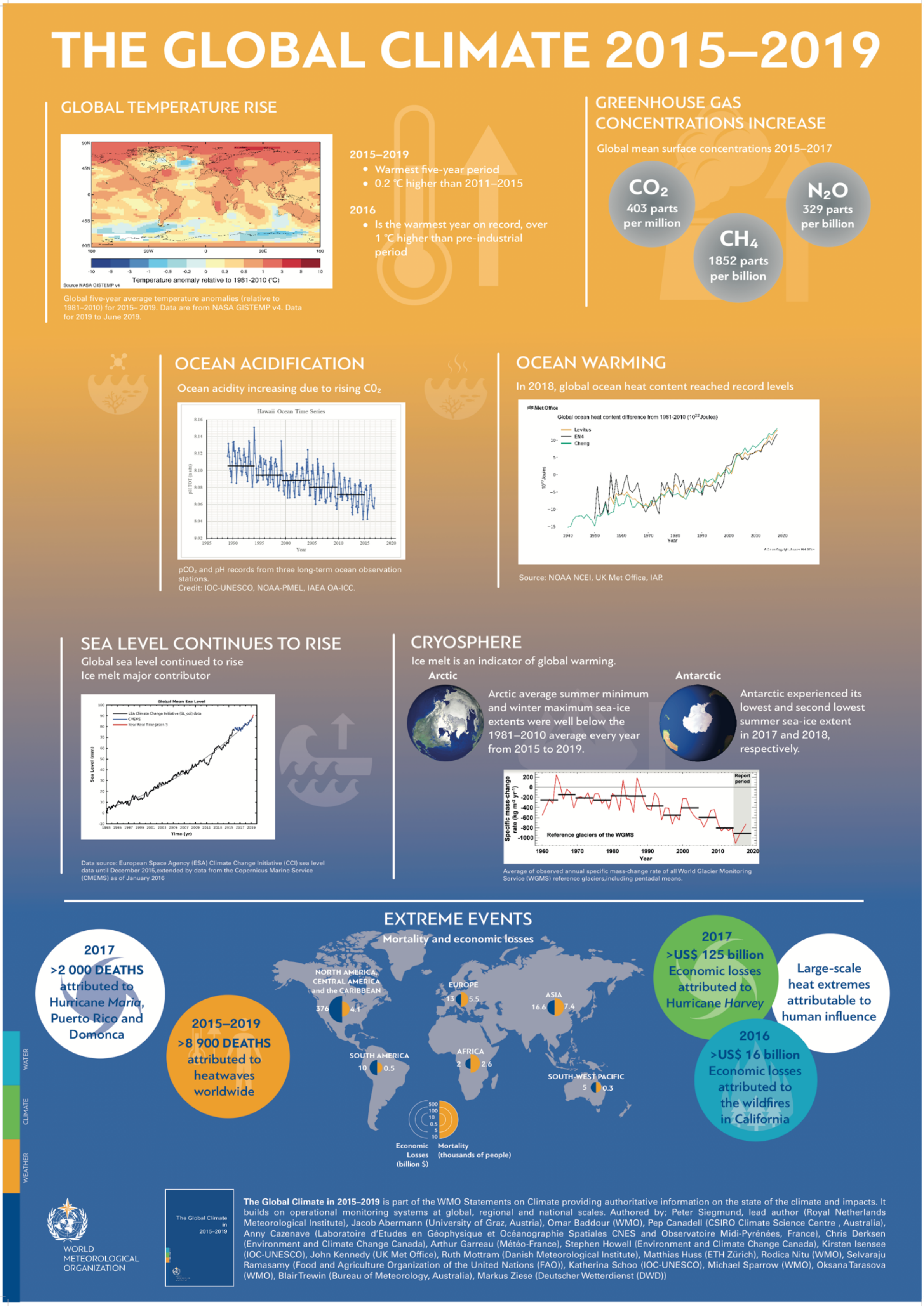
- In June 1816, Mary Shelley was forced by the weather to spend her Swiss holiday indoors with her literary companions, where to pass the time they decided to have a contest to see who could write the scariest story. The result was the novel Frankenstein; or, The Modern Prometheus.

Map source: *Year without summer,* Wikipedia.
source: *Blast of the Past.* Smithsonian magazine

Annex 4

WEATHER HEADLINES

Annex 5

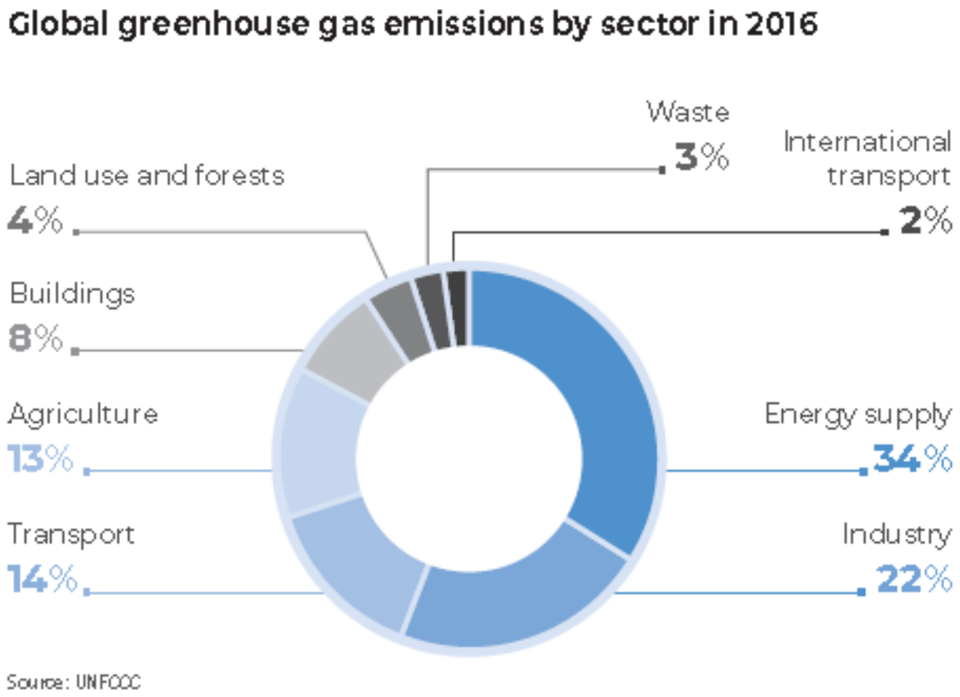


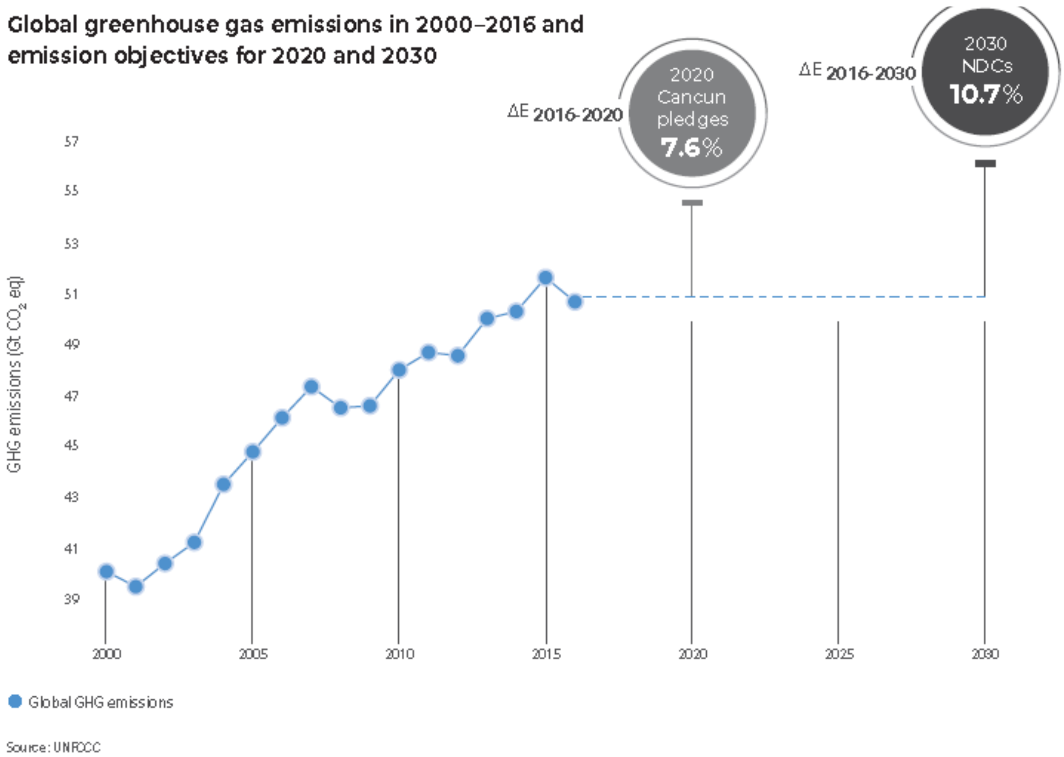
THE GLOBAL CLIMATE 2015–2019
GLOBAL TEMPERATURE RISE
Temperature anomaly relative to 1981-2010 (°C)
Source NASA GISTEMP v4
Global five-year average temperature anomalies (relative to 1981–2010) for 2015– 2019. Data are from NASA GISTEMP v4. Data for 2019 to June 2019.
2015–2019
Warmest five-year period
0.2 °C higher than 2011–2015
2016
Is the warmest year on record, over 1 °C higher than pre-industrial period
GREENHOUSE GAS CONCENTRATIONS INCREASE
Global mean surface concentrations 2015–2017
CO2 403 parts per million
CH4 1852 parts per billion
N2O 329 parts per billion
OCEAN ACIDIFICATION
Ocean acidity increasing due to rising CO2
Hawaii Ocean Time Series
pCO2 and pH records from three long-term ocean observation stations.
Credit: IOC-UNESCO, NOAA-PMEL, IAEA OA-ICC.
OCEAN WARMING
In 2018, global ocean heat content reached record levels
Met Office
Levitus
EN4
Cheng
Year
Source: NOAA NCEI, UK Met Office, IAP.
SEA LEVEL CONTINUES TO RISE
Global sea level continued to rise
Ice melt major contributor
Global Mean Sea Level
Sea Level (mm)
Time (yr)
Data source: European Space Agency (ESA) Climate Change Initiative (CCI) sea level data until December 2015,extended by data from the Copernicus Marine Service (CMEMS) as of January 2016
CRYOSPHERE
Ice melt is an indicator of global warming.
Arctic
Arctic average summer minimum and winter maximum sea-ice extents were well below the 1981–2010 average every year from 2015 to 2019.
Antarctic
Antarctic experienced its lowest and second lowest summer sea-ice extent in 2017 and 2018, respectively.
Specific mass-change rate (kg m⁻² yr⁻¹)
Report period
Reference glaciers of the WGMS
Year
Average of observed annual specific mass-change rate of all World Glacier Monitoring Service (WGMS) reference glaciers,including pentadal means.
EXTREME EVENTS
Mortality and economic losses
NORTH AMERICA, CENTRAL AMERICA and the CARIBBEAN 376 4.1
EUROPE 13 5.5
ASIA 16.6 7.4
SOUTH AMERICA 10 0.5
AFRICA 2 2.6
SOUTH-WEST PACIFIC 5 0.3
Economic Losses (billion $)
Mortality (thousands of people)
2017 >2 000 DEATHS attributed to Hurricane Maria, Puerto Rico and Domonca
2015–2019 >8 900 DEATHS attributed to heatwaves worldwide
2017 >US$ 125 billion Economic losses attributed to Hurricane Harvey
Large-scale heat extremes attributable to human influence
2016 >US$ 16 billion Economic losses attributed to the wildfires in California
WATER
CLIMATE
WEATHER
WORLD METEOROLOGICAL ORGANIZATION
The Global Climate in 2015–2019
The Global Climate in 2015–2019 is part of the WMO Statements on Climate providing authoritative information on the state of the climate and impacts. It builds on operational monitoring systems at global, regional and national scales. Authored by; Peter Siegmund, lead author (Royal Netherlands Meteorological Institute), Jacob Abermann (University of Graz, Austria), Omar Baddour (WMO), Pep Canadell (CSIRO Climate Science Centre , Australia), Anny Cazenave (Laboratoire d'Etudes en Géophysique et Océanographie Spatiales CNES and Observatoire Midi-Pyrénées, France), Chris Derksen (Environment and Climate Change Canada), Arthur Garreau (Météo-France), Stephen Howell (Environment and Climate Change Canada), Kirsten Isensee (IOC-UNESCO), John Kennedy (UK Met Office), Ruth Mottram (Danish Meteorological Institute), Matthias Huss (ETH Zürich), Rodica Nitu (WMO), Selvaraju Ramasamy (Food and Agriculture Organization of the United Nations (FAO)), Katherina Schoo (IOC-UNESCO), Michael Sparrow (WMO), Oksana Tarasova (WMO), Blair Trewin (Bureau of Meteorology, Australia), Markus Ziese (Deutscher Wetterdienst (DWD))

Annex 6

Climate action and support trends

2019 United Nations Climate Change Secretariat





Impacts in key vulnerable sectors identified in Parties' intended nationally determined contributions

Sector	Observed and projected impacts
Agriculture	› Increased frequency and severity of crop disease › Increased soil erosion › Losses in agricultural production and crop yield due to extreme weather
Water	› Changes in water distribution › Reduced water availability and quality
Health	› Hunger and malnutrition due to increased food insecurity › Increase in water-borne diseases such as diarrhea due to water scarcity › Increase in vector-borne diseases such as malaria due to higher temperatures › Mortality and morbidity due to extreme events
Forestry	› Increase or projected increase in forest fires › Changes in the distribution of forest species
Biodiversity	› Changes in the timing and duration of growing seasons › Changes in the distribution of species › Species endangerment and extinction
Coastal zones	› Increased risk of flooding and inundation due to extreme weather › Increased coastal erosion › Changes to coastal ecosystems › Alterations in sediment deposition patterns
Fisheries	› Changing population numbers and distribution because of ocean acidification and ocean circulation patterns › Habitat loss and degradation for marine animals
Tourism	› Reduced winter tourist traffic due to reduced snow cover › Archaeological sites and ancient buildings threatened by extreme weather › Endangered tourist areas due to coastal erosion and sea level rise
Energy	› Challenges for thermal generation › Higher demand for cooling › Economic losses due to interruptions caused by extreme weather

Adaptation measures identified by Parties in priority sectors

Sector	Examples
Agriculture	› Drought-resilient crops › Food storage, monitoring and distribution › Training for farmers, local administrators and other stakeholders › Implementing climate criteria for agricultural programmes › Adapting agricultural calendars
Water	› Water harvesting, storage, metering and saving tools › Integrated water resource management practices › Water treatment facilities › Enhancing water allocation schemes › Public awareness campaigns
Health	› Developing contingency plans for health emergencies › Early warning systems for extreme events › Public awareness campaigns
Forestry	› Sustainable forest management, including through community forest management › Quantitative objectives for forest protection › Economic incentives for forest protection
Biodiversity	› Establishing protected areas and biodiversity corridors › Recovering ecosystems, including forests and marine (mangroves and coral reefs) › Providing water and food points for wildlife
Coastal zones	› Coastal afforestation, including mangroves › Integrated coastal zone management practices › Sand banks and structural technologies › Implementing local monitoring networks
Fisheries	› Aquaculture › Using technology for open sea cultivation › Monitoring, diagnosing and treating diseases
Tourism	› Nature-based and sustainable tourism › Diversification of tourism offerings › Artificial snow in ski areas
Energy	› Diversification of energy generation › Climate proofing, and integrating climate considerations into energy sector investments › Public awareness campaigns to increase energy efficiency
Disaster risk management	› Early warning systems › Risk management institutions › Hazard mapping › Resilience standards for buildings and infrastructure › Emergency operation plans