Influence of the Sun for Global Warming

Asko Vuorinen
Ekoenergo Oy

2019

Based on the Book:
”Fundamentals of Global Warming”

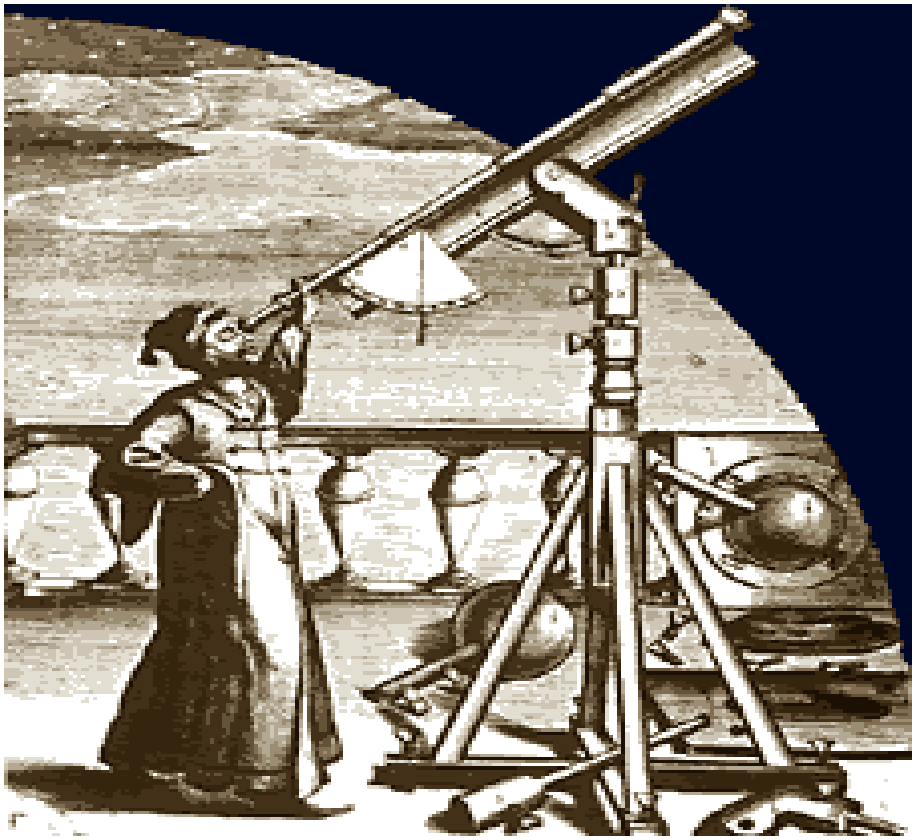
Presentation Slides about Global Warming

1. Global Warming 1901-2018
2. Influence of the Sun
3. CO2 Emissions and Concentration
4. Forecasting Global Warming
5. Seawater and Ice Conditions
6. Milankovich Cycles
7. Action Plans
8. Target Scenario 2050

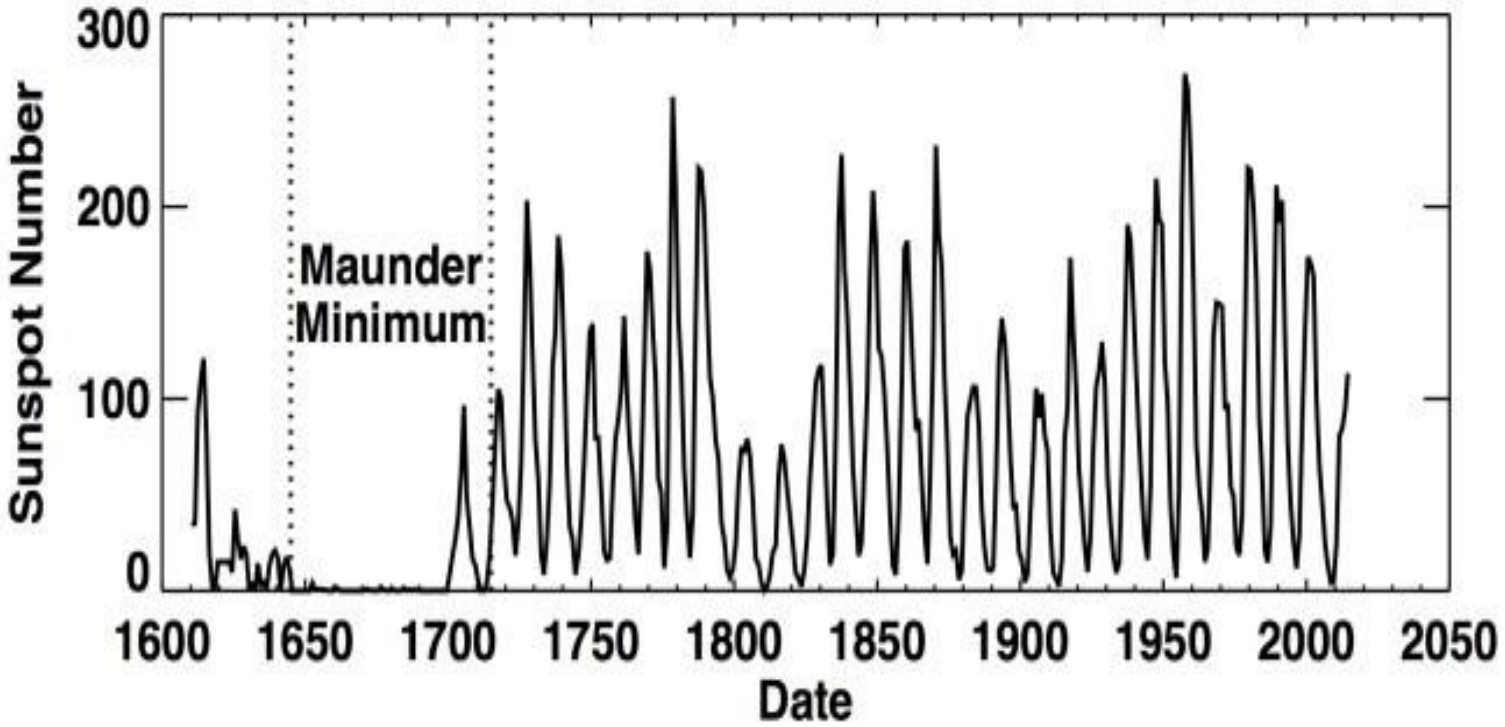
Contents

SUNSPOTS

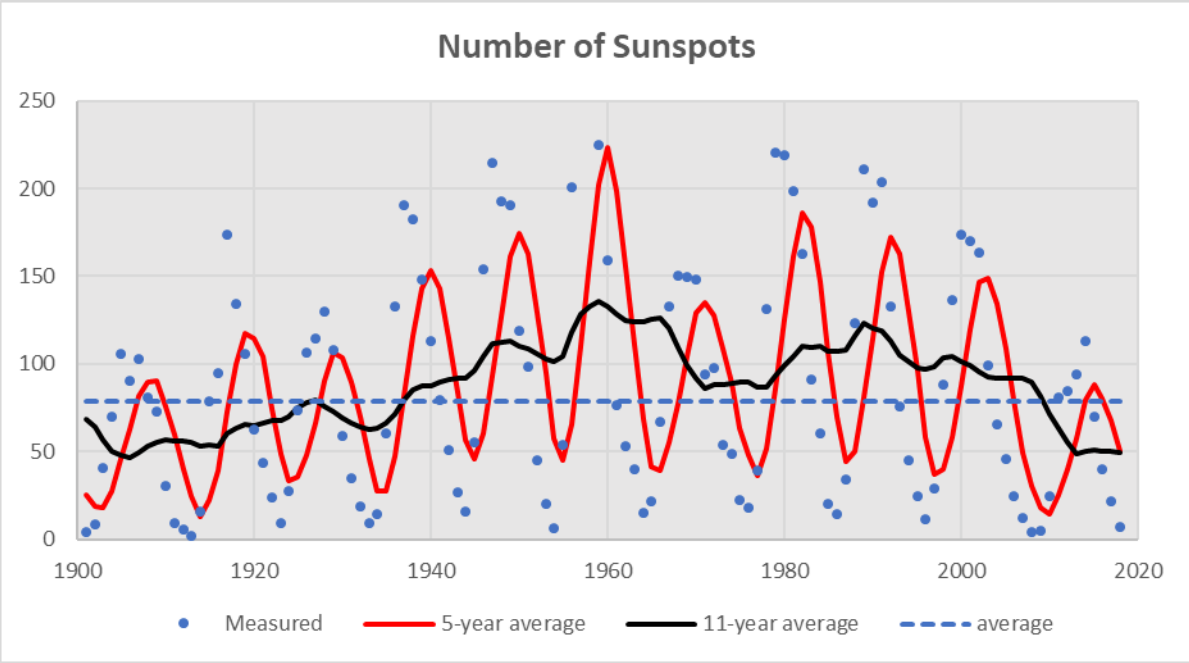
Invention of telescope and finding of sunspots



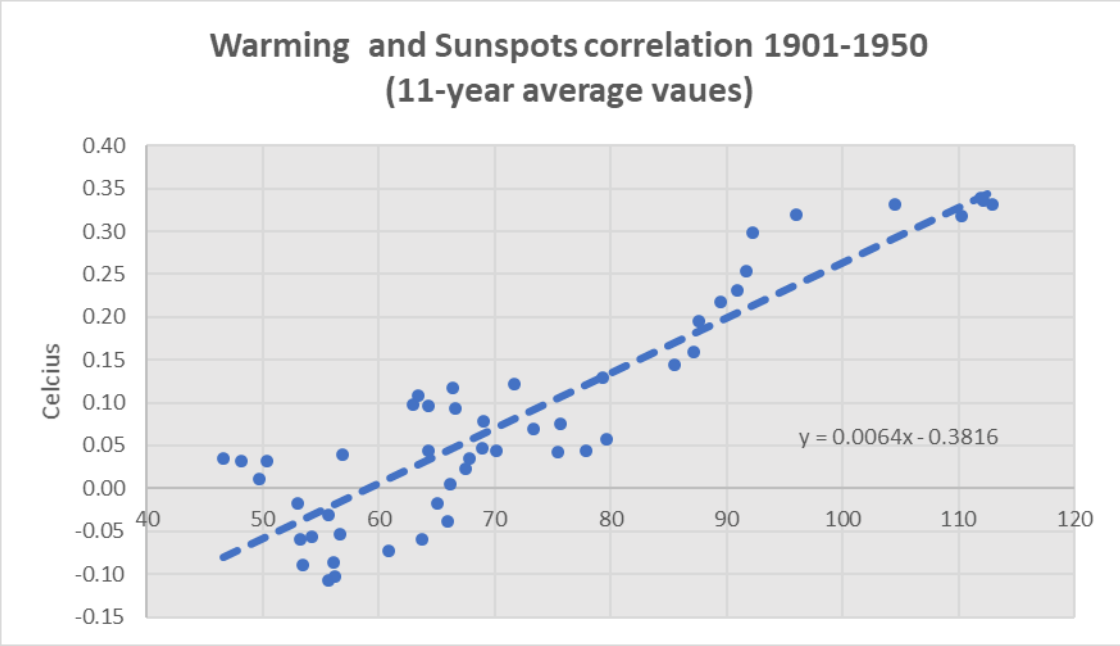
Number of sunspots vary in 11-year cycle



Sunspot Numbers from 1890 to 2018

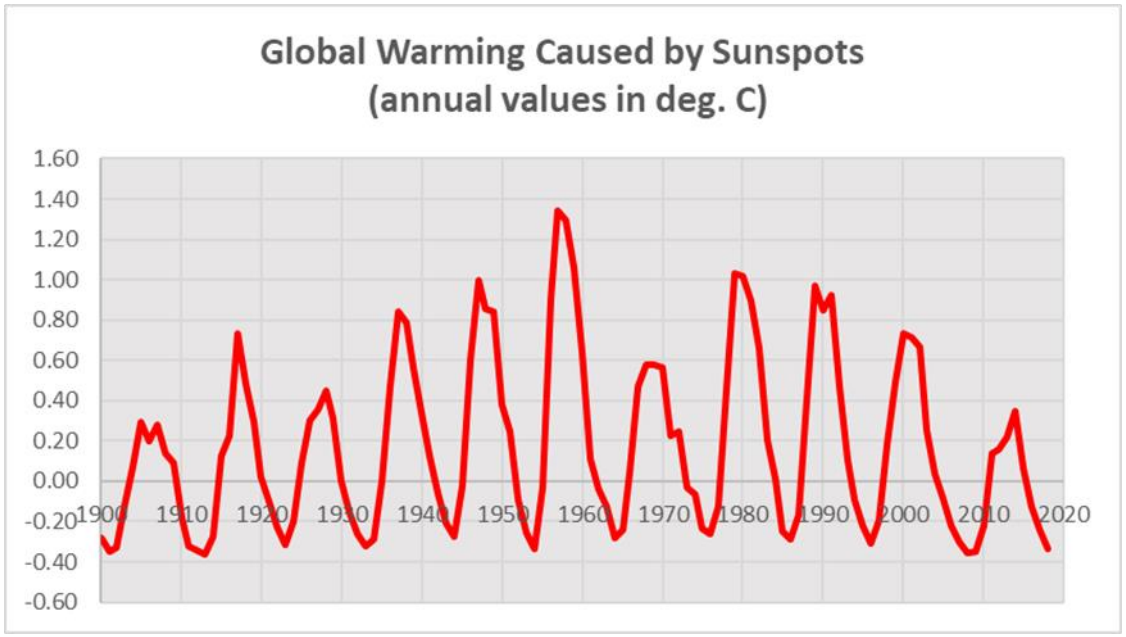


Global Warming and Sunspots happen at the same time 1890-1950



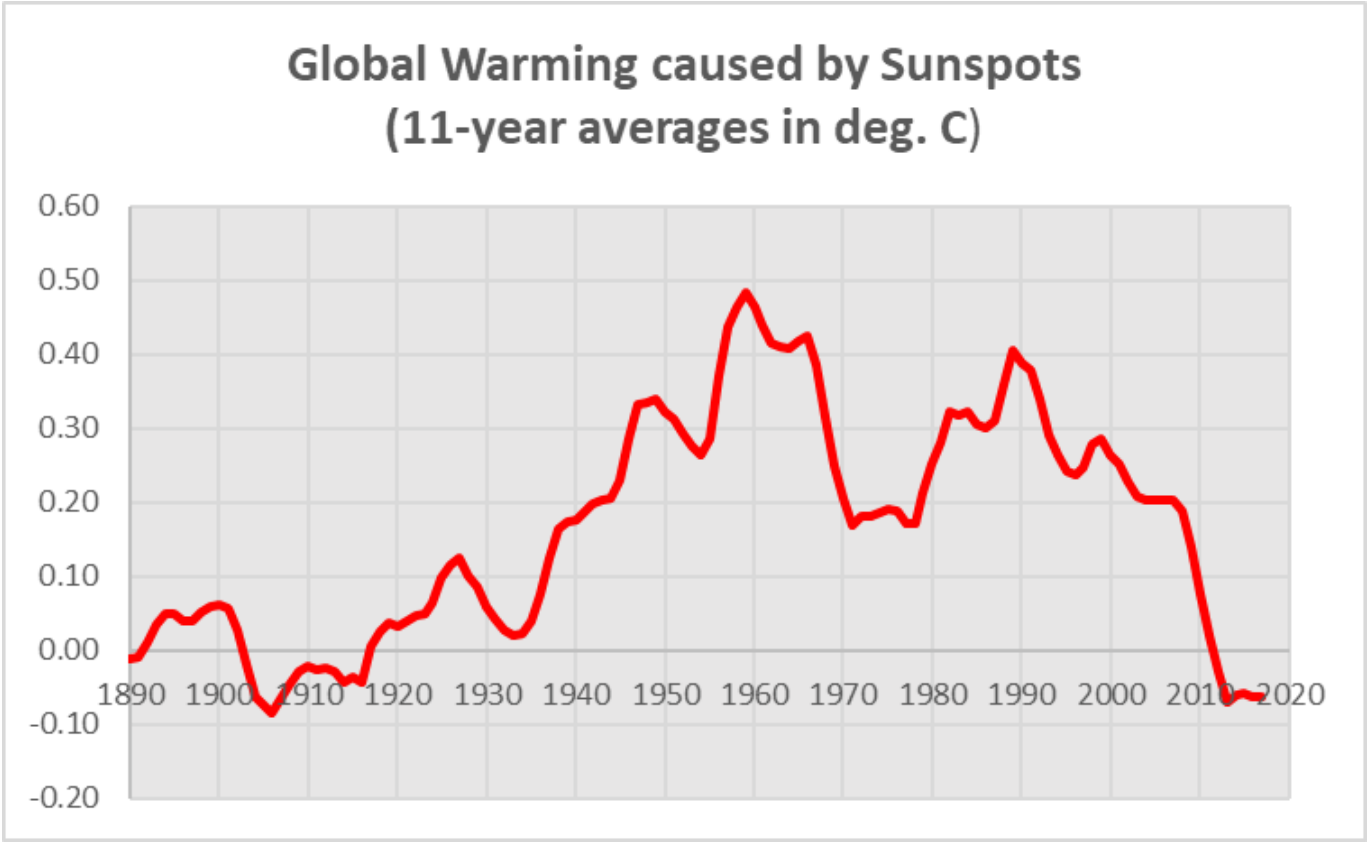
No warming at 60 spots, but +0.35 deg. C at 160 spots and -0.1 deg. C at

Global Warming caused by Sunspots (annual values)



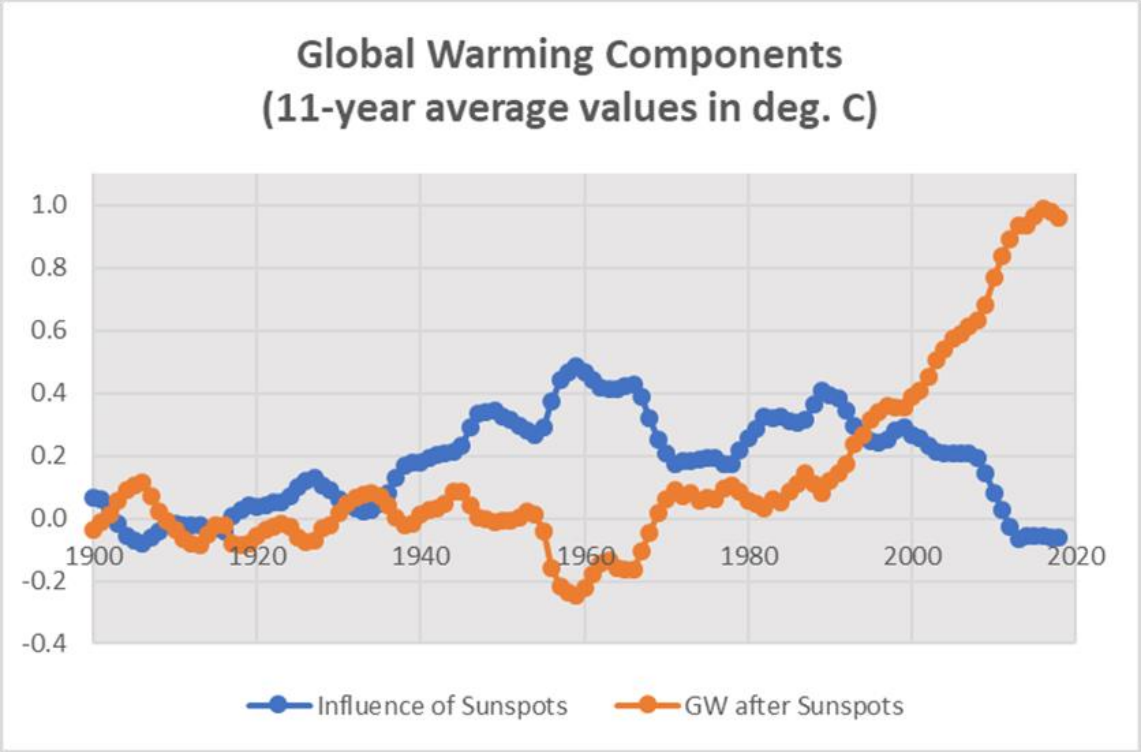
annualvalues peaked at 1.4 deg. C in 1957

Global Warming caused by Sunspots (11-year average values)



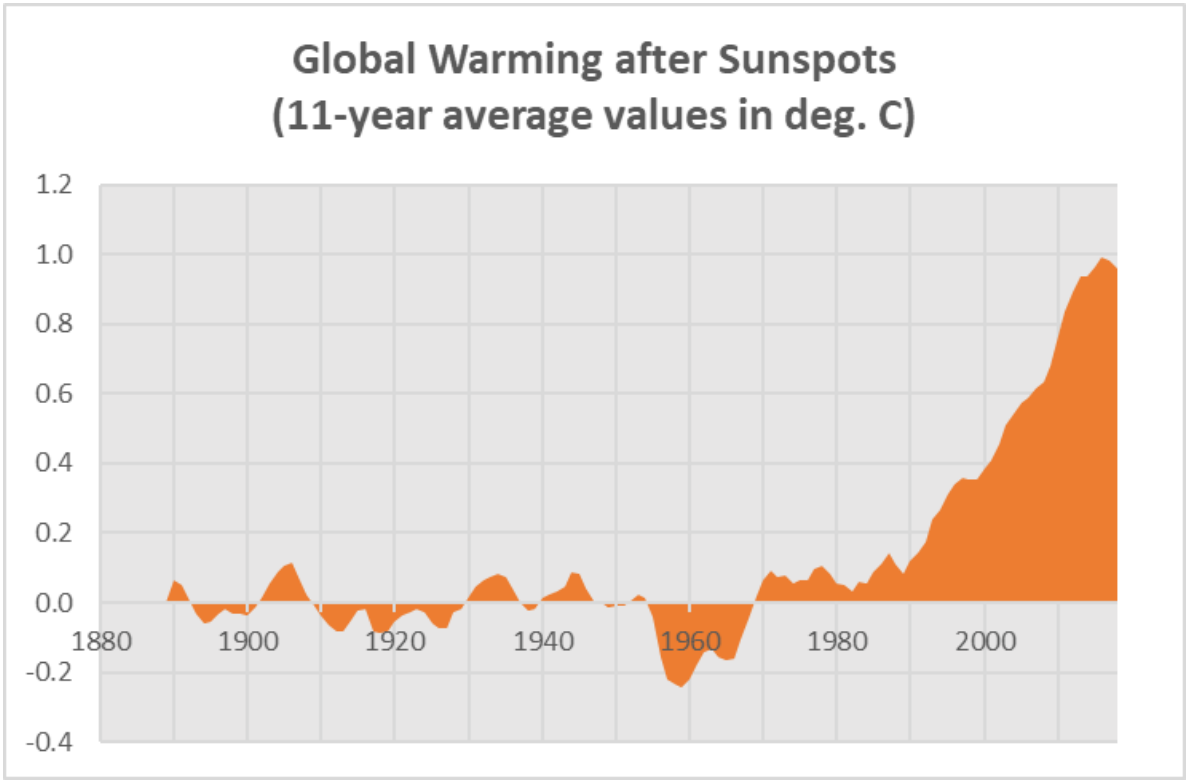
11-year average values peaked at + 0.5 deg. C in 1959

Influence of sunspots and other reasons (11-y. average values)



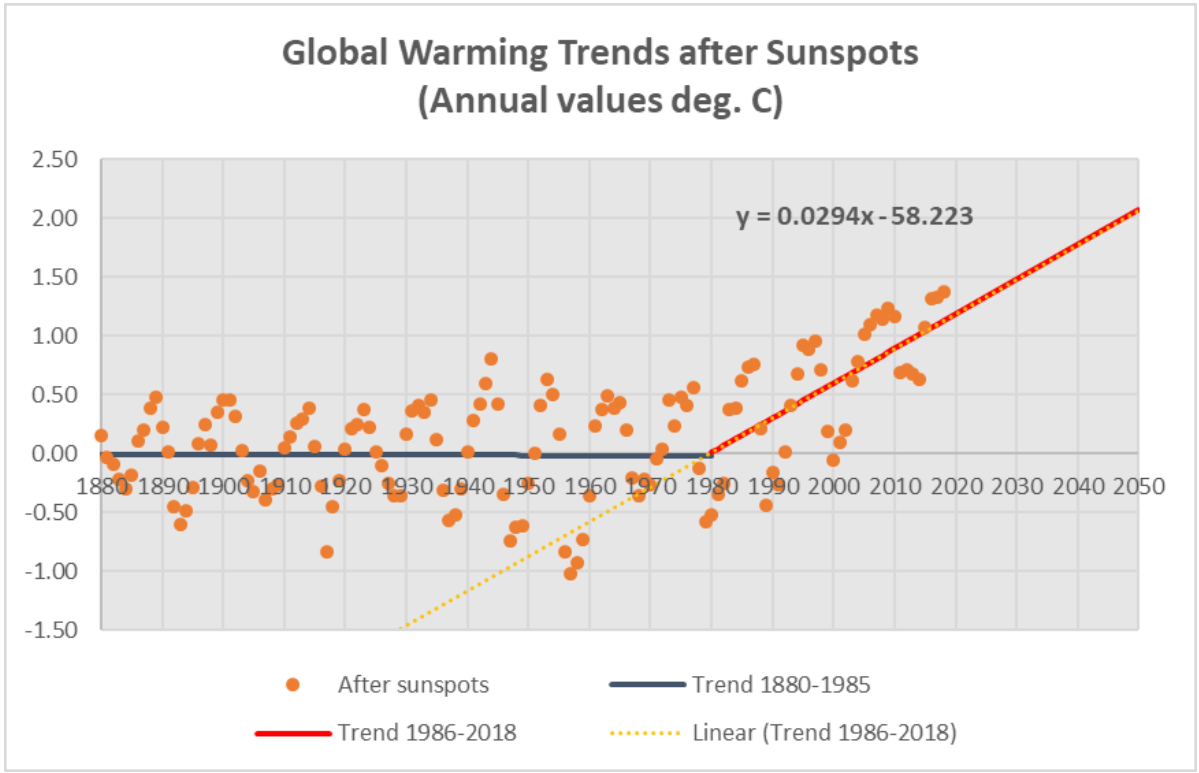
Global warming has mainly caused by sunspots until 1990, but in the year 2018 sunpots cause – 0.1 and other reasons + 1.0 deg. C warming

Global Warming after correction of influence of sunspots (11-y. averages)



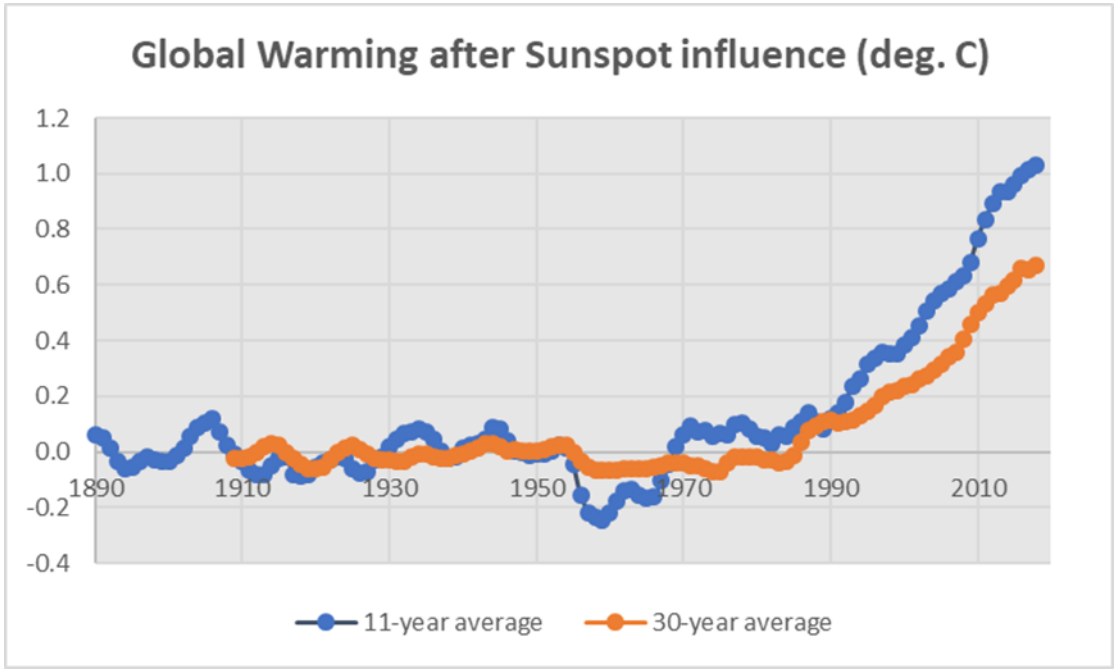
Warming after sunspots + 1.0 deg. C

GW Trend after Correction of Sunspots indicate Warming only after 1980



After 1980 trend is 0.29 deg. C/decade.
+1.5 deg C by 2035 and +2.0 deg C by 2050

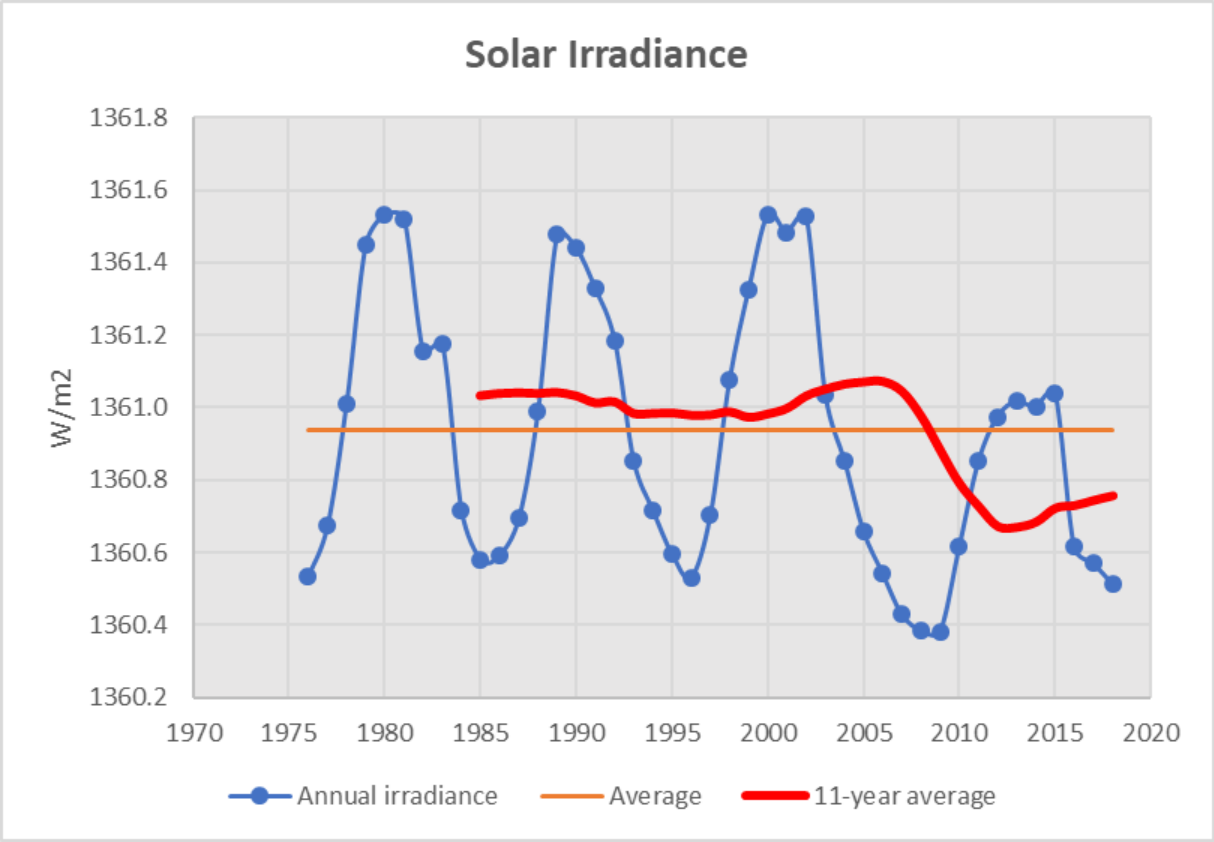
Global Warming after correction of influence of sunspots



Warming after sunspots + 1.0 deg. C (11-year average) and 0.67 deg. C in 30-year average

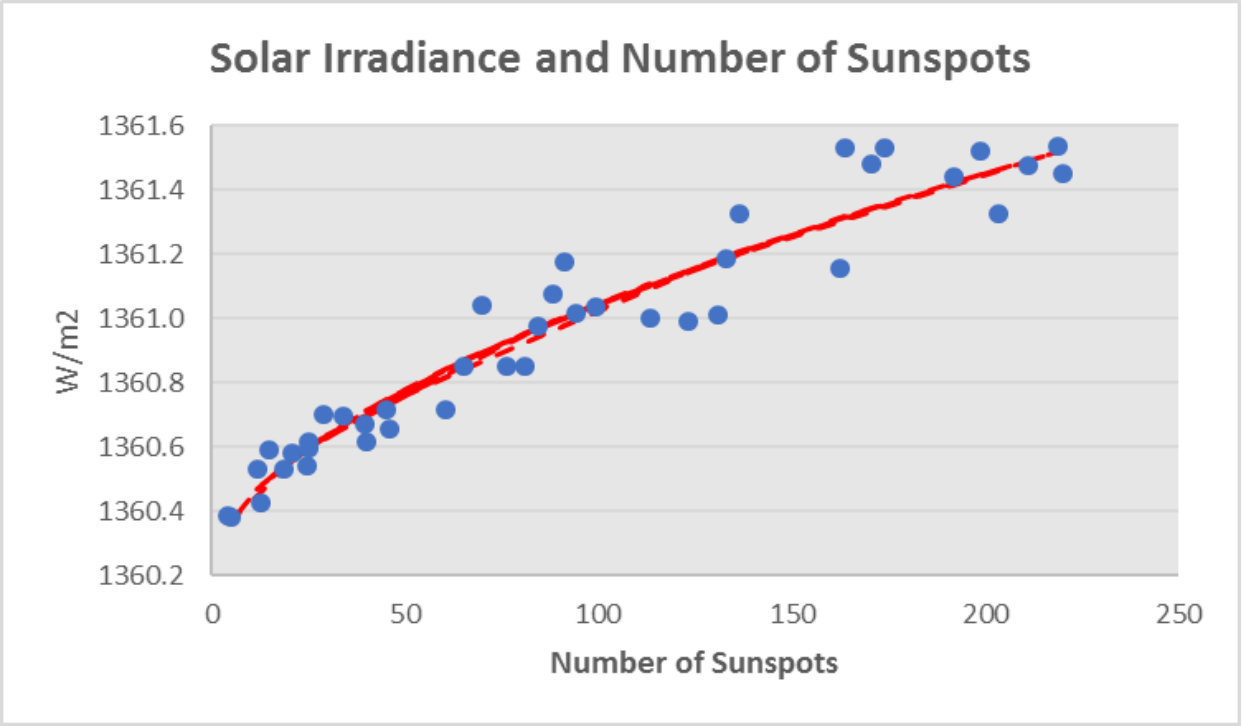
SOLAR IRRADIANCE

Total Solar Irradiance (TSI) has been measured since 1975 by satellites



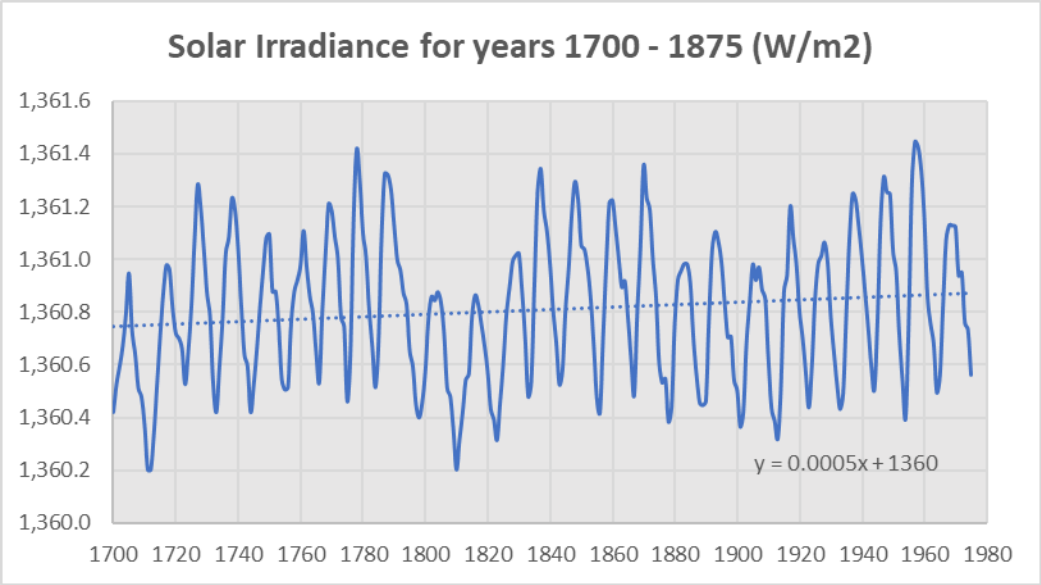
TSI follows 11-year sunspot cycle

Total Solar Irradiance (TSI) can be calculated from the number of sunspots



TSI = 1360.202+SQRT(SPOTS/175)+0.0009*SPOTS

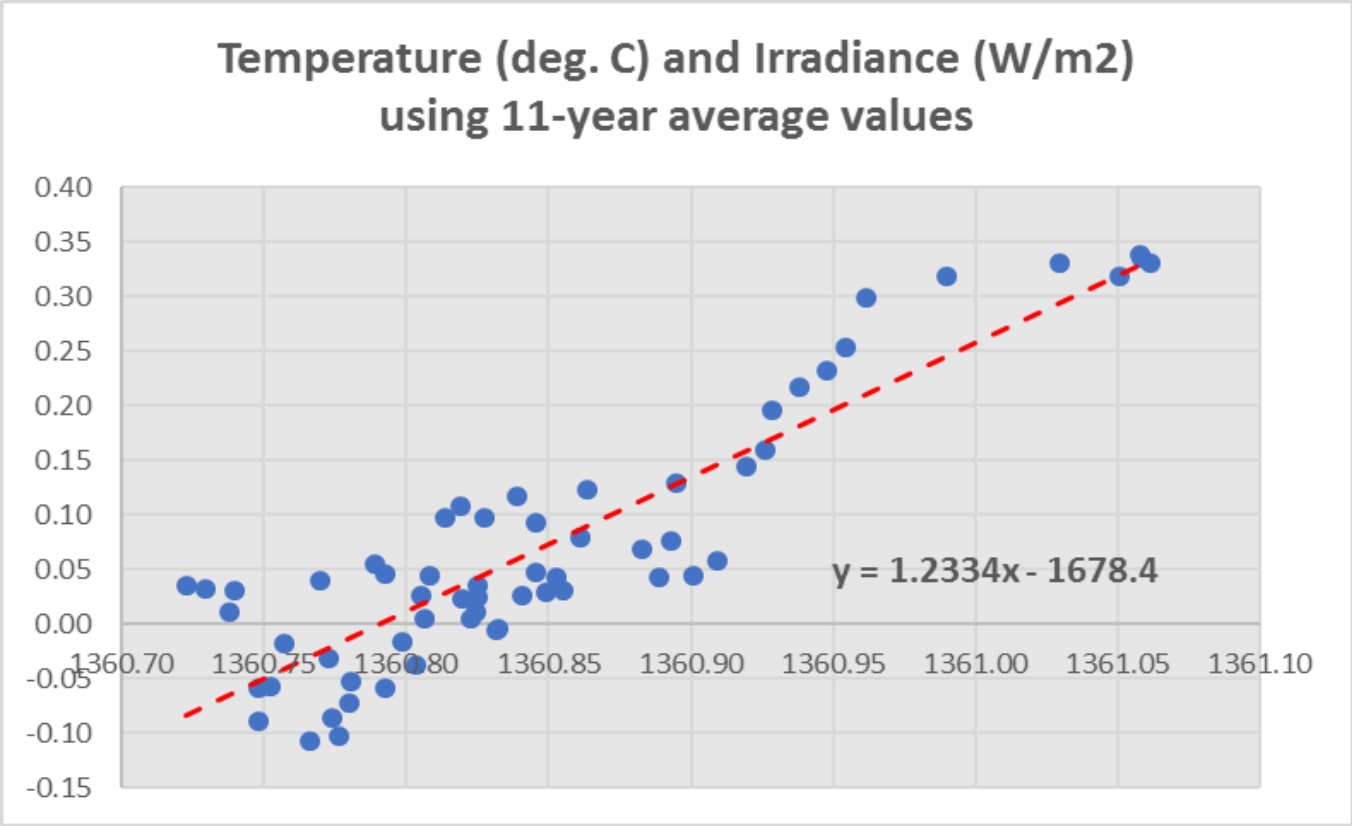
TSI can be extrapolated to the years 1700 – 1975 by using sunspot numbers



TSI = 1360.202+SQRT(SPOTS/175)+0.0009*SPOTS

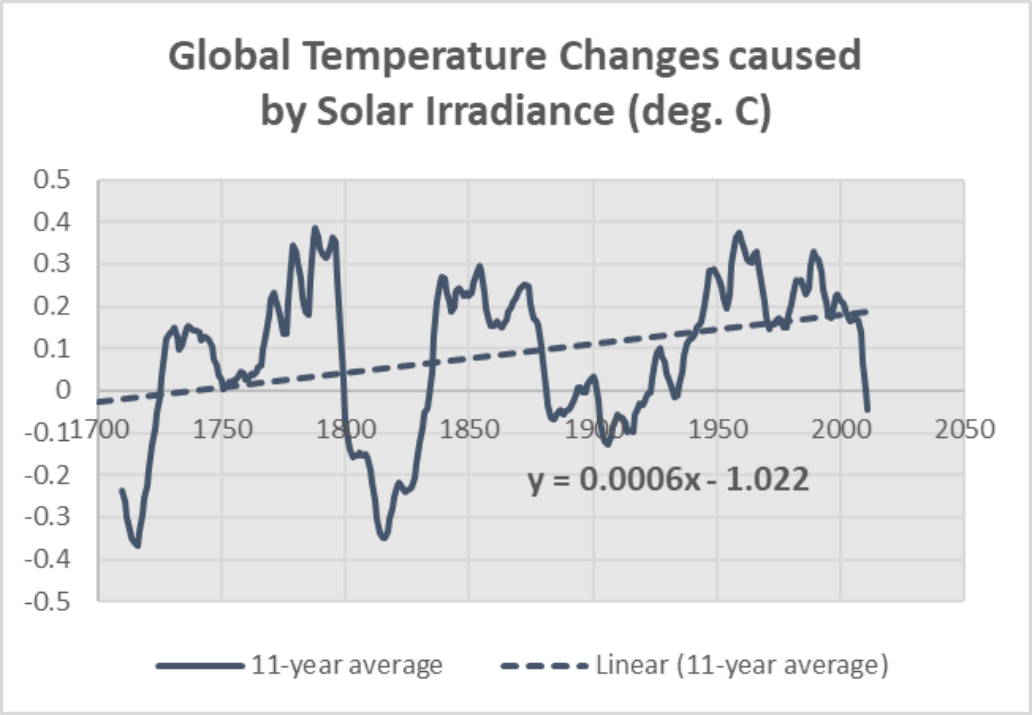
GLOBAL WARMING AND SOLAR IRRADIANCE

Global warming is following total solar (TSI) irradiance with a linear relation



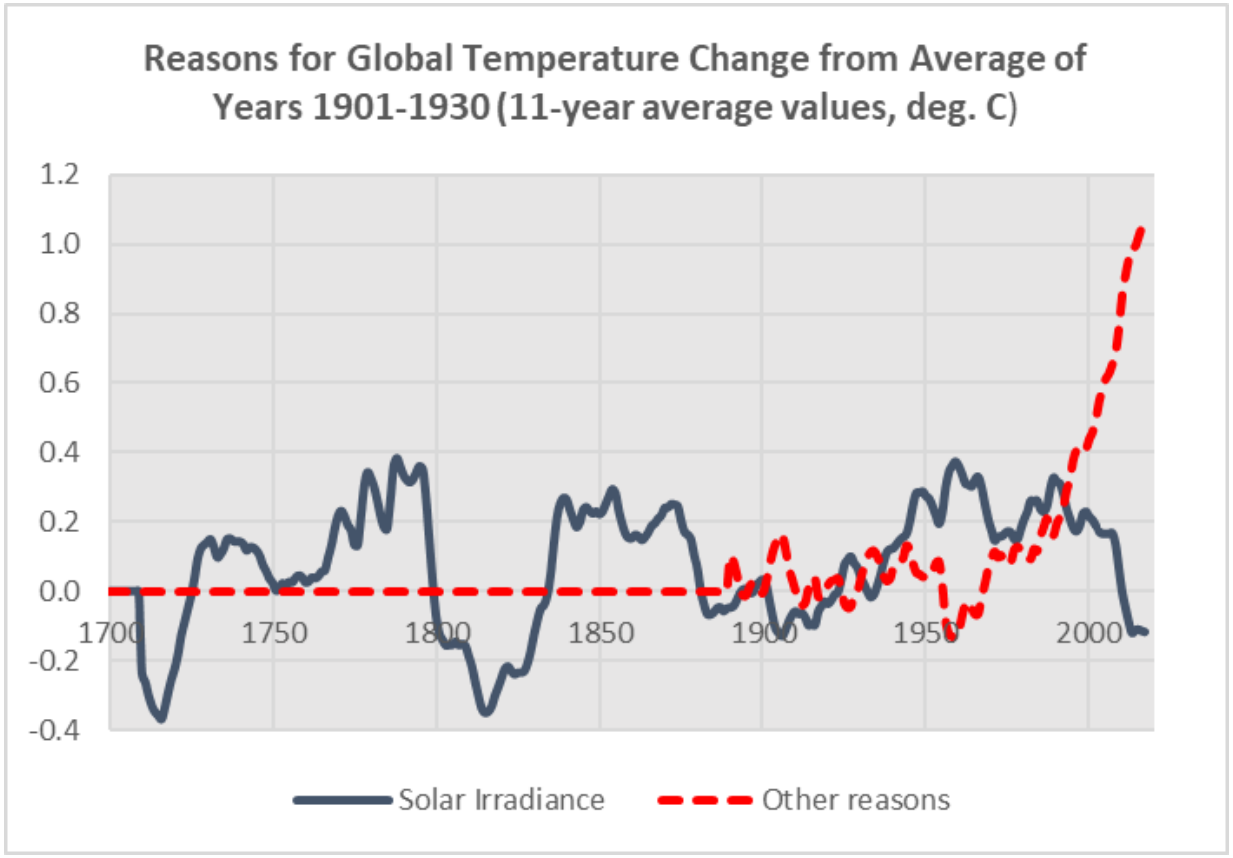
dT = 1.2334 x (TSI – 1360.79)

Temperature changes caused by solar irradiance since the year 1700

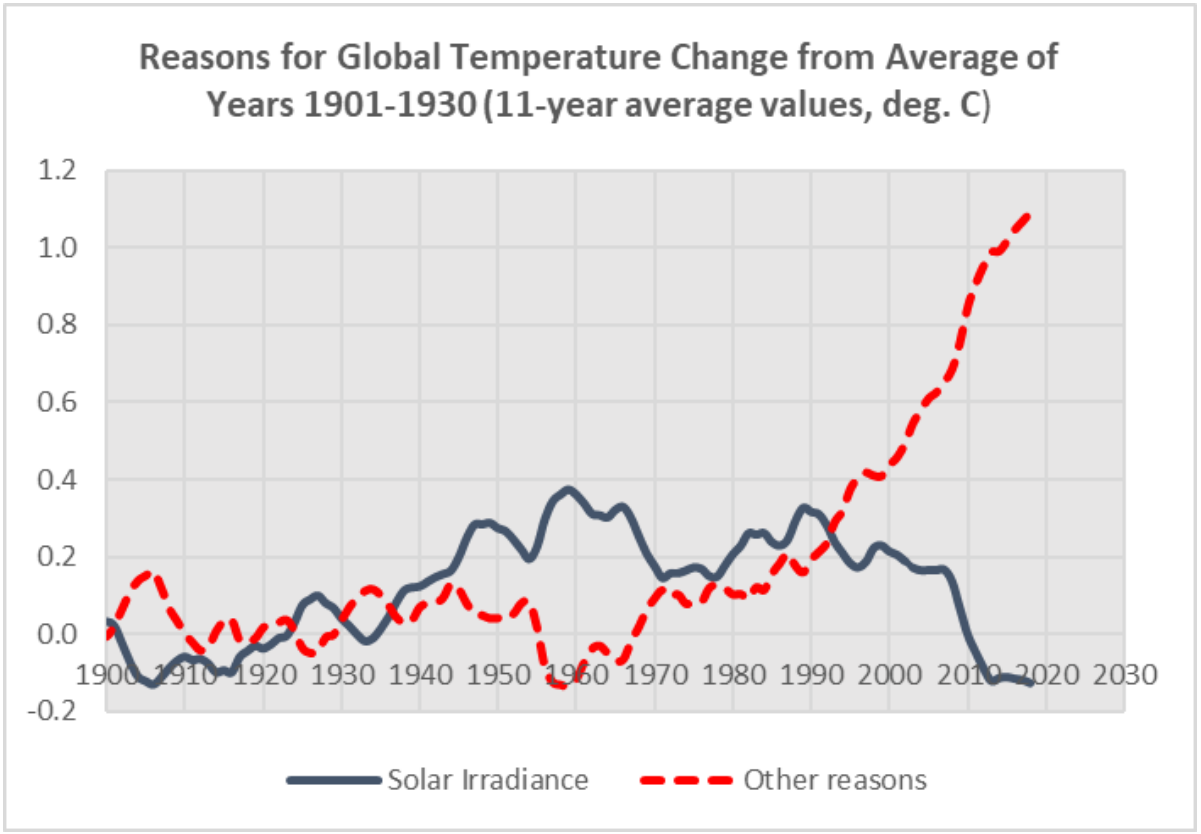


Trend in global warming caused by TSI has been 0.2 deg. C during last 300 years (0.0006 x 300 = 0.18)

Reasons for Global Temperature Changes (11-y. averages)

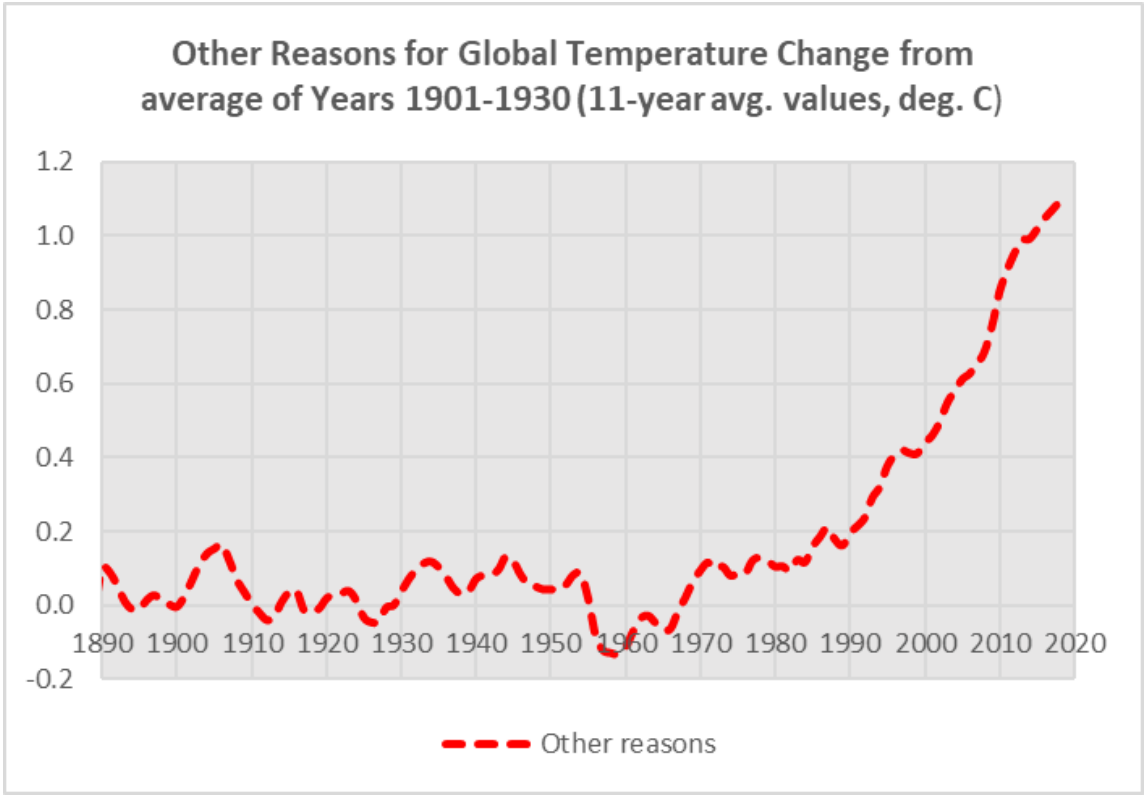


Reasons for Global Warming



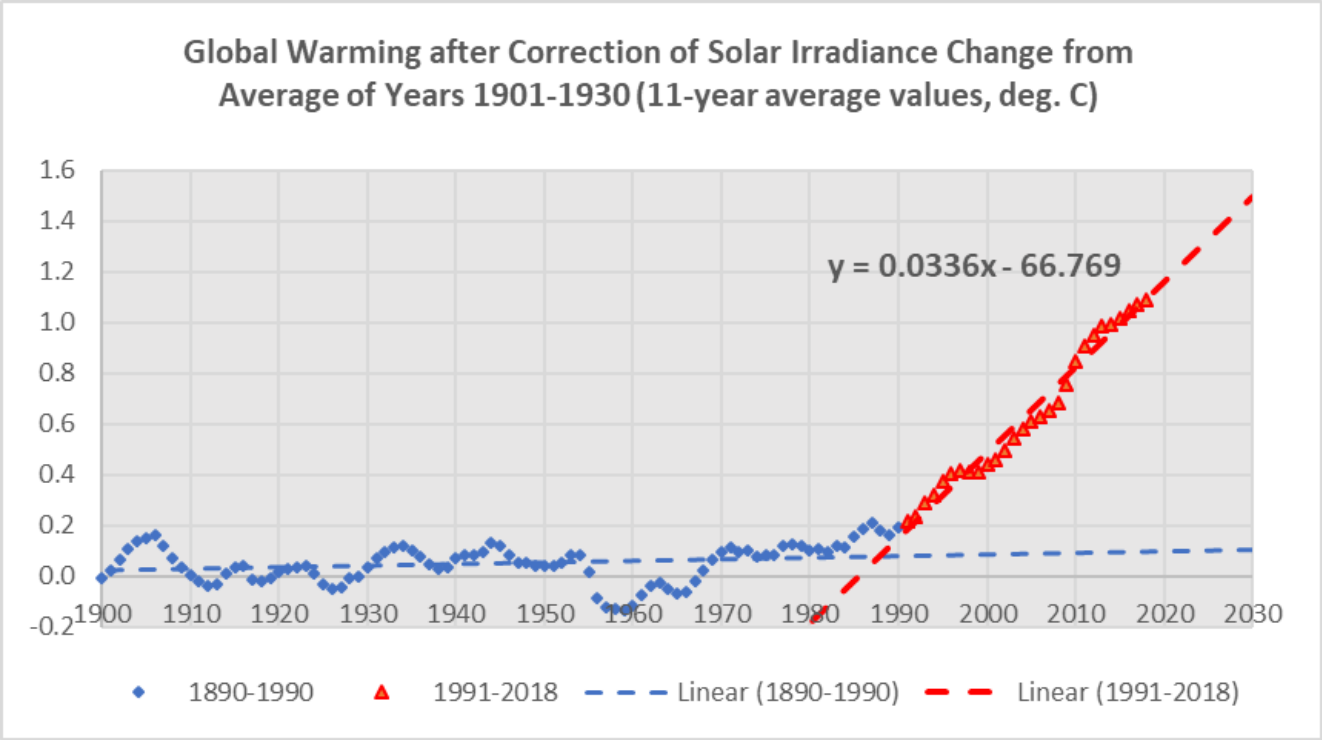
Solar irradiance has been the main reason for warming until 1990

Other Reasons for Global Warming after Solar Irradiance



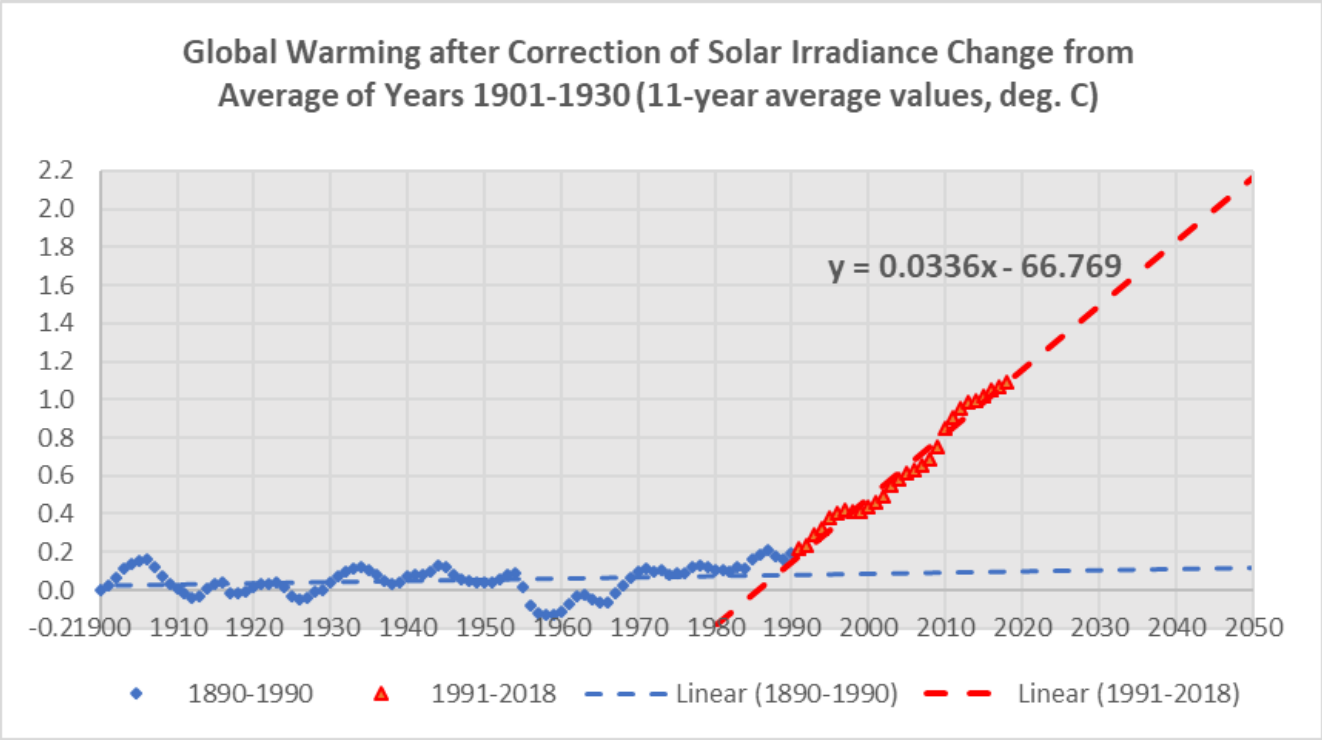
Other reasons (AGW) has caused 1.09 deg. Global Warming
(AGW = Antropogenic Global Warming)

GW Trends after Solar Irradiance



Trend after 1985: dT = 0.0336 x (Year – 1985.6)

GW Trends after Solar Irradiance



With this trend the1.5 deg. C limit will be exceeded by 2030 and the 2.0 deg. C limit by 2045

Summary

- **WARMING UNTIL 1990 WAS MAINLY CAUSED BY SOLAR IRRADIANCE**
- **AFTER 1990 TEMPERATURE HAS BEEN RISING BY OTHER REASONS**
- **THE TREND AFTER 1990 HAS BEEN ABOUT +0.34 DEG. C/DECADE**
- **+2.0 DEGREE LIMIT WILL BE ACHIEVED BY 2045**
- **IMMEDIATE ACTIONS WILL BE NEEDED**

Reference

The book
"Fundamentals of Global Warming"
can be downloaded from

www.ekoenergo.fi