

Greta Thunberg Came Too Late: Greenland Ice and West Antarctic Ice Will Completely Melt

Rainer W. Kühne
Bürgerstr. 4, 38118 Braunschweig, Germany

E-mail: kuehne70@gmx.de
ORCID: 0000-0001-7449-761X
ResearcherID: M-7659-2014
Web of Science: 793831
Scopus Author: 16487830600
Google Scholar: W_OUOaEAAAAJ
Loop Profile: 712006
SciProfiles: 211535
Mathematics Genealogy Project: 200060

Abstract

I argue that the present global atmospheric carbon dioxide concentration of 410 parts per million by volume will increase the global atmospheric temperature by about 4°C above that of the pre-industrial time. This temperature rise is sufficient to completely melt the Greenland ice sheet and the West Antarctic ice sheet and thereby rise the global sea-level by approximately 10 meters within the next one thousand years.

Keywords

Fridays for Future, carbon dioxide, greenhouse gas, global warming, climate change, Anthropocene, Ice Age

1. The Geological Situation

During the last four Ice Ages the global atmospheric carbon dioxide concentration has varied between 175 and 300 parts per million by volume, as follows from the data of the European Project for Ice Coring in Antarctica (EPICA) [1], that is by a factor of $300/175 = 1.7$. Simultaneously, the global atmospheric temperature has varied by 6°C, as can be inferred from the data of the European Project for Ice Coring in Antarctica (EPICA) [2].

The Anthropocene has been defined by Paul Crutzen as the epoch after James Watt's design of the steam engine in 1784 which is characterized by growing man-made global concentrations of the greenhouse gases carbon dioxide and methane [3].

The man-made global warming during the Anthropocene is mainly driven by the greenhouse gas carbon dioxide which is liberated by burning coal and mineral oil.

Between AD 1880 and AD 2020 the global atmospheric carbon dioxide concentration has increased from 280 ppm to 410 ppm, that is by a factor of $410/280 = 1.4$. Hence, the global atmospheric temperature should have increased by about 4°C since AD 1880. This is higher than the observed value of 1.2°C. The reason is that the global warming follows the increase of the atmospheric carbon dioxide concentration with a delay of several decades [4].

An increase of the global atmospheric temperature by 4°C above that of the pre-industrial time would cause the complete melting of the Greenland ice sheet and the West Antarctic ice sheet and thereby rise the global sea-level by approximately 10 meters within the next one thousand years [5].

2. March for Science and Fridays for Future

The March for Science was held on 22 April 2017 in more than 600 cities across the world. Its main goal was to protest against climate change denial and misinformation [6, 7]. Its German declaration named Science March Germany was signed by approximately 1000 scientists, among them the five Nobel Prize winners Gerhard Ertl (chemistry 2007), Wolfgang Ketterle (physics 2001), Klaus von Klitzing (physics 1985), Erwin Neher (physiology or medicine 1991), and Horst Störmer (physics 1998). A list of the participating organizations and scientists was presented in Ref. [8].

Fridays for Future was started by Swedish climate activist Greta Thunberg on 20 August 2018 at the Mynttorget in her hometown Stockholm under the name Skolstrejk för klimatet. According to her book which was published in English [9], Spanish [10], French [11], German [12], Catalan [13], Norwegian [14], Dutch [15], and Italian [16] her Skolstrejk för klimatet was motivated by a scientific paper that was published in June 2017 which stated that there was only three years time to reach the goal of the Paris agreement of 2015 to hold global warming below two centigrades above the pre-industrial levels of AD 1850. This paper is Ref. [17].

Scientists for Future was an initiative of scientists to support Fridays for Future. Its declaration was signed for the Global Climate Strike for Future on 15 March 2019 by 26,800 scientists [18]. Among the signatories were the three Nobel Prize winners Jacques Dubochet (chemistry 2017), Gerhard Ertl (chemistry 2007), and Klaus Hasselmann (physics 2021). A list of the signatories was presented in Ref. [8].

Another declaration of Scientists for Future was signed by more than 3,000 scientists, among them Jacques Dubochet and Klaus Hasselmann, and published in the magazine 'Science' on 12 April 2019 [19].

Greta Thunberg's second book was published in English [20], German [21], and Dutch [22].

References

- [1] U. Siegenthaler et al.: Stable carbon cycle-climate relationship during the late Pleistocene. *Science* **310** (2005) 1313-1317.
- [2] J. Jouzel et al.: Orbital and millennial Antarctic climate variability over the past 800,000 years. *Science* **317** (2007) 793-796.
- [3] P. J. Crutzen: Geology of mankind. *Nature* **415** (2002) 23-23.
- [4] R. W. Kühne: Short review of climate change in support of Greta Thunberg and Fridays for Future. *OSF preprints* (2019) doi:10.31219/osf.io/cyhpd.

- [5] T. Naish et al.: Obliquity-paced Pliocene West Antarctic ice sheet oscillations. *Nature* **458** (2009) 322-328.
- [6] A. Abbott et al.: March for Science attracts thousands across the globe. *Nature* **544** (2017) 404-405.
- [7] T. Appenzeller: An unprecedented march for science. *Science* **356** (2017) 356-357.
- [8] R. W. Kühne: Political initiatives of scientists: Göttingen Seven, Einstein-Szilard Letter, Franck Report, Göttingen Manifesto, March for Science, Scientists for Future. OSF preprints (2020) doi:10.31219/osf.io/4y7k8.
- [9] G. Thunberg: *No One is Too Small to Make a Difference* (Penguin, 2019).
- [10] G. Thunberg: *Cambiamos el mundo: #huelgaporelclima* (Lumen, 2019).
- [11] G. Thunberg: *Rejoignez-nous : #grevepourleclimat* (Kero, 2019).
- [12] G. Thunberg: *Ich will, dass ihr in Panik geratet! Meine Reden zum Klimaschutz* (S. Fischer, 2019).
- [13] G. Thunberg: *Canviem el mon #vagapelclima* (Destino, 2019).
- [14] G. Thunberg: *Streik for klimaet* (Cappelen Damm, 2019).
- [15] G. Thunberg: *Niemand is te klein om het verschil te maken* (De Bezige Bij, 2021).
- [16] G. Thunberg: *Nessuno è troppo piccolo per fare la differenza* (Mondadori, 2019).
- [17] C. Figueres et al.: Three years to safeguard our climate. *Nature* **546** (2017) 593-595.
- [18] M. Warren: Thousands of scientists back kids' climate strike. *Nature* **567** (2019) 291-292.
- [19] G. Hagedorn et al.: Concerns of young protesters are justified. *Science* **364** (2019) 139-140.
- [20] G. Thunberg: *The Climate Book Created by Greta Thunberg* (Allen Lane, 2022).
- [21] G. Thunberg: *Das Klima-Buch von Greta Thunberg: Der aktuellste Stand der Wissenschaft unter Mitarbeit der weltweit führenden Expert:innen* (S. Fischer, 2022).
- [22] G. Thunberg: *Het klimaatboek* (De Bezige Bij, 2022).