

Climate history of Iceland

Temperature

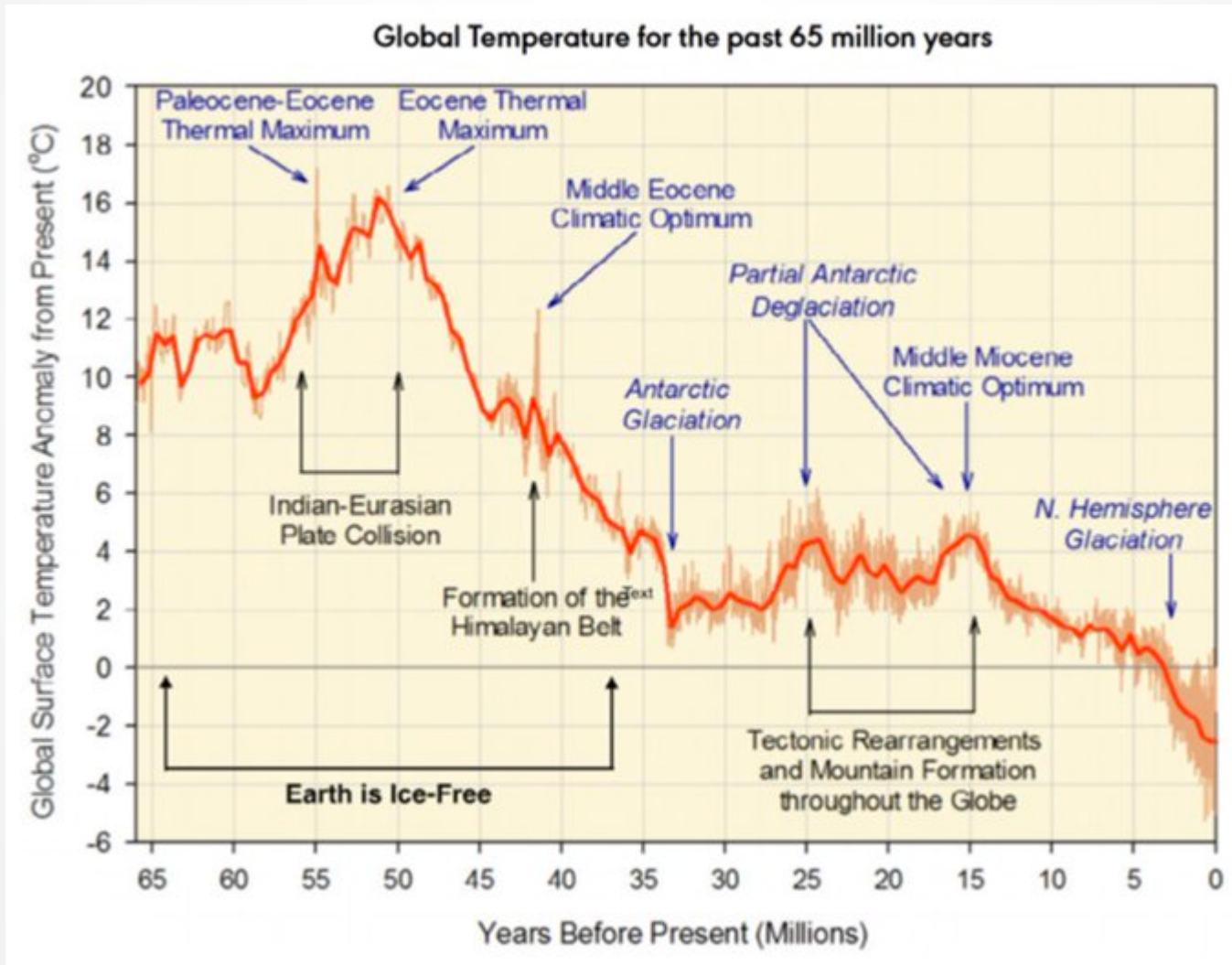
Fridrik Danielsson

<https://www.frjalstland.is/>

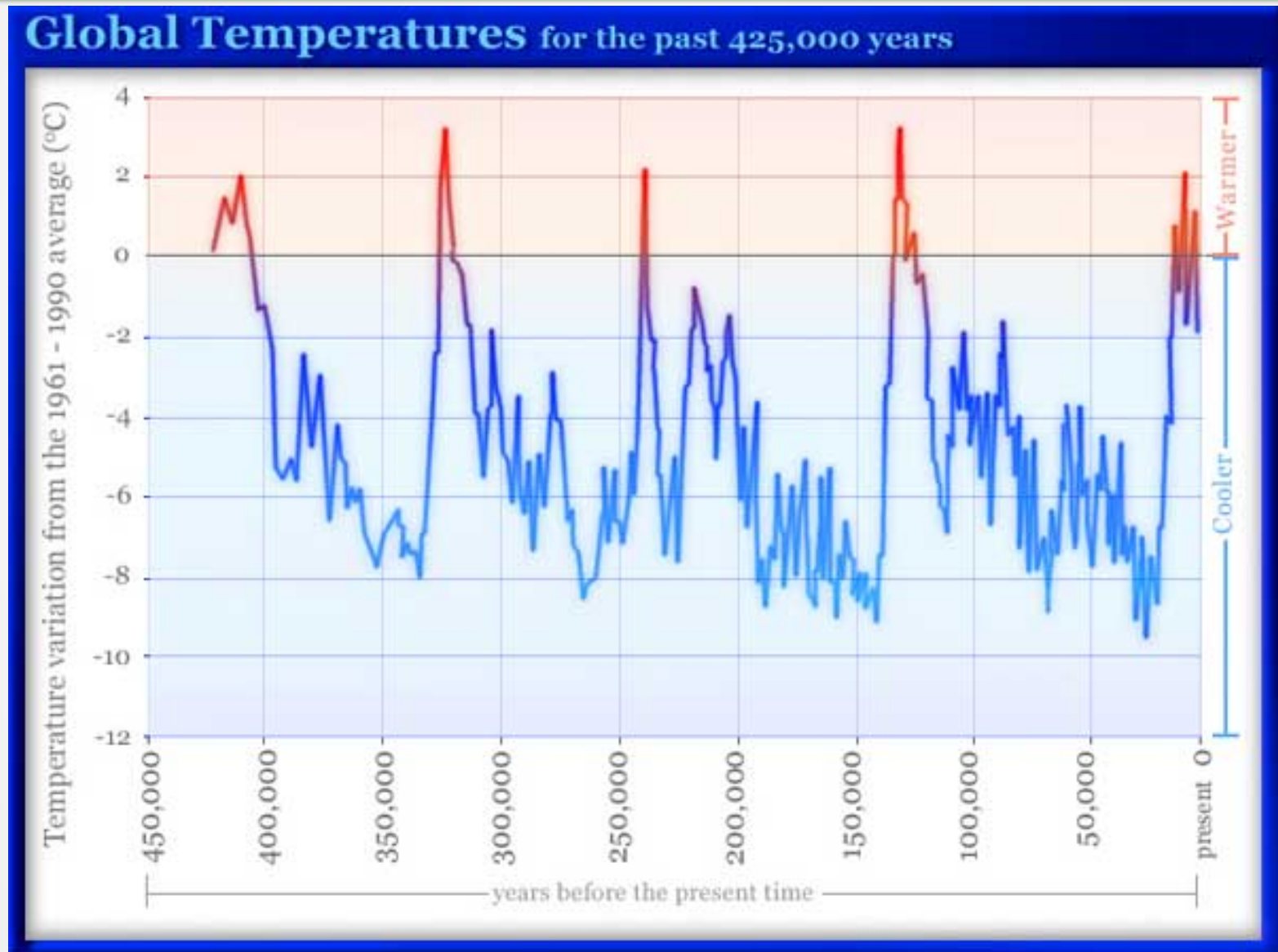
11.7.2021

Global temperature

13°C warmer 65 million years ago (Patrick Moore)



5 warm periods last 425.000 years



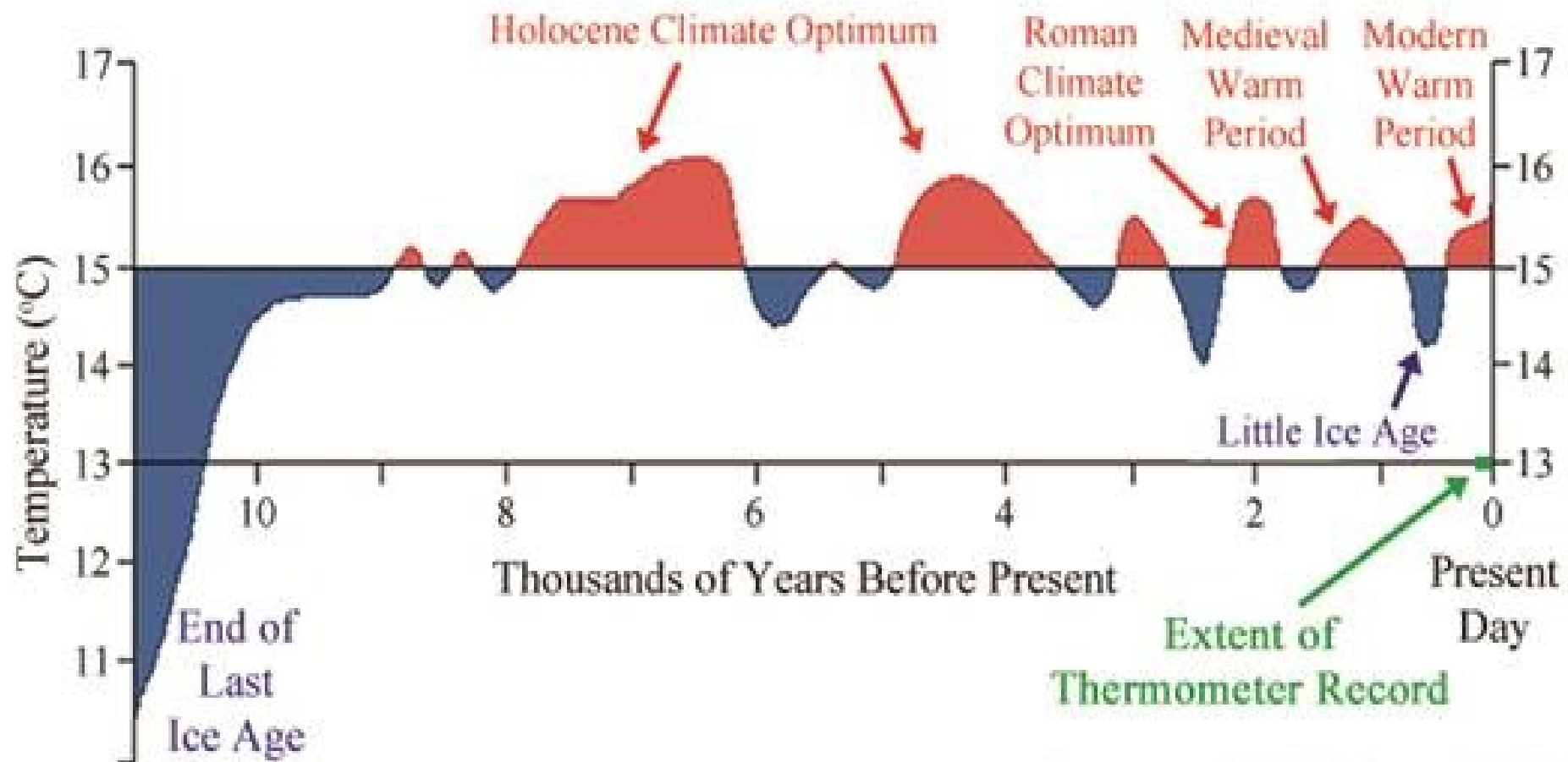
Temperature in Iceland

- Highest temperature during the present warm period (Holocene) was 6-8000 years ago**
- Highest temperature since Iceland settlement was 1130 AD**
- Highest during last 100 years was 1940**
- Warming 1918-1941 and 1979-2003**
- Cooling 1960-1979 and 2014-2020**

Temperature changes last 11.000 years

Warmest 6000-8000 years ago

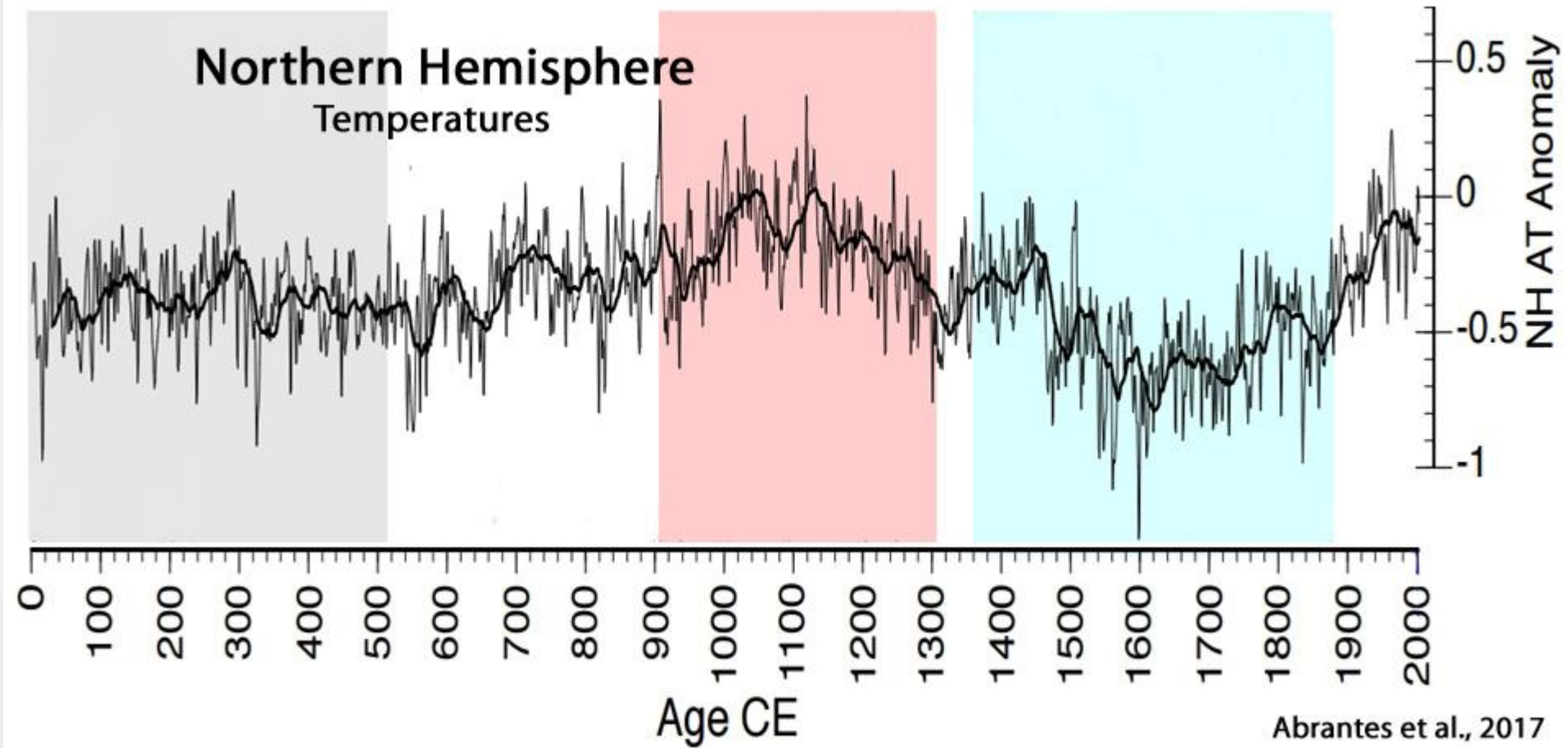
Temperatures of the Last 10,000 Years
(Ice core data from Crete site in central Greenland)



Daansgaard (1984), Avery (2009)

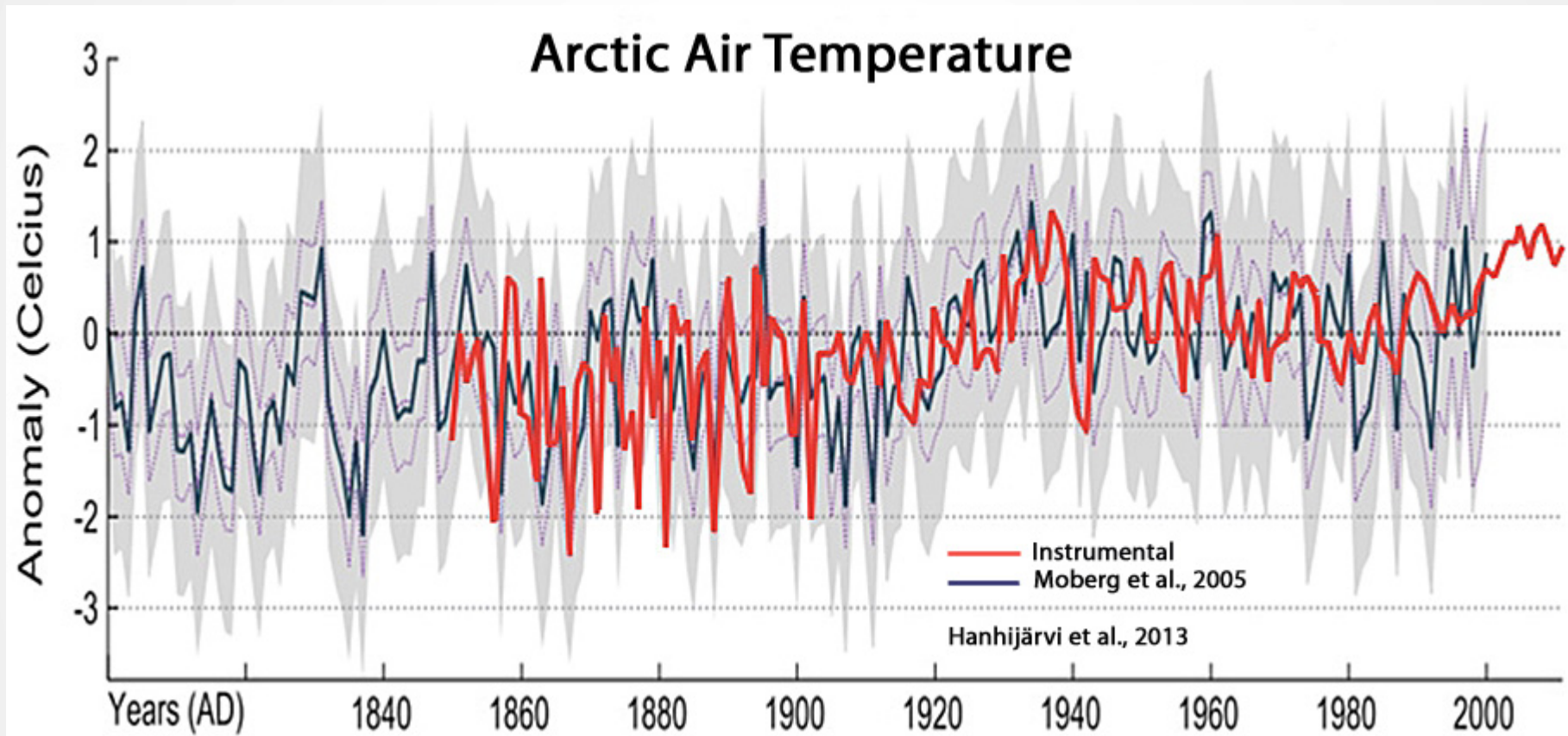
Temperature changes 0 - 2000 CE

Warmest 1130 CE



Temperature in the Arctic from 1800 AD

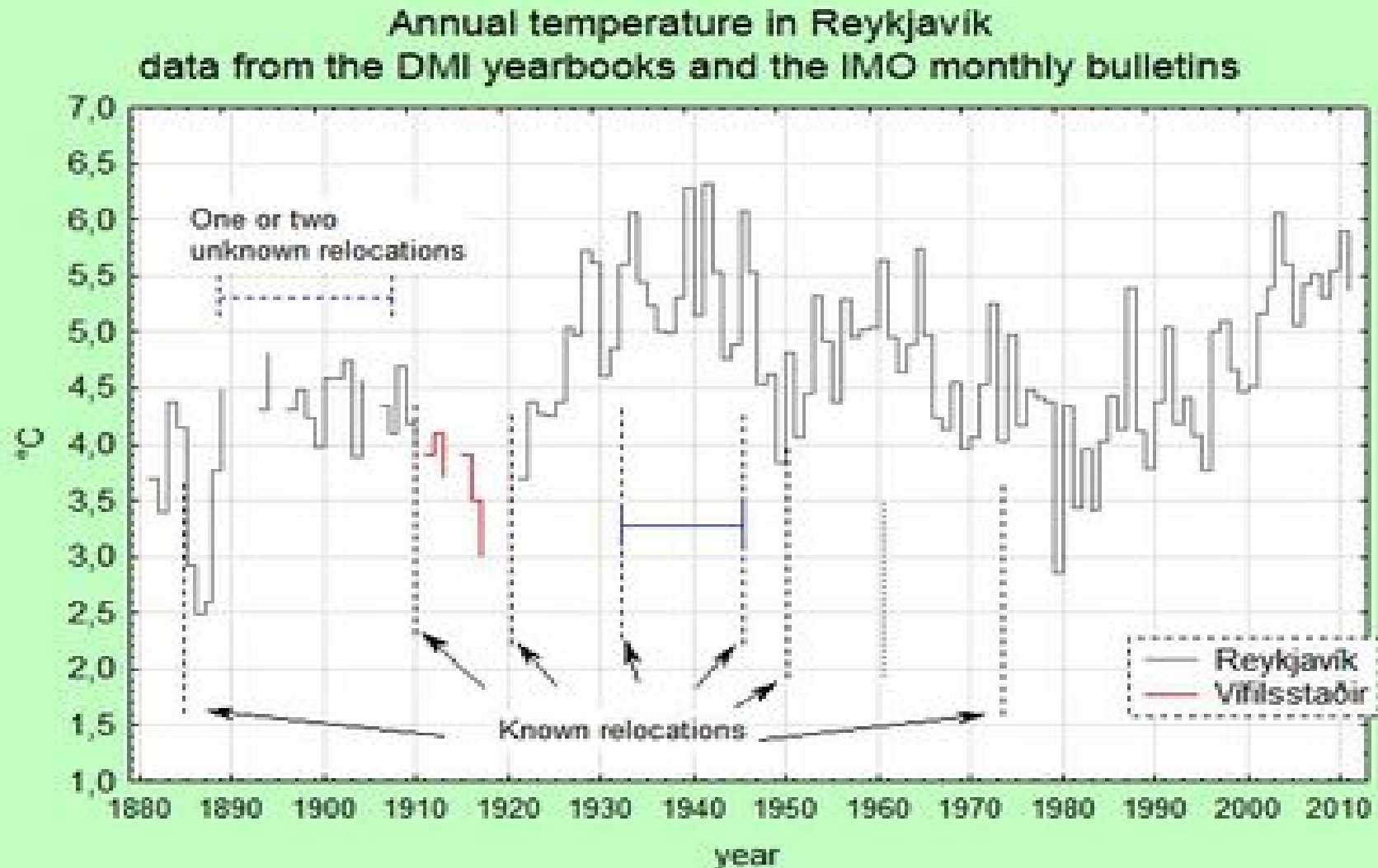
Warmest around 1940



Annual temperature, Reykjavík, 1881-2011.

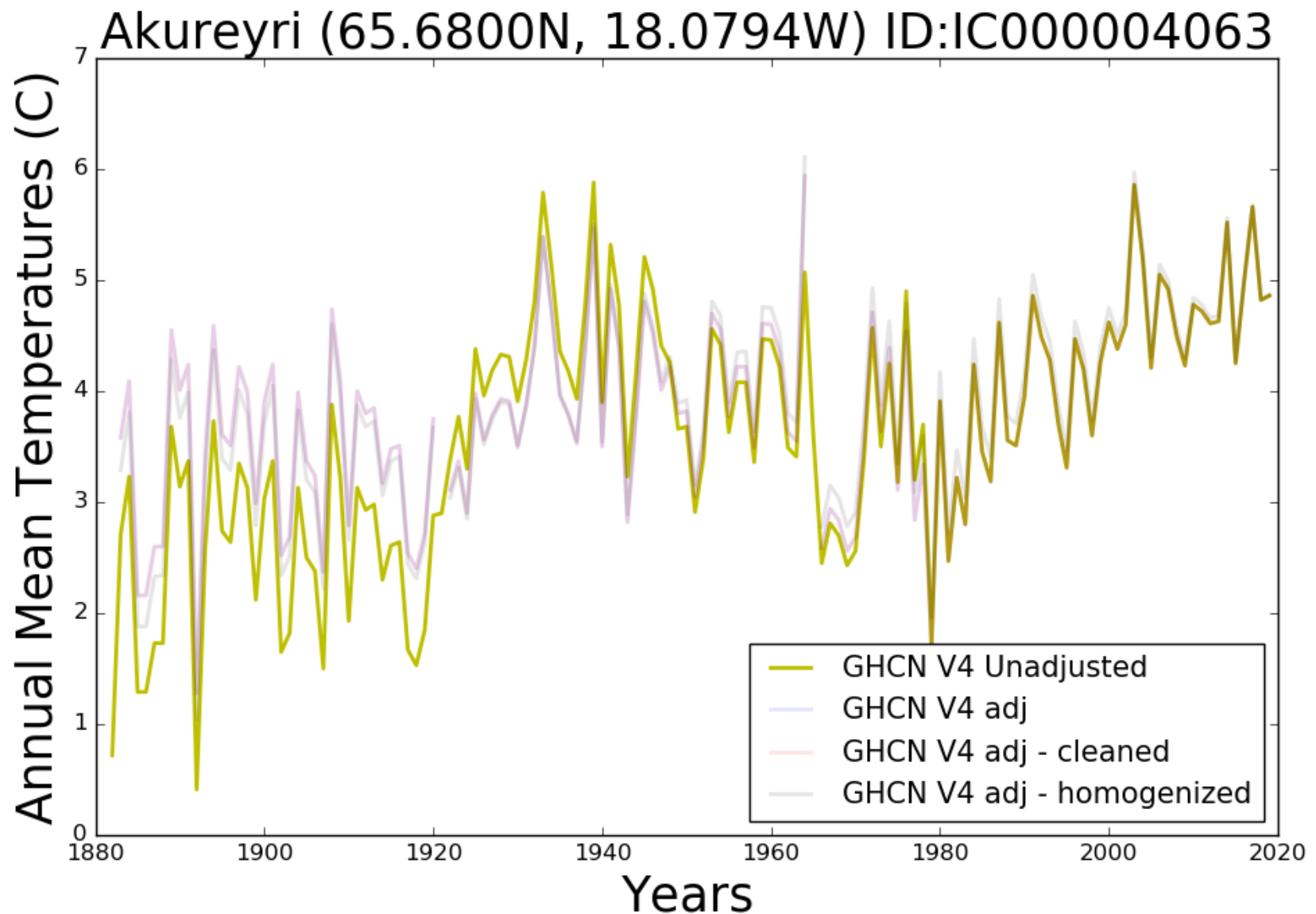
Warmest around 1940

Hungurdiskar (Iceland Weather blog) Trausti Jónsson, 21.3.2012.

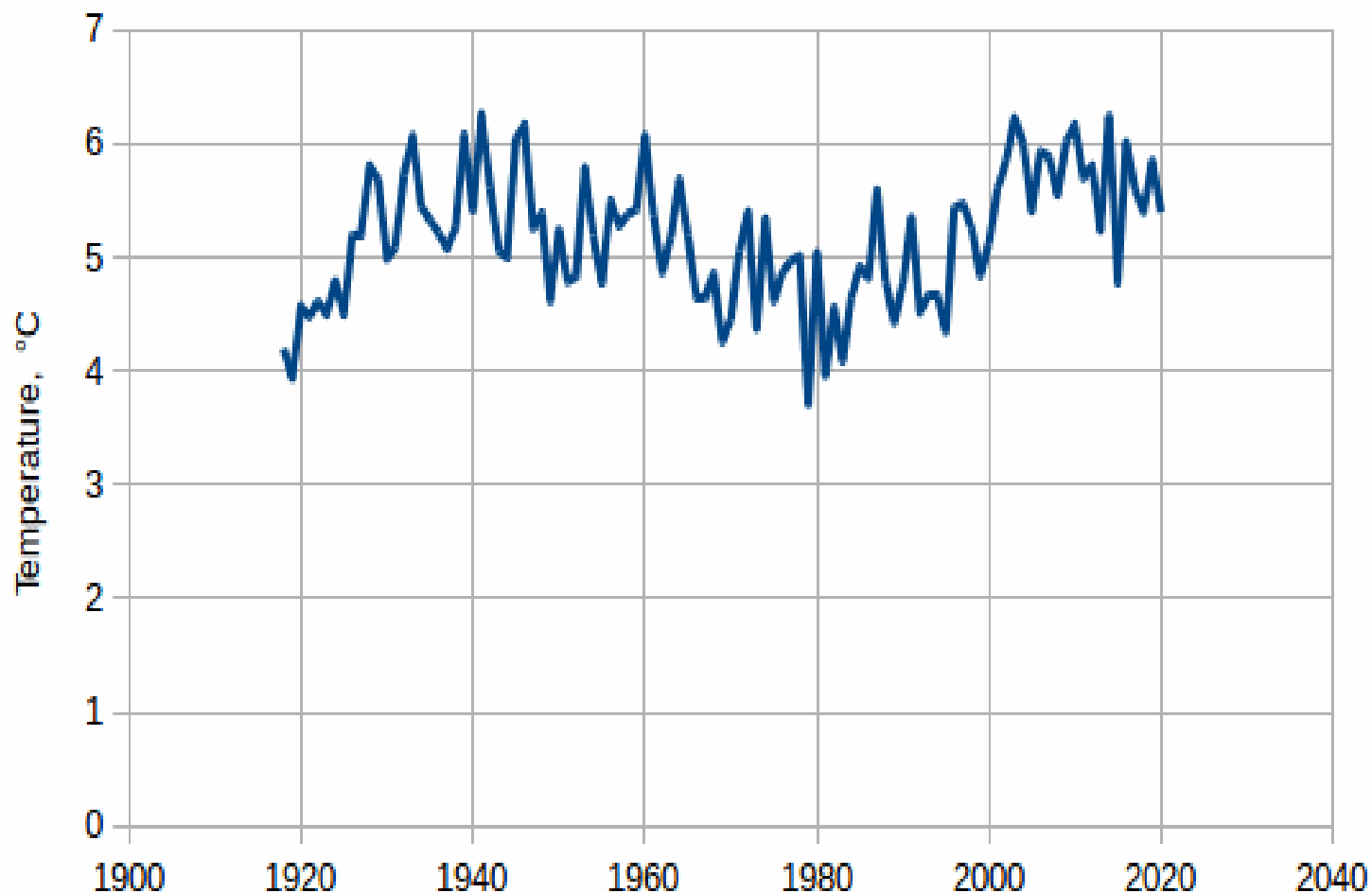


Temperature, Akureyri, 1880-2020

Warmest around 1940 (NASA Giss)



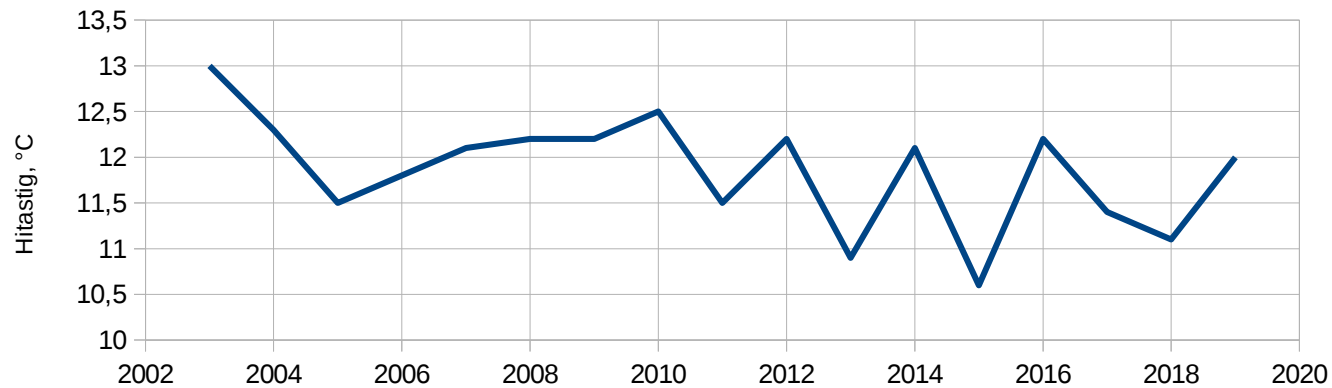
Temperature 1918-2020 on the North-Atlantic at the south coast of Iceland. Warmest year 1941=6,26 coldest 1979=3,71 C°. No net warming 1941-2020. Data from Iceland Met. office.



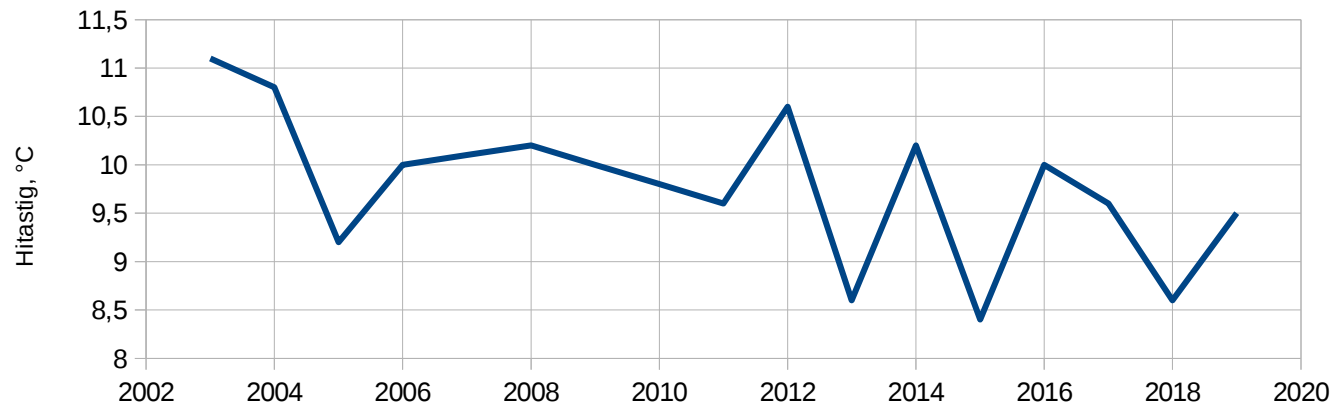
Annual mean temperature 1918-2020, Storhofdi, Vestmannaeyjar

Sea temperature at south and north coast of Iceland. Summer maxima. Cooling trend 2003 to 2018

Data from Hafrannsóknastofnun (MFRI)



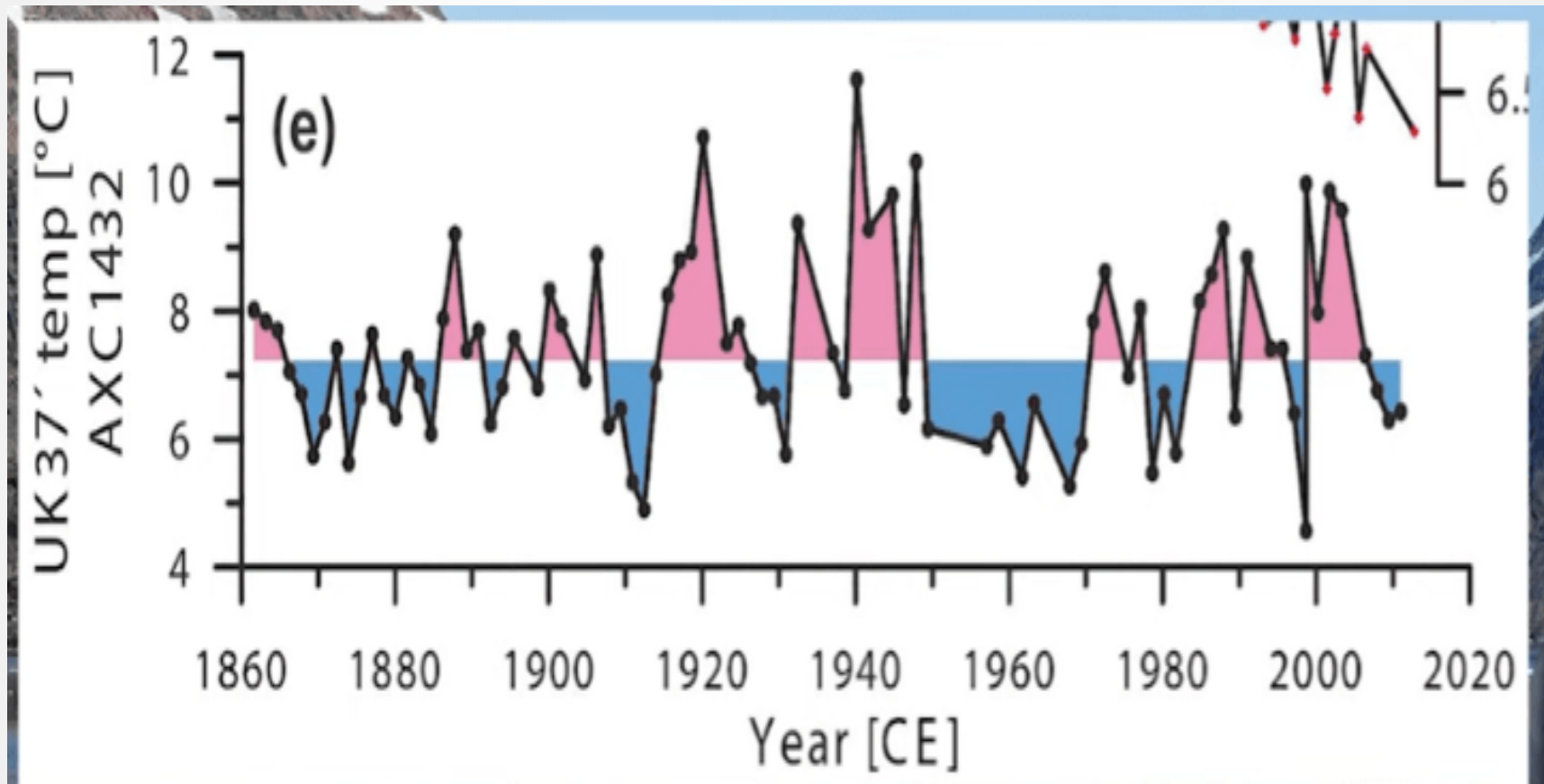
Sjávarhiti við strönd, sumarhámark 2003-2019, Vestmannaeyjar



Sjávarhiti við strönd, sumarhámark 2003-2019, Grímsey

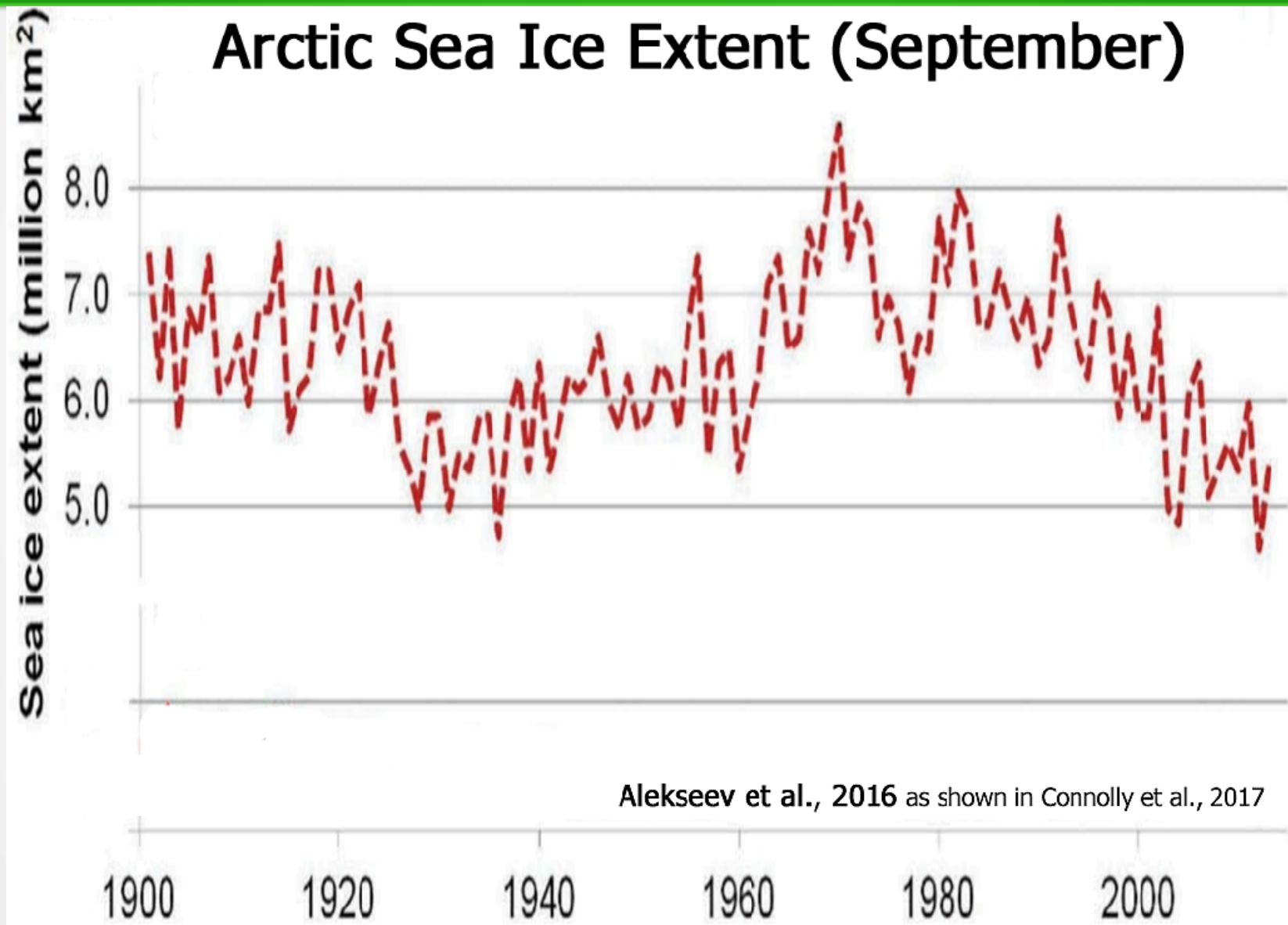
Sea surface temperature ,East-Greenland

<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019PA003692>



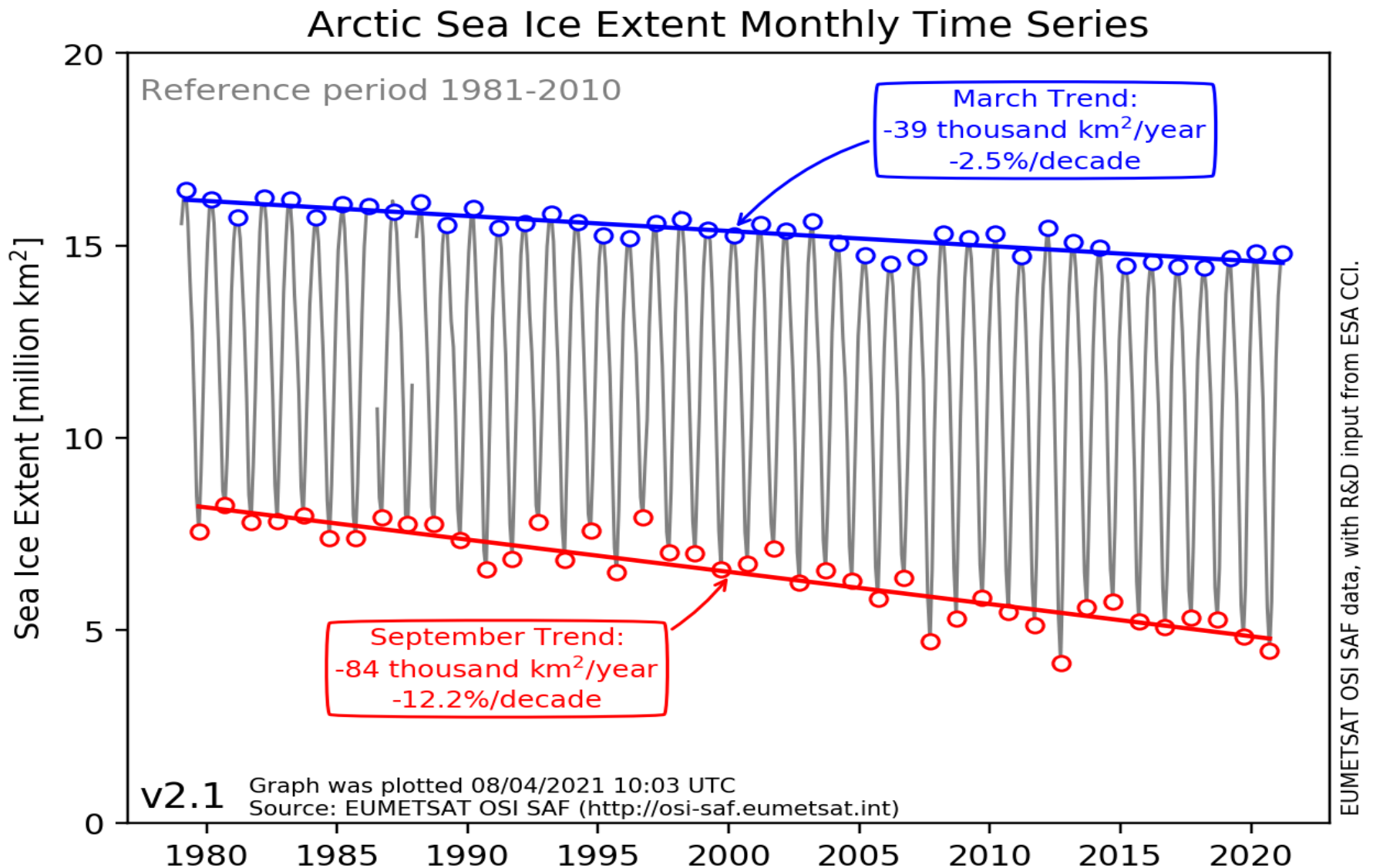
Wangner et al. 2020

Autumn sea ice area in the Arctic, 1900 -2016



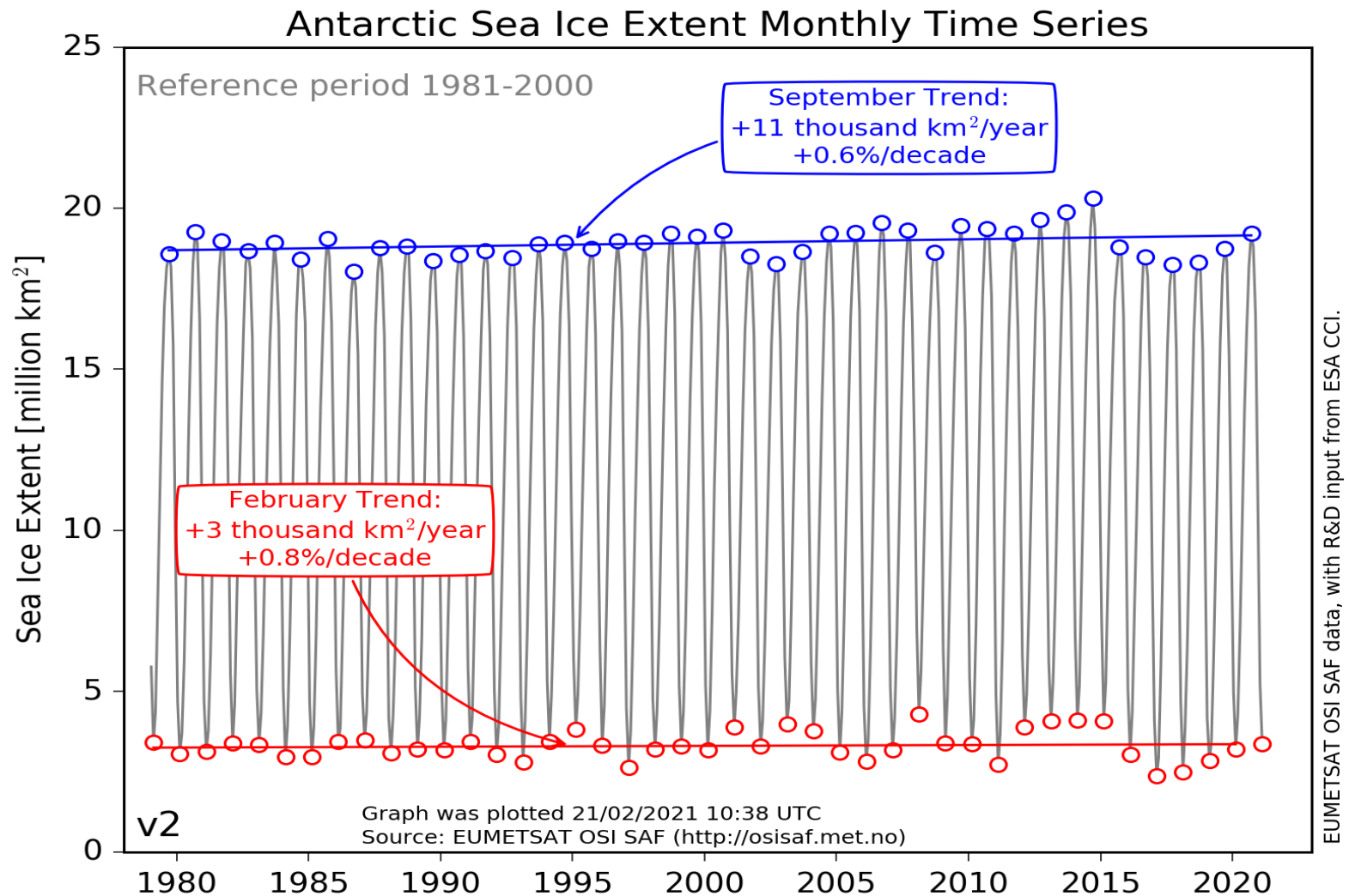
Arctic sea ice extent 1981-2021.

Lowest 2006 (spring) and 2012 (autumn)



Antarctic sea ice extent 1981-2021.

Growing 1981-2021



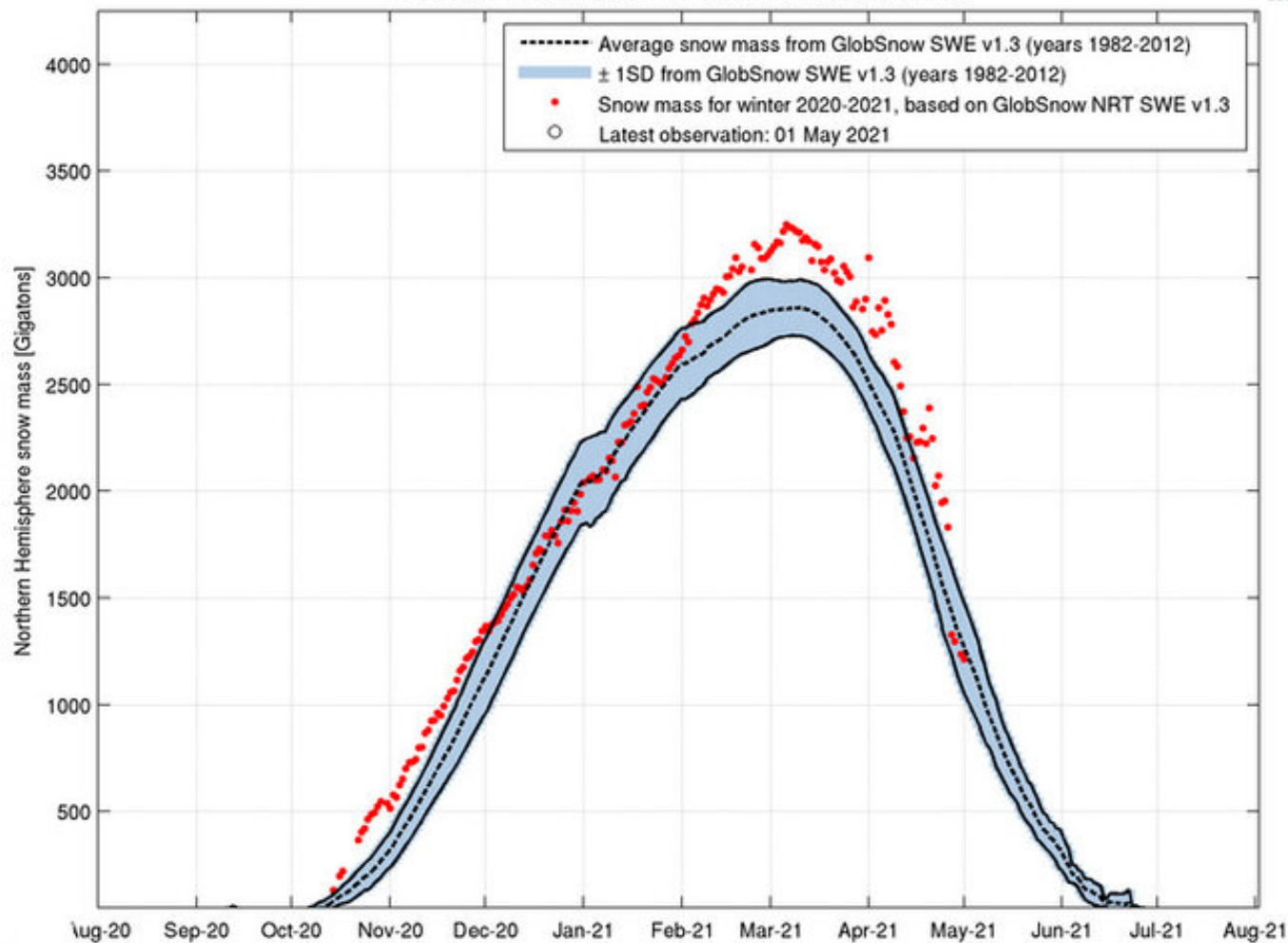
Snow mass in Northern Hemisphere



FINNISH METEOROLOGICAL INSTITUTE



Total snow mass for Northern Hemisphere, excluding mountains

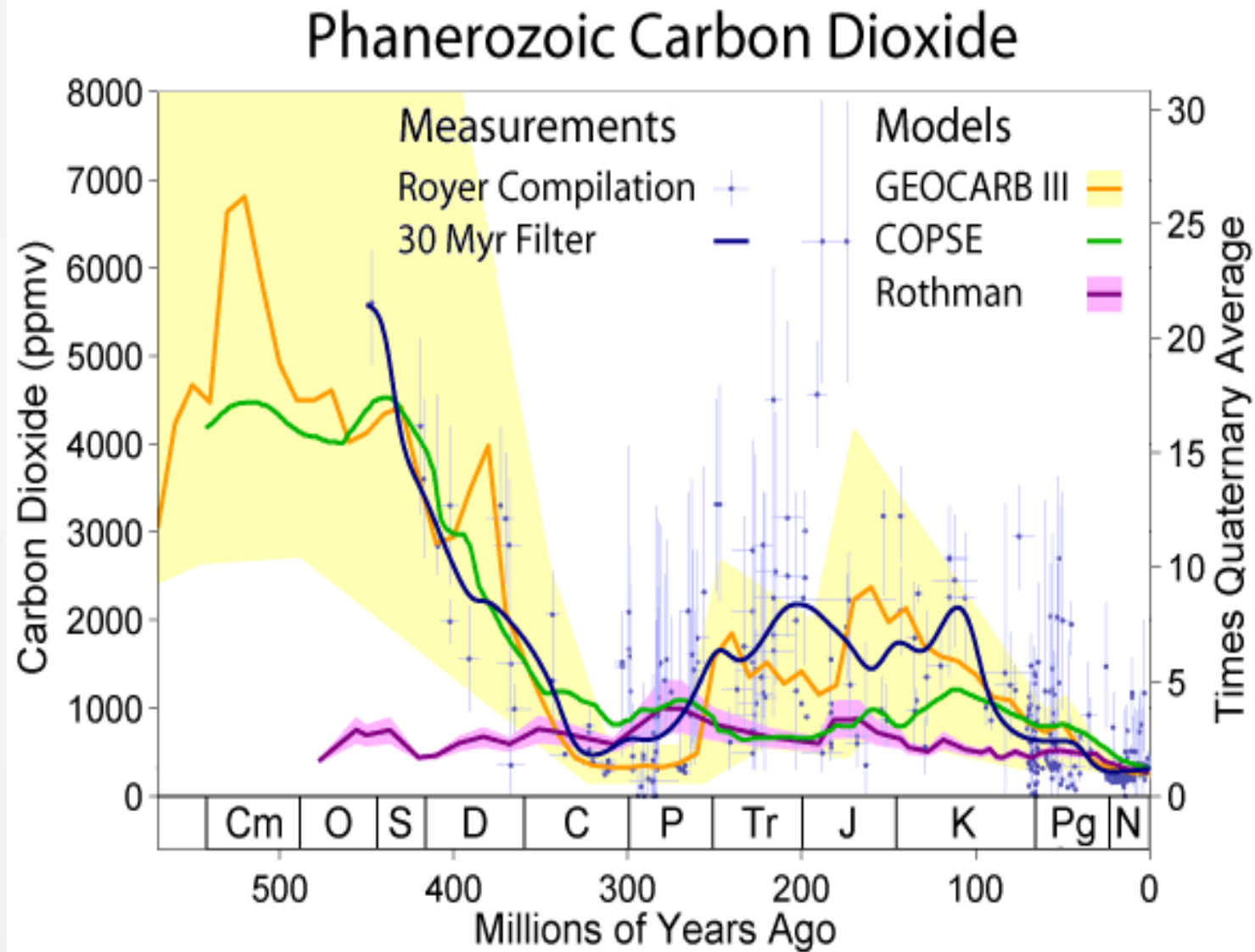


Carbon dioxide and surface temperature

- Earth's atmosphere takes up at present concentration of CO₂ most of the outgoing IR-radiation that CO₂ can absorb, centered around 4.3 and 14.9 micron wavelengths.
- The same is valid for both methane that absorbs IR-radiation around 3.5 and 8 micron and nitrous oxide that absorbs around 4.5 and 8 micron
- Most of the outgoing IR-radiation from the atmosphere has wavelengths around 10 micron which is outside the main absorption wavelength of carbon dioxide, methane and nitrous oxide
- Increase in concentration of carbon dioxide, methane and nitrous oxide have therefore small effect on the uptake of IR-radiation in the atmosphere and hence temperature. The moisture dominates the IR-uptake
- Temperature on Earth and carbon dioxide concentration in the atmosphere have oscillated independently, concentration was more than 15 times the present 600 million years ago

Carbon dioxide concentration in the atmosphere

GEOCARB III (Berner and Kothavala 2001)



Changes of temperature and carbon dioxide concentration have been independent for 570 million years (Patrick Moore)

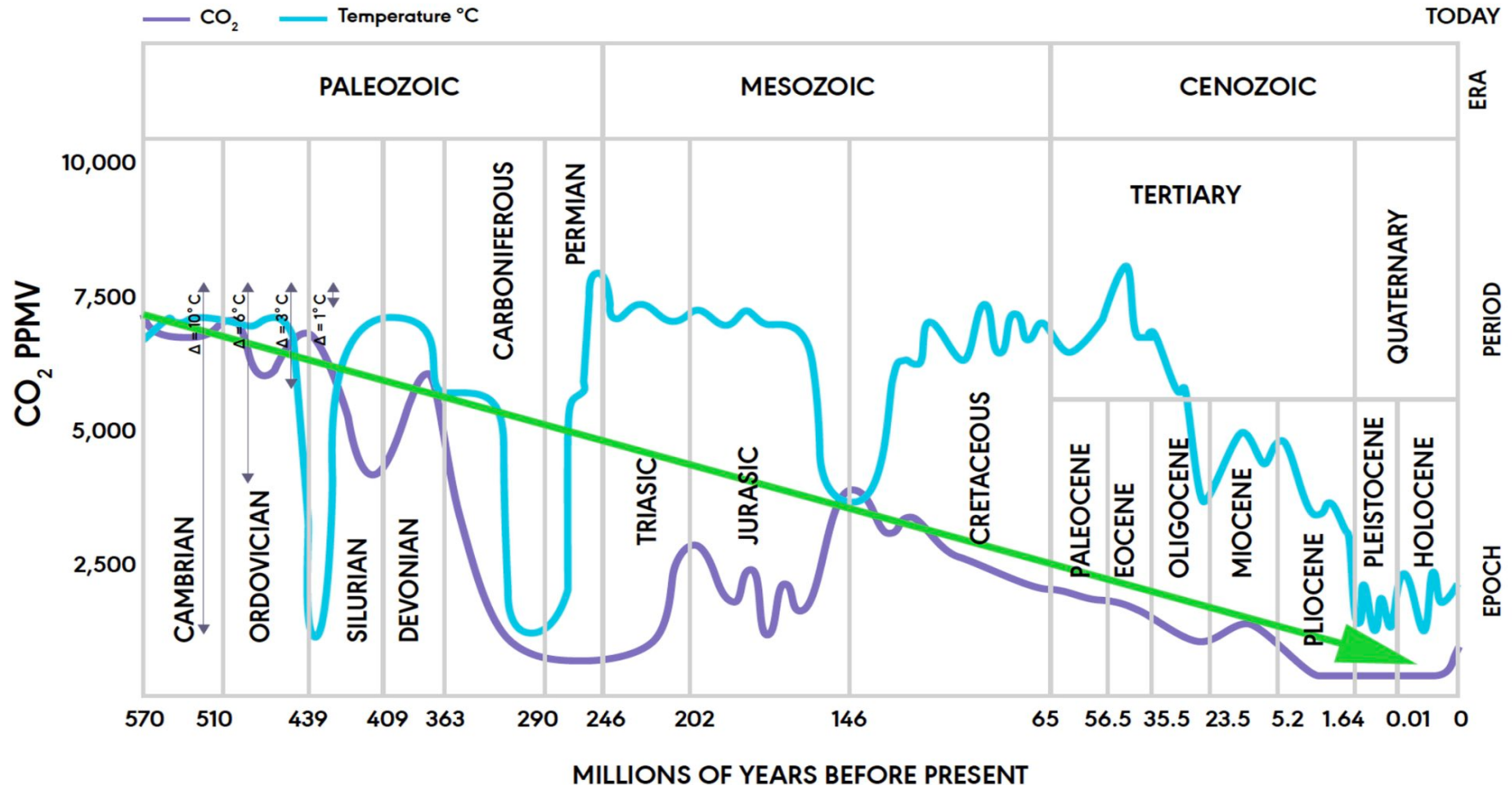
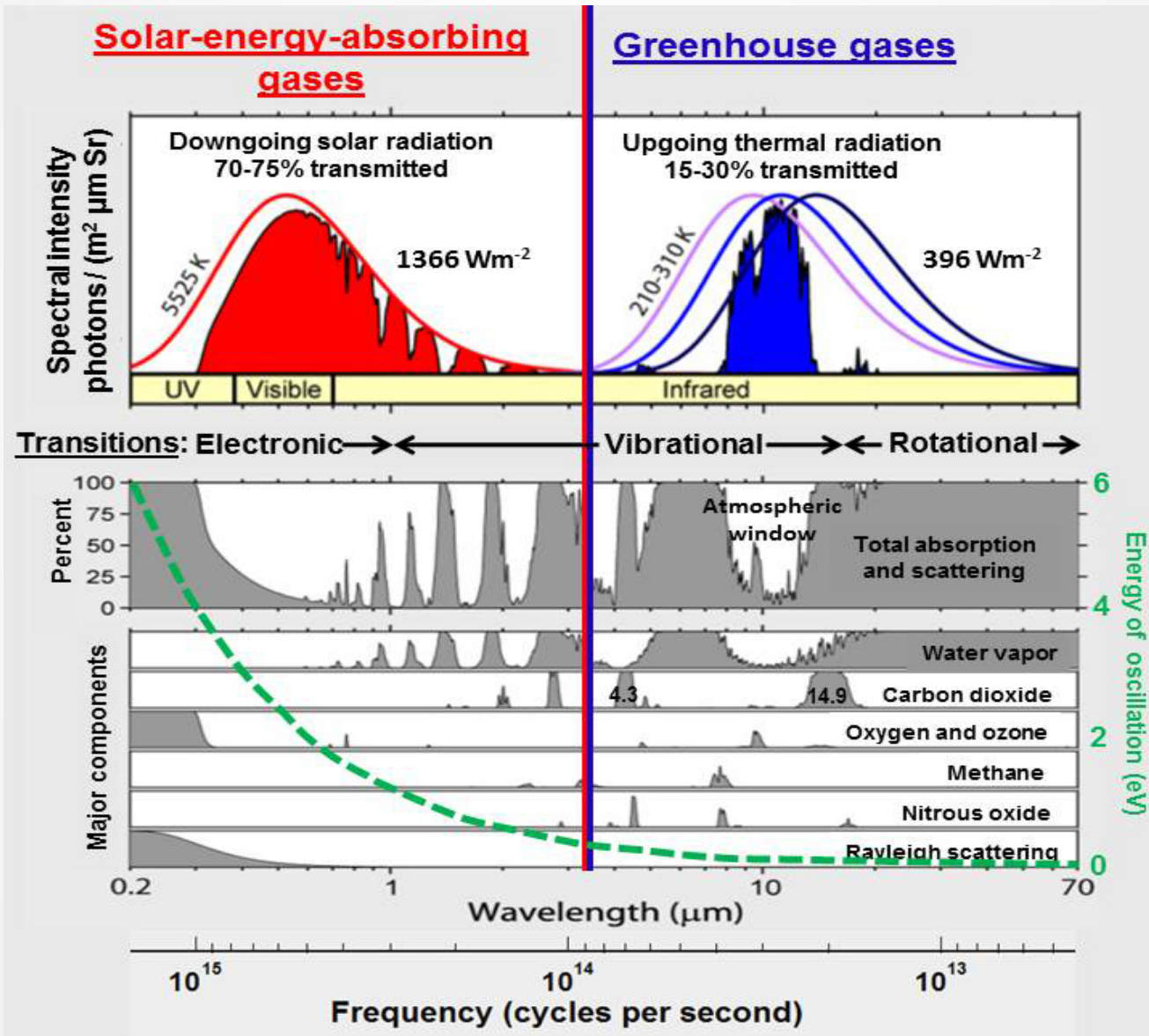


Figure 2. The graph of CO₂ and temperature shown in Figure 1 with the trend in CO₂ concentration in the global atmosphere represented by the green arrow. Note the uptick at the far right of the graph representing the reversal of the 600 million-year downward trend due primarily to emissions of CO₂ from the use of fossil fuels for energy. Note that even today, at 400 ppm, CO₂ is still far lower than it has been during the most of this 600 million history.

Absorption of infrared radiation by atmosphere („greenhouse effect“).
 The bulk of the IR-radiation carbon dioxide can absorb, centered on 4.3 and 14.9 micron wavelengths, is already absorbed at present concentration (ResearchGate) (Rohde)



Carbon cycle simplified: Earth and oceans emit and take up approx. 800 gigatons of carbon dioxide (220 Gt carbon) per year

