

HOT, HOTTER... HEATWAVE!

**AN INTRODUCTION TO
CLIMATE CHANGE**

- The undertaking: “**Let’s talk about the climate!**”, number: 2019-I-PMU-I052 carried out as part of the Transnational mobility of pupils' project funded by the European Social Fund within the framework of the Operational Programme Knowledge Education Development

Zajęcia przygotowawcze do mobilności: naukowo - badawcze

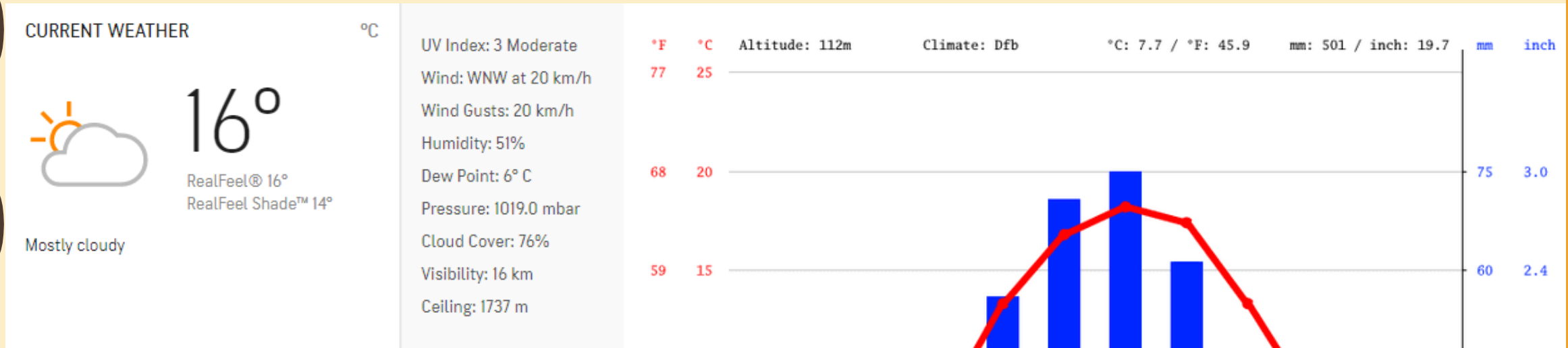


INTRODUCTION

To talk about climate changes we should discuss:

- what is a climate?
- how can we describe climate and its changes?
- what are evidences for climate changes?
- why the climate is changing?
- is it natural or human-induced process?

WHAT IS A CLIMATE?



Current weather in Warsaw

Climategraph for Warsaw

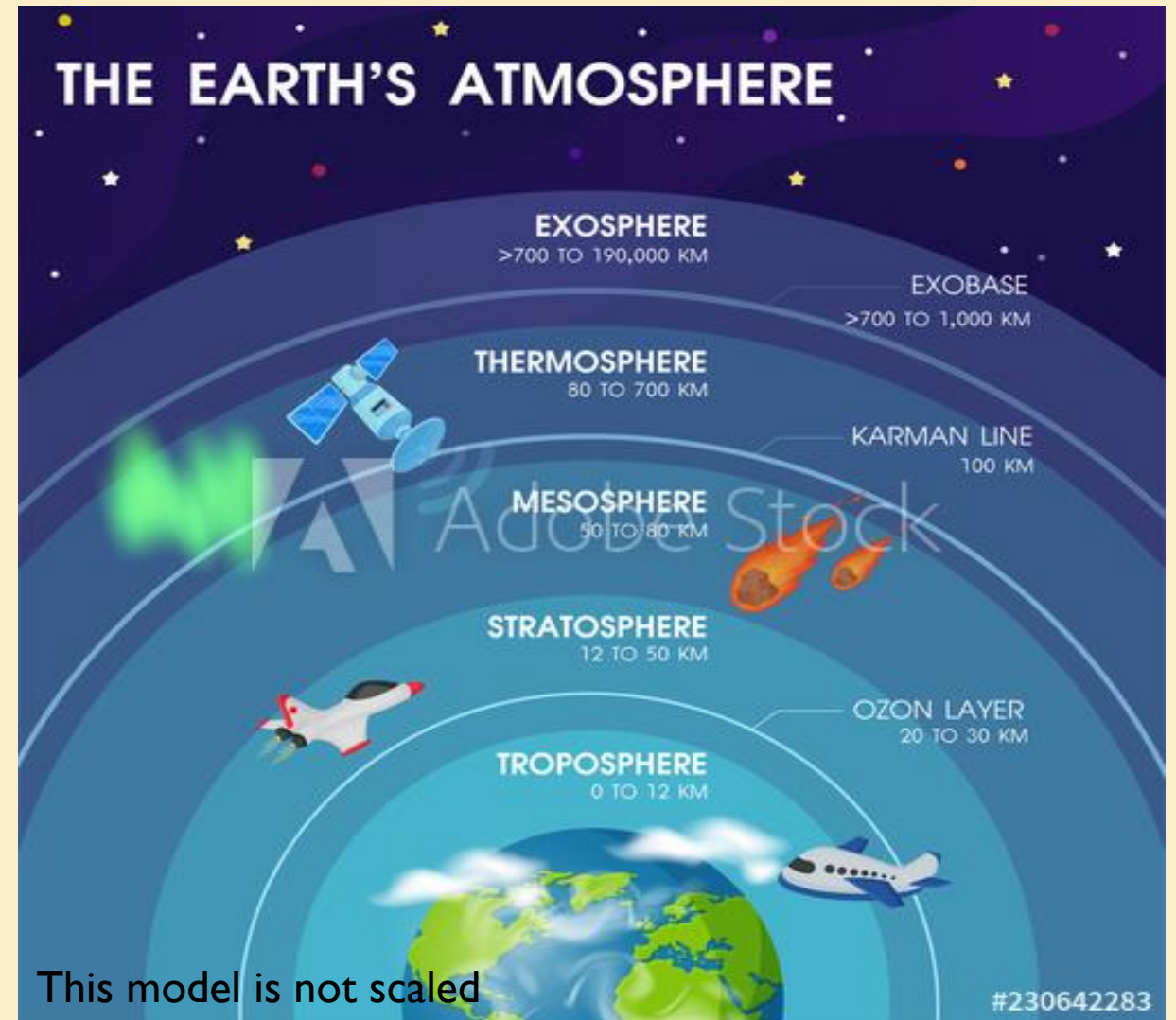
WEATHER AND CLIMATE

- **Weather-** the state of the atmosphere at a particular place and time (now, one hour, one day etc.)
- **Climate-** the weather conditions prevailing in an area in general or over a long period (30 years and longer)

WHERE DO CLIMATE PROCESSES TAKE PLACE?

ATMOSPHERE

- **Atmosphere-** the layer of gases surrounding the Earth or another planet.
- All climate processes take place in the atmosphere, mainly in the troposphere, because it's dense and there is a lot of water vapour. The atmosphere consists of: nitrogen (78%), oxygen (21%), argon (1%) and other gases.



HOW DO WE DESCRIBE THE CLIMATE?

CLIMATE DATA

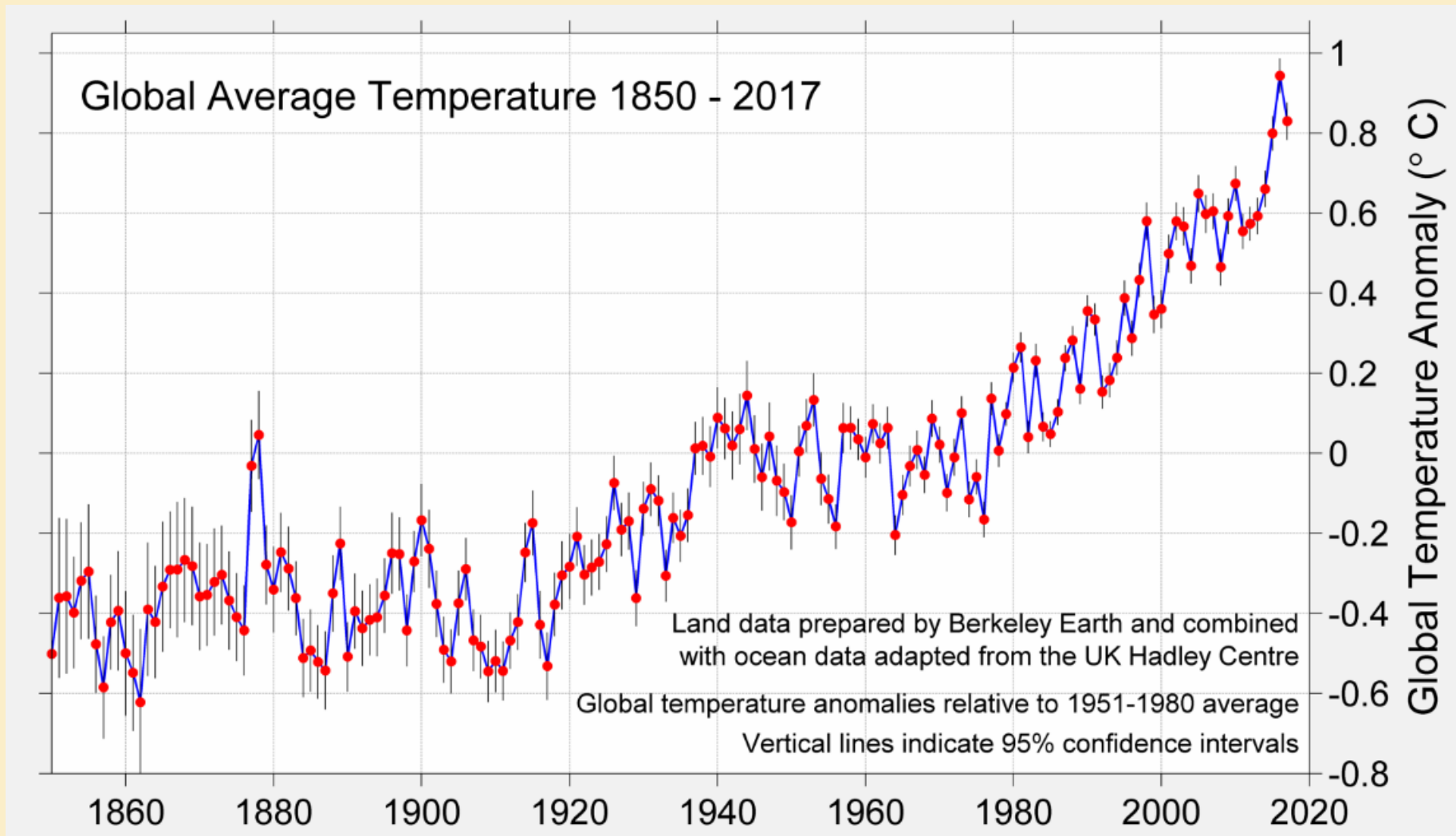
- To describe weather and climate, there are needed some data series about climate elements. **Climate elements** are: a temperature, a precipitation, an air pressure, a cloudiness, wind speed and direction, an information about extreme events (for example a storm) and many more. All these data can be observed and measured using instruments in **meteorological station** or thanks to a **weather satellite**. It's very important that climate data must be correct.



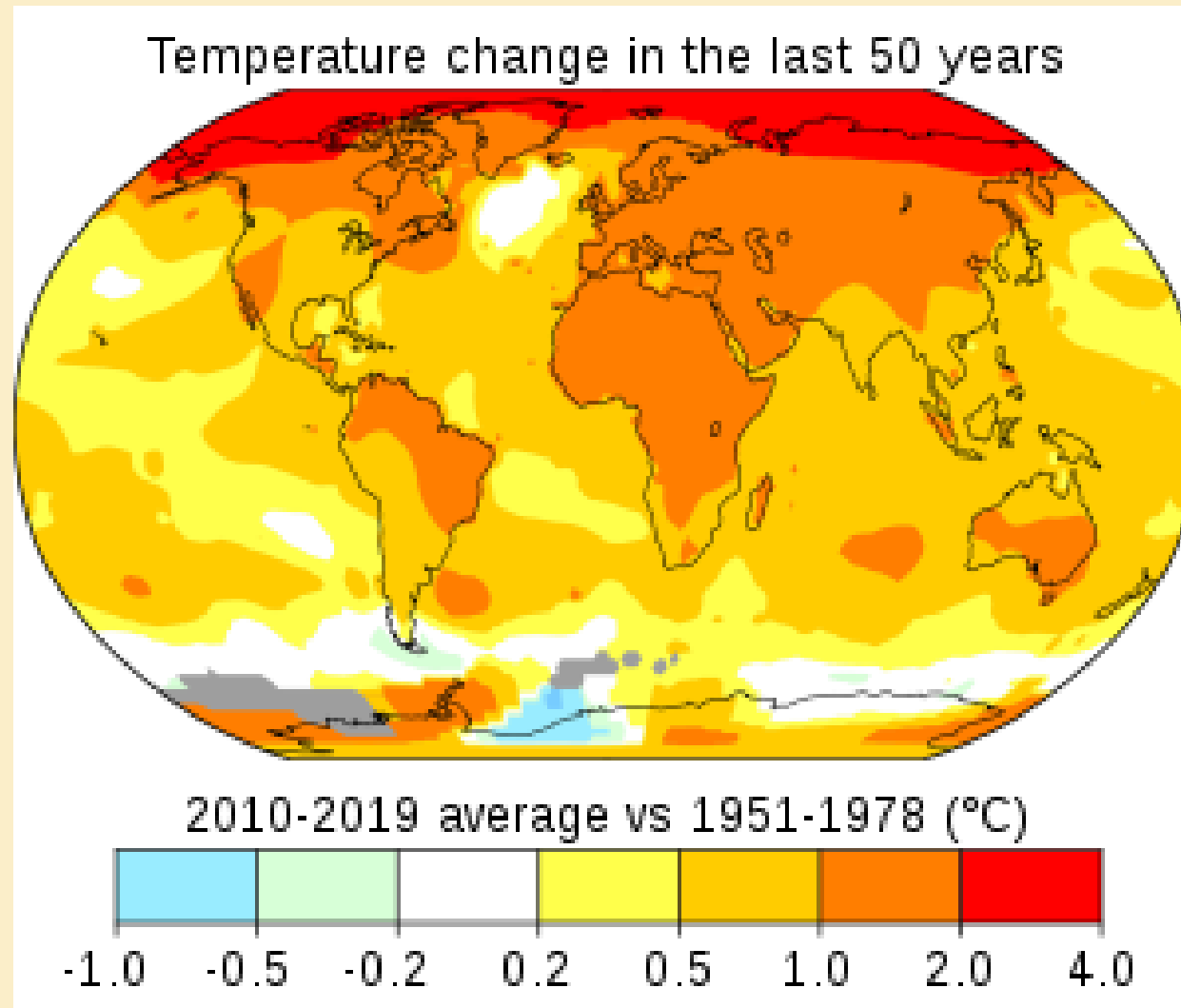
Model of EUMETSAT MSG-II - weather satellite

HOW DO WE KNOW THE CLIMATE IS CHANGING?

GLOBAL TEMPERATURE RISE



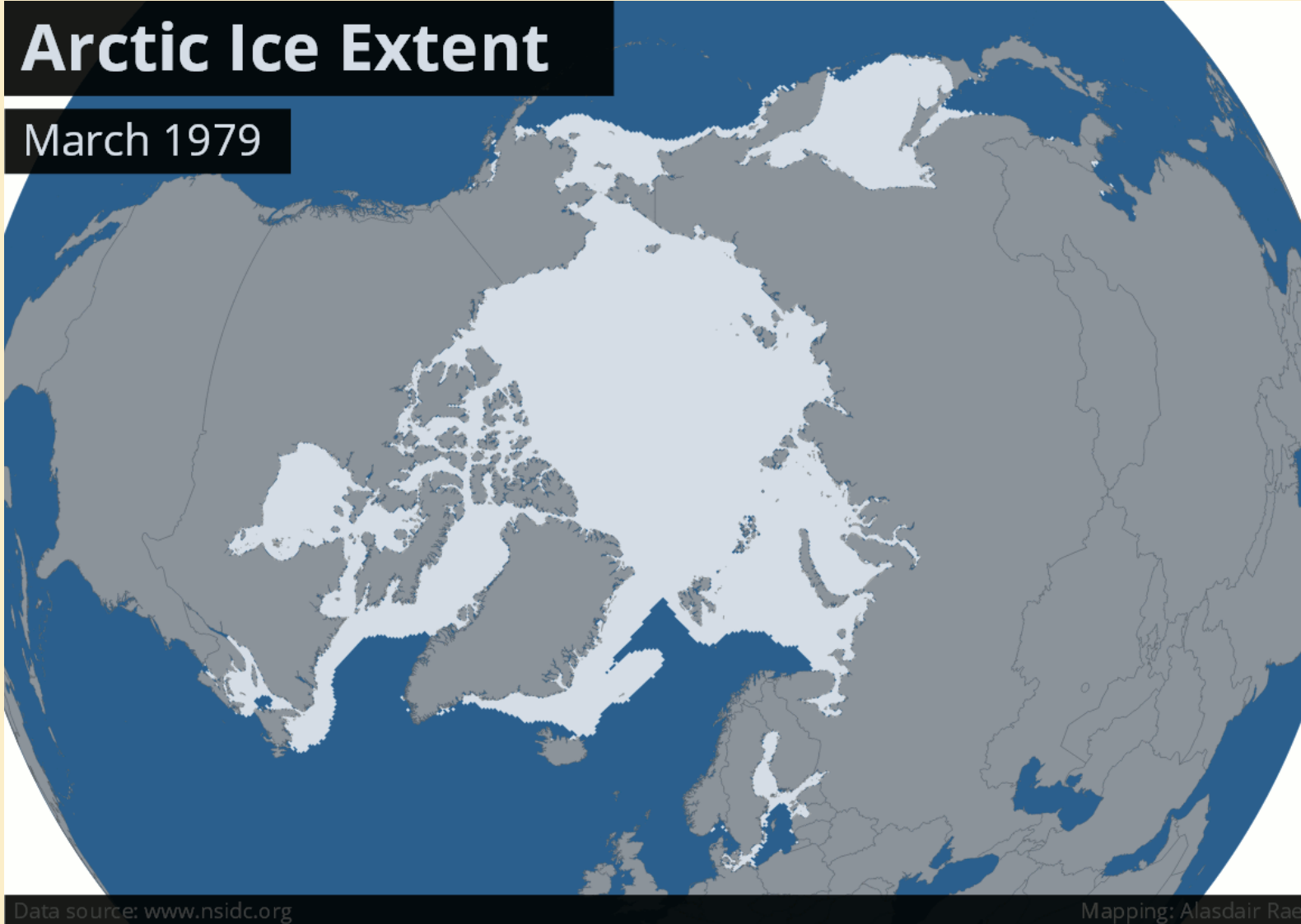
GLOBAL TEMPERATURE RISE



SHRINKING ICE SHEETS

Arctic Ice Extent

March 1979



SHRINKING ICE SHEET

Arctic Ice Extent

September 1979



Data source: www.nsidc.org

Mapping: Alasdair Rae

GLACIAL RETREAT IN MOUNTAINS



SEA LEVEL RISE



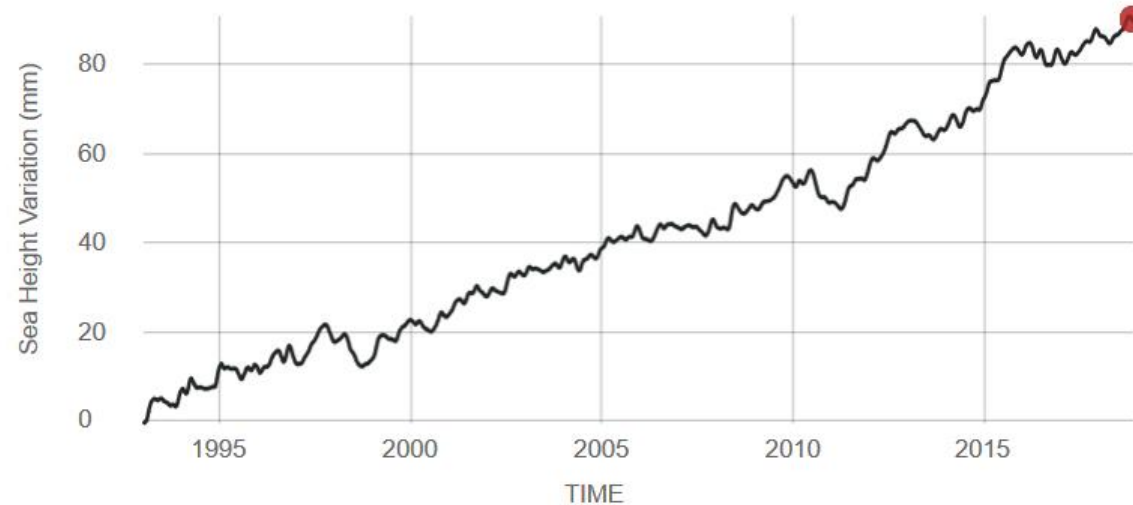
Maldives

SATELLITE DATA: 1993-PRESENT

Data source: Satellite sea level observations.
Credit: NASA Goddard Space Flight Center

RATE OF CHANGE

↑ 3.3
millimeters per year



MORE EXTREME EVENTS

- Storms
- Droughts
- Floods
- Tornadoes
- Hurricanes



Whirlwind in Poland

Climate change= global warming+more extreme events

EVIDENCES OF CLIMATE CHANGE

- Observations show that climate on the Earth is changing. It's getting warmer and there are more extreme events.

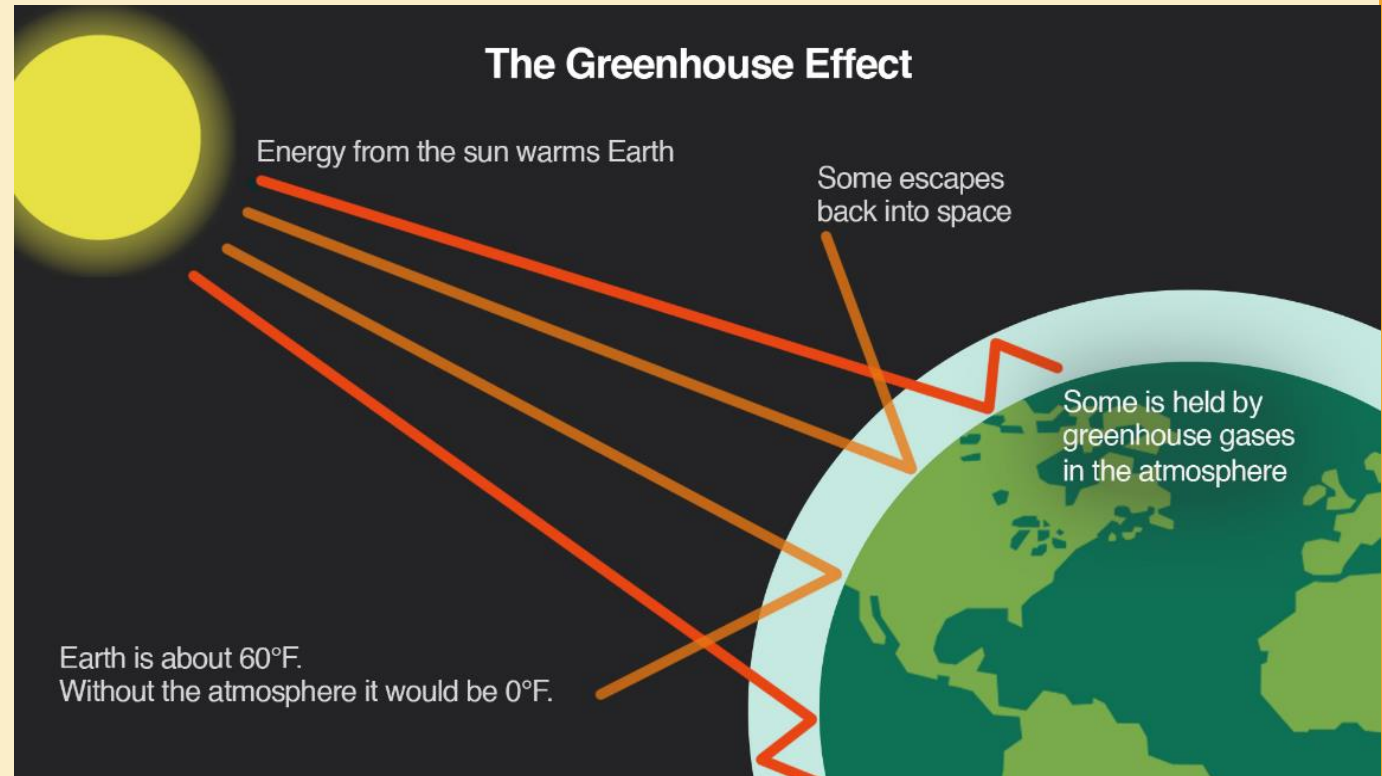
Main evidences of the climate change:

- global temperature rise
- warming oceans
- shrinking ice sheets
- glacial retreat in the mountains
- decreased snow cover in winter
- sea level rise
- more extreme events
- ocean acidification

WHY THE CLIMATE IS CHANGING?

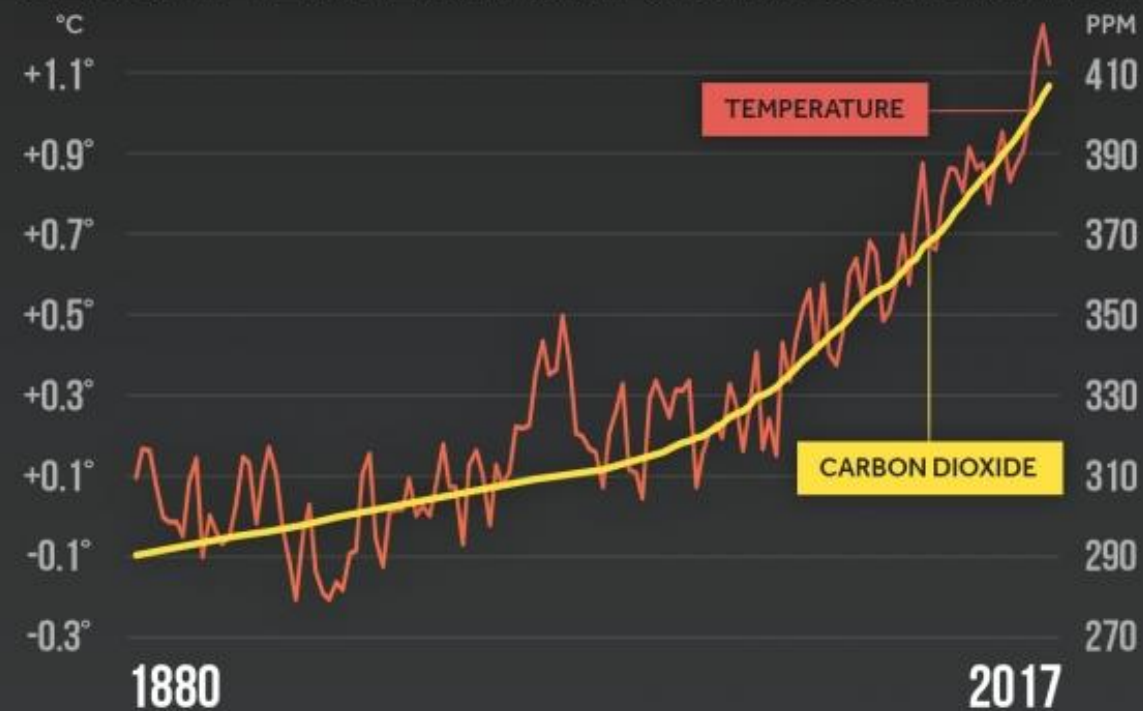
REASON OF CLIMATE CHANGES

- Global temperature rises, because of **the greenhouse effect**.
Greenhouse gases in the atmosphere block energy from escaping the Earth into space. If there are more greenhouse gases in atmosphere, the temperature will be higher. However, thanks to greenhouse effect, it is warm enough to live on the Earth.
- The primary **greenhouse gases** in Earth's atmosphere are water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3).




IS CLIMATE CHANGE NATURAL OR HUMAN-INDUCED PROCESS?

GLOBAL TEMPERATURE & CARBON DIOXIDE

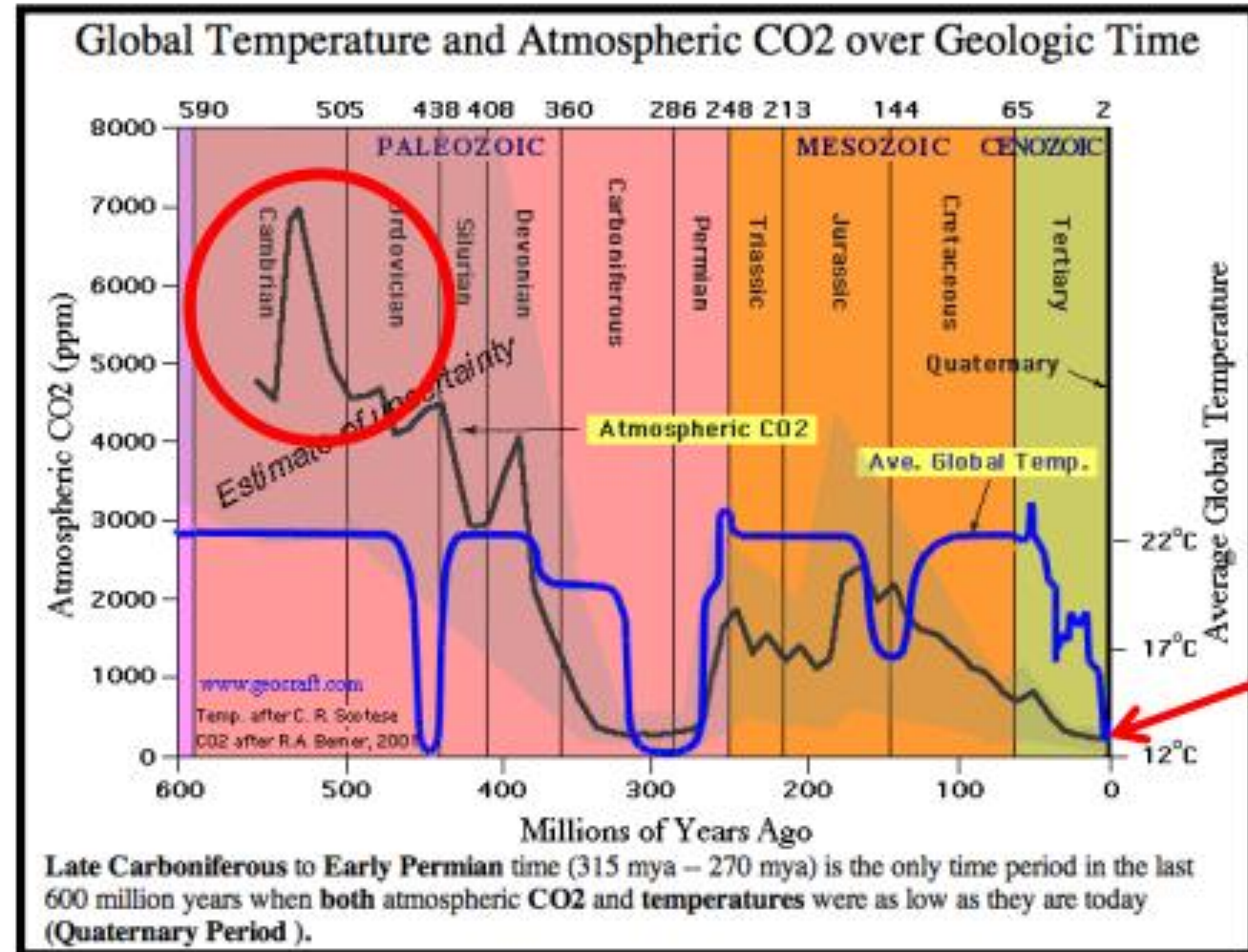


Global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910)
Source: NASA GISS, NOAA NCEI, ESRL

CLIMATE  CENTRAL

CLIMATE CHANGE - NATURAL PROCESS

- Climate of the Earth has changed many times since the birth of our planet. Thanks to the examination of fossils, rocks and ice, it is possible to describe the climate in the past. For example Mesozoic era (time of the dinosaurs) was much warmer than present. On the other hand, last great Ice Age ended 12 000 years ago.



CLIMATE CHANGE- NATURAL PROCESS

- Greenhouse gases go into the atmosphere, because of many **natural processes**. Volcanoes during eruption emit carbon dioxide, vegetation (plants) can regulate concentration of greenhouse gases, swamps and wetland are great storehouses for methane.

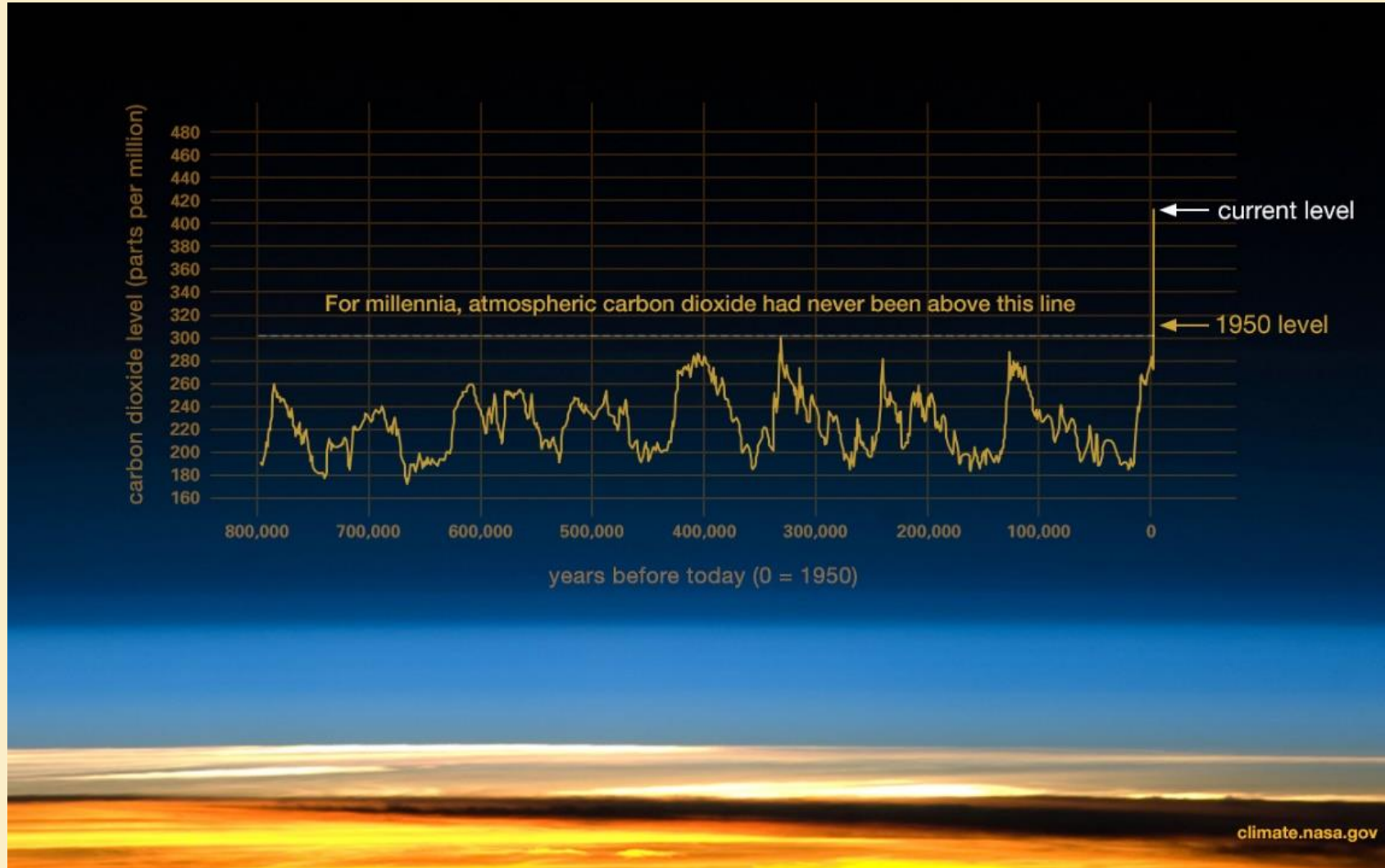


Calbuco volcano, Chile



Biebrza wetlands, Poland

CLIMATE CHANGE- HUMAN- INDUCED PROCESS



CLIMATE CHANGE- HUMAN- INDUCED PROCESS



Bełchatów thermal power station, Poland



Intense farming, United States

CLIMATE CHANGE- HUMAN- INDUCED PROCESS

- Humans are also responsible for producing and **emission** of the greenhouse gases. **Burning fossil fuels** such as coal, lignite, oil and natural gas produces carbon dioxide. **Animals produce** methane and humans keep millions of cows, pigs, chickens and more. Humans **drain wetlands** and **cut forests** to make place for agriculture and cities.



Logging of taiga in Central Siberia, Russia

COMPLEX PROCESS

- There is a great discussion who is responsible for the climate change- nature or humans? Climate change is **a complex process**, which is affected **both** by the natural events and the human activity.
- Humans play great role in it, which means they can (and should) somehow **react** to climate change.

SOURCES

- <https://climate.nasa.gov/>
- <http://klimada.mos.gov.pl/>
- <http://nsidc.org/arcticseaicenews/>
- https://en.wikipedia.org/wiki/Sea_level_rise
- <https://www.eumetsat.int/website/home/index.html>

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- Przedsięwzięcie: „Porozmawiajmy o klimacie” (2019-1-PMU-1052)
- Projekt "Ponadnarodowa mobilność uczniów"

