Global warming:
Mostly human-caused or mostly natural?

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February 24, 2023

The Heartland Institute ICCC15
Orlando, Florida

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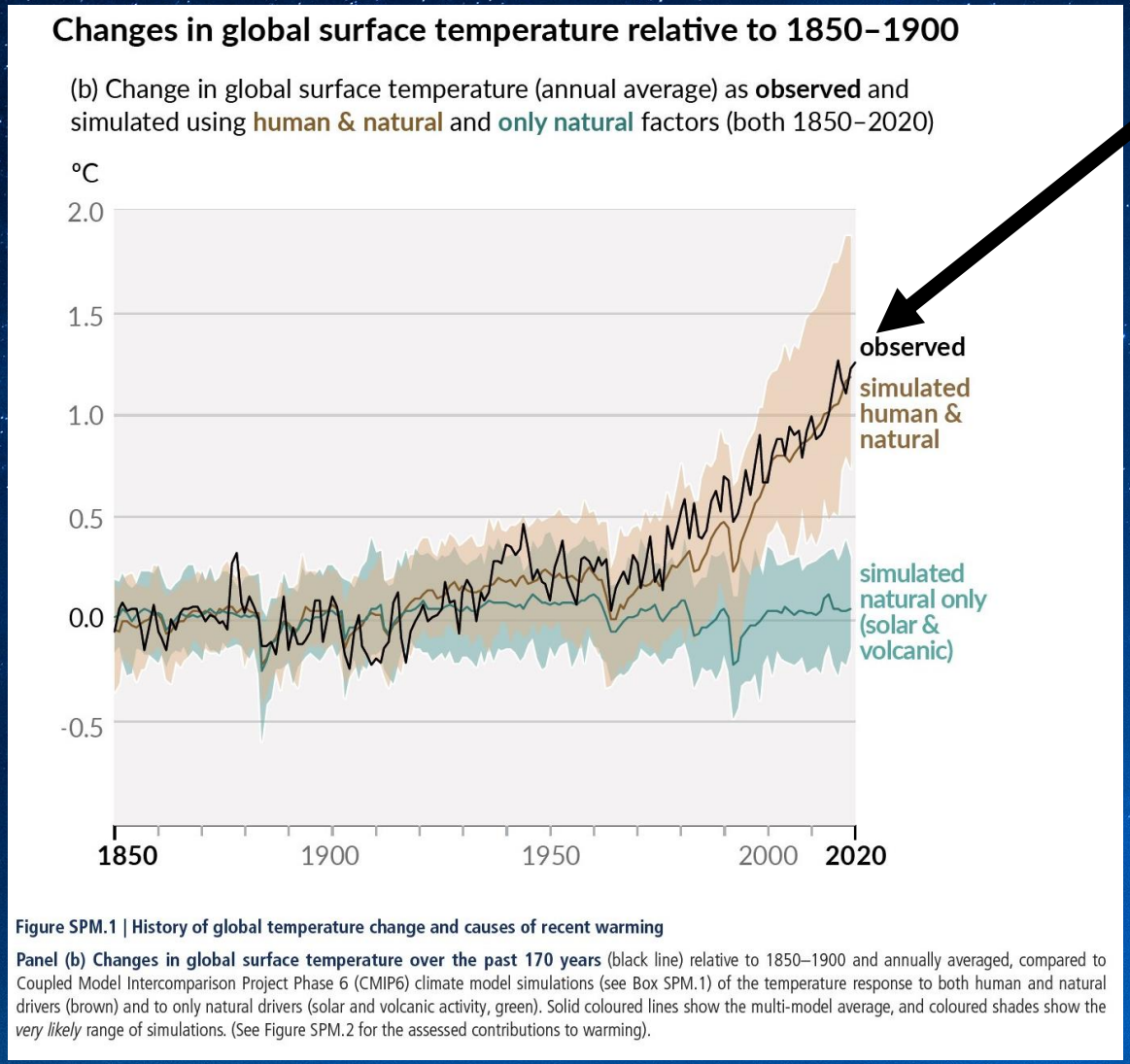
The UN IPCC's views on global warming

The UN's Intergovernmental Panel on Climate Change (IPCC) concluded in its latest report (6th Assessment Report, AR6, 2021) that:

- Claim 1: Global land surface temperatures have increased by 1.6°C (2.9°F) since the 2nd half of the 19th century (1850-1900). This is what they mean by "global warming".
- Claim 2: Contamination of this global warming estimate by "urbanization bias" is under 10%. (More on this later!)
- Claim 3: All the global warming estimates are almost identical and beyond dispute.
- Claim 4: Human-activity (chiefly carbon dioxide, CO_2 emissions) is to blame.
- Claim 5: Natural factors cannot explain this warming. The two natural climate drivers the IPCC considered are "solar forcing" and "volcanic forcing". Both of these factors are unable to explain **any** warming since 1950s.

The IPCC's basis for saying global warming is "mostly human-caused"



- The **black** "observed" line is IPCC's estimate of global temperatures since 1850-1900
- When the computer models used by the IPCC ("CMIP6") try to simulate the "observed" record with "natural only factors", i.e., solar and volcanic, they fail miserably – See the green line.
- But, when they add in "human forcings", they get a reasonable match – see the brown line.
- From this, they conclude that global warming is human-caused!

Outline of this talk (A lot to cover in 20 min!!!)

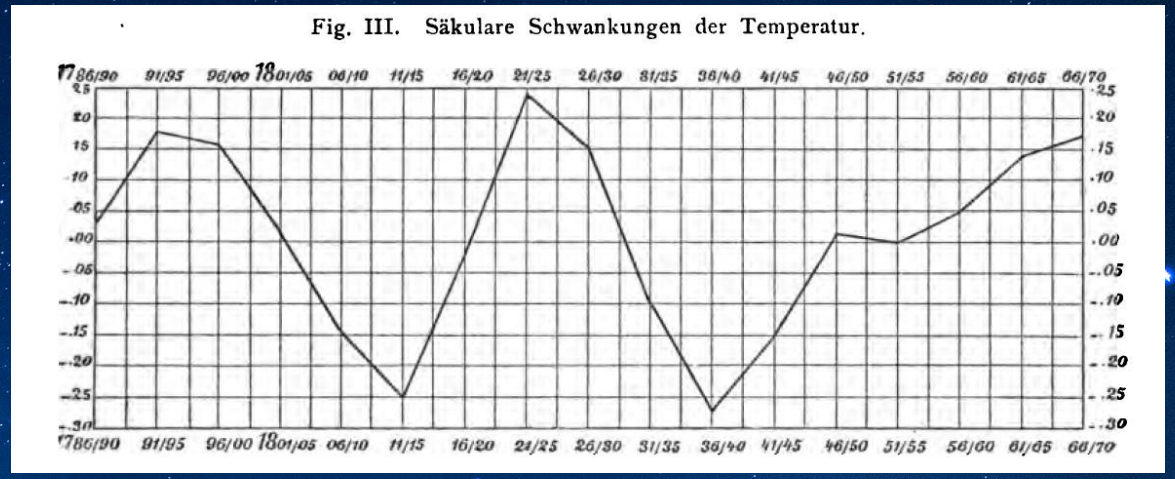
1. History and the evolution of the global land temperature records
2. The urban heat island problem and other non-climatic biases
3. What happens if we just use rural stations?
4. “Statistical homogenization of the temperature data” as a possible solution?
5. Problems with current “homogenization” attempts
6. Are the IPCC’s “solar forcing” estimates correct?
7. Can the Sun explain the global warming of rural stations?

For the slides see www.ceres-science.com/post/ICCC15

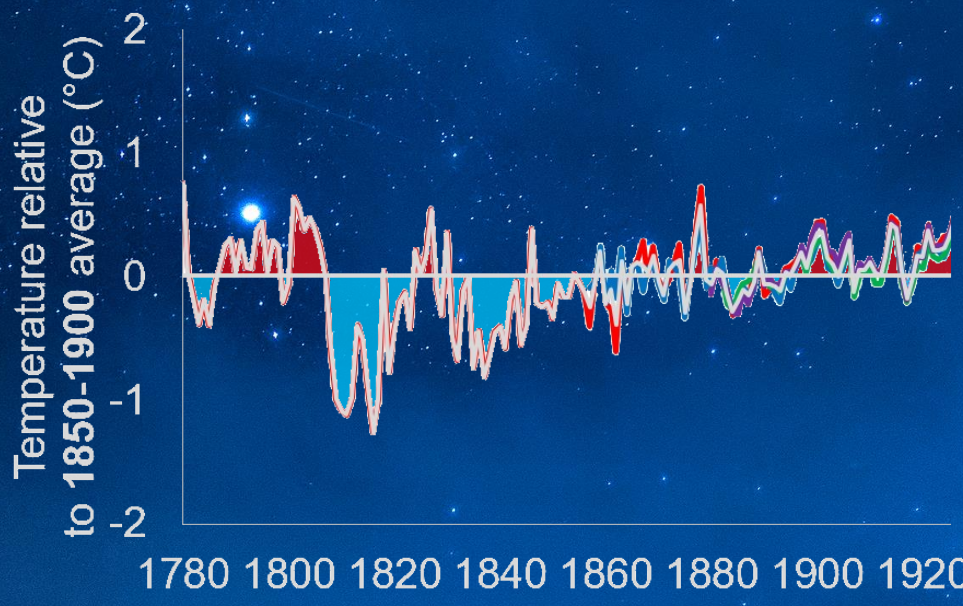
History of global land temperature estimates

Stage 1 (1870s-1920s) – Climate CHANGES!

- Köppen (1873); Brückner (1889); Clough (1920)
- Researchers stressed – climate is NOT "constant"; global temperatures rise and fall over the years
- Speculated that changes in solar activity were most likely explanation



Brückner (1889) calculated 5 year average global temperatures from 1786-90 to 1866-70. NOT "constant", but up and down



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Stage 2 (1930s-1940s) – Global Warming!

- Kincer (1933) noted that temperatures had been increasing world-wide for decades
- Callendar (1938) also noted the same, but blamed it on his theory that increasing CO_2 emissions were causing human-caused global warming
- Callendar (1961) updated his analysis but mostly just up to 1940s & felt his theory still held.

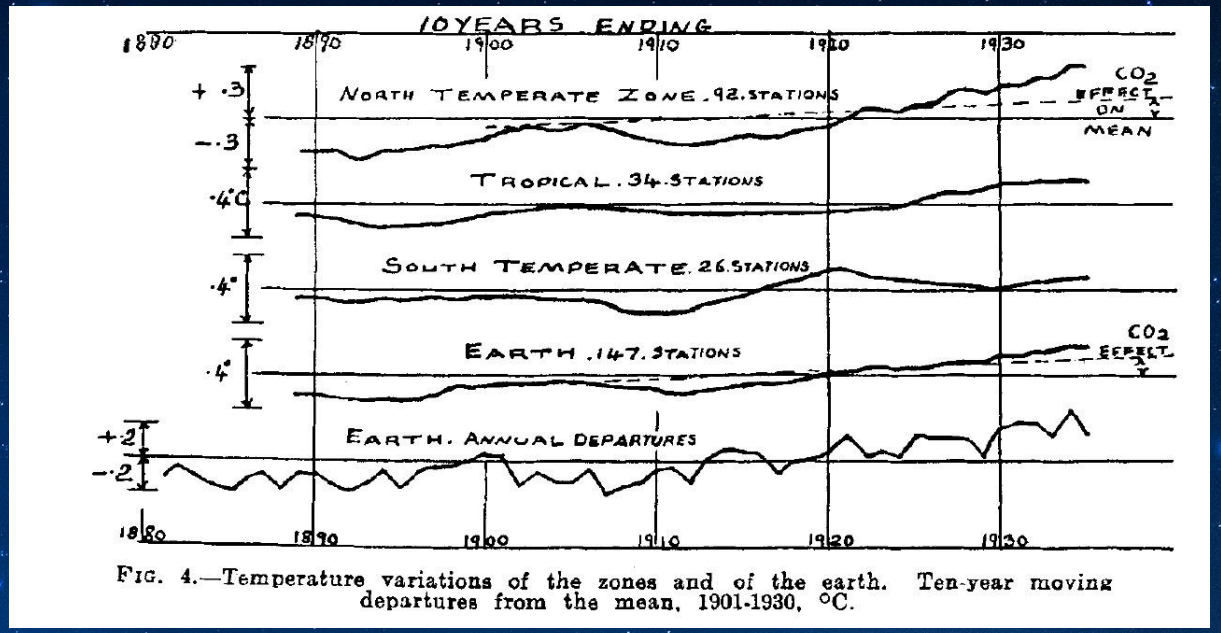
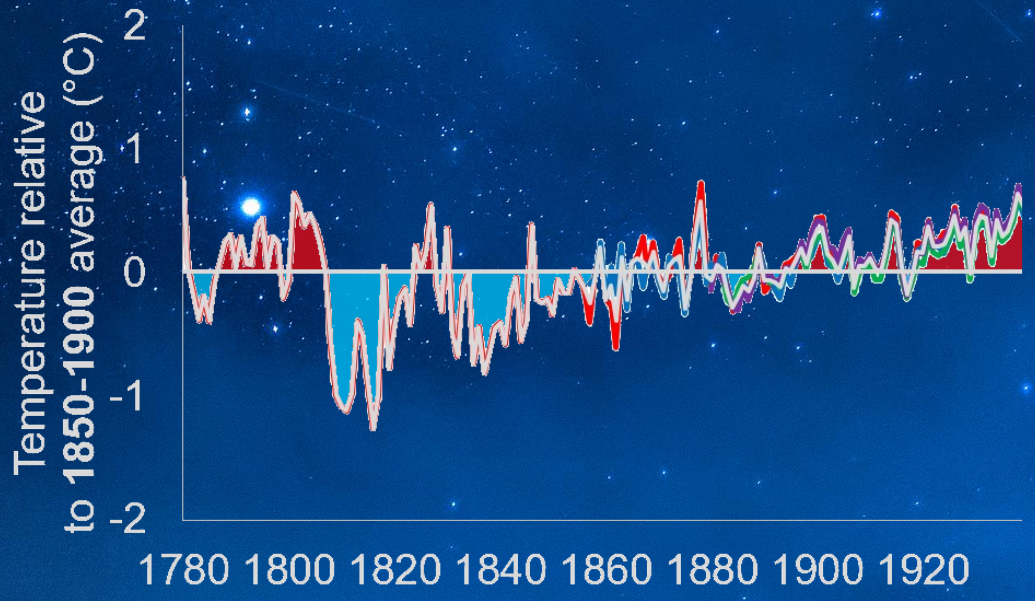


FIG. 4.—Temperature variations of the zones and of the earth. Ten-year moving departures from the mean, 1901-1930, °C.

Callendar (1938) calculated both 10-year moving departures from mean (top plots) and annual (bottom) from 1880-1935. Noted long-term warming. Blamed CO_2



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Stage 3 (1940s-1970s) – Global Cooling!

- Kincer (1946) noted that the warming had stopped and was reversing
- Mitchell (1961); Budyko (1969); Schneider & Mass (1975); Kukla et al. (1977); Yamamoto & Hoshiai (1980); etc. found global cooling
- Some said human-caused cooling from air pollution, e.g., Rasool & Schneider (1971)
- Others believed CO_2-caused global warming would kick in later, e.g., Broecker (1975)

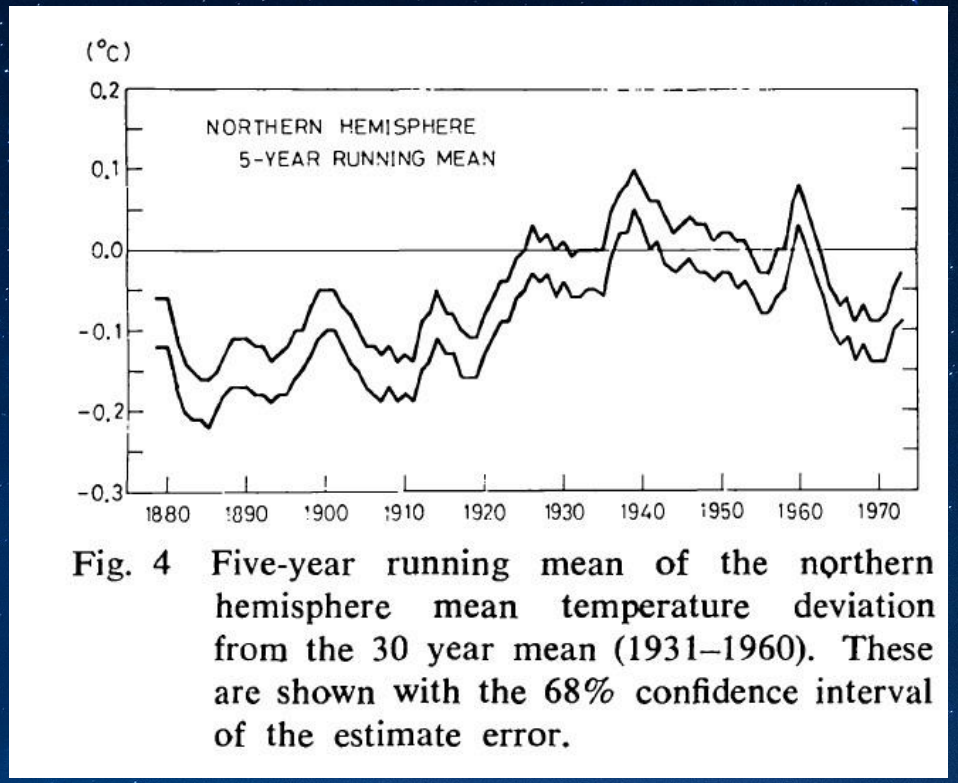
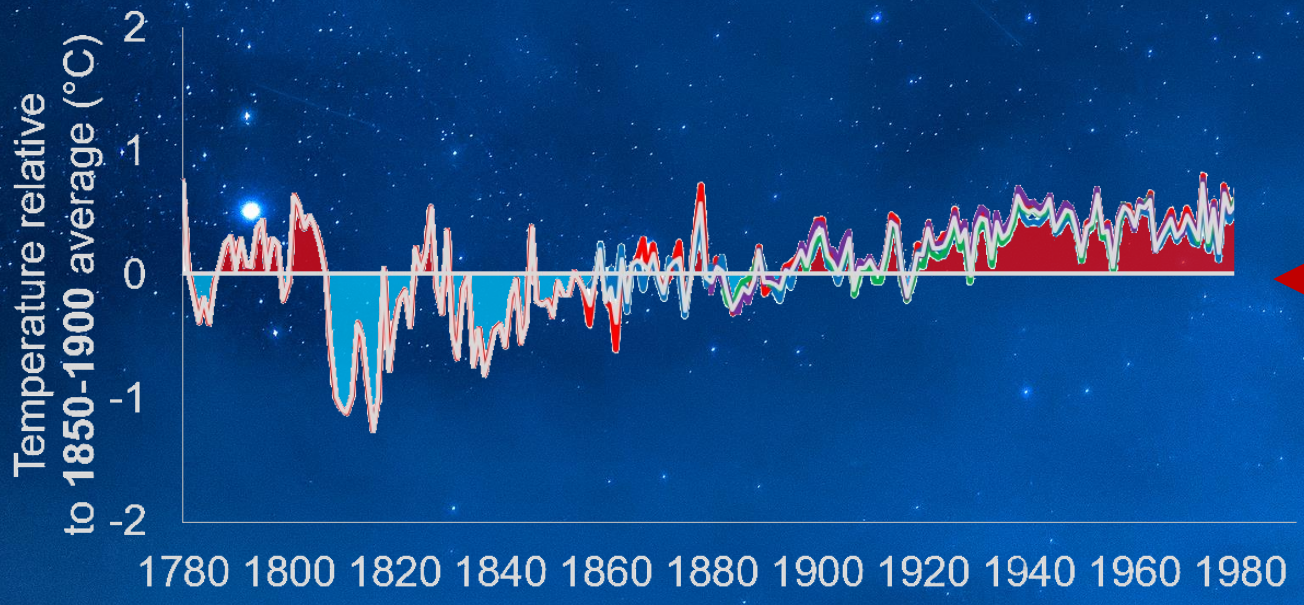


Fig. 4 Five-year running mean of the northern hemisphere mean temperature deviation from the 30 year mean (1931–1960). These are shown with the 68% confidence interval of the estimate error.

Yamamoto & Hoshiai (1980). NH-only as SH data was too limited



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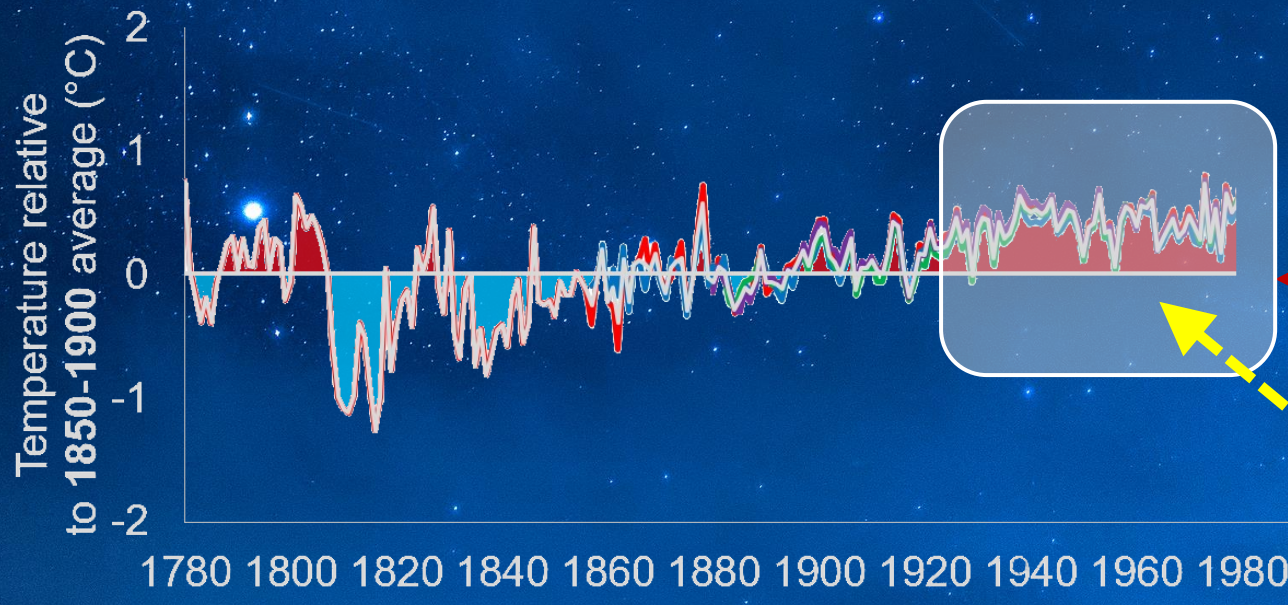

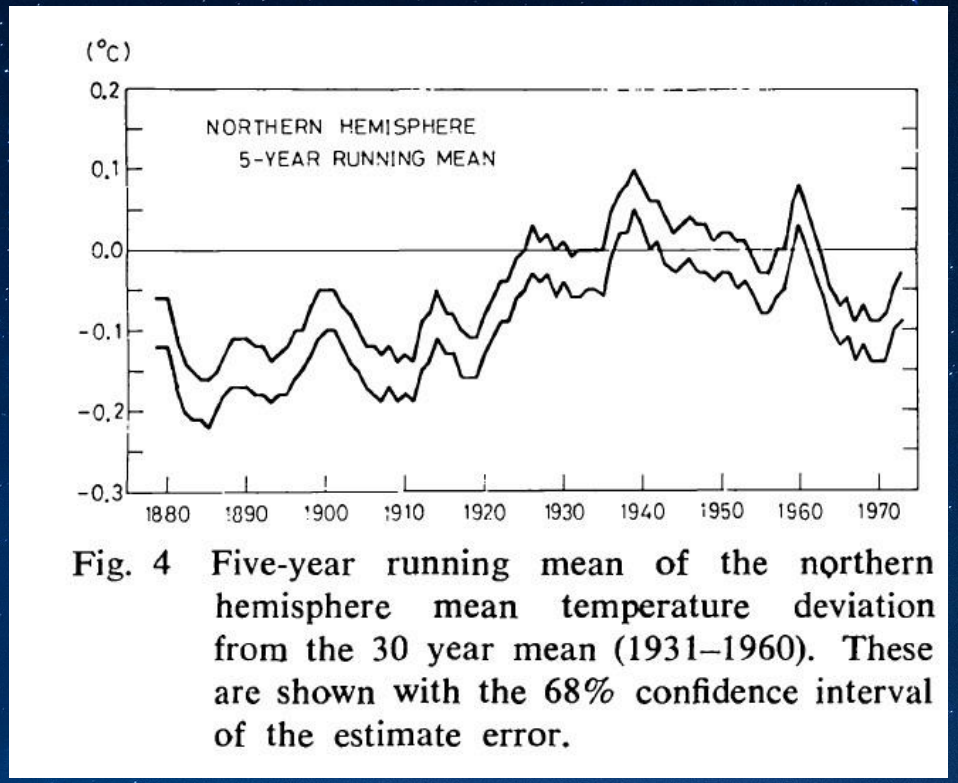

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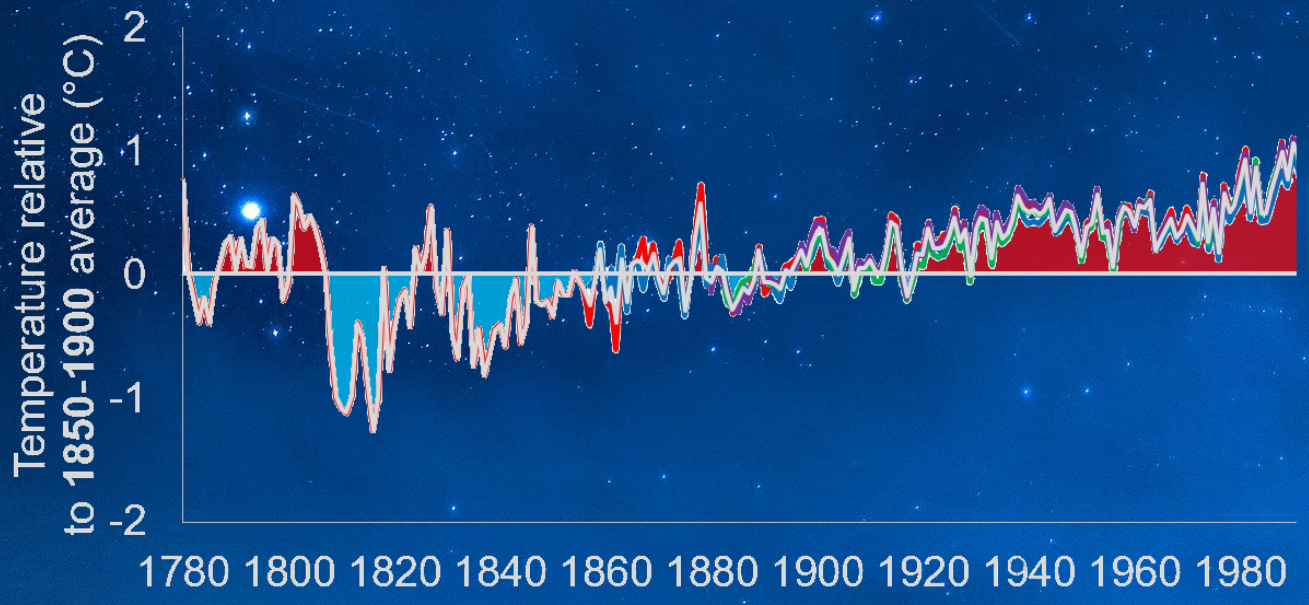
Note: Current estimates have flattened 1940s-70s cooling! More on this later

Stage 4 (1980s) – Global warming!

- In the 1980s, warming returned. Three groups developed regular updates:
- CRU (UK, e.g., Jones et al. 1986)
- NASA (USA, e.g., Hansen & Lebedeff, 1987)
- Russian group following Budyko's work (e.g., Vinnikov et al. 1990)
- In 1988, NASA GISS presented their findings to US Senate testimony and blamed the warming on "the greenhouse effect".

June 1988: NASA GISS' Director, Dr. James Hansen testifies for US Senate that "*It is time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here.*"



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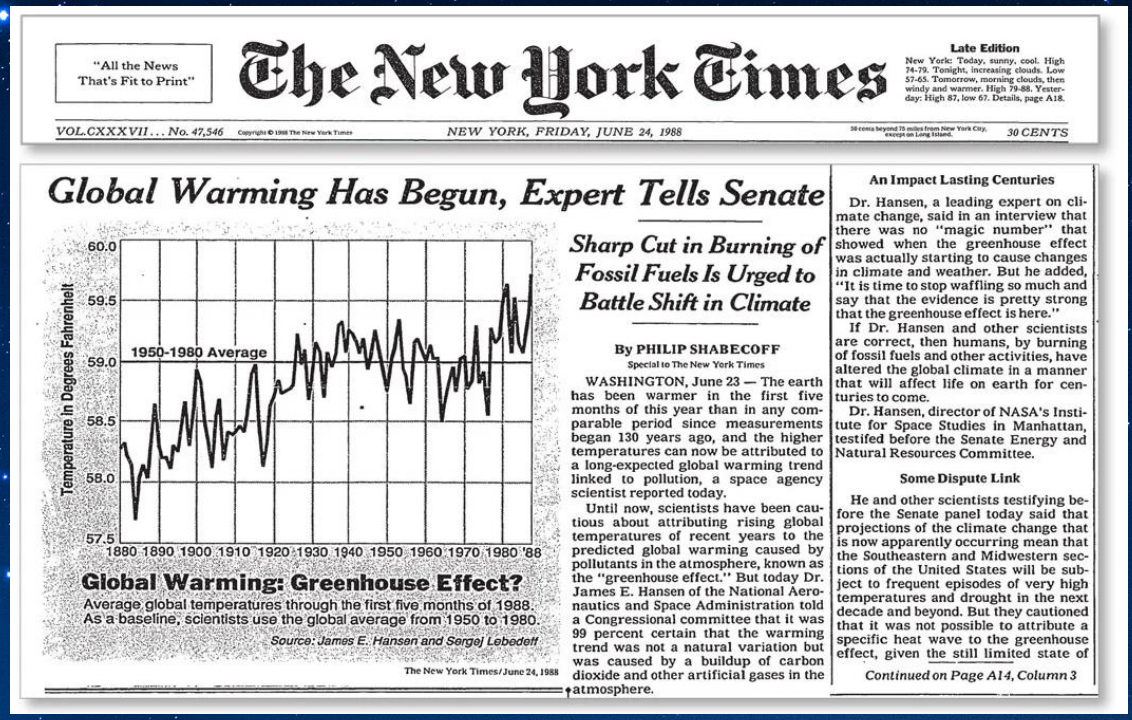


"All the News That's Fit to Print"

The New York Times

Late Edition

New York: Today, sunny, cool. High 74-79. Tonight, increasing clouds. Low 57-65. Tomorrow, morning clouds, then windy and warmer. High 79-88. Yesterday: High 87, low 67. Details, page A18.

VOL. CXXXVII . . . No. 47,546 NEW YORK, FRIDAY, JUNE 24, 1988 30 CENTS

Global Warming Has Begun, Expert Tells Senate

Global Warming: Greenhouse Effect?

Average global temperatures through the first five months of 1988. As a baseline, scientists use the global average from 1950 to 1980.

Source: James E. Hansen and Sergej Lebedeff

The New York Times/June 24, 1988

Sharp Cut in Burning of Fossil Fuels Is Urged to Battle Shift in Climate

By PHILIP SHABECOFF
Special to The New York Times

WASHINGTON, June 23 — The earth has been warmer in the first five months of this year than in any comparable period since measurements began 130 years ago, and the higher temperatures can now be attributed to a long-expected global warming trend linked to pollution, a space agency scientist reported today.

Until now, scientists have been cautious about attributing rising global temperatures of recent years to the predicted global warming caused by pollutants in the atmosphere, known as the "greenhouse effect." But today Dr. James E. Hansen of the National Aeronautics and Space Administration told a Congressional committee that it was 99 percent certain that the warming trend was not a natural variation but was caused by a buildup of carbon dioxide and other artificial gases in the atmosphere.

An Impact Lasting Centuries

Dr. Hansen, a leading expert on climate change, said in an interview that there was no "magic number" that showed when the greenhouse effect was actually starting to cause changes in climate and weather. But he added, "It is time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here."

If Dr. Hansen and other scientists are correct, then humans, by burning of fossil fuels and other activities, have altered the global climate in a manner that will affect life on earth for centuries to come.

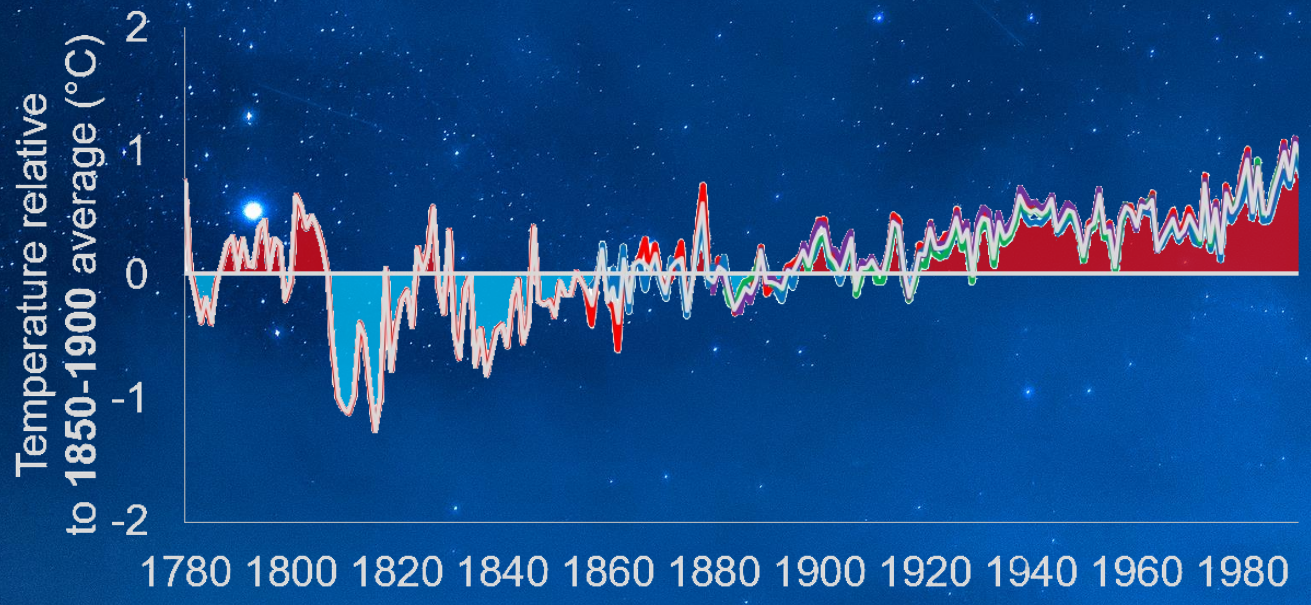
Dr. Hansen, director of NASA's Institute for Space Studies in Manhattan, testifed before the Senate Energy and Natural Resources Committee.

Some Dispute Link

He and other scientists testifying before the Senate panel today said that projections of the climate change that is now apparently occurring mean that the Southeastern and Midwestern sections of the United States will be subject to frequent episodes of very high temperatures and drought in the next decade and beyond. But they cautioned that it was not possible to attribute a specific heat wave to the greenhouse effect, given the still limited state of

Continued on Page A14, Column 3

After Dr. Hansen's 1988 Senate testimony, **the world panicked and the IPCC was formed.**



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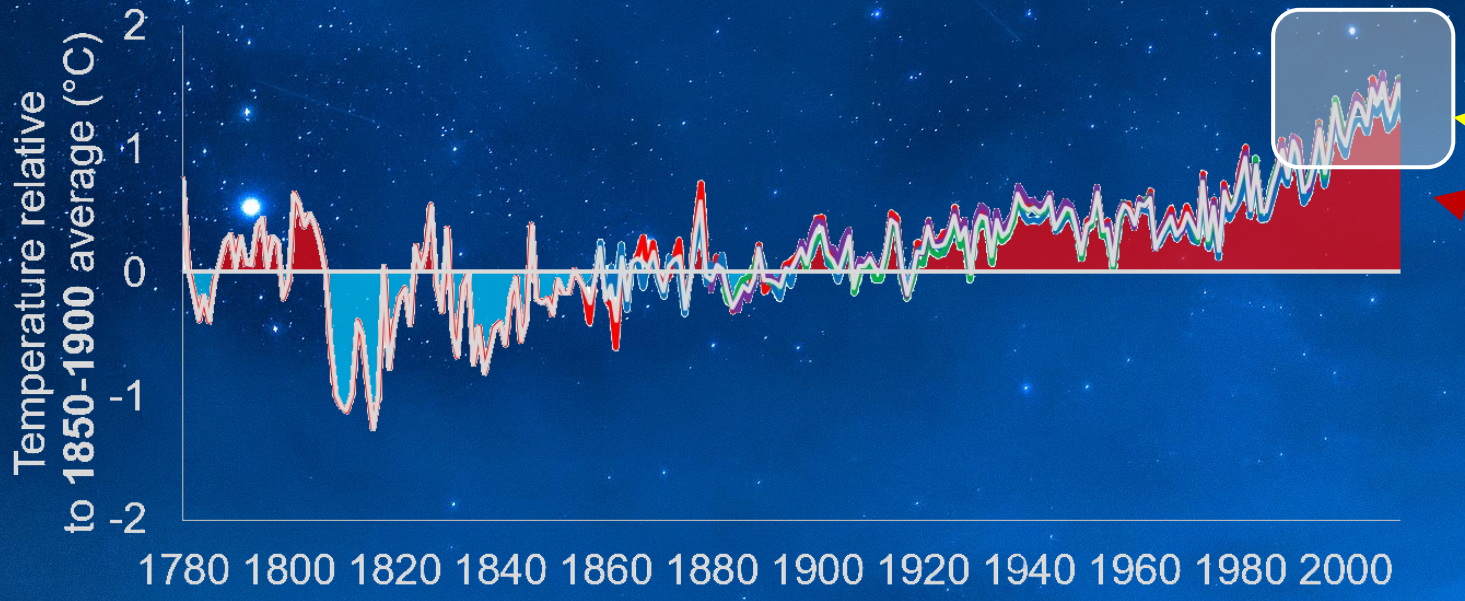
Stage 5 (1990s-2009) – War against the climate skeptics!

- Narratives were created to stop climate skeptics from interfering with UN goals by claiming:
  1. Urbanization bias is not a problem
  2. Raw data is unreliable. Data must be "homogenized"
  3. There was no "hiatus" in global warming

- Stage 5 ended in November 2009 with "Climategate"




AGU PUBLICATIONS

Earth's Future

RESEARCH ARTICLE
10.1002/2013EF000165

An apparent hiatus in global warming?

Kevin E. Trenberth[1] and John T. Fasullo[1]

[1]National Center for Atmospheric Research, Boulder, Colorado, USA

Key Points:
- There is a hiatus in the rise in global mean surface temperatures over the past decade

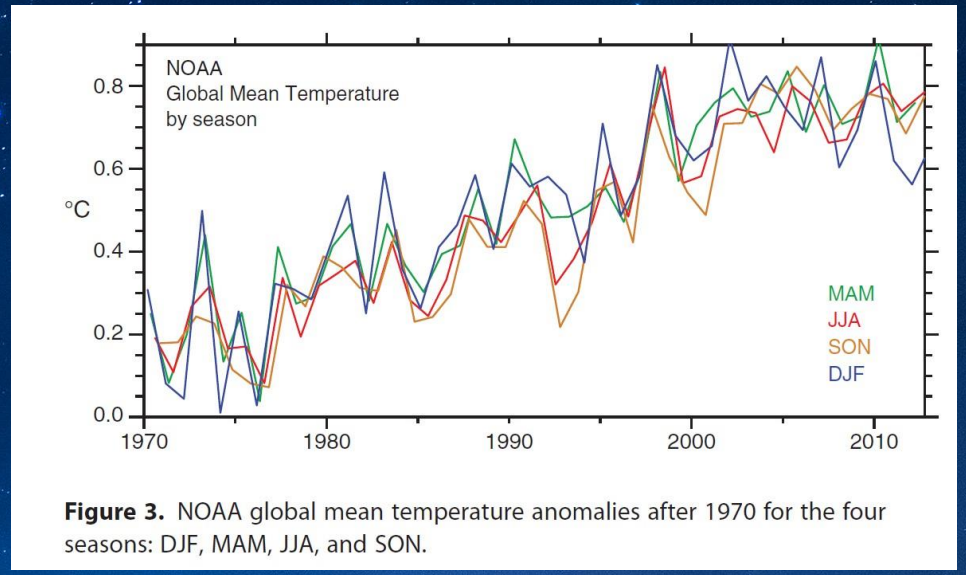


Figure 3. NOAA global mean temperature anomalies after 1970 for the four seasons: DJF, MAM, JJA, and SON.

Note: Current estimates "fixed" the hiatus! More on this later

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Stage 6 (post-ClimateGate) – "Science is Settled on global warming"

- 2010: Berkeley Earth decided quantity is better than quality. Compiled dataset of >30,000 records
- 2011: CRU finally made their data public – turned out there was no "special sauce" vs. GHCN
- 2018: GHCN upgraded from version 3 (7,200 stations) to version 4 (20,000 stations)
- Present: All groups insist unhomogenized data is unreliable & Urbanization bias is not a problem

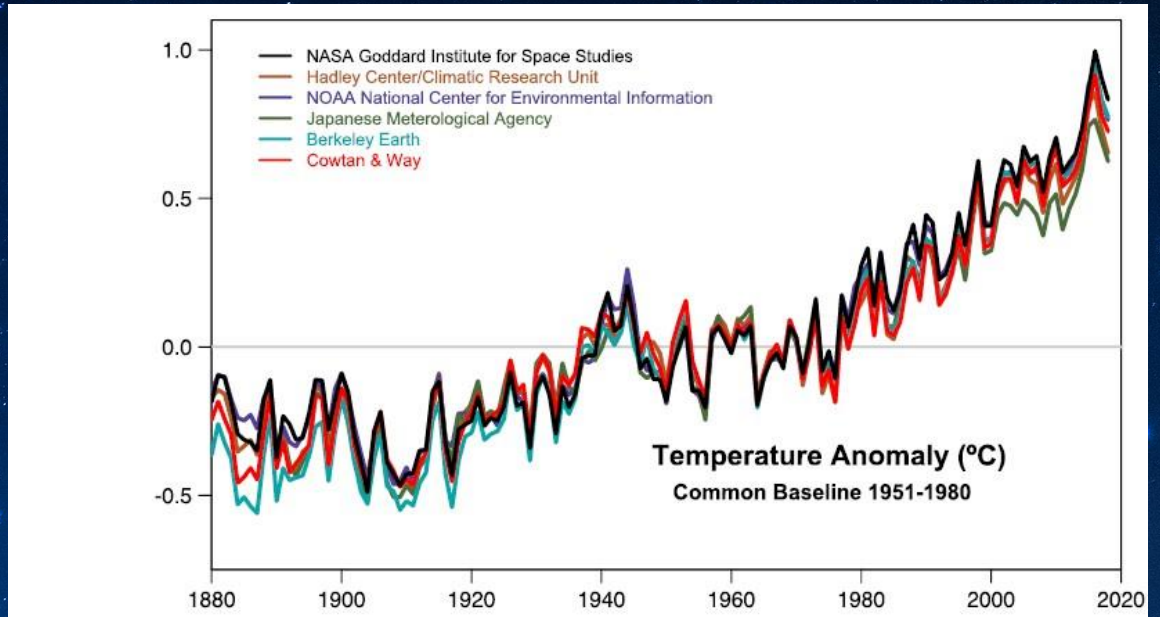
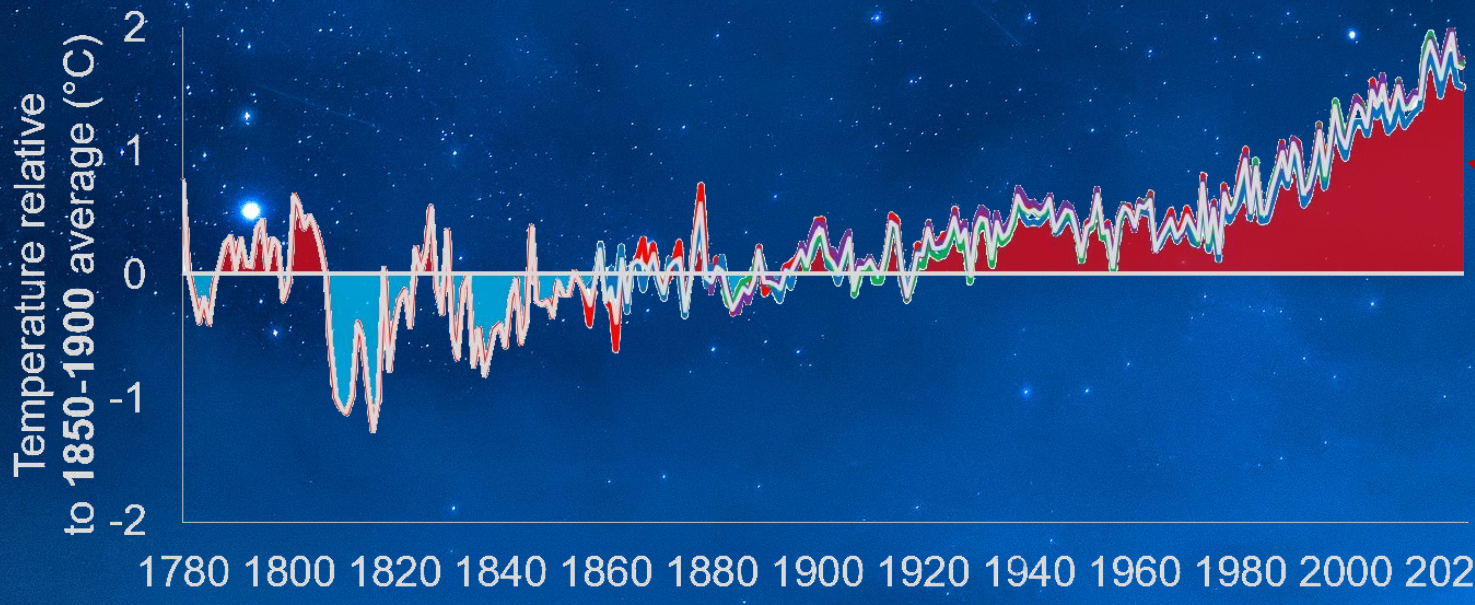


Figure 1. Comparison of six analyses of the annual global surface temperature anomaly through 2018. NASA = National Aeronautics and Space Administration; NOAA = National Oceanic and Atmospheric Administration.

Lenssen, Hansen et al. (2019)



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How reliable are the raw station records?

Unfortunately, most station records are plagued by "**non-climatic biases**".
Weather stations are typically set up to observe the current weather conditions.
Their records are usually not set up to study long-term multi-decadal temperature changes.

Many biases lead to one-off abrupt "**step changes**" that have nothing to do with climate change. The term "step" means that the average temperatures will increase or decrease by some fixed value after the change.

Other biases are subtler "**trend biases**" that slowly become larger over the years.

Examples of non-climatic "step biases"

- Changes in instrumentation
- Changes in thermometer shelter
- Station moves
- Changes in observation methods
- Cutting down of nearby trees and/or shrubs

Examples of non-climatic "trend biases"

- Urbanization of area – almost always a warming bias
- Other changes in land use, e.g., crops, reforestation – often cooling biases
- Changes in local microclimate – often a warming bias:
  1. Construction of buildings within 100 m
  2. Concrete, asphalt, etc.
  3. Growth of trees, shrubs, etc. (often cooling)

Step biases: E.g., Changes in thermometer screen

Monastery Kremsmünster, Austria

Climatic Change (2010) 101:41–67
DOI 10.1007/s10584-009-9649-4

The early instrumental warm-bias: a solution for long central European temperature series 1760–2007

Reinhard Böhm · Philip D. Jones · Johann Hiebl · David Frank · Michele Brunetti · Maurizio Maugeri

(Photos 21 March 2007, R. Böhm)

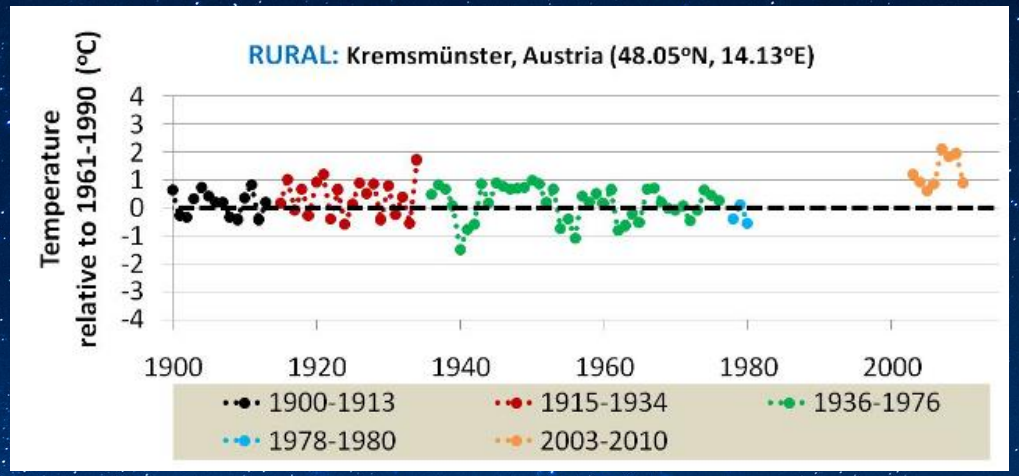
Historic site (1767-now)

(Indoors, manual observations, 6.9 m above ground)

Modern site (1980s-now)

(Stevenson Screen, automatic thermometer, 2.2 m above ground)

The change in recording site for Kremsmünster (rural)



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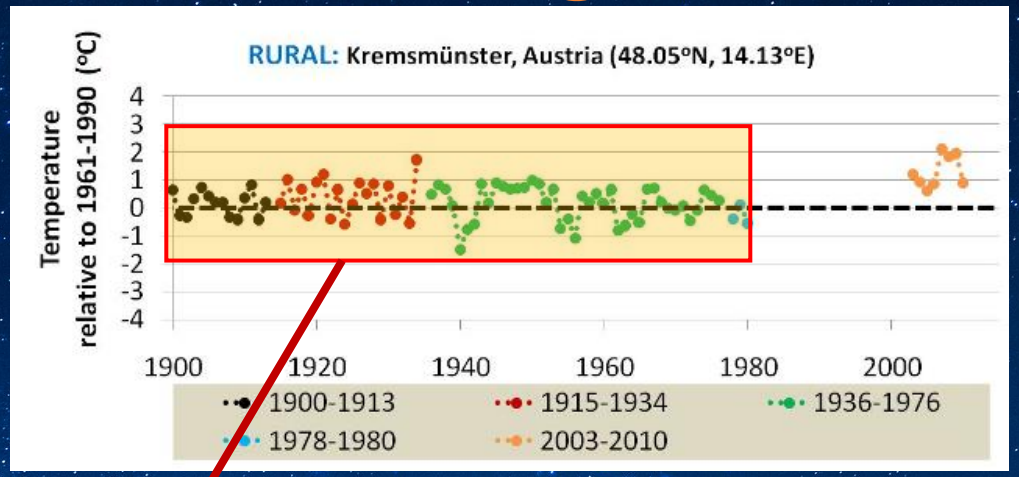

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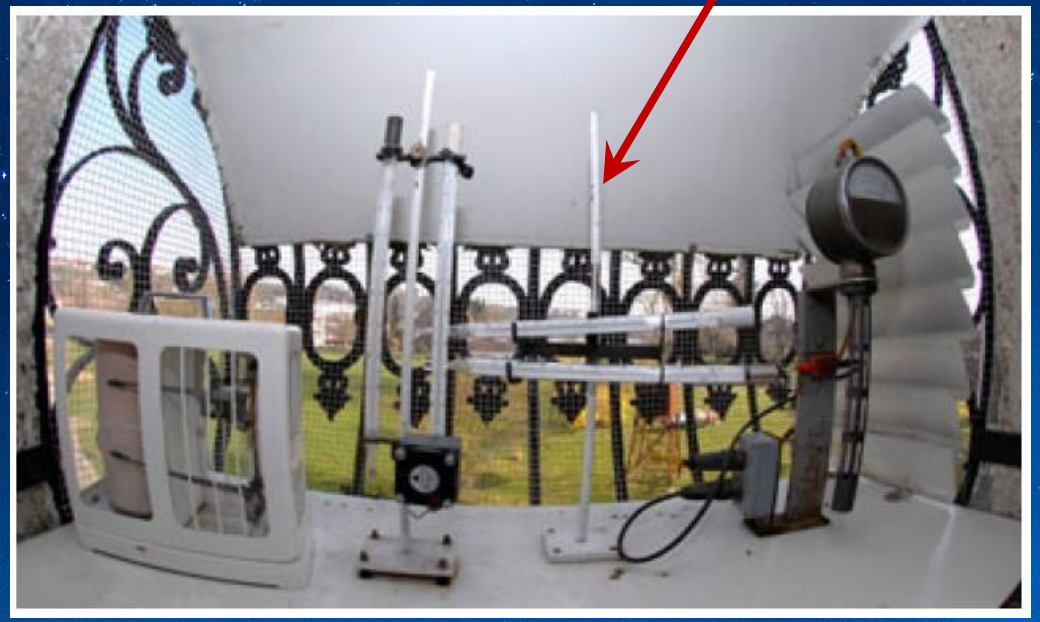

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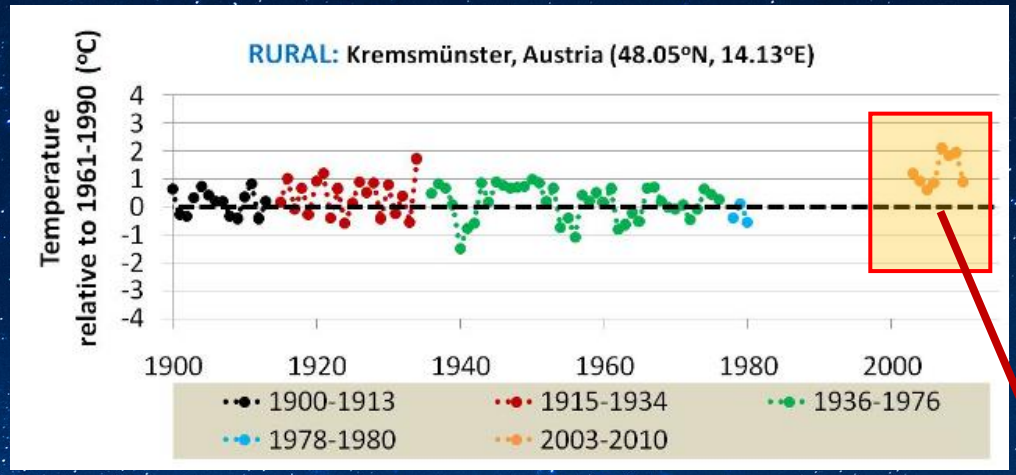

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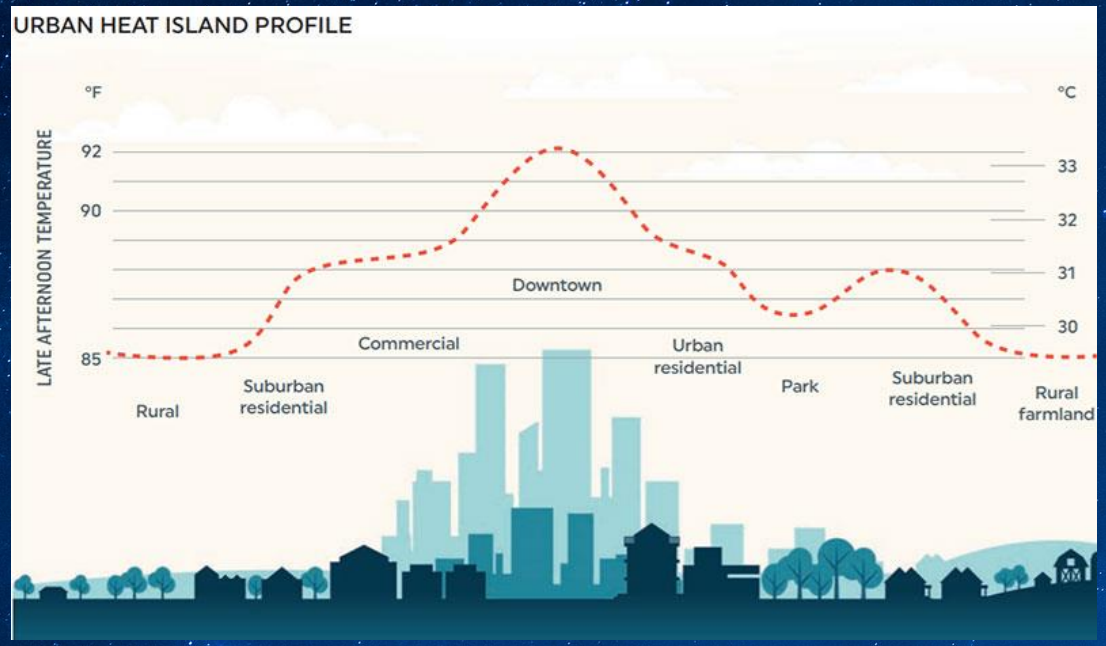
The Urban Heat Island (UHI) problem

Schematic showing the UHI profile of a typical modern city with a population of about 1 million

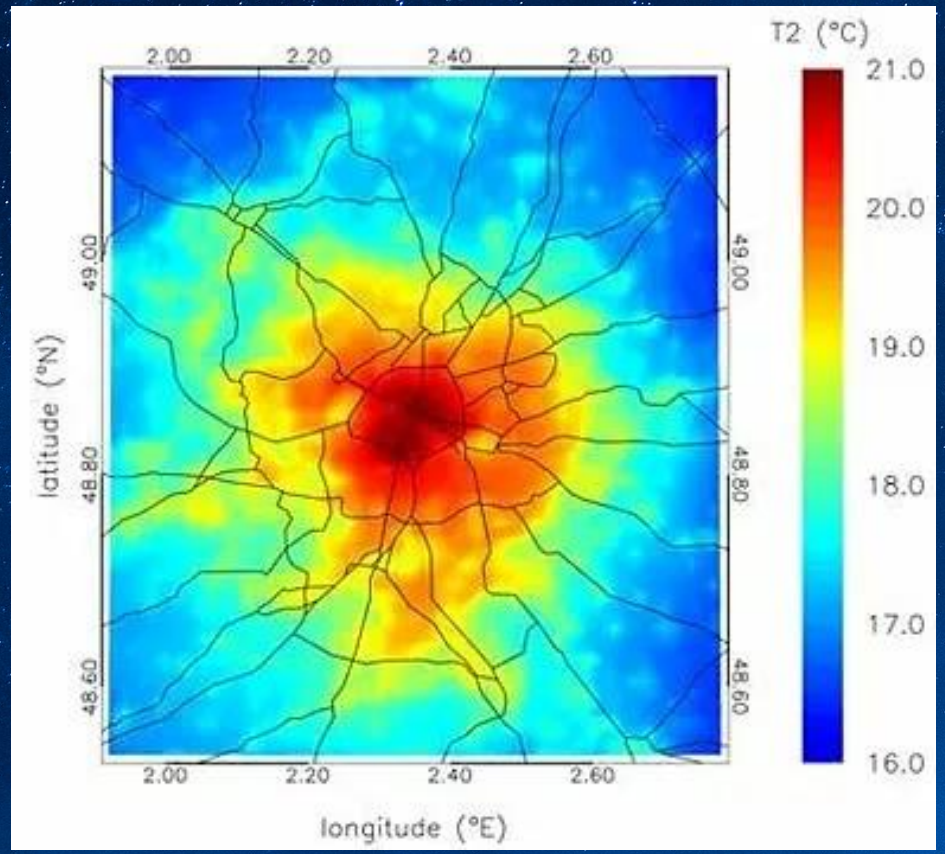


Source: Heat Island Group, Lawrence Berkeley National Laboratory, 2019

- Cities are warmer than surrounding countryside
- Watch the thermometer in your car next time you enter or leave a city!
- The magnitude of this "urban heat island" increases the more urbanized the area becomes
- But, in 1820s, Luke Howard had already observed the phenomenon for London
- This is "climate change". Human-caused climate change. But, **local** climate change. And nothing to do with greenhouse gases!

The Urban Heat Island (UHI) problem

UHI heat map for Paris, France (summer 2003)



Mean air temperature in Paris, France at 22:00 CEST in summer 2003. Credits: VITO, Planetek.

UHI heat map for Singapore (2016)

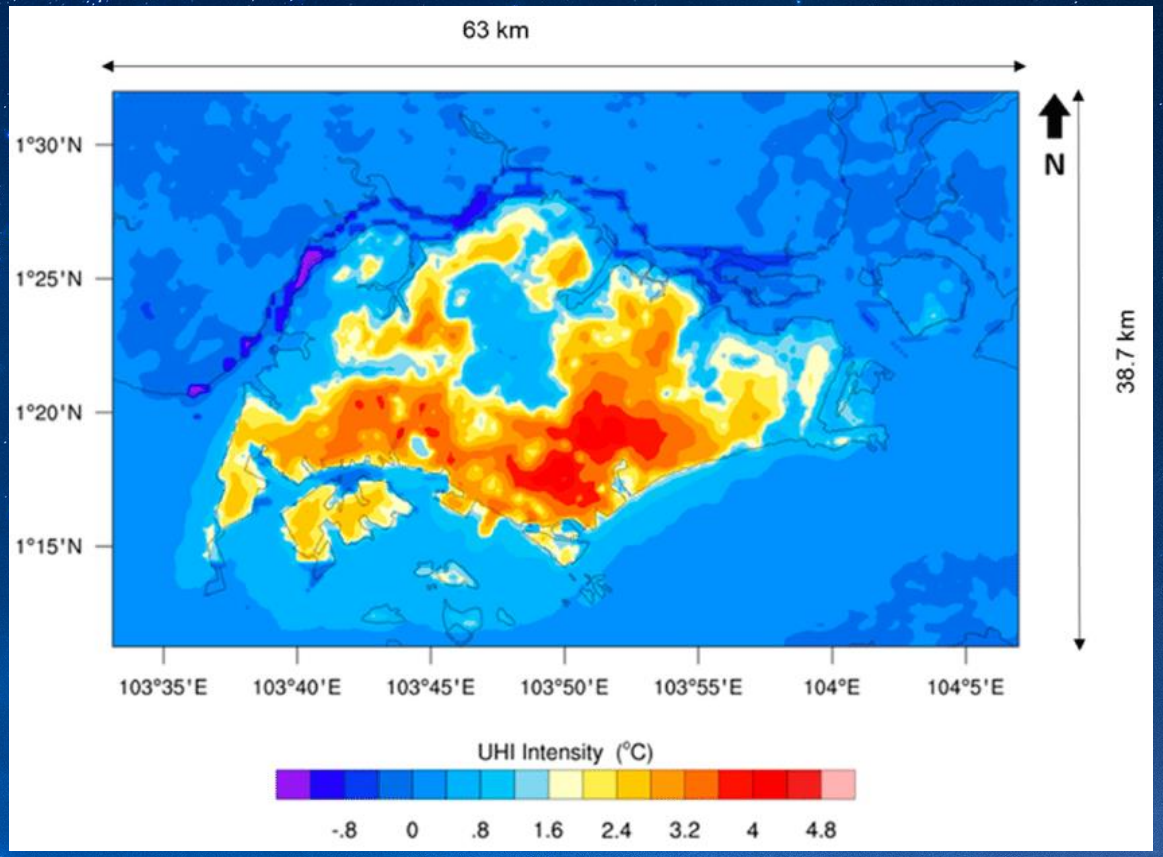
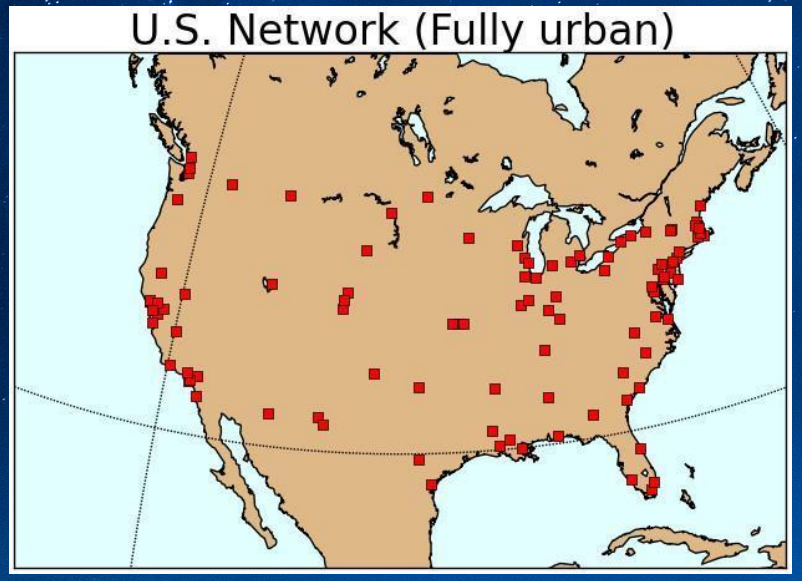


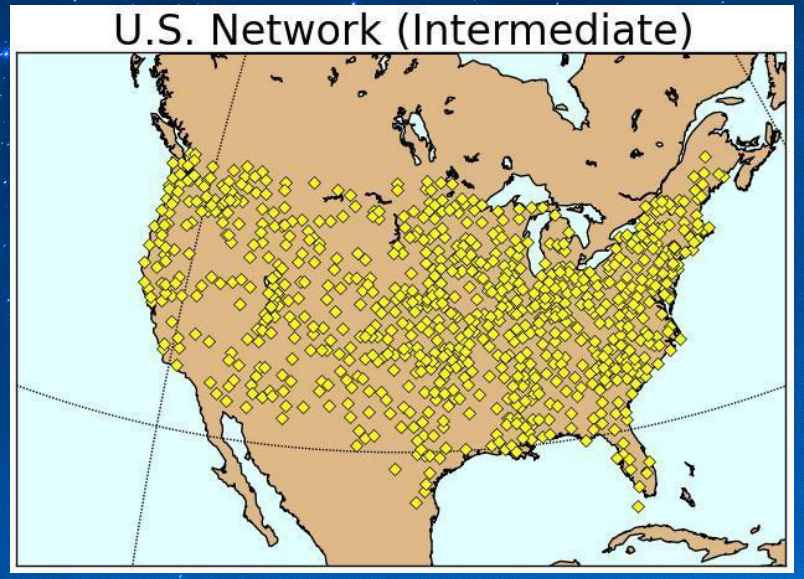
Figure 2 from Natalia Borzino et al. (2020). Climate, 8, 82; doi:10.3390/cli8070082

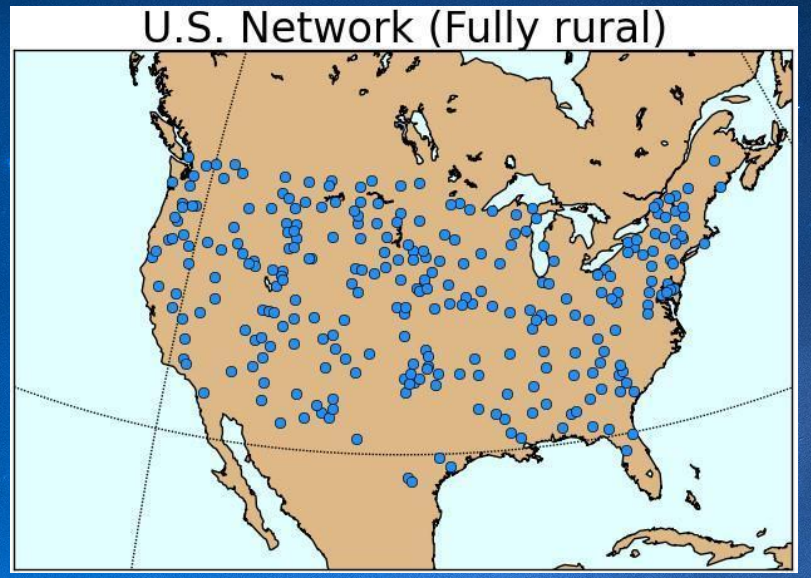
The Urban Heat Island (UHI) problem

- In 2014, Drs. Ronan and Michael Connolly carried out an investigation of the UHI problem for the U.S. and the rest of world in a series of three working papers published on their www.oprj.net website.

- They divided the 1200 contiguous U.S. stations in version 3 of the GHCN dataset (more later) according to how urbanized they were according to (a) night brightness and (b) associated population size







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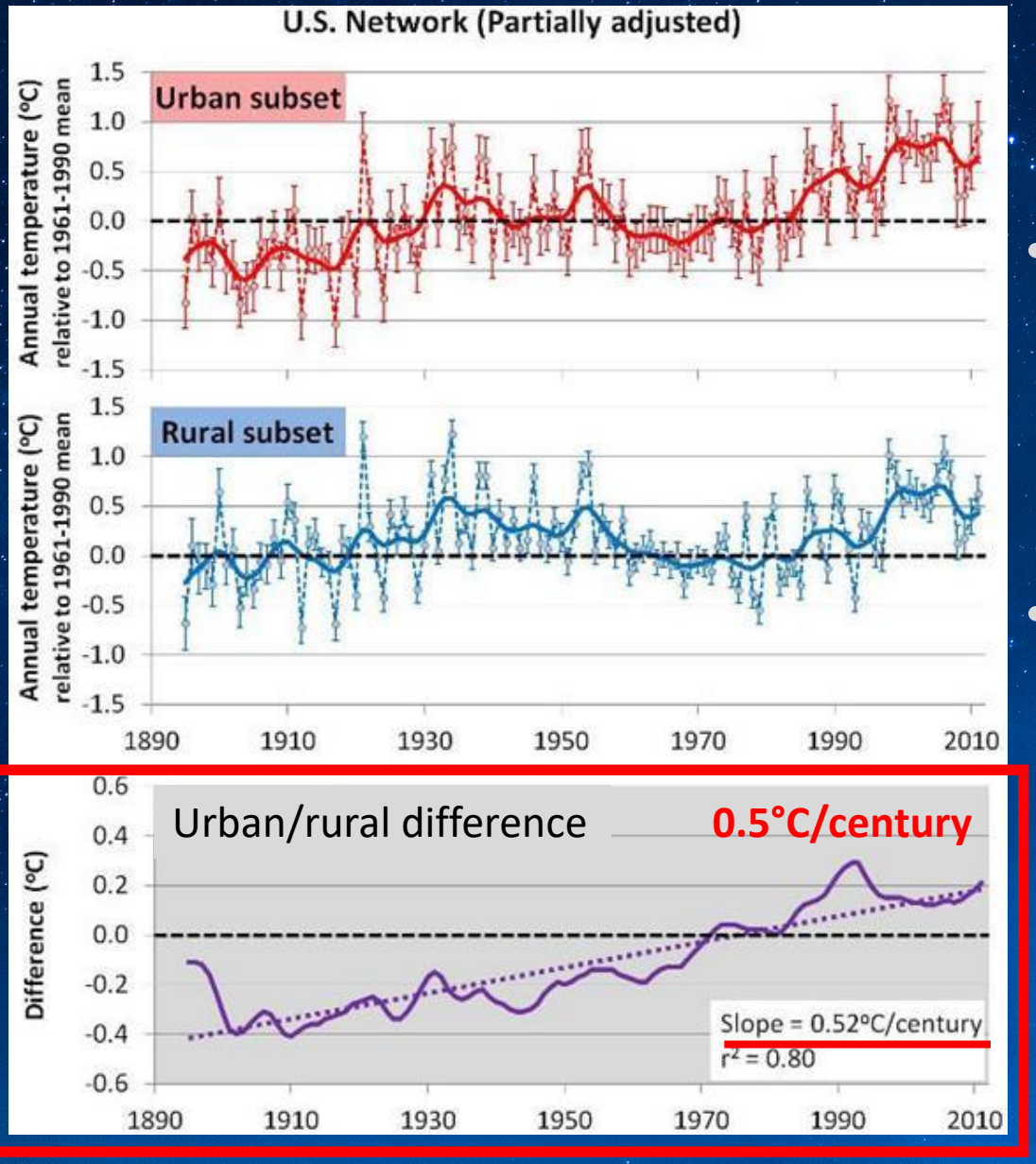
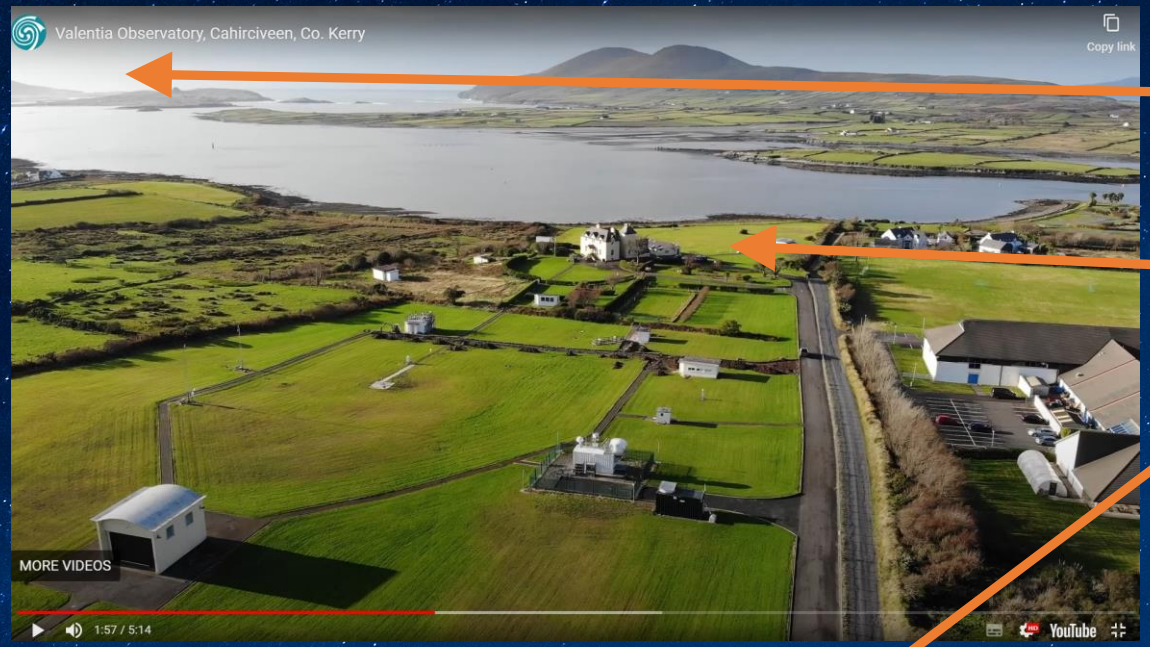
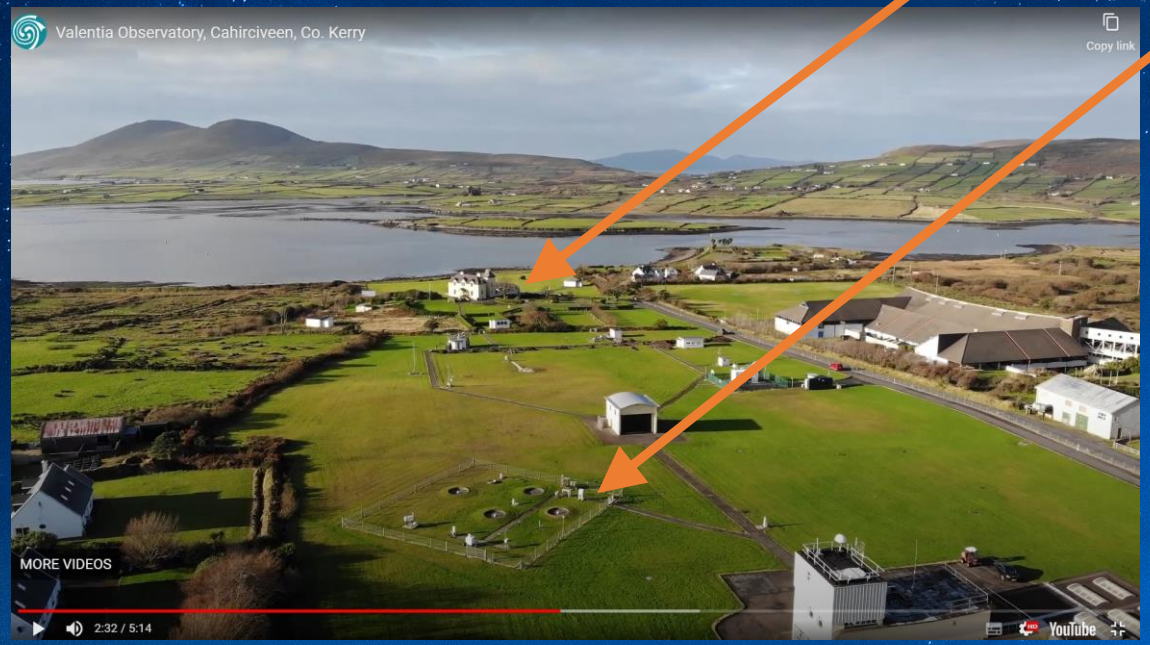


- The graph on the left shows the gridded mean temperature trends of the most urban (top) and most rural (middle) stations for the entire contiguous U.S.
- The data had also been corrected for documented changes in observation time.

A rare long, rural record: Valentia Observatory, Ireland





1867-1892: Located on Valentia Island

1892-2001: Located near ocean

2001-present: Current location.
Automatic weather station since 2012

Station history metadata (key changes)

- 1892. Station move. Valentia Island to the mainland
- 1937. Change in government. Republic of Ireland formed. But staff and observations remained the same.
- 2001. Station move 350 m inland (~20 m higher)
- 2012. Instrumentation change. Manual weather station to automatic

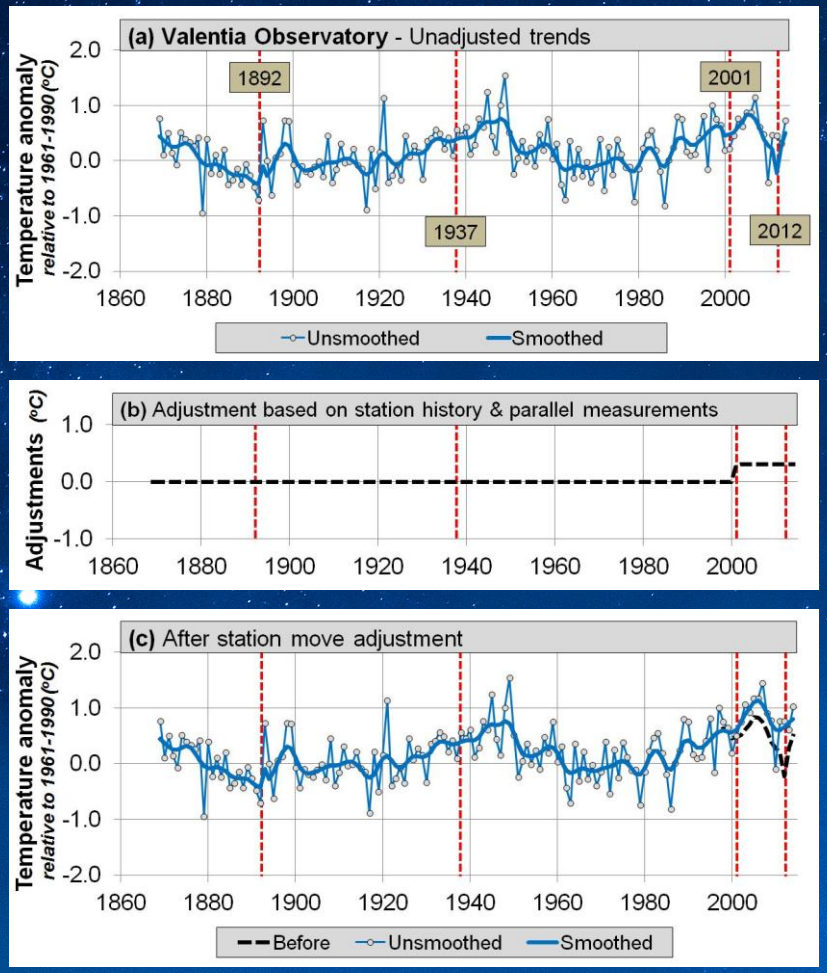
Correcting the raw Valentia Observatory record

Earth-Science Reviews 150 (2015) 409–452

Re-evaluating the role of solar variability on Northern Hemisphere temperature trends since the 19th century

Willie Soon [a,*], Ronan Connolly [b], Michael Connolly [b]

[a] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA
[b] Independent research scientists, Dublin, Ireland



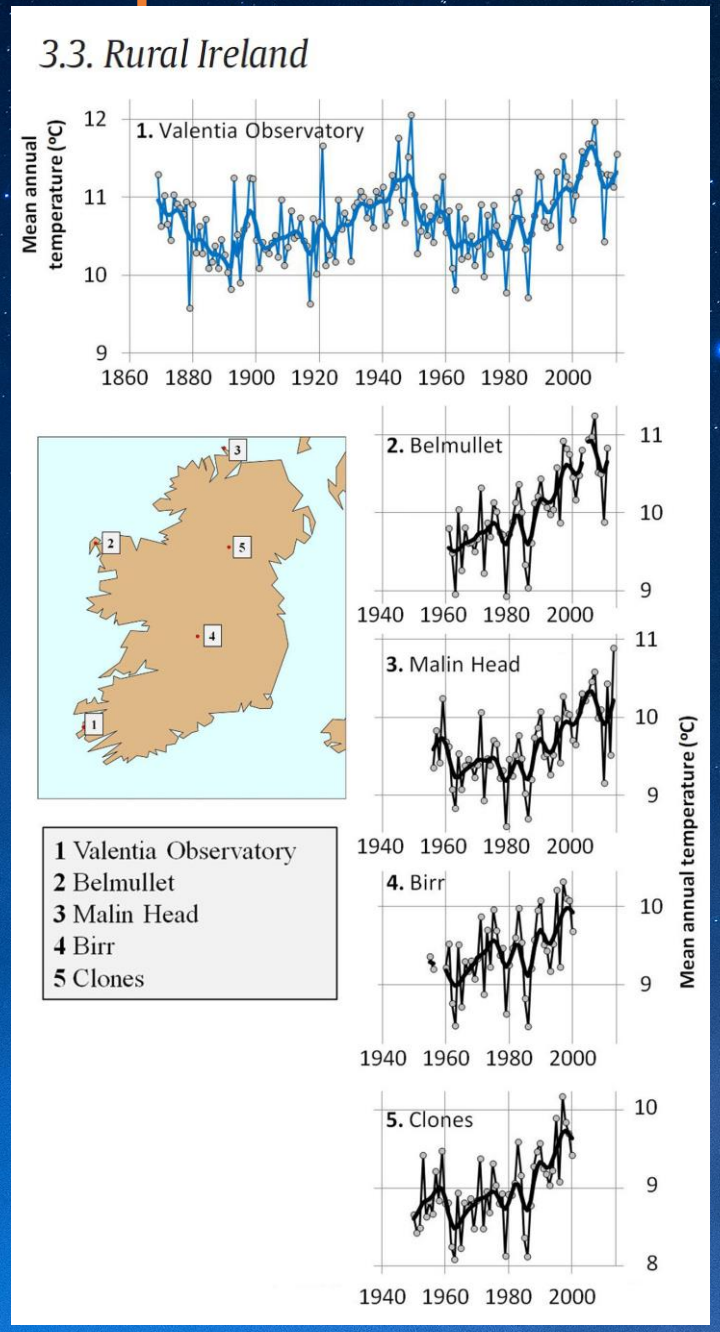
Soon et al. 2015: Corrections for non-climatic biases

- **1892**. Station move. Valentia Island to the mainland. Possible bias, but unclear what magnitude or sign. **No adjustments applied**.
- **1937**. Change in government. Republic of Ireland formed. But staff and observations remained the same. **No adjustments necessary**
- **2001**. Station move. 350 m. Parallel measurements reveal the new location was 0.3 °C colder. **+0.3 °C adjustment applied**.
- **2012**. Instrumentation change. Parallel measurements show bias was less than 0.1 °C. **No adjustments necessary**

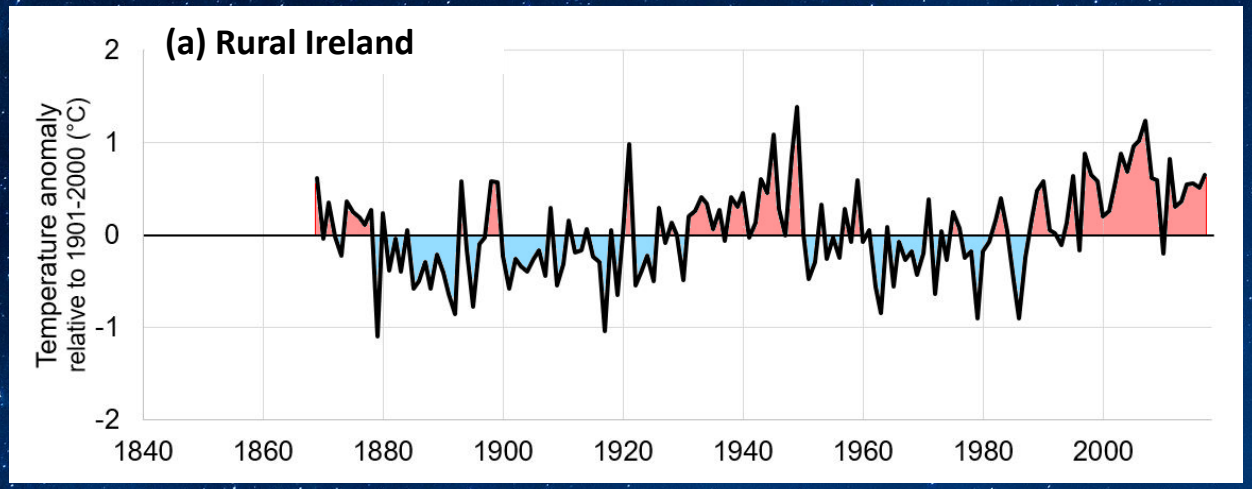
How we constructed “rural Ireland” temperature

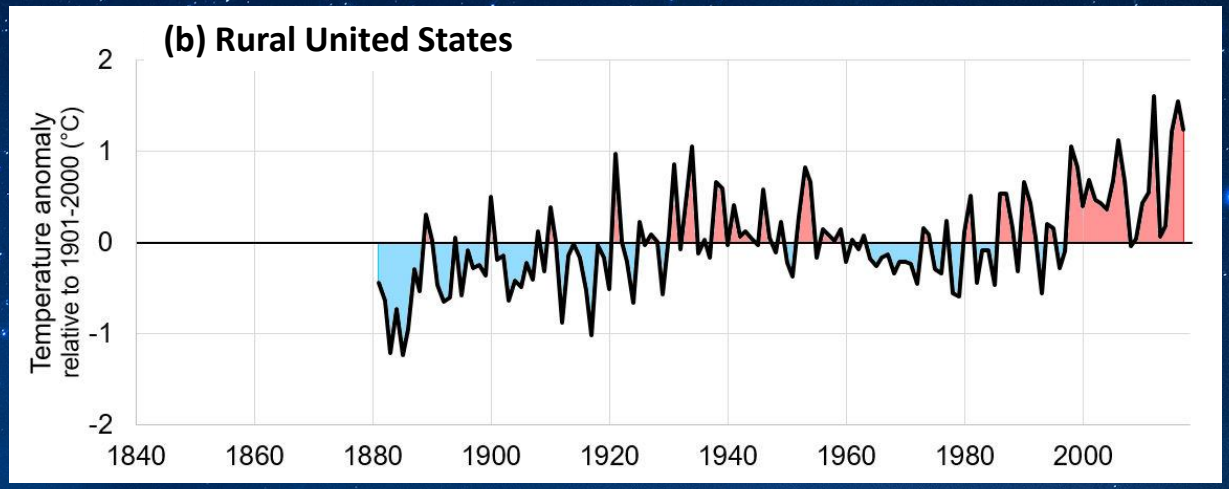
Soon et al. 2015; Connolly et al., 2021 – “rural Ireland”

- In version 3 of the GHCN dataset (more on this later), 5 of the 13 Irish stations remain rural.
- Recently, a lot of early measurements from Irish stations (including rural stations) have been digitized (see Mateus et al. 2020)
- At the time, Valentia Observatory was the only one Irish rural record in the dataset covering the period pre-1950. But, as can be seen, the trends of all five were similar during overlap.
- Therefore, we could **as a start**, estimate “Rural Ireland”.
- In our papers, we called on others to expand our analysis to cover rest of Europe. Until recently, our cries have been ignored! However, some of our colleagues in O’Neill et al., 2022 are working with us … Watch this space!



Soon et al. 2015; Connolly et al. 2021 – Rural Northern Hemisphere time series – 4 regions

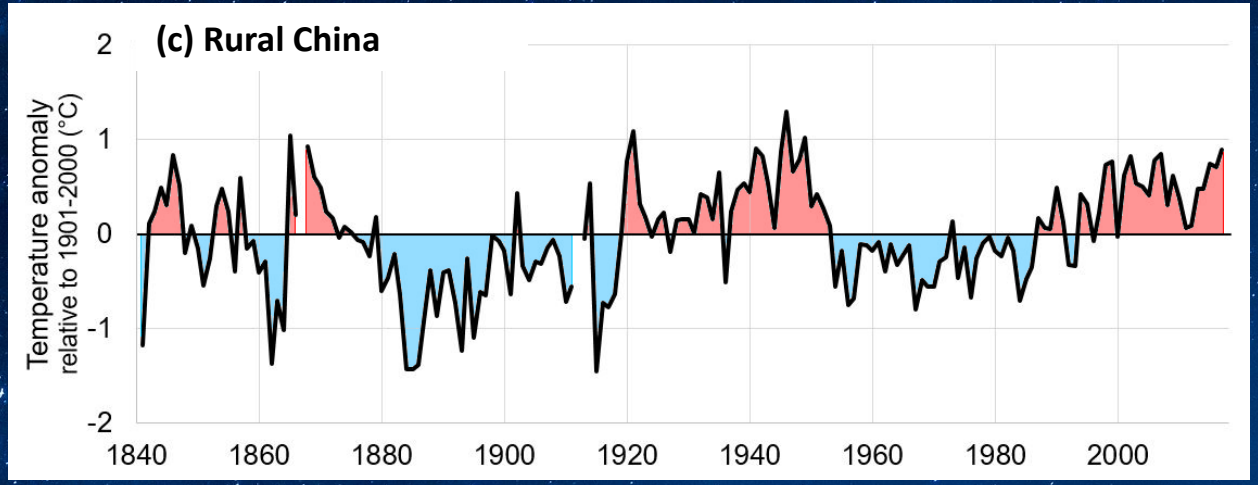


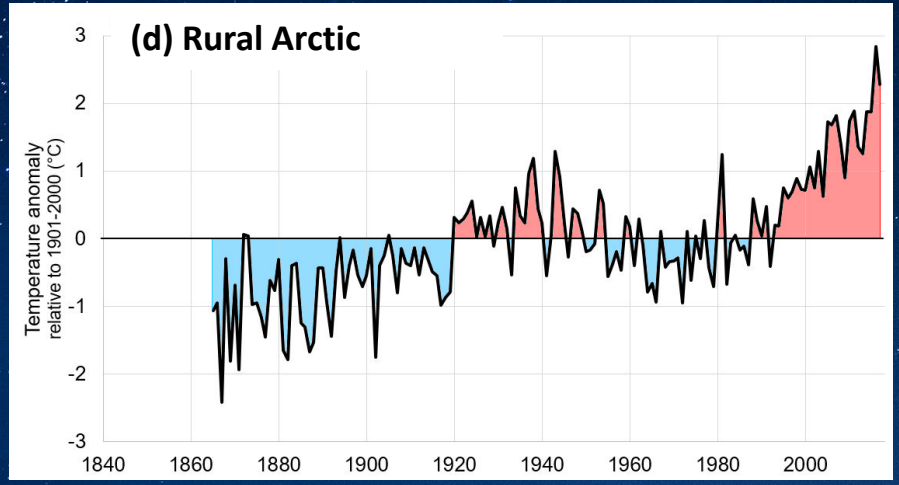


- All five rural Ireland stations after applying the corrections for Valentia Observatory
- A small geographic area. But, a lot of careful work to correct for non-climatic biases
- We called for similar work for the rest of Europe. This is ongoing work.

- US has a lot of rural data – only used fully rural stations (~25% of records)
- Used version corrected by NOAA for changes in Time of Observations
- Applied empirical correction to account for siting biases based on Watts et al.'s Surfacestations project (2011 version)

Soon et al. 2015; Connolly et al. 2021 – Rural Northern Hemisphere time series – 4 regions

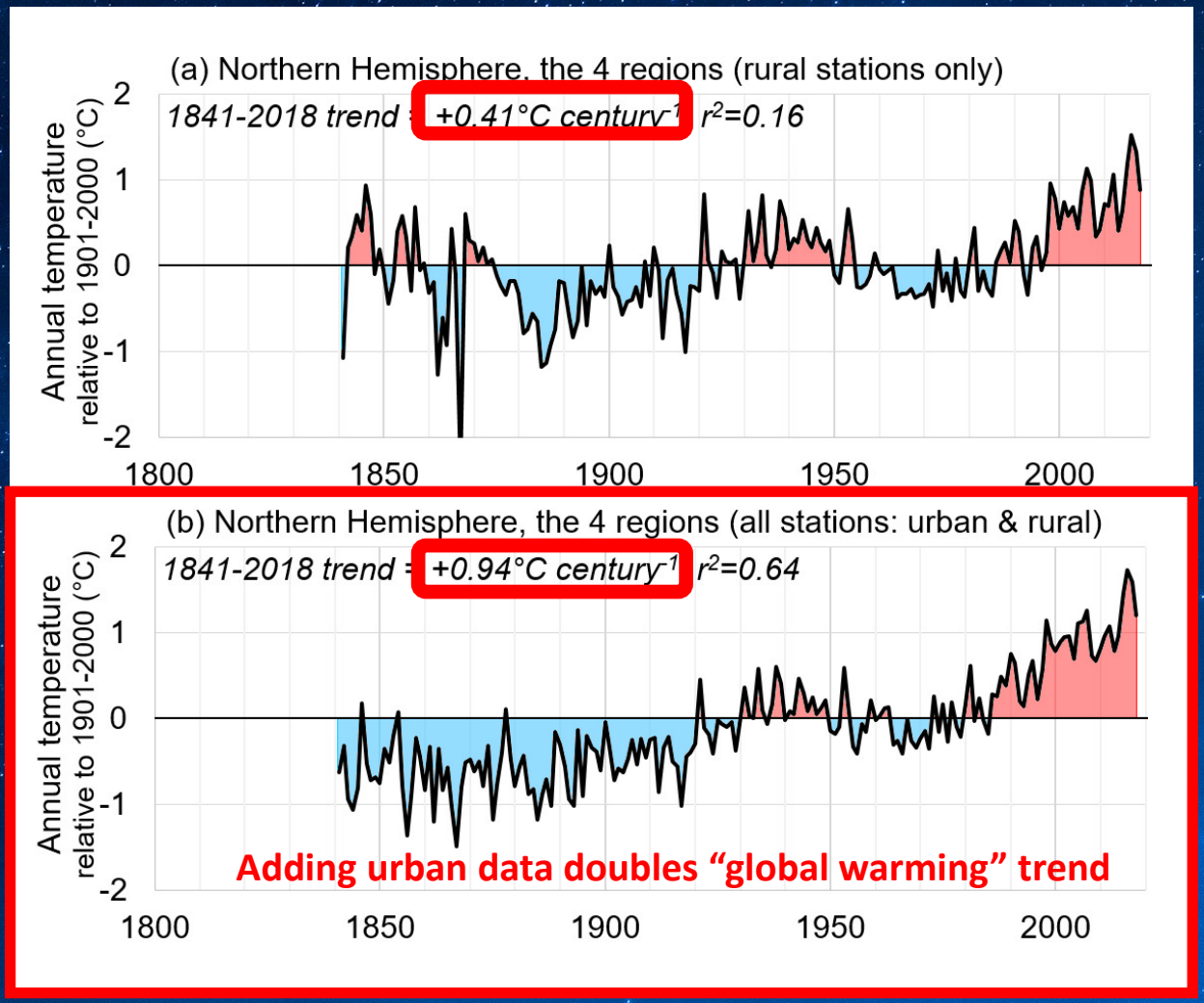


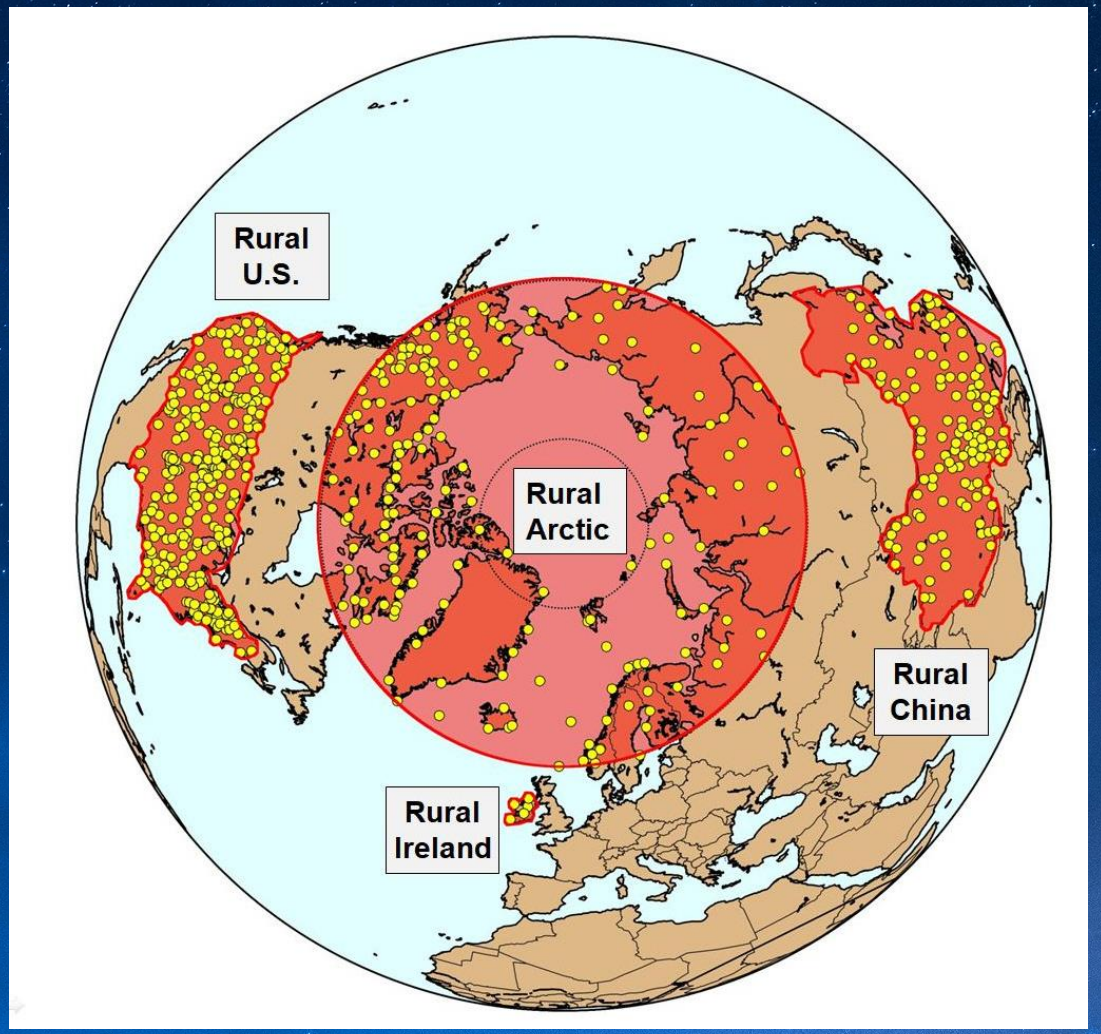


- China has some rural data for 1950-present, but very limited pre-Mao
- Whenever not enough rural data, used the longer urban records, but applied adjustments to match the rural records during overlap period

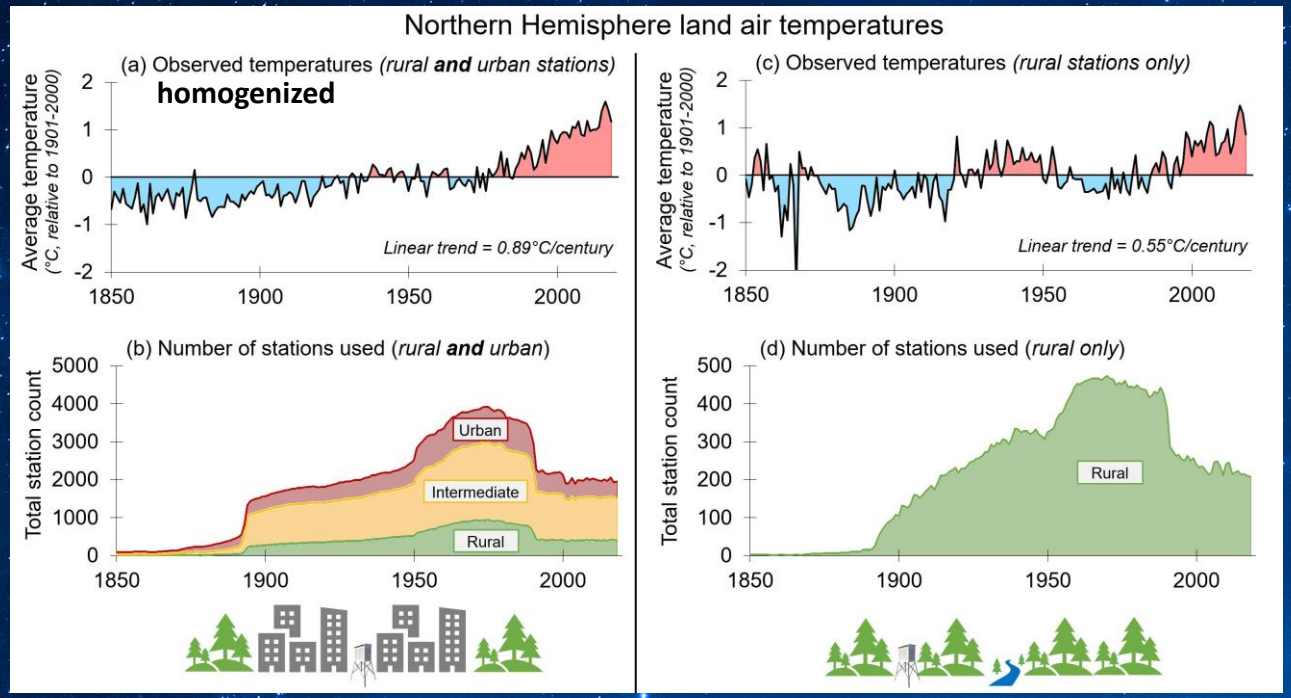
- All rural stations north of 60°N
- Probably our weakest region. Despite months of research and attempted collaboration with Arctic researchers, nobody at the time (2015-2019) seemed to have relevant station history metadata.
- So, we simply excluded any urban stations

Soon et al. 2015; Connolly et al. 2021 – Rural Northern Hemisphere time series – 4 regions





How does our "rural Northern Hemisphere" compare to the standard estimates using both urban and rural (homogenized) data?

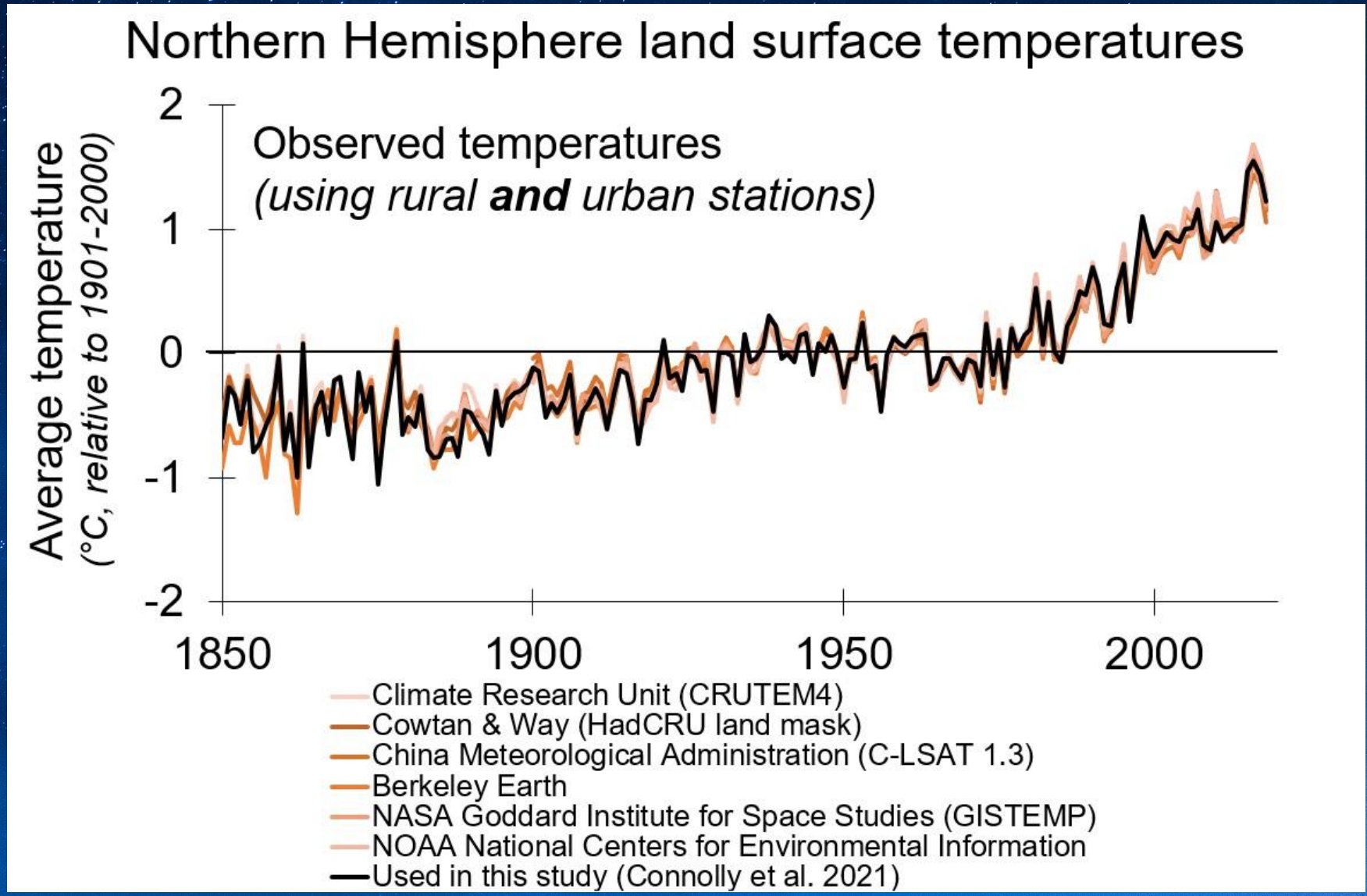


- Only enough rural data for N. Hemisphere
- Only ~10-15% of the total data
- So, noisier – especially for early years!
- Still shows "global warming"… but this time, it's more cyclical – cooling, warming, cooling, warming, etc.
- "Linear trend" is only 62% of the standard estimates. **Implies urbanization bias ~38% of the warming (not IPCC's "under 10%"!)**

For more details, see:

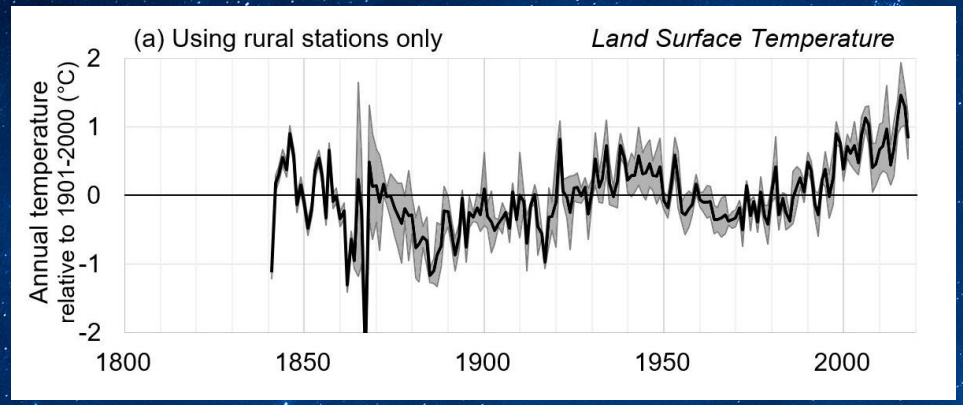
- R. Connolly, **W. Soon**, M. Connolly, et al. (**2021**). "*How much has the Sun influenced Northern Hemisphere temperature trends? An ongoing debate*". **Research in Astronomy and Astrophysics**, 21, 131.
- **W. Soon,** R. Connolly and M. Connolly (**2015**). "*Re-evaluating the role of solar variability on Northern Hemisphere temperature trends since the 19th century*". **Earth-Science Reviews**. Vol. 150, p409-452.

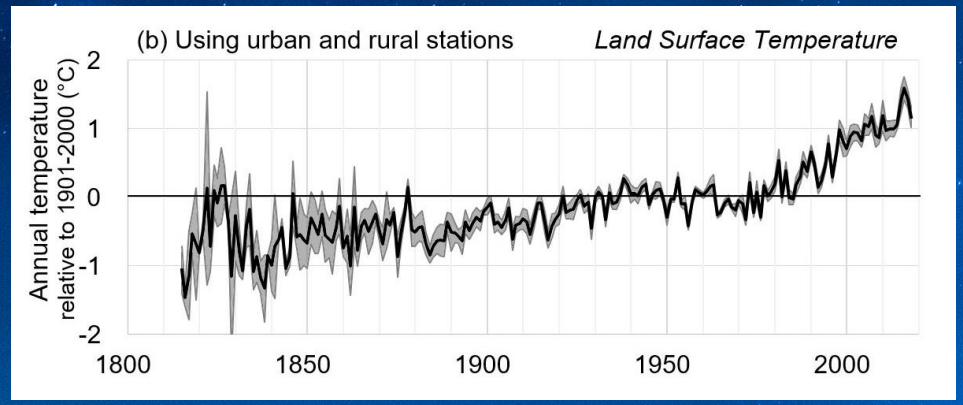
Can we replicate the estimates of the other groups? Yes, we can!



But, what about the oceans? And temperature proxies? Don't they agree with the IPCC?

Let's compare our two competing estimates of Northern Hemisphere land temperatures to other estimates!





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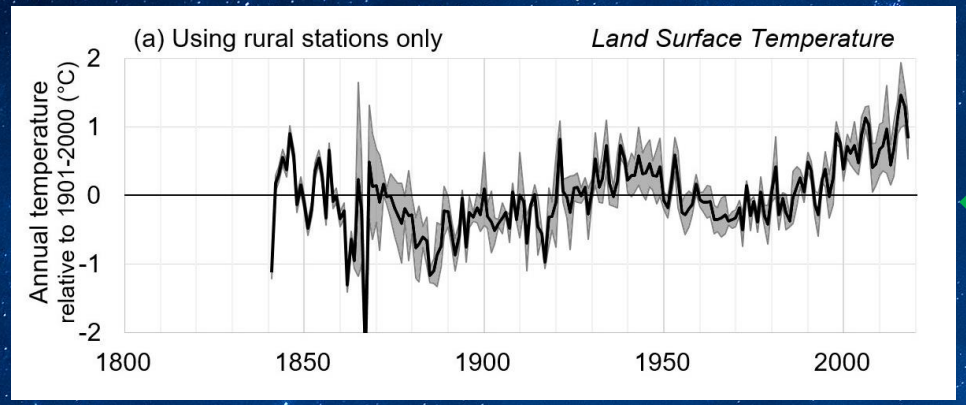

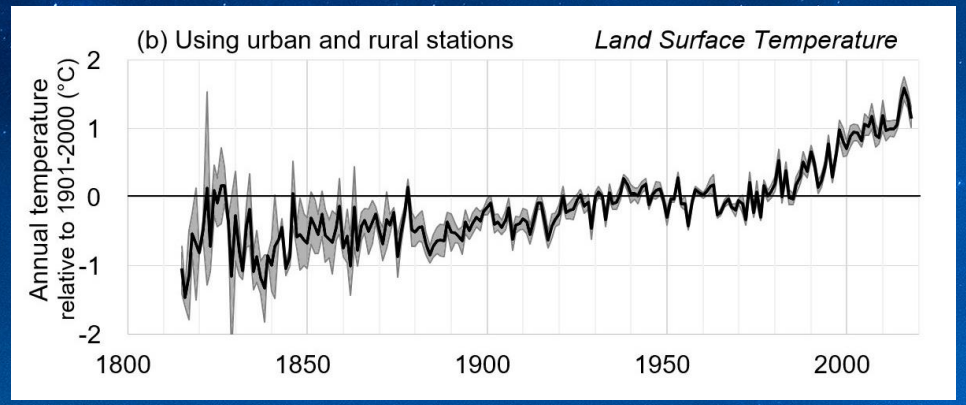

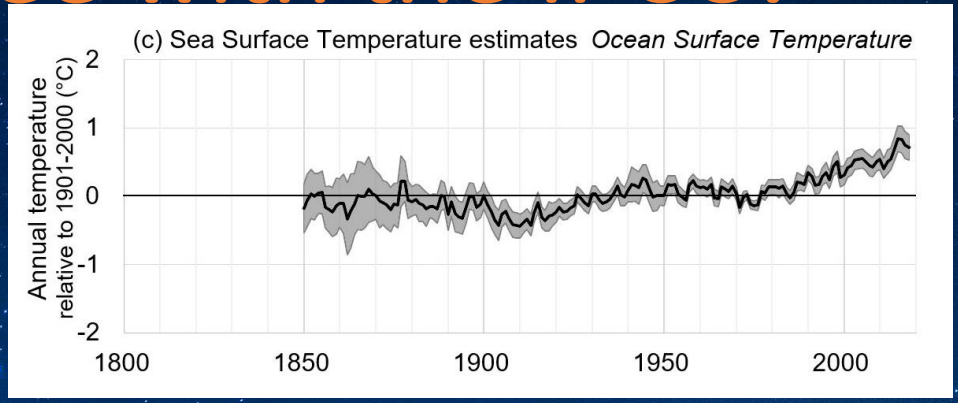

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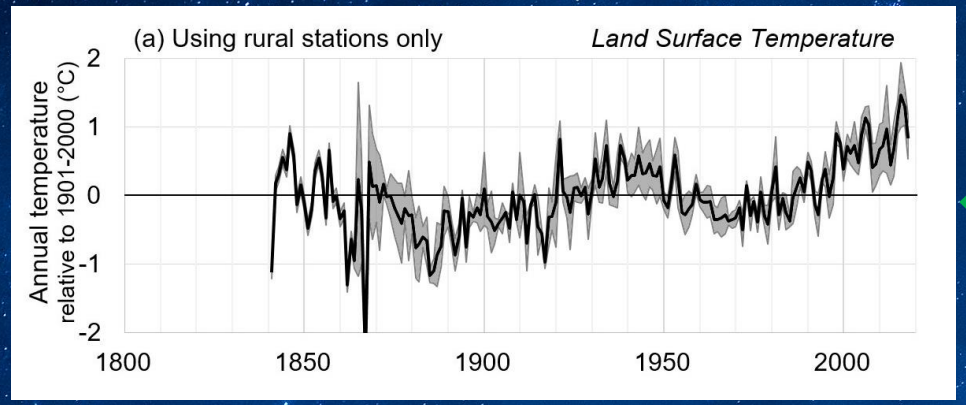

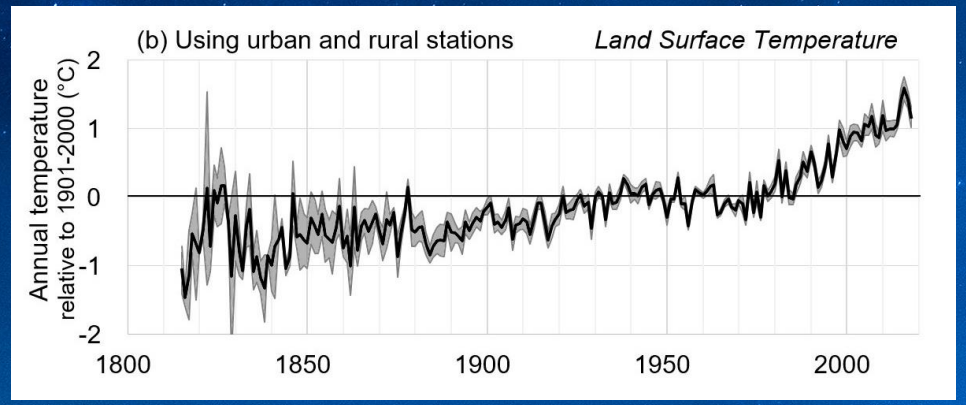

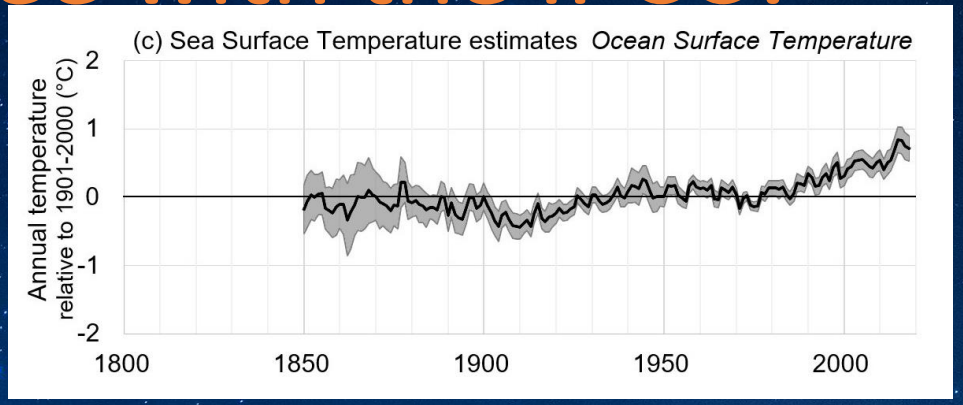

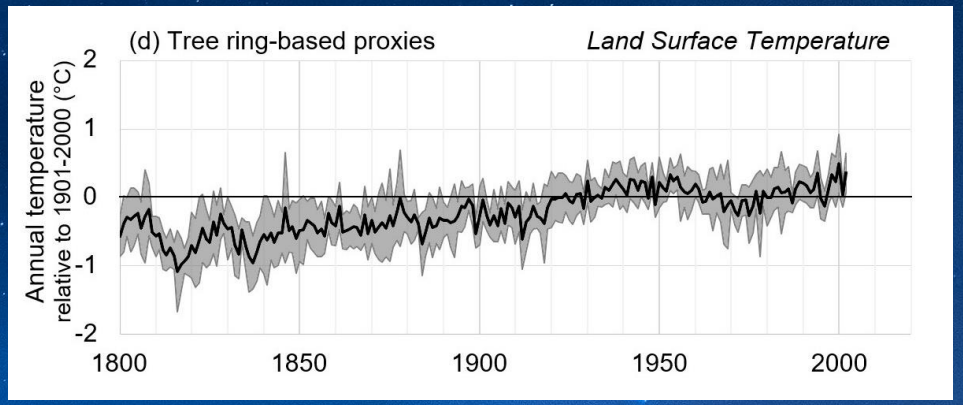

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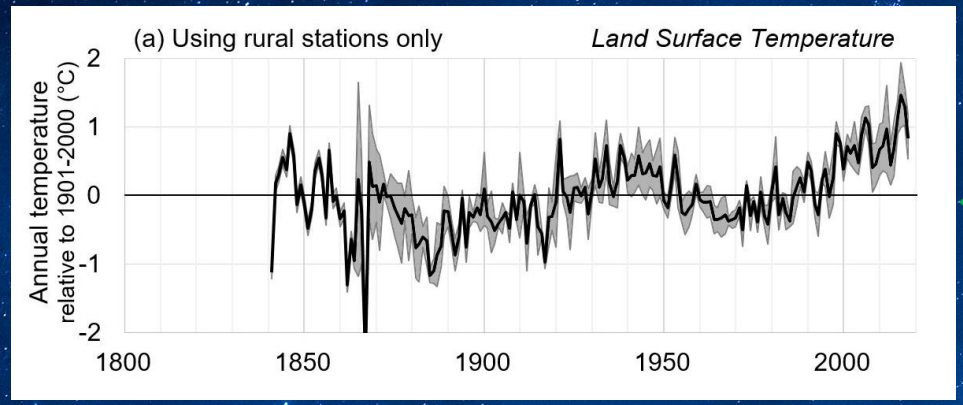

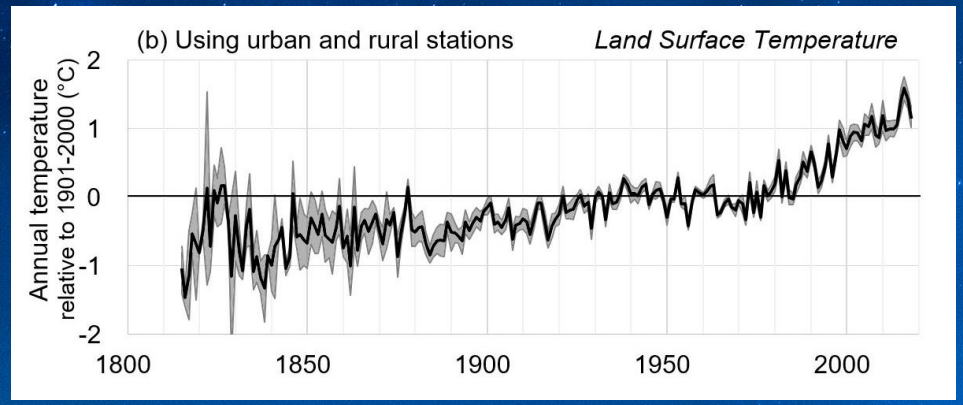

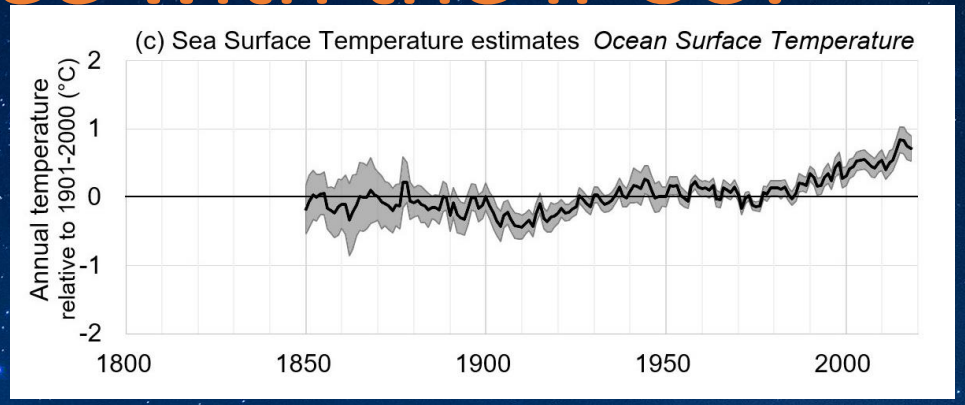

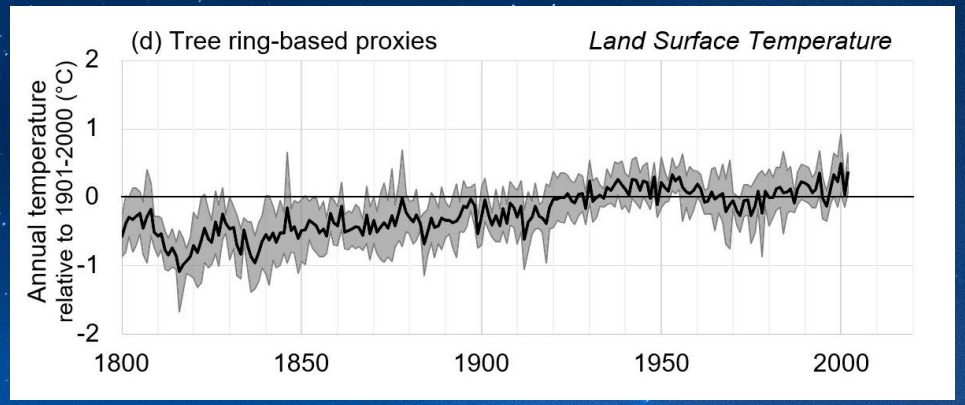

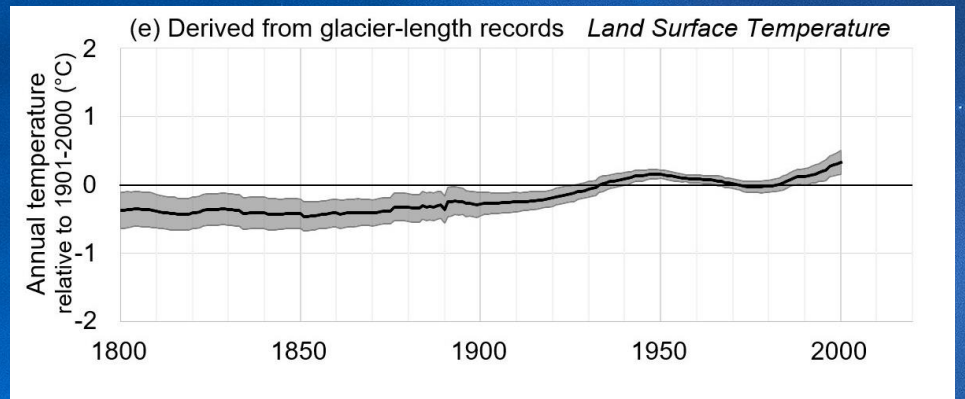

Ongoing work: Update our analysis using version 4

- GHCN version 3 was discontinued in late-2019. Therefore our rural-only estimate only has complete data up to 2018
- Also, version 4 now has more station data
- However, unlike version 3, the dataset doesn't yet provide any urban/rural ratings
- Neither version 3 nor version 4 provided **any** station history metadata for properly correcting for non-climatic biases

Ongoing work: Update our analysis using version 4

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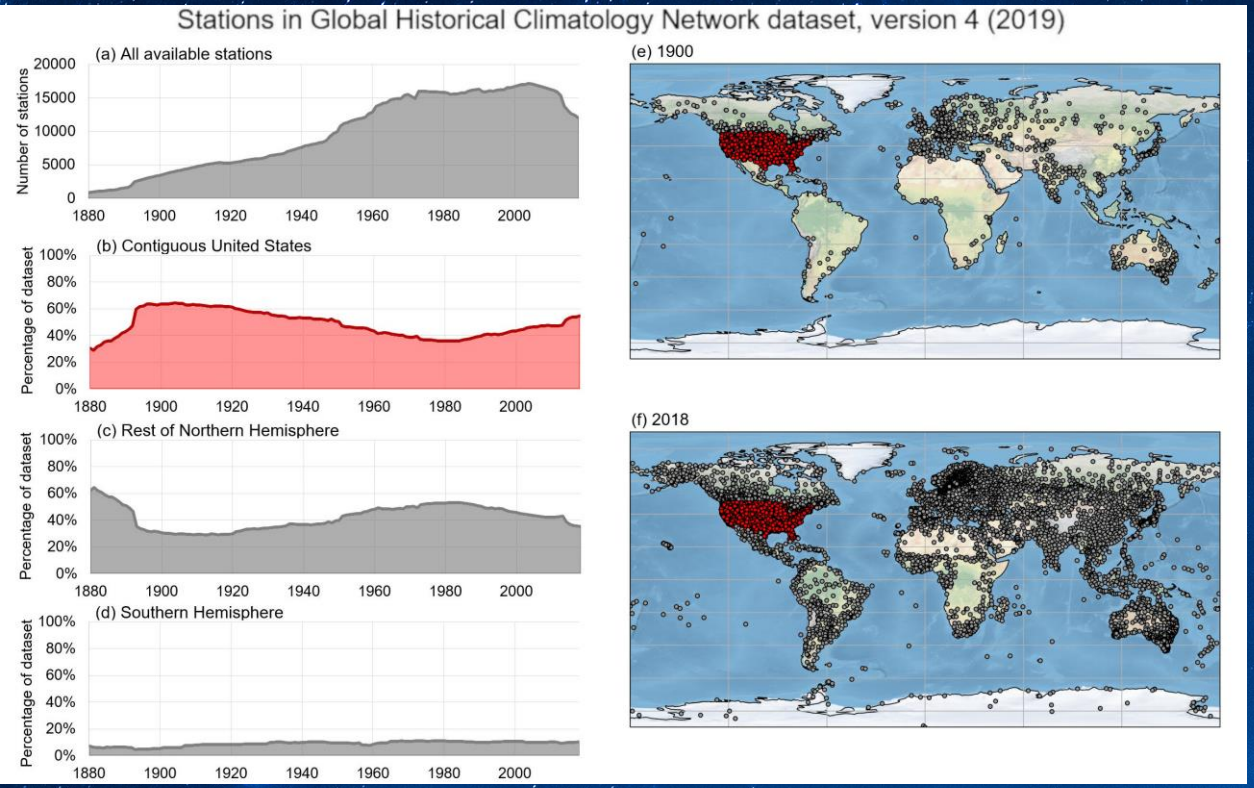
- Neither version 3 nor version 4 provided **any** station history metadata for properly correcting for non-climatic biases

Our work on this update so far:

1. Peter O'Neill has been developing urbanization estimates for all GHCN version 4 stations. Our ratings for the Chinese stations have already been published (Soon et al. 2018)
2. We have been collaborating with European colleagues to compile station history metadata for Europe – currently have metadata for 847 European stations (O'Neill et al., 2022)

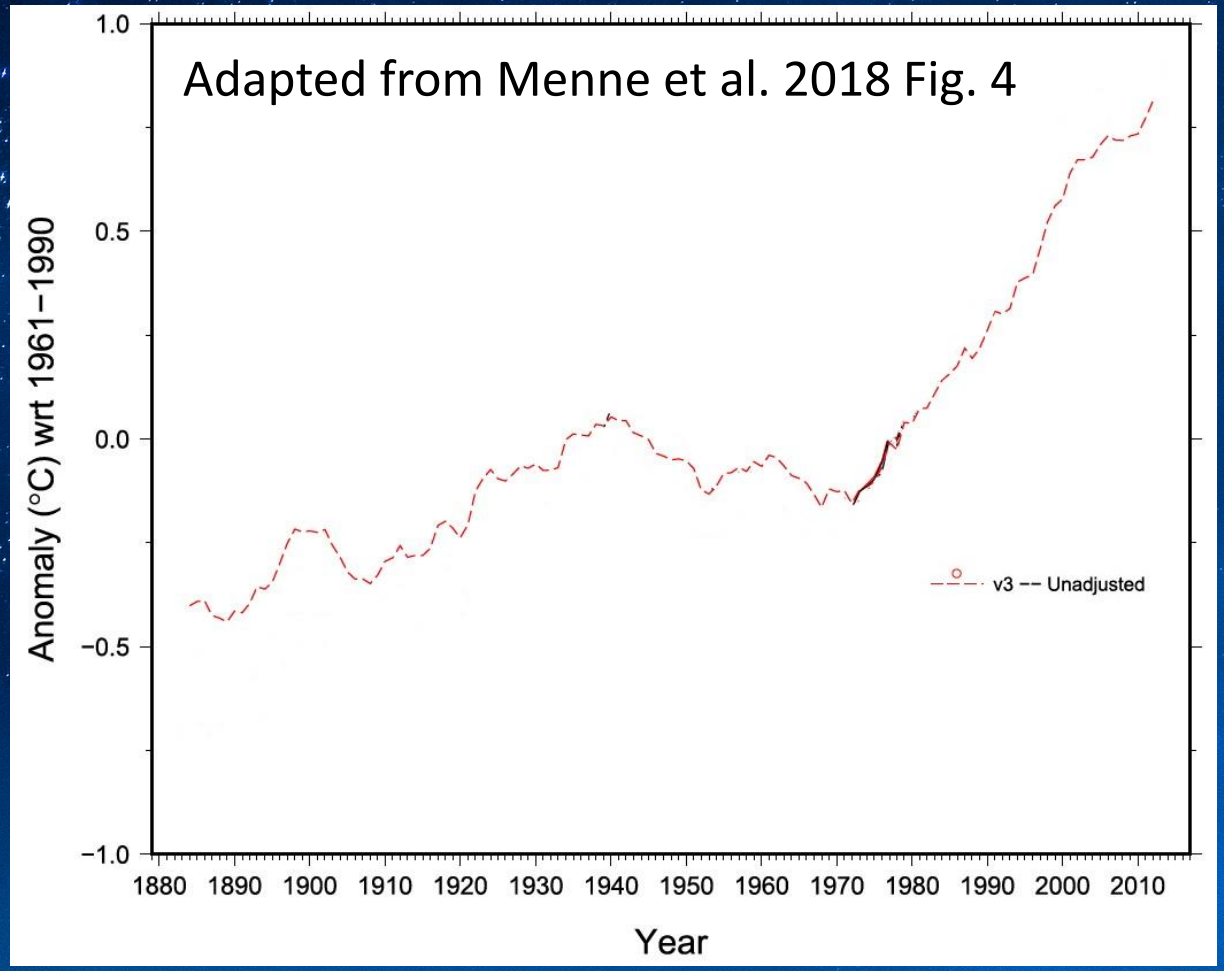
What is GHCN version 4 like?



- Lots of stations after 1957/58 ("International Geophysical Year"). Before then, data coverage is much more limited.
- Crucially, most records began during the 1940s-70s global cooling
- Unlike version 3, urban ratings for the version 4 stations have not **yet** been published (We are working on this!)
- **>80% of stations are Northern Hemisphere. Nearly half the version 4 stations are in U.S.**
- In 1900, almost no Southern Hemisphere coverage except Australia and a few cities

To homogenize or not to homogenize: Effects on GHCN version 3 and 4 trends

Global temperatures using all GHCN v3 stations (**urban & rural**) **without** homogenization



- Before homogenization, the global temperature curve is very similar to those used up until the late 1990s
- Doesn't make any attempt to correct for urbanization biases OR any other non-climatic biases
- Note the warming/cooling/warming pattern is still very clear

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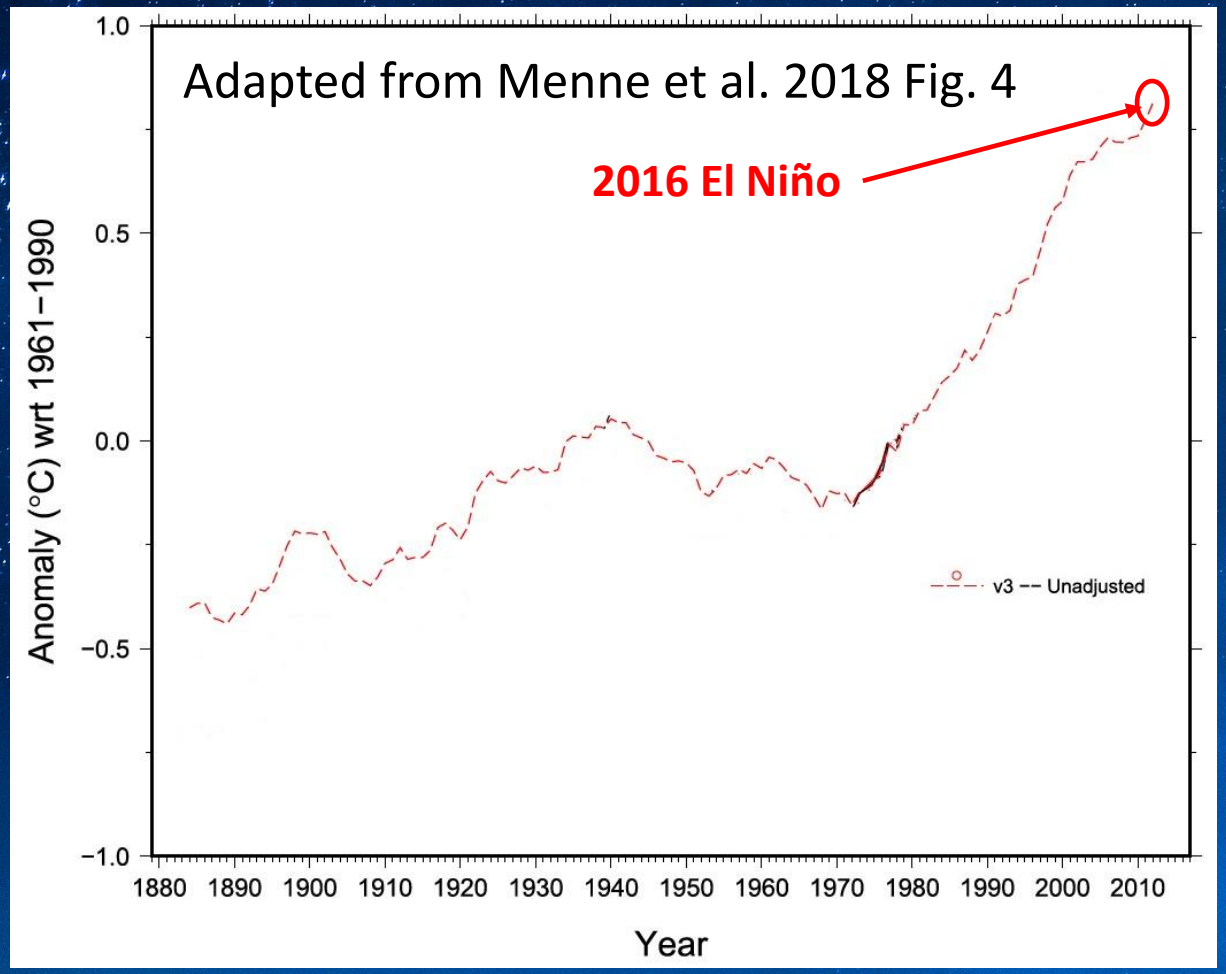

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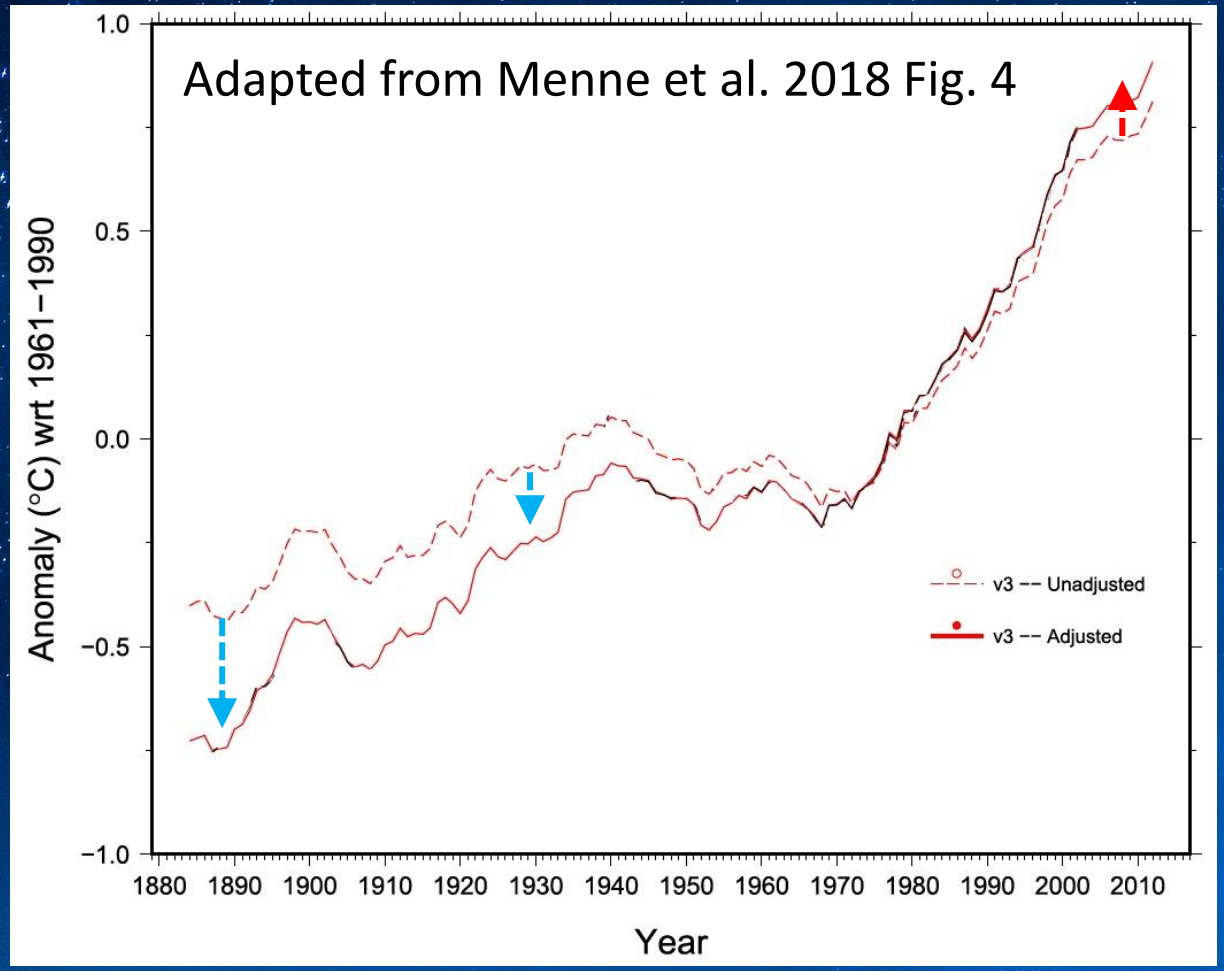
To homogenize or not to homogenize: Effects on GHCN version 3 and 4 trends

All GHCN v3 stations (urban & rural) with or without homogenization

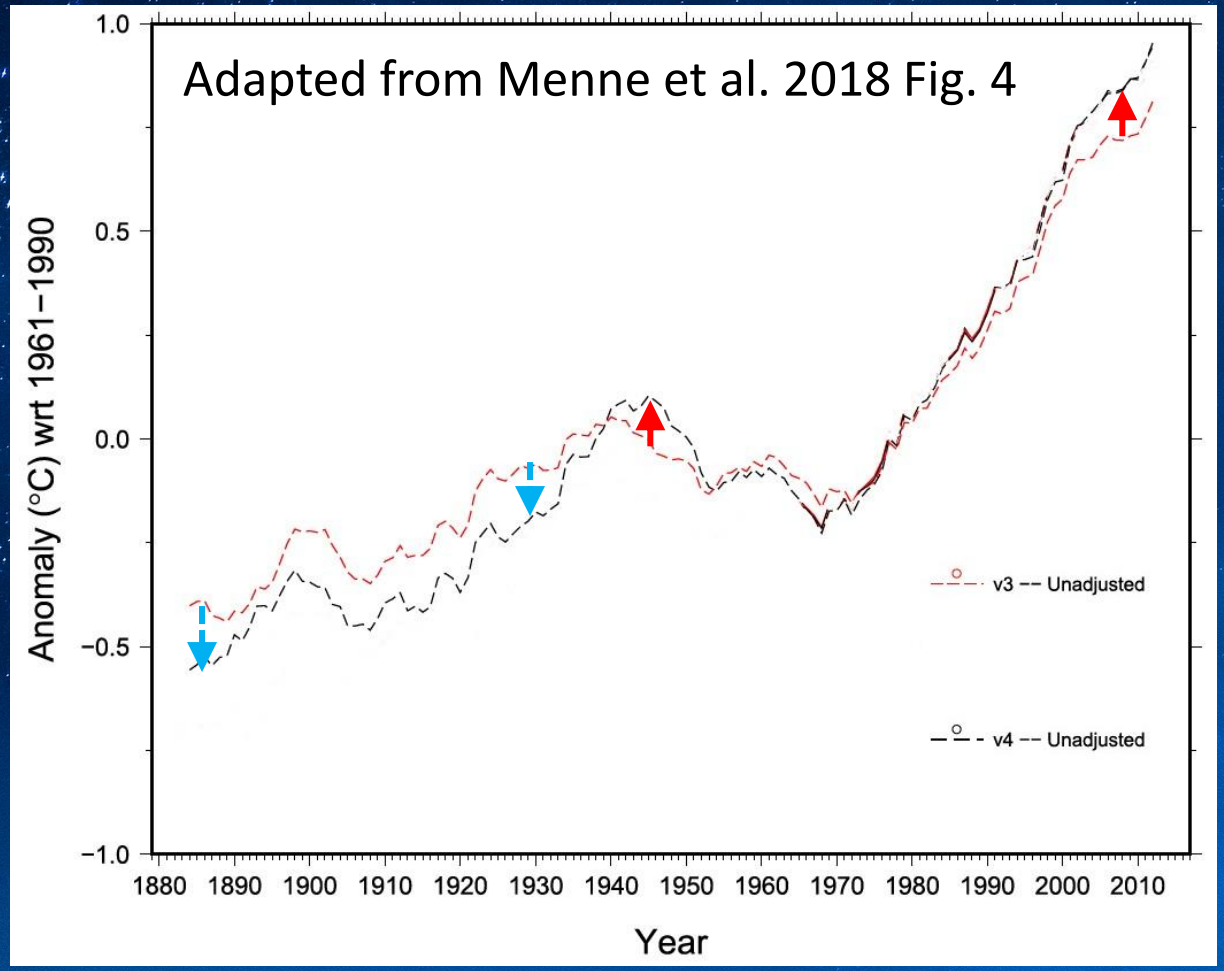


- Net effects of homogenization are:
  1. To increasingly cool temperatures from mid-1970s backwards in time.
  2. To a lesser extent, increasingly warm recent decades.
  3. To "flatten out" the 1940s-1970s cooling period.

- This makes the time series look much more continuous and dramatic. The IPCC team were probably delighted!

To homogenize or not to homogenize: Effects on GHCN version 3 and 4 trends

Changing from v3 to v4 of the GHCN
1) **without** homogenization

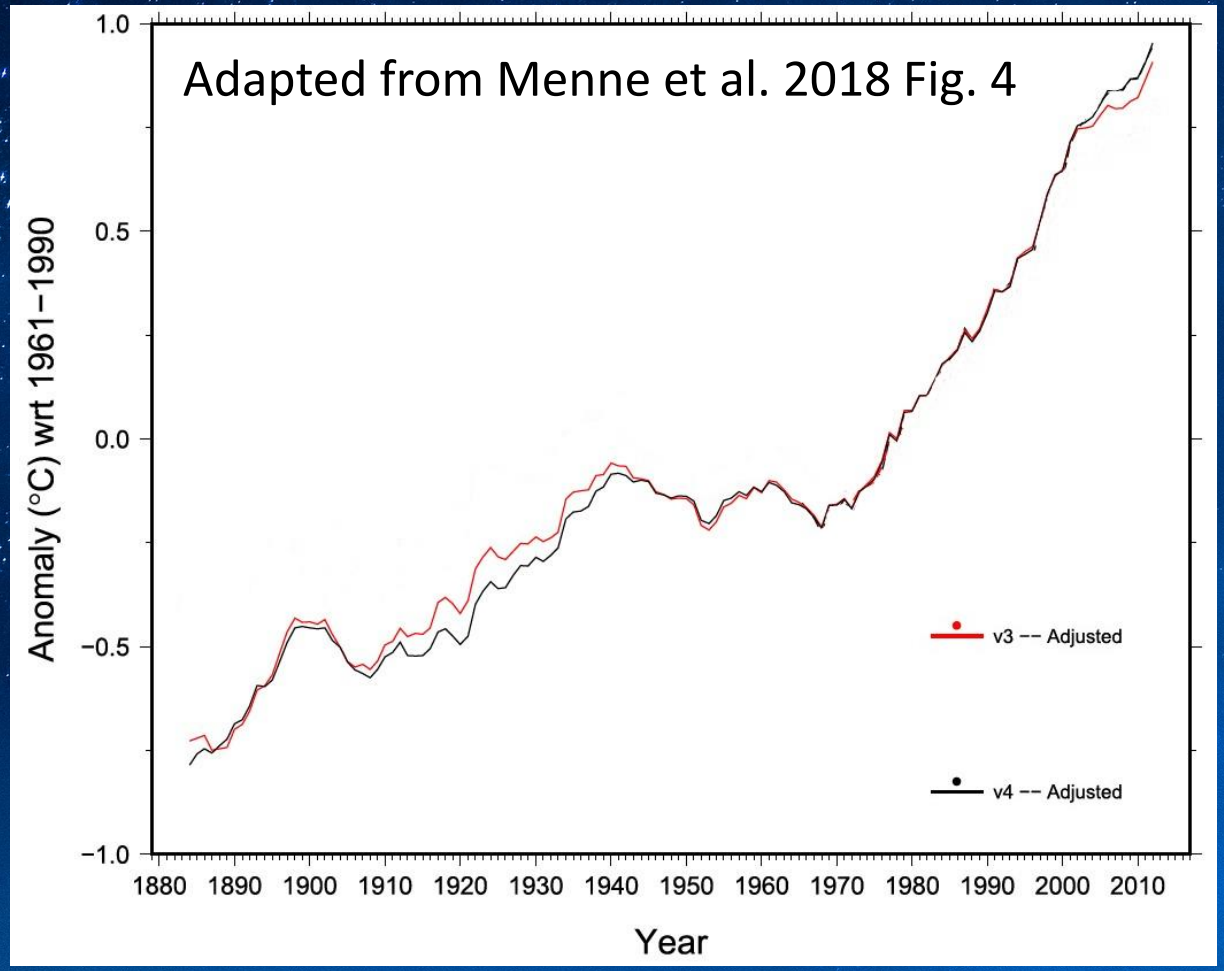


- Version 3 contained ~7200 stations. ~1200 of these were in contiguous U.S.
- Version 4 contains ~20,000 stations, ~40% of these are in contiguous U.S.

- Net effects of the new dataset (unhomogenized):
  1. Slightly cools temperatures from 1940s backwards in time.
  2. Slightly warms recent decades (largely gets rid of “hiatus”)
  3. But, slightly increases the 1940s-1970s cooling period.

To homogenize or not to homogenize: Effects on GHCN version 3 and 4 trends

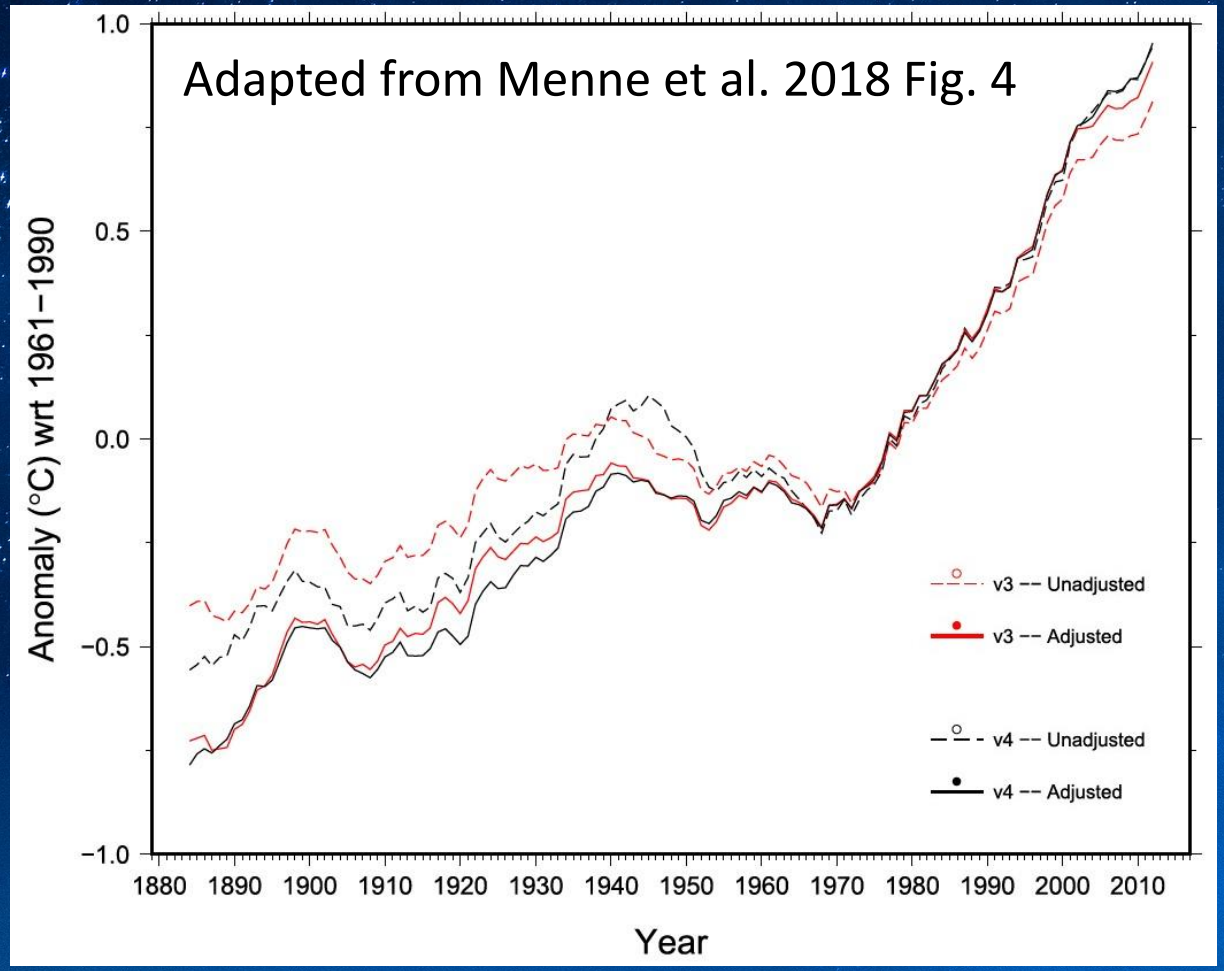
Changing from v3 to v4 of the GHCN
2) **after** homogenization



- After homogenization, both datasets give almost identical results
- Net effects of new homogenized dataset:
  1. Slightly cools temperatures from 1910s-1940s.
  2. Slightly warms recent decades (gets rid of “hiatus” even more)

To homogenize or not to homogenize: Effects on GHCN version 3 and 4 trends

All four plots shown now



- In general, the combined effects of increasing the station numbers and carrying out statistical homogenization:
  1. Flatten 1940s-1970s cooling
  2. Remove the post-20th century hiatus
  3. Increase the global warming trend

- **But, surprisingly, the increase in station numbers from version 3 to 4 was not as important as the homogenization process.**

- **Why does homogenization add warming?**

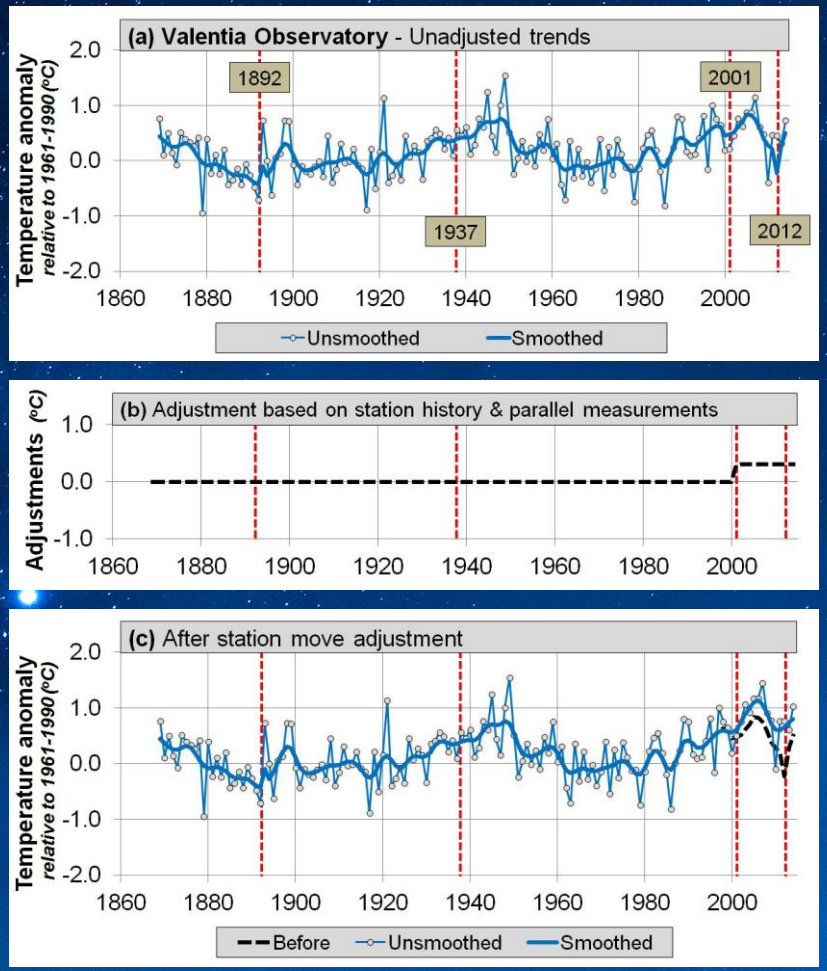
IPCC's preferred approach: Use "statistical homogenization" to correct for non-climatic biases

- The "adjusting the past" approach is a bit odd, but doesn't affect the trends
- Seems to do well with computer models tests of the statistical homogenization methods on "synthetic temperature records" with artificial biases added in, e.g., Venema et al. 2013; Williams et al. 2012
- The net effect seems to be to "add warming". But, this fits the narrative and is widely believed to be because it's working
- Comparing homogenized rural stations to homogenized urban stations seems to suggest that there's not much difference, e.g., Peterson et al. 1999; Li et al. 2004.
- **Since the 1990s, the climate community has insisted that this "homogenized" data is better.**

How well does statistical homogenization work with real data, e.g., our Valentia Observatory record?

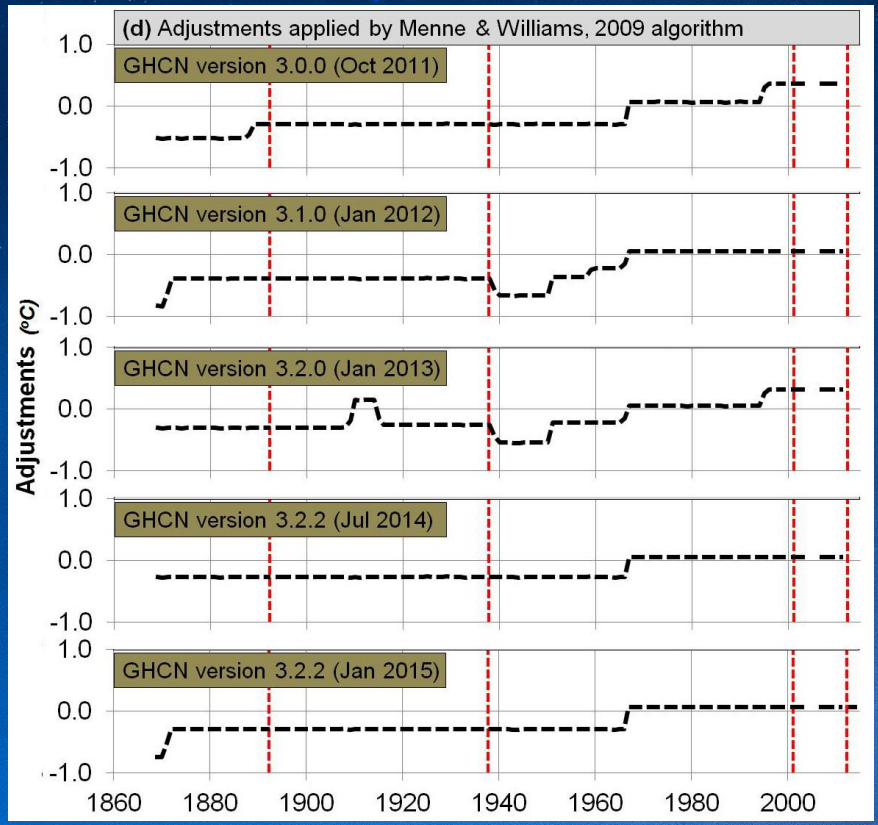
Soon et al. 2015:

Our empirically-based corrections for non-climatic biases using station histories



NOAA's statistical homogenization adjustments

- Every time they run the program, NOAA changes their mind!
- None of their adjustments matched with reality!



Problem #1: No consistency to the adjustments

- If the statistical homogenization was actually working correctly, then it should give the same (or at least similar) results every time the program was run
- But, for Valentia Observatory at least, the "homogenization adjustments" changed every day! And didn't seem to match up with the documented station changes
- Had we stumbled on a rare station or was this a systemic problem?
- **We needed to analyse a larger sample. We met Peter O'Neill, who had been quietly collecting the data for more than 10 years**

"A man who uses an imaginary map, thinking that it is a true one, is likely to be worse off than someone with no map at all."
— Ernst F. Schumacher (1911-1977)

European Thermometers Project at CERES-science.com

- May 2011: P.O'N. began downloading and archiving the dataset (then version 3) from NOAA's website roughly fortnightly.
- March 2012: The download rate was increased to roughly weekly.
- March 2014: An automated script was set up to download the dataset daily. However, NOAA's updates appear to have been only approximately every 24 hours. Therefore, on some days, the datasets downloaded were identical to the preceding day. We have removed these identical copies from our analysis. Furthermore, on some days, the download was not carried out due to P.O'N's computer being offline for maintenance or travel. Hence, the annual totals for each dataset in Table 2 are less than 365 for all years.
- October 2015: NOAA launched the "beta" version 4. Therefore, P.O'N. began downloading and archiving both version 3 and 4 daily.
- October 2018: NOAA launched the official version 4. For the purposes of this analysis, we have treated the "beta" and official version 4 datasets as equivalent, but for reference we have listed the numbers of "beta" datasets downloaded in the right-hand column of Table 2.
- August 2019: NOAA discontinued version 3.
- July to August 2021: P.O'N. processed the data for each of the stations in this analysis in several stages over the period from 7 July–20 August 2021. However, he still continues to download and archive the dataset daily at the time of writing.

Peter O'Neill, retired engineer
UCD, Ireland

European Thermometers Project at CERES-science.com

Table 2. Numbers of distinct GHCN datasets downloaded from NOAA's website for each year. Version 4 was originally introduced as a "beta" version in October 2015 until the official version was released in October 2018. Version 3 was discontinued in August 2019. For this study, we consider all distinct datasets up to July/August 2021 (some stations were analyzed up to July and others up to August). This comprises 1877 for version 3 (covering the period 2011–2019) and 1812 for version 4 (covering the period 2015–2021).

Year	GHCN Version 3	GHCN Version 4	Version 4 ("Beta")
2011	6	-	-
2012	39	-	-
2013	34	-	-
2014	283	-	-
2015	316	71	(71)
2016	342	303	(303)
2017	346	322	(322)
2018	315	314	(256)
2019	196	287	-
2020	-	310	-
2021	-	205	-
Total distinct datasets	1877	1812	(952)

atmosphere

MDPI

Article

Evaluation of the Homogenization Adjustments Applied to European Temperature Records in the Global Historical Climatology Network Dataset

Peter O'Neill [1], Ronan Connolly [2,3,*], Michael Connolly [3], Willie Soon [2,4], Barbara Chimani [5], Marcel Crok [6], Rob de Vos [7], Hermann Harde [8], Peter Kajaba [9], Peter Nojarov [10], Rajmund Przybylak [11,12], Dubravka Rasol [13], Oleg Skrynyk [14,15], Olesya Skrynyk [14,16], Petr Štěpánek [17,18], Agnieszka Wypych [19,20] and Pavel Zahradníček [17,18]

1 School of Mechanical and Materials Engineering, University College Dublin, Belfield, D04 Dublin, Ireland; peter.oneill@ucd.ie
2 Center for Environmental Research and Earth Science (CERES), Salem, MA 01970, USA; willie@ceres-science.com
3 Independent Researcher, D01 Dublin, Ireland; michael@ceres-science.com
4 Institute of Earth Physics and Space Science (ELKH EPSS), H-9400 Sopron, Hungary
5 Zentralanstalt für Meteorologie and Geodynamik (ZAMG), Hohe Warte 38, 1190 Wien, Austria; barbara.chimani@zamg.ac.at
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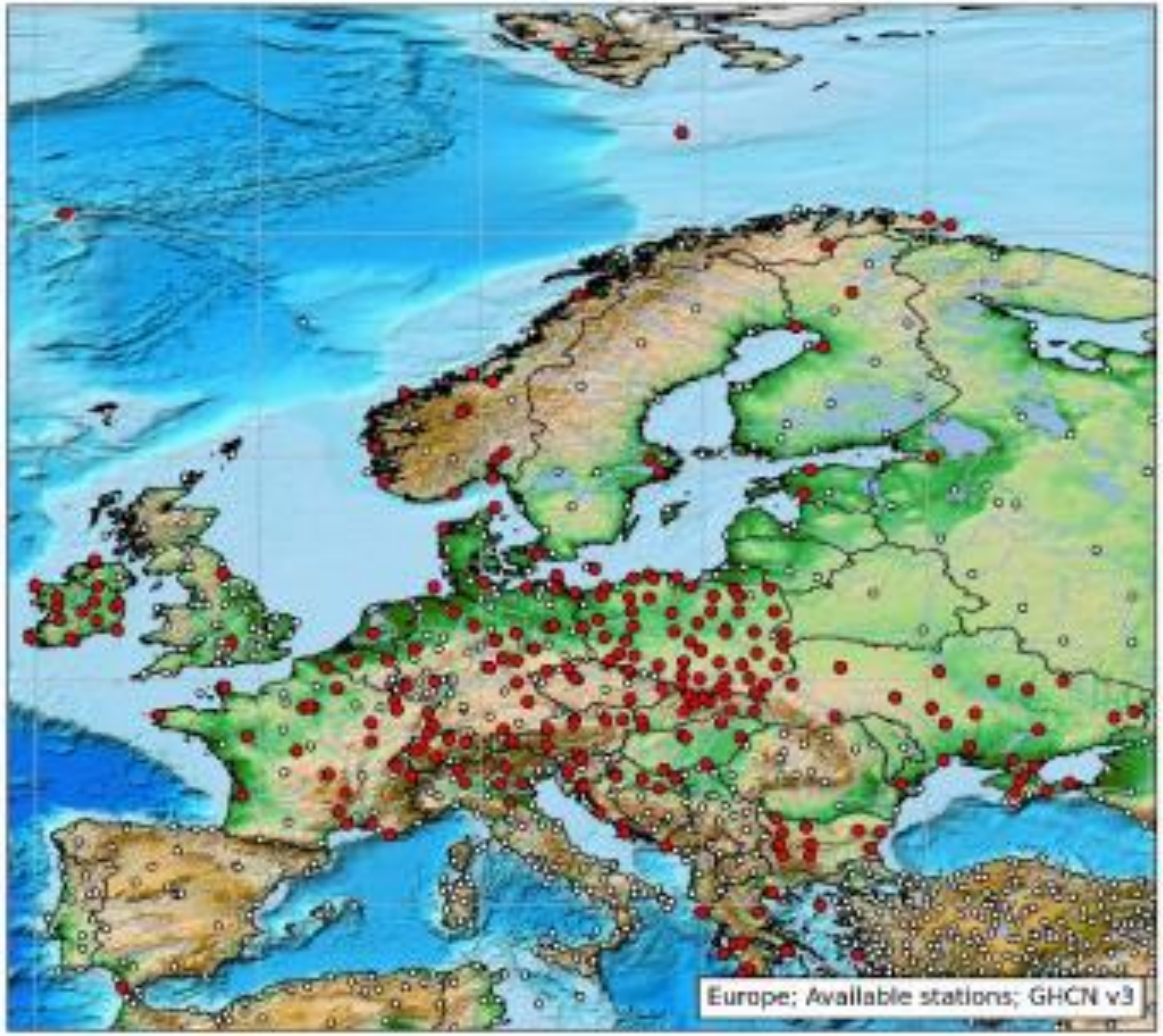
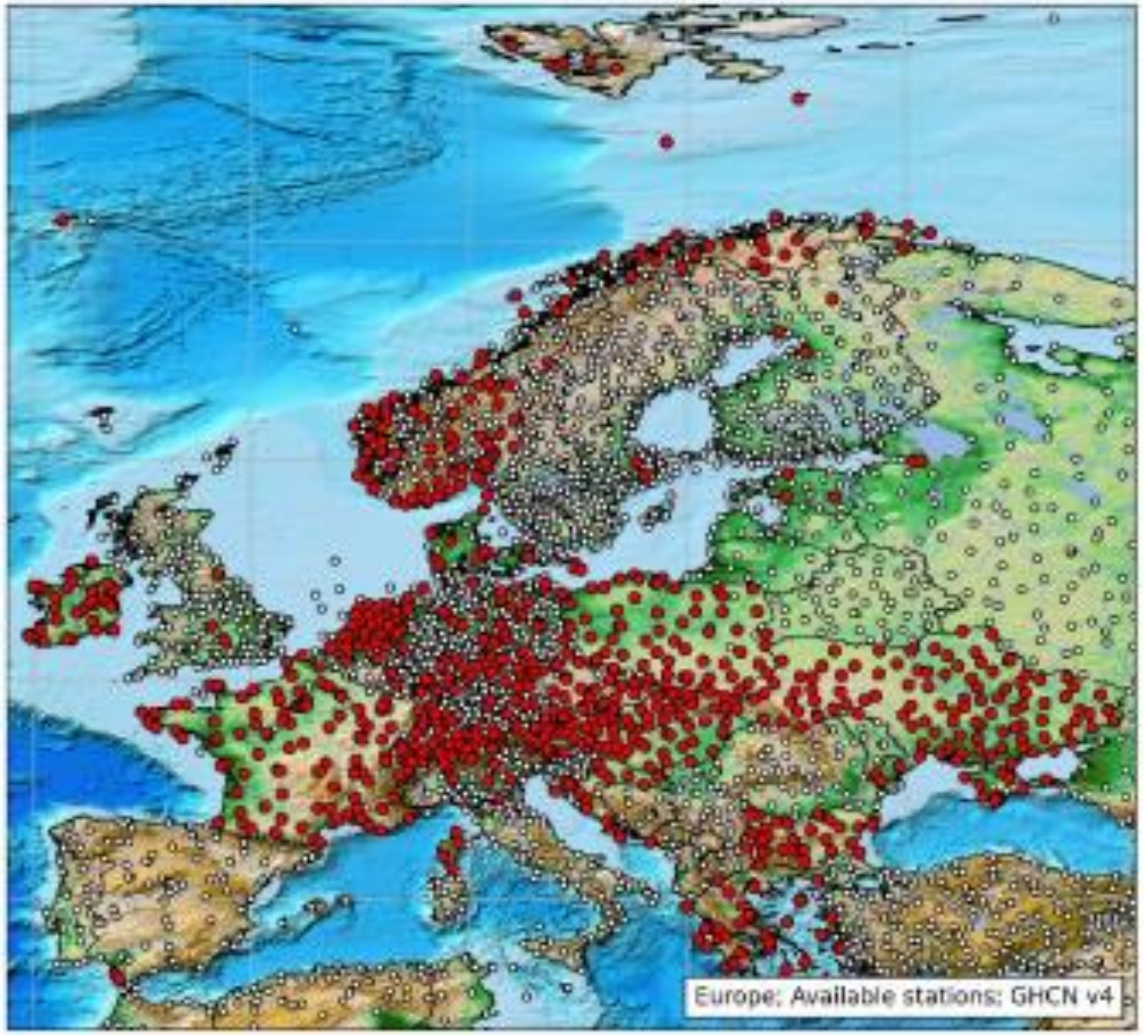
European Thermometers Project at CERES-science.com

GHCN v3



GHCN v4

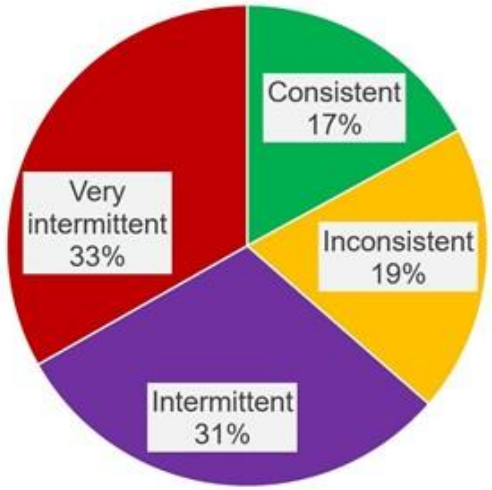


● Stations where we have historical metadata (259 for v3; 847 for v4)

European Thermometers Project at CERES-science.com

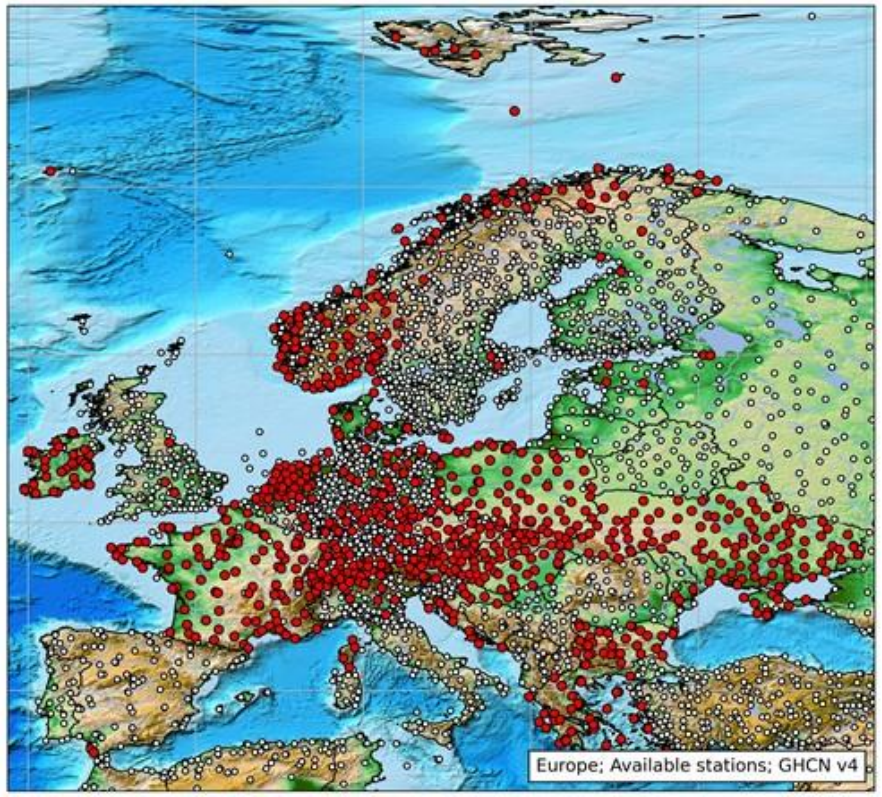
Summary of the new study on NOAA's temperature adjustments

Consistency of NOAA's adjustments for each station

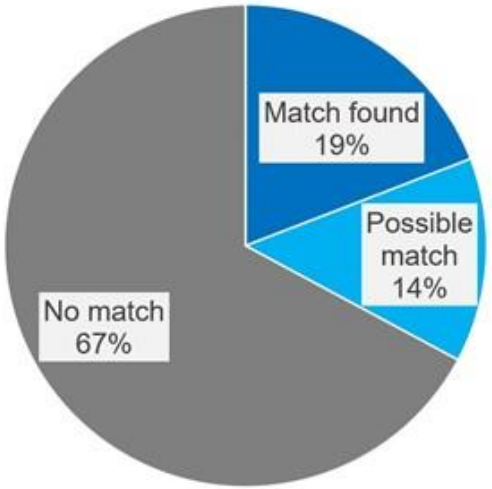


Only 17% of NOAA's adjustments are applied consistently

Details on the histories of more than 800 weather stations from 24 European countries were collected to check if the adjustments corresponded to documented changes associated with the weather station. The locations of these stations are indicated below in red.



How often do NOAA's adjustments match to known documented station events?



Less than 20% of NOAA's adjustments were clearly associated with a documented change to the weather station observations

Problem #2: The urban blending problem

Earth-Science Reviews 185 (2018) 80–101

Contents lists available at ScienceDirect

Earth-Science Reviews

journal homepage: www.elsevier.com/locate/earscirev

Comparing the current and early 20th century warm periods in China

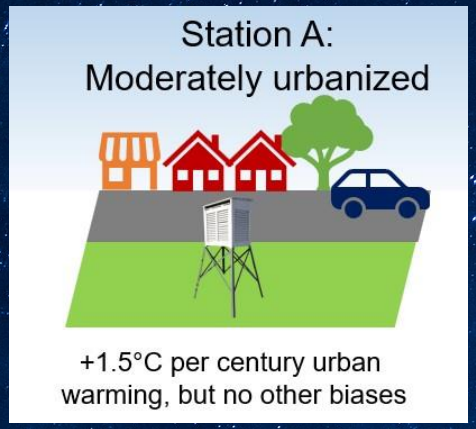
Willie Wei-Hock Soon[a], Ronan Connolly[b,*], Michael Connolly[b], Peter O'Neill[c], Jingyun Zheng[d], Quansheng Ge[d], Zhixin Hao[d], Hong Yan[e]

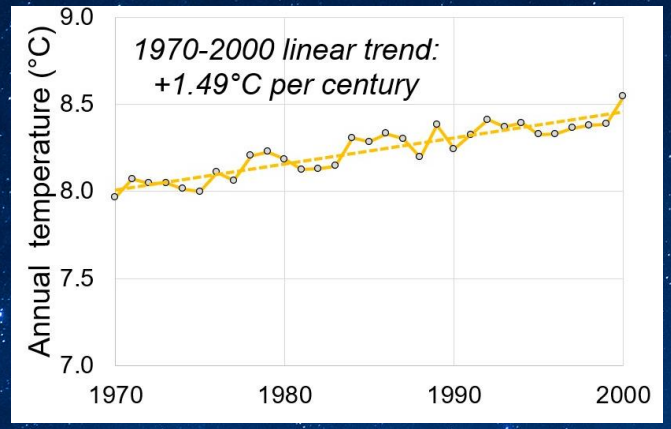
There is also another subtle, but major problem with current statistical homogenization, **"Urban blending"** (see Soon et al. 2018)

1. The magnitude of step biases are calculated from the differences with station neighbors
2. If the neighbor is more urbanized, then some of its UHI will be added to the homogenization adjustment
3. If less urbanized, then the homogenization adjustment will remove some UHI
4. Net effect: all homogenized records converge towards the average urbanization

Let's look at a thought experiment

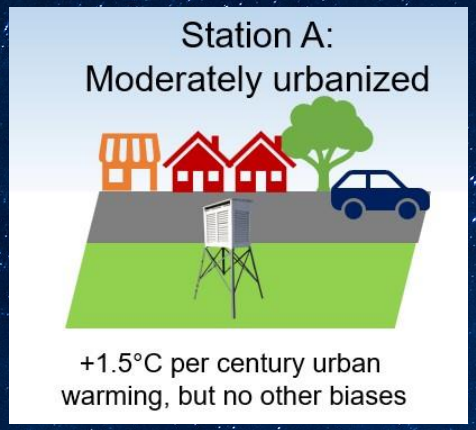
Imagine a world with no global warming, but some stations have urban warming

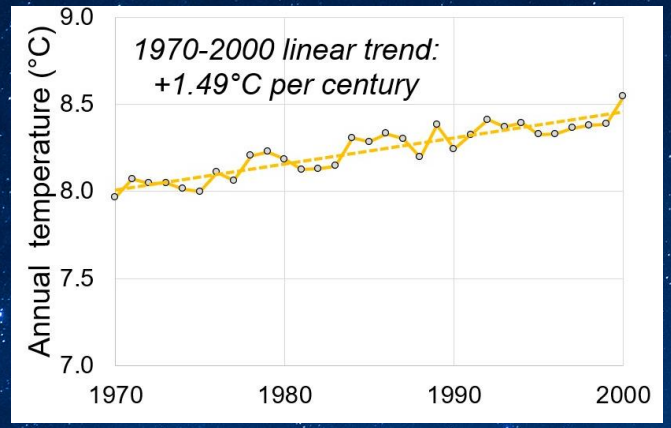


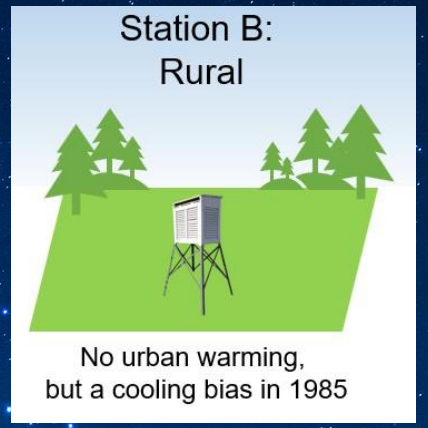


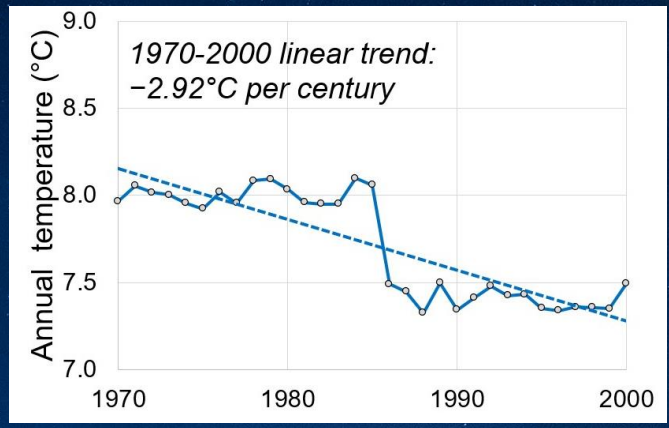
- Station A is moderately urbanized, but has no other non-climatic biases

Imagine a world with no global warming, but some stations have urban warming



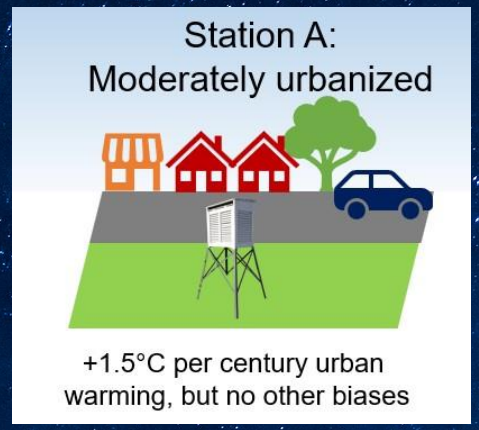


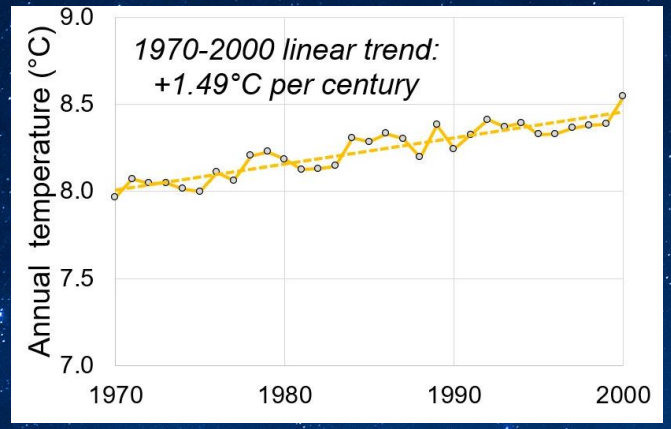


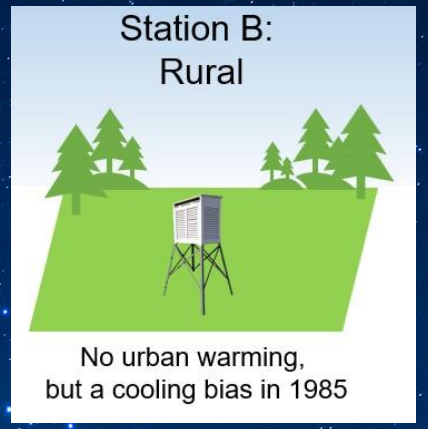


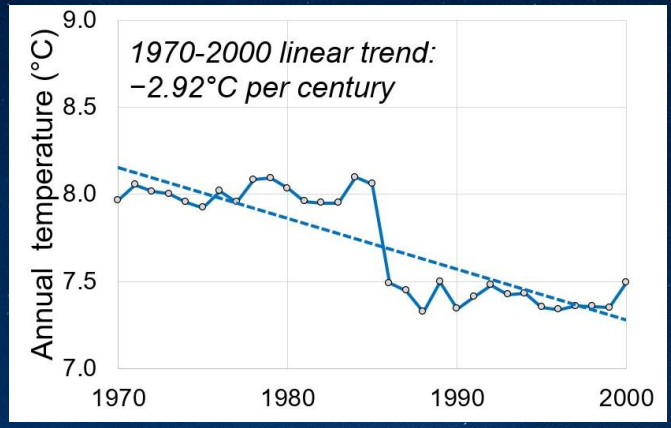
- Station B is completely rural, but has a step change cooling bias due to a station move in 1985

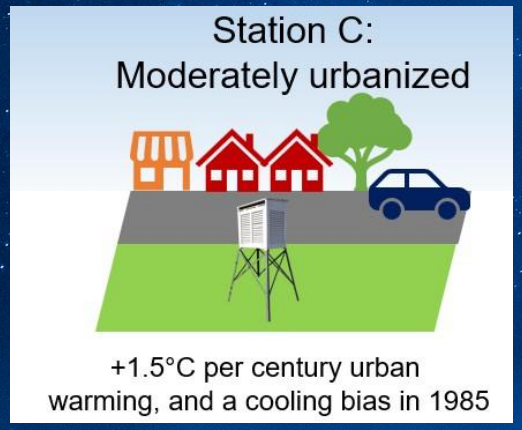
Imagine a world with no global warming, but some stations have urban warming

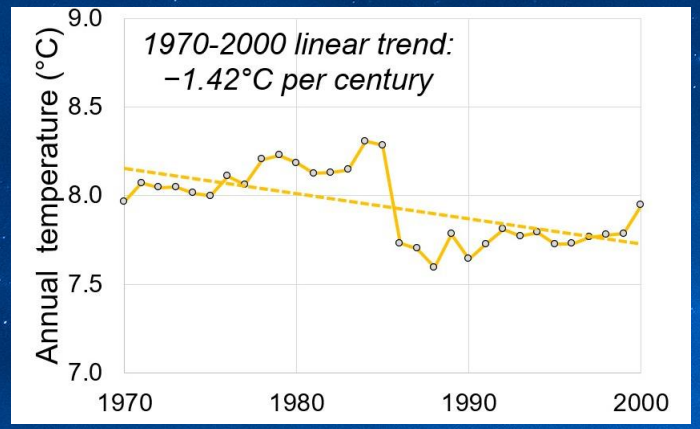






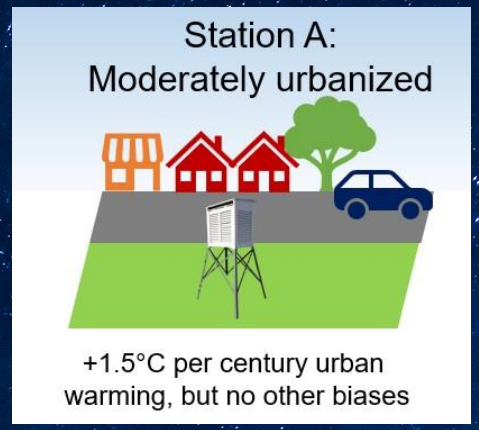


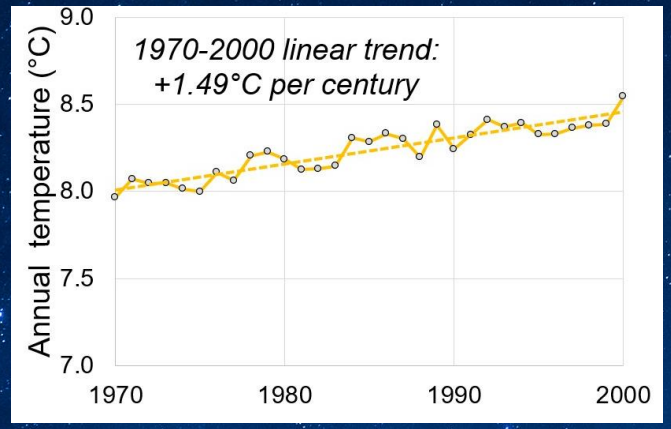


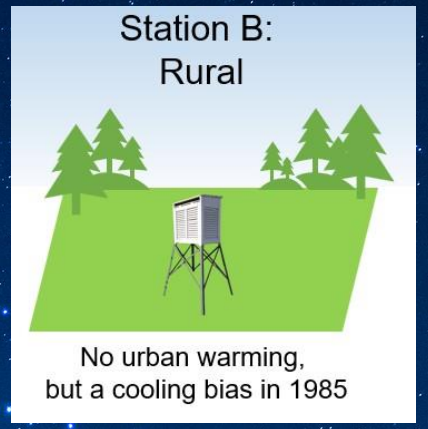


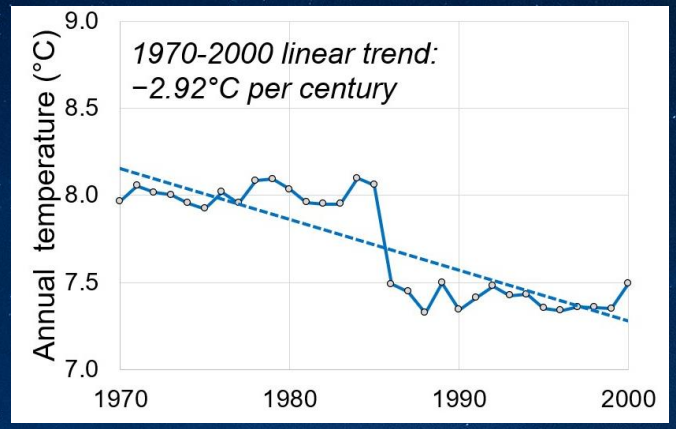
- Station C is just as urbanized as Station A, but also has a step change cooling bias due to a station move in 1985 like Station B

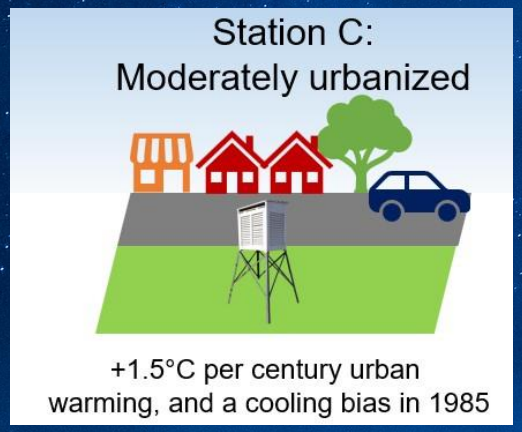
Imagine a world with no global warming, but some stations have urban warming

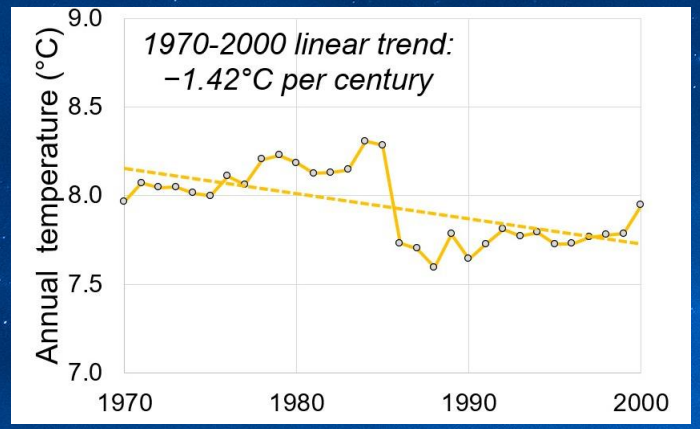


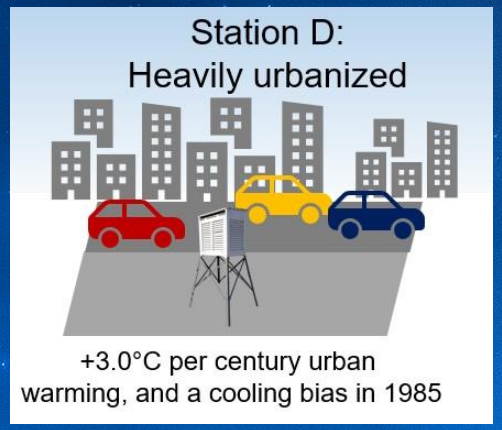


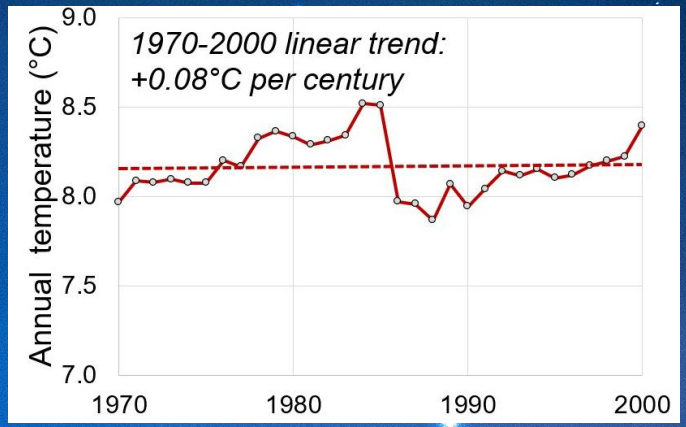












- Station D is like Station C, but even more urbanized

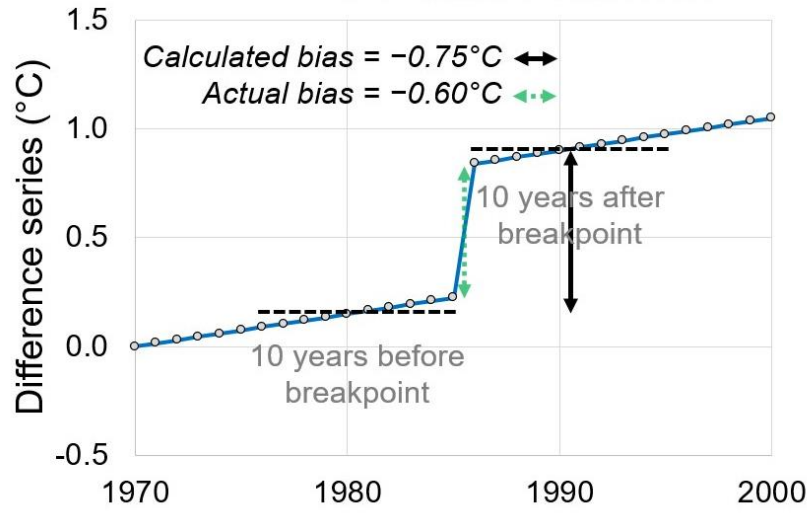
What happens when we use Station A (moderately urbanized) to homogenize the other three stations?

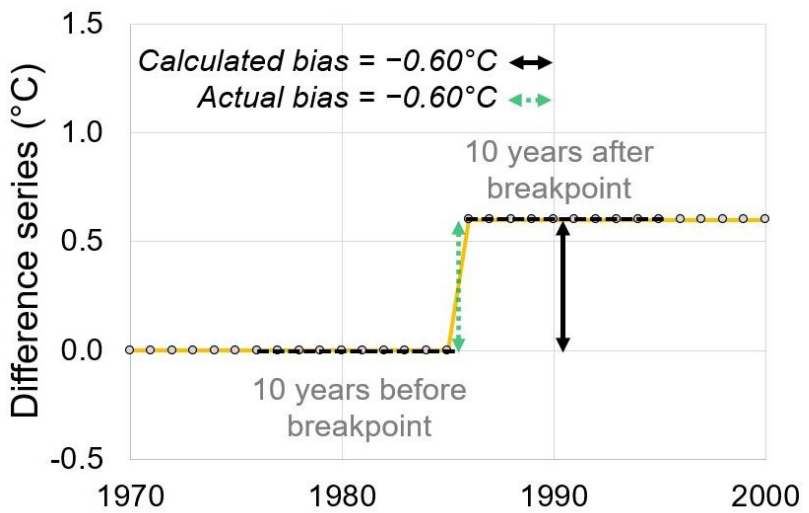
Step 1. Calculate the difference series between each station and Station A

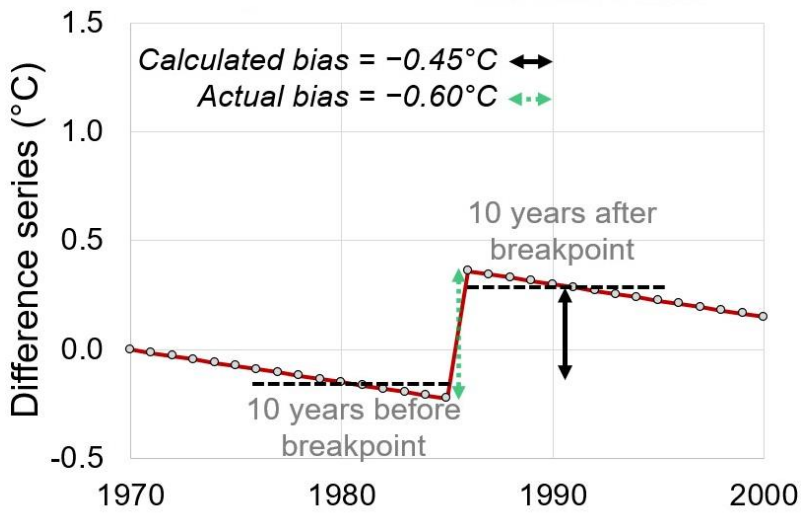
Station B – actual bias is overestimated – "urban warming" added to rural

Station C – actual bias is correctly estimated

Station D – actual bias is underestimated – some urban warming removed







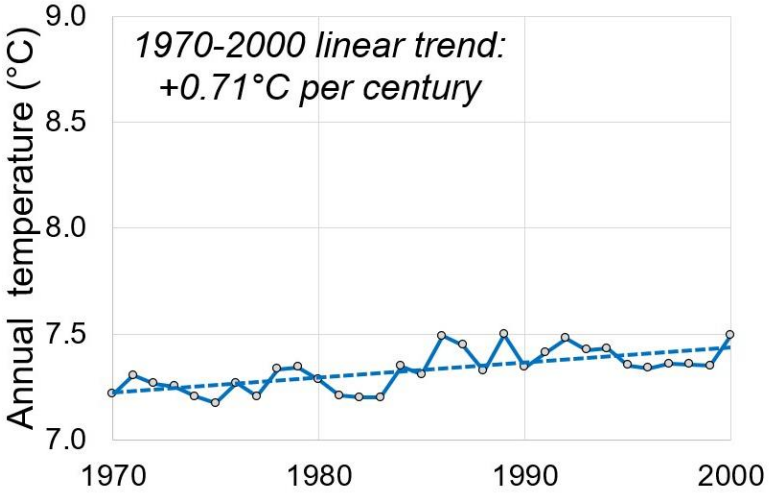
What happens when we use Station A (moderately urbanized) to homogenize the other three stations?

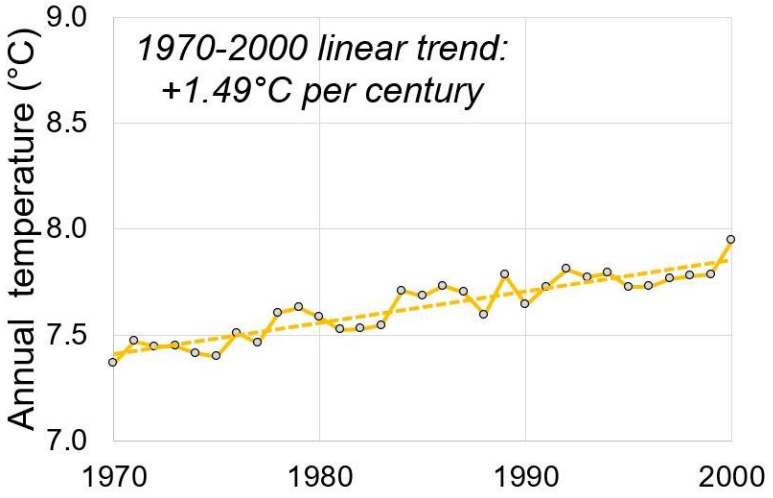
Step 2. Apply adjustments based on the results of the previous step

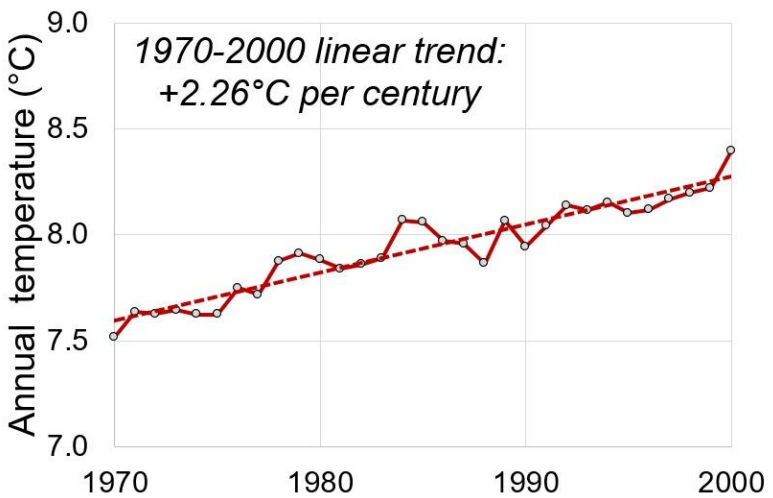
Station B – homogenized "rural" station now has "urban warming"

Station C – homogenized urban station retains its urban warming

Station D – homogenized urban station has its urban warming slightly reduced

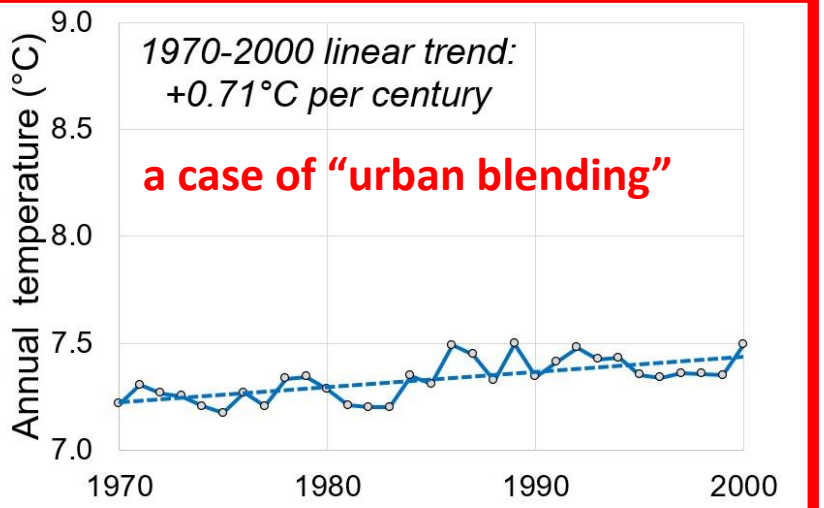




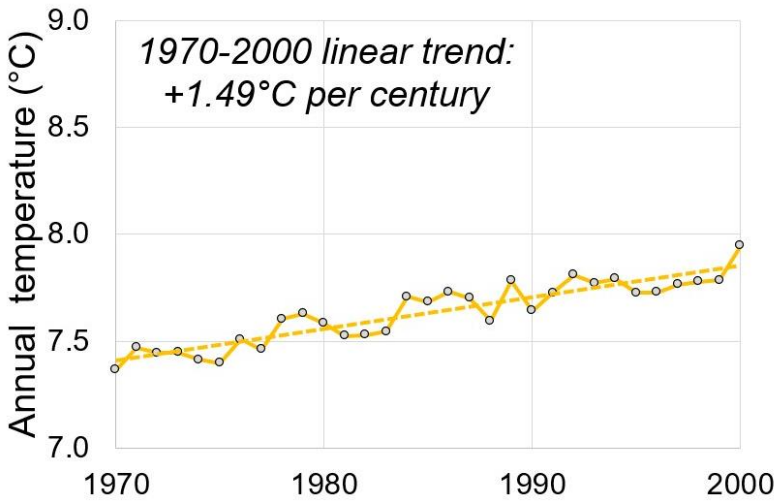


After homogenization (using current “statistical homogenization”)

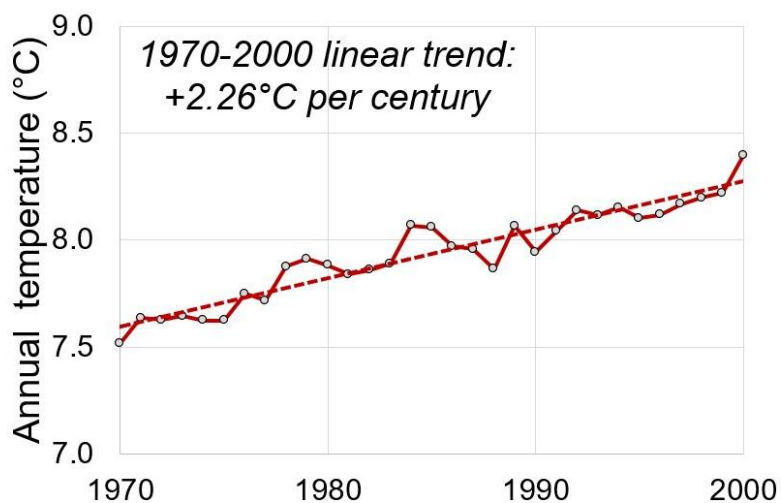
Station B



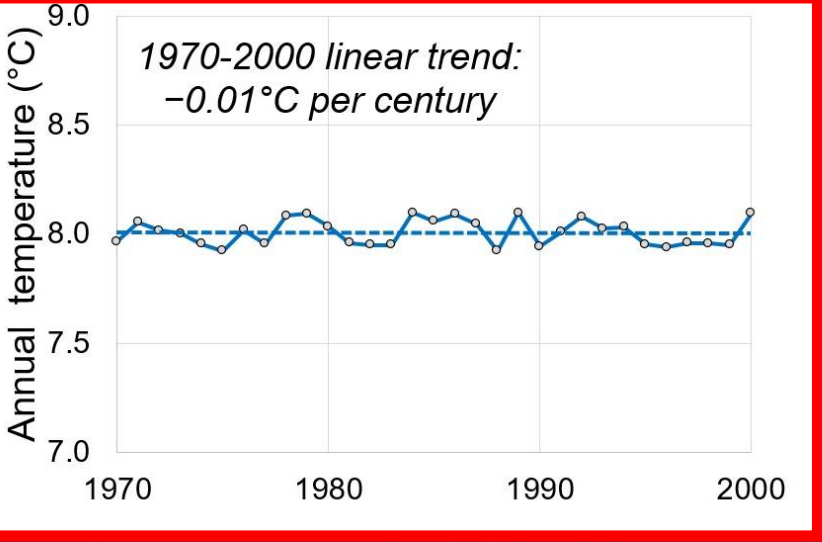
Station C

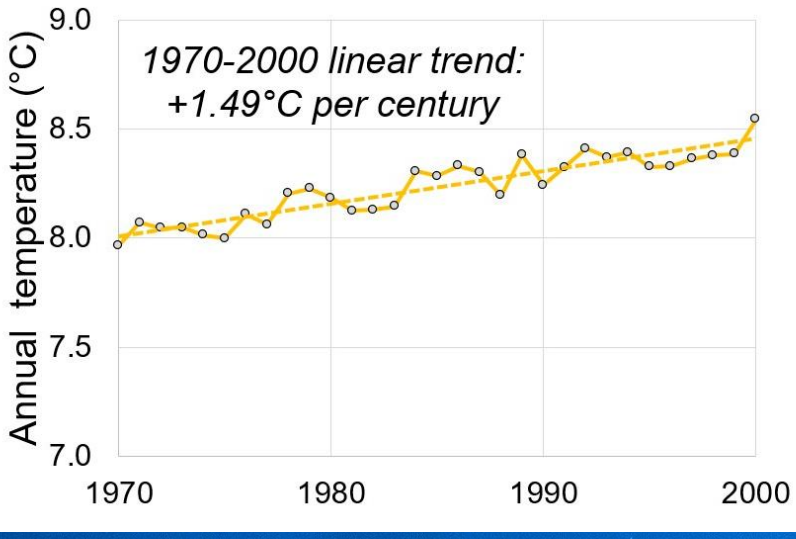


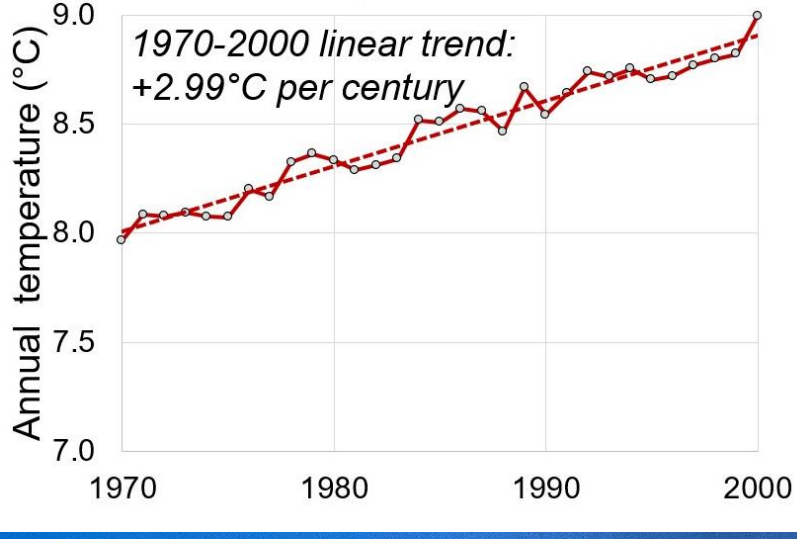
Station D



True trends if urban blending had been somehow avoided





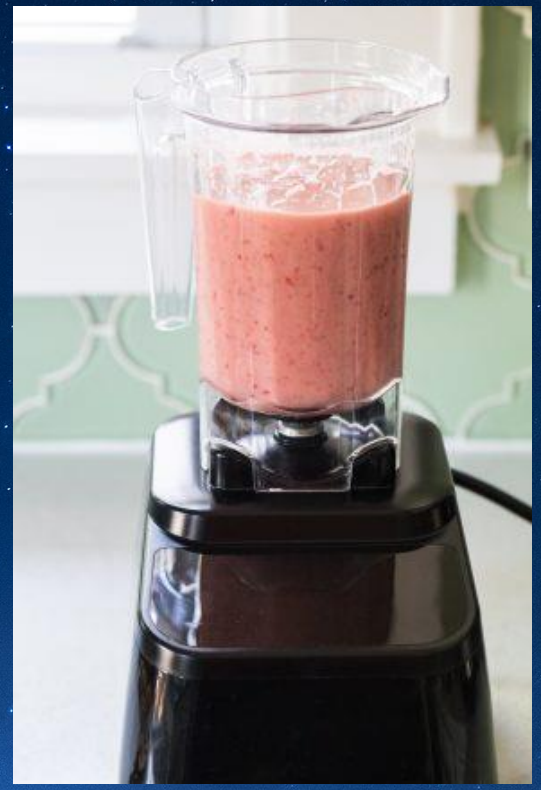


Consequences of urban blending

When you blend strawberries and bananas together, you get a nice smoothie.

But, this is no longer "pure strawberries" Or "pure bananas"

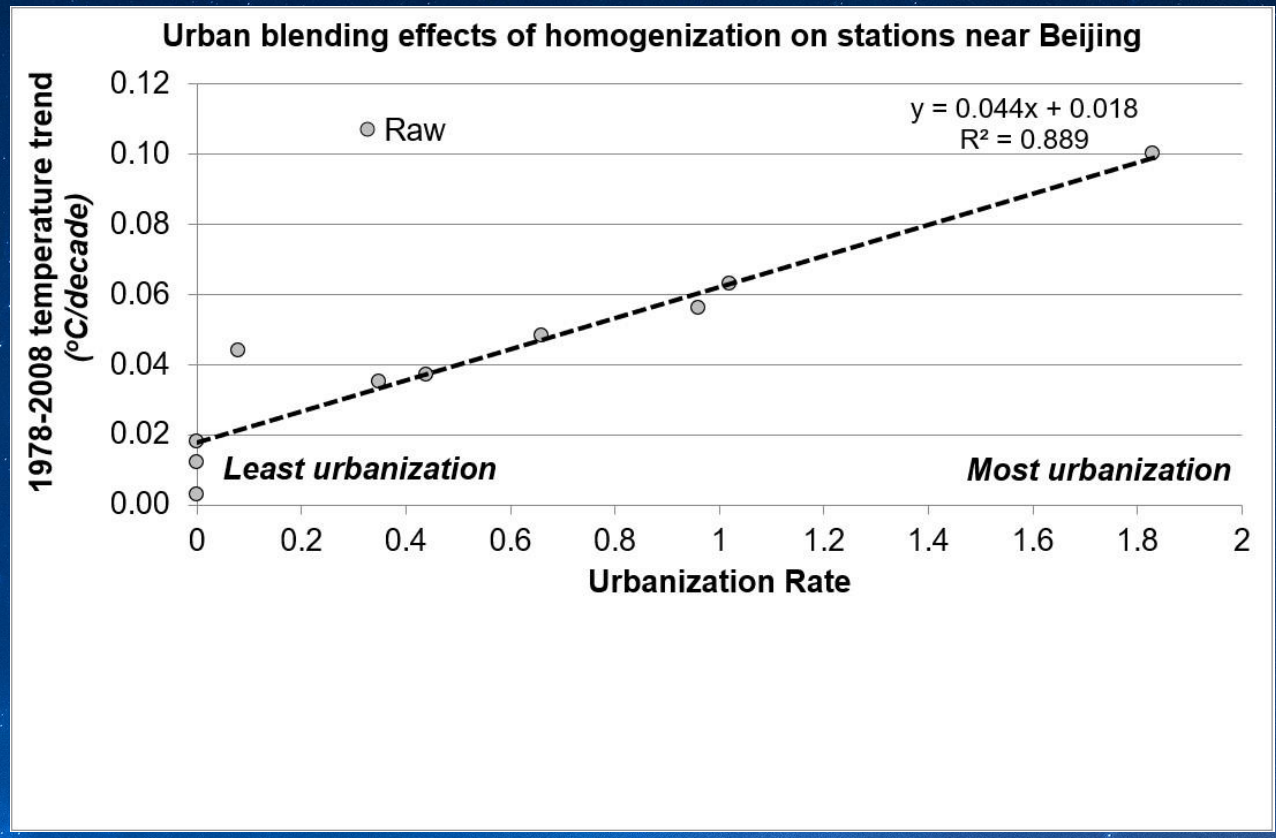
- Urban blending means that after homogenization, the trends of all stations converge towards the average of all stations – they become "homogeneous"
- It's true that the urban bias of the most urbanized stations is slightly reduced
- But, the rural stations have urban warming added by the homogenization process
- This is why, the apparent "rural/urban differences" of **homogenized** stations appears to be small.



Blending creates a homogeneous mix!

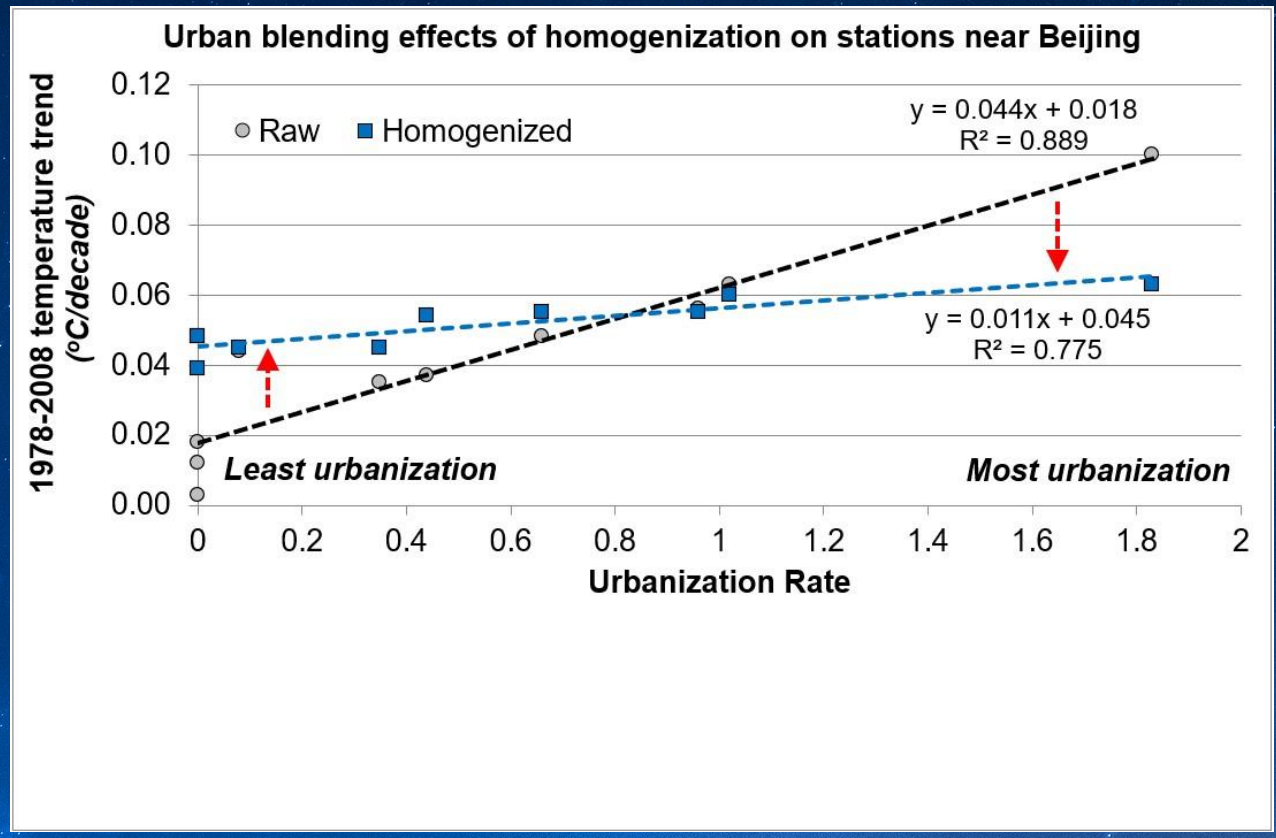
- He & Jia (2012) had compared the trends of 10 stations near Beijing before and after homogenization
- They sorted them according to how much urbanization they experienced
- Before homogenization, there was a clear urbanization bias – the more urbanized, the more 1978-2008 warming

Figure from Soon et al. (2018) – adapted from He & Jia (2012)



- He & Jia (2012) had compared the trends of 10 stations near Beijing before and after homogenization
- They sorted them according to how much urbanization they experienced
- Before homogenization, there was a clear urbanization bias – the more urbanized, the more 1978-2008 warming
- After homogenization, **the most rural stations became warmer** and the most urban became cooler.
- All station trends converged towards those of the moderately urbanized stations

Figure from Soon et al. (2018) – adapted from He & Jia (2012)



What should be done instead?

1. If you are going to use statistical homogenization, then you need to ensure that the neighbors you use for homogenizing a station are similarly urbanized, e.g., use rural neighbors to homogenize rural stations and urban neighbors to homogenize urban stations

2. This should then correct for the various step change biases… but retain the trend biases after homogenization

3. Urbanization biases can then be corrected separately afterwards

4. We need to collect station history metadata so that adjustments can be justified and confirmed with documented events

What should be done instead?

1. If you are going to use statistical homogenization, then you need to ensure that the neighbors you use for homogenizing a station are similarly urbanized, e.g., use rural neighbors to homogenize rural stations and urban neighbors to homogenize urban stations

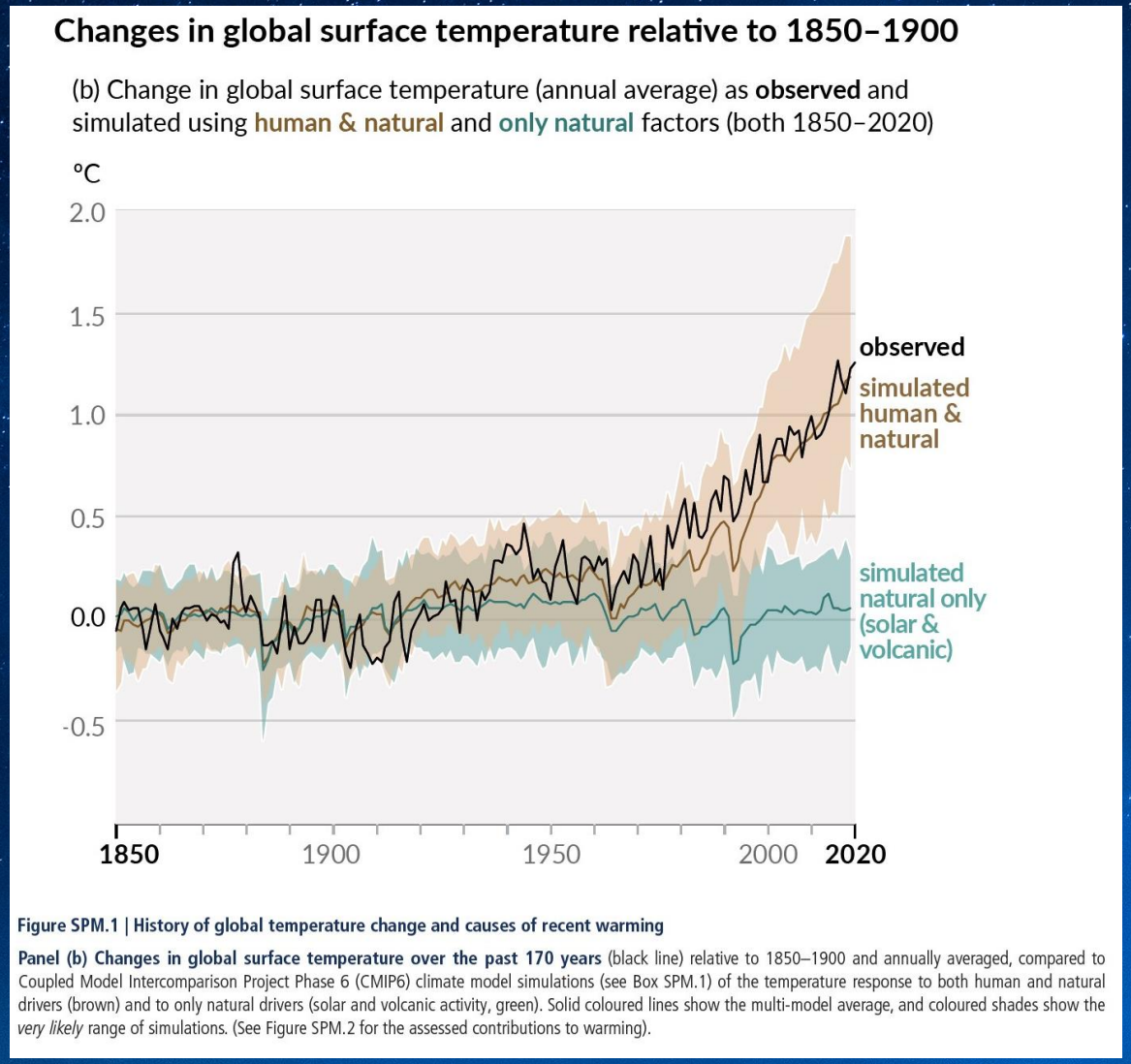
2. This should then correct for the various step change biases… but retain the trend biases after homogenization

3. Urbanization biases can then be corrected separately afterwards

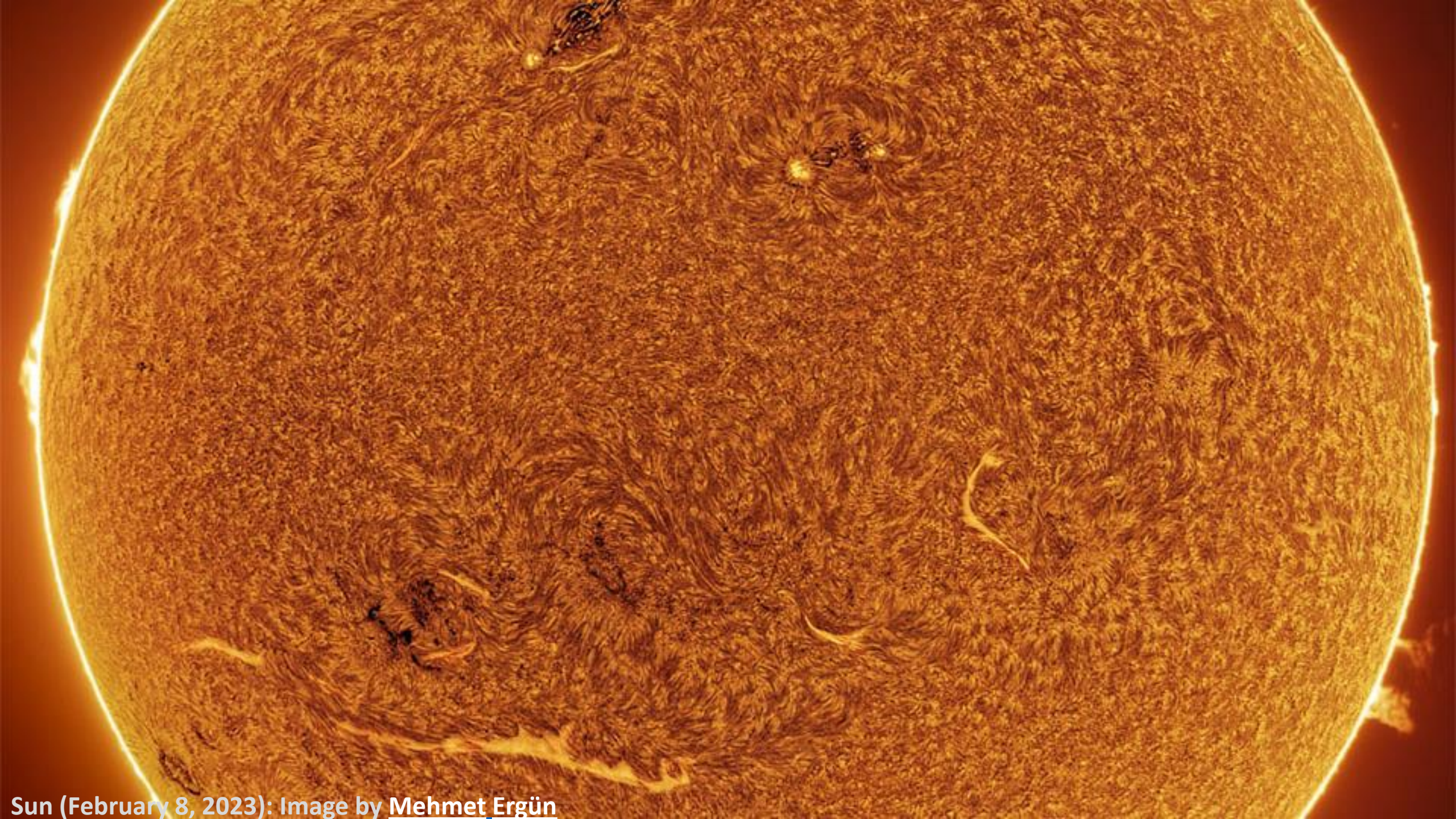
4. We need to collect station history metadata so that adjustments can be justified and confirmed with documented events

In the meantime, we propose that our “rural Northern Hemisphere” is more climatically representative than the current “global land” estimates based on homogenized urban and rural stations

Ok, so the IPCC got the temperature record wrong … but are they still correct anyway?



- If you remember back to the start of this talk, the IPCC based their "mostly human-caused" claim on computer simulations
- **Now, we know that their "observed" record was contaminated by UHI and "urban blending"**
- **When they ran their models with "just the Sun and volcanoes" they couldn't fit the "observed" temperature record**
- But, surely, they're right about the Sun?

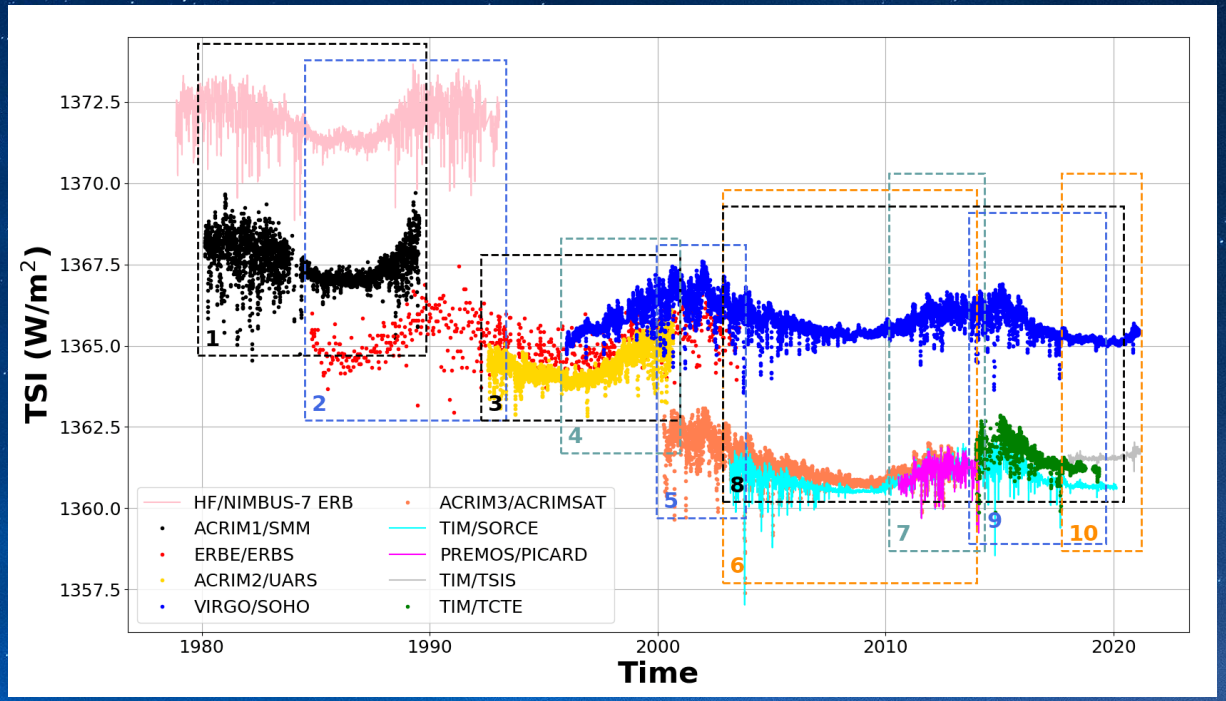


Sun (February 8, 2023): Image by Mehmet Ergün

How has solar activity changed since 1850? Part 1. The Satellite era (1978-present)

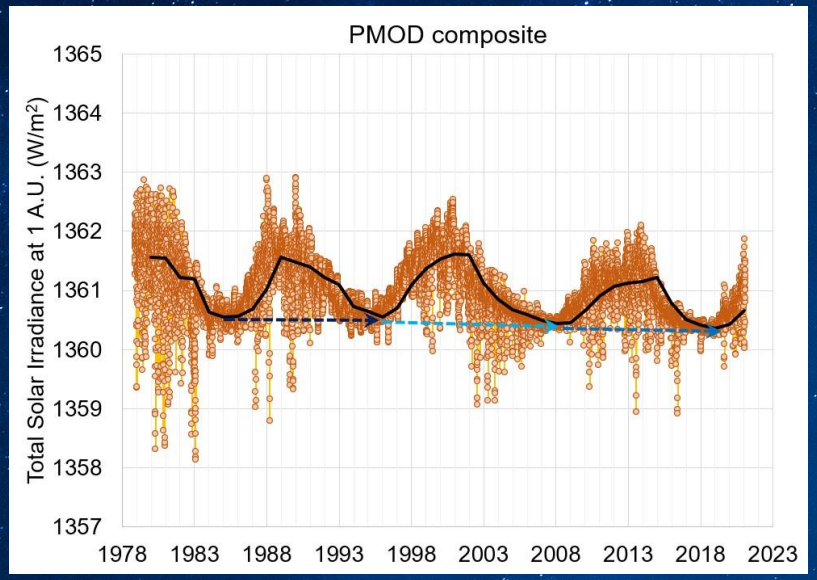
- Multiple satellites have been launched to directly monitor the Sun's output – see right
- Each mission only lasts 10-15 years or so
- Each mission suggests a different "average TSI" – from 1372 W/m^2 to 1360 W/m^2
- However, all capture the up & down of the ~11 year "solar cycle" (not strictly cyclical)
- So, by rescaling each satellite during overlap periods, we can create a longer "satellite TSI composite record"

Total Solar Irradiance (TSI) satellite missions

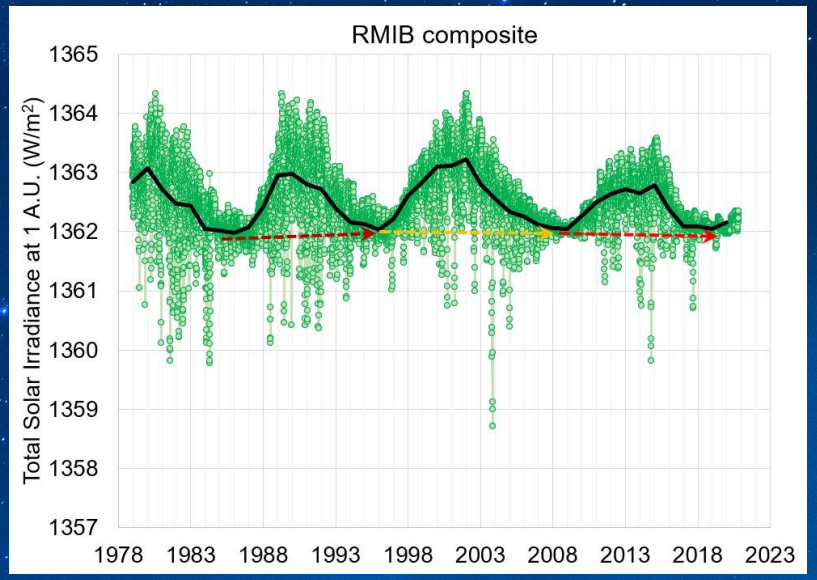


How has solar activity changed since 1850? Part 1. The Satellite era (1978-present)

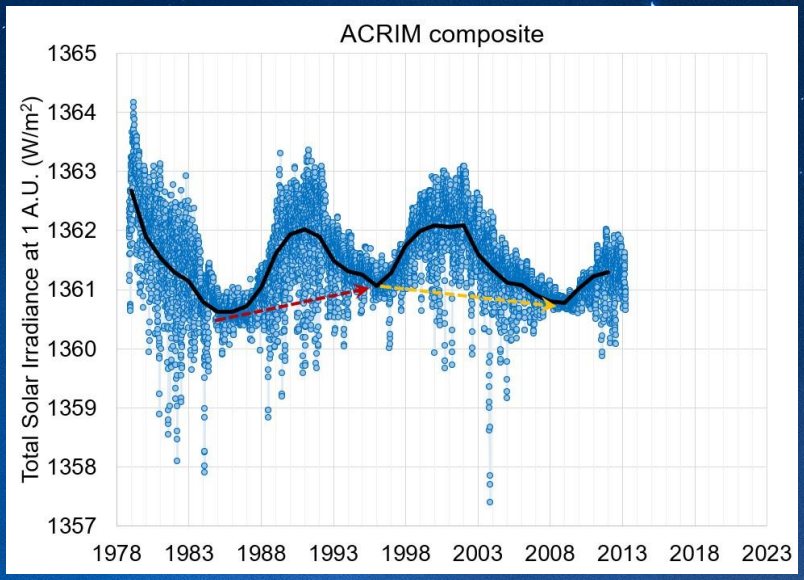
However, there are many ways to composite the data together! Each gives different answers. At present, there are three main rival composites: PMOD, RMIB & ACRIM



- TSI slightly decreased over the satellite era
- TSI mostly follows sunspot cycles



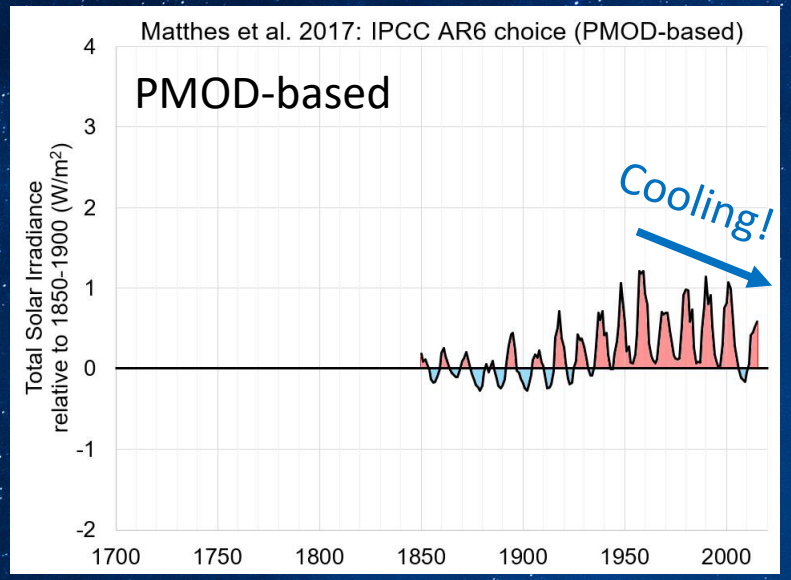
- TSI has been almost flat between minima
- TSI mostly follows sunspot cycles



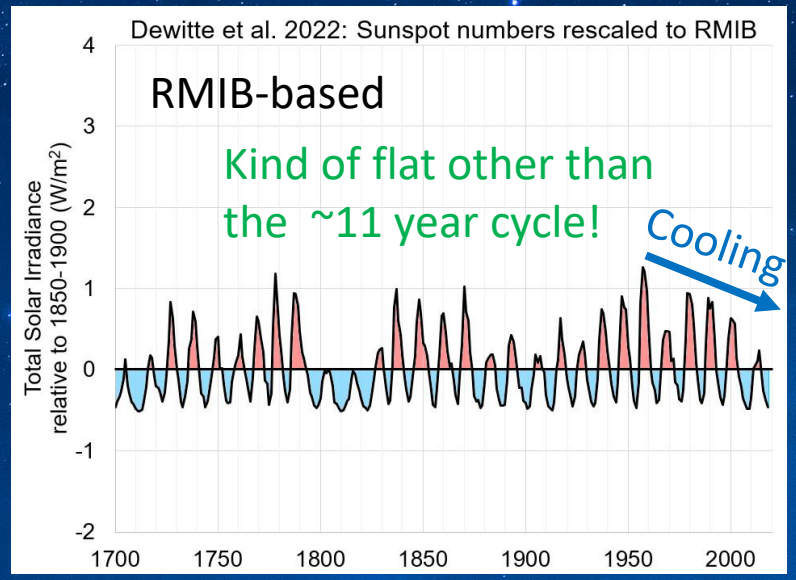
- TSI varies between solar cycle minima
- More complex than “just sunspots”

How has solar activity changed since 1850? Part 2. The pre-satellite era (using solar proxies)

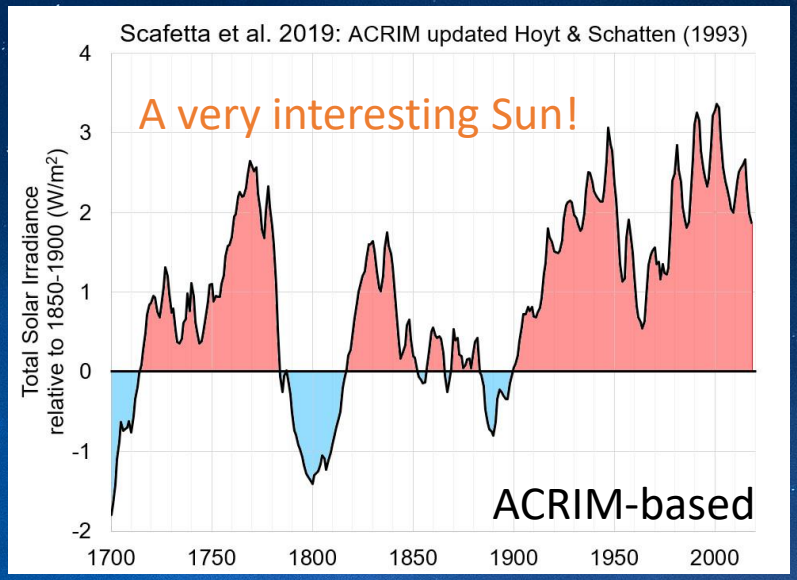
Depending on (a) which satellite composite you use for calibration and (b) what solar proxies you use for your reconstruction, you can get different solar activity histories!



- IPCC AR6 choice!
- Not much of a role for "solar"
- Has declined since 1950s peak
- Cannot explain "warming"

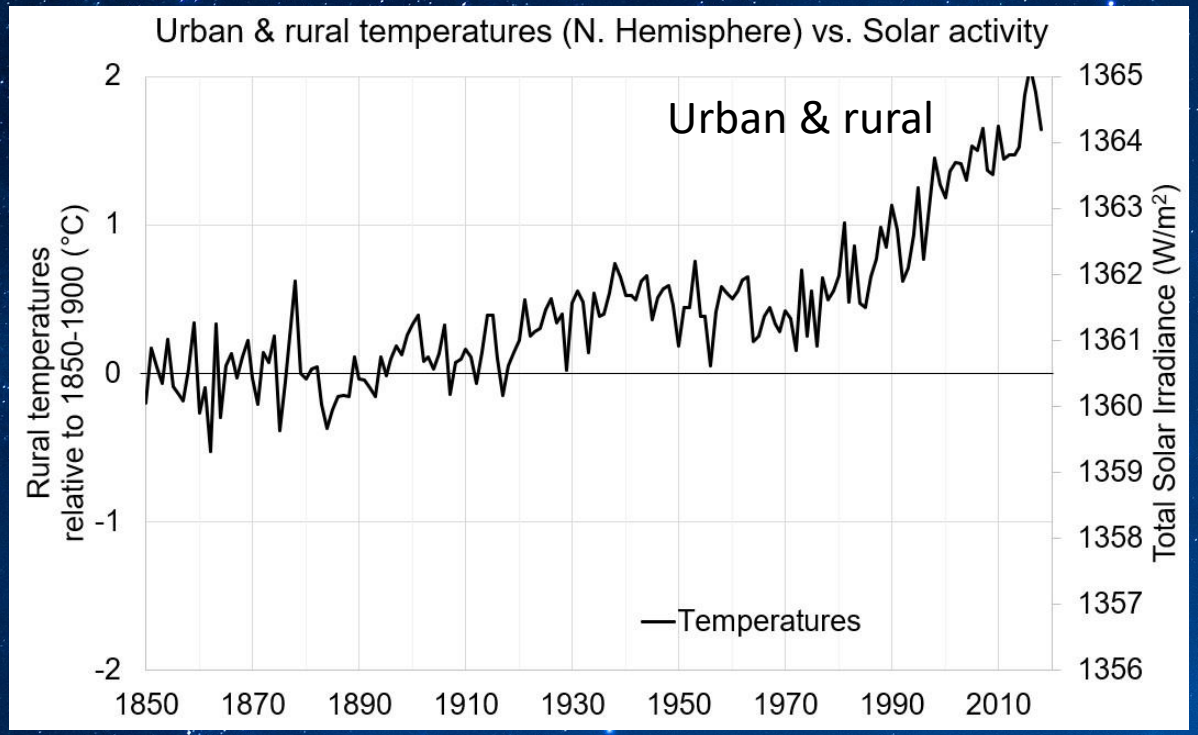


- Assuming TSI = sunspot numbers rescaled to RMIB gives an even "flatter" Sun
- The Sun becomes a minor player



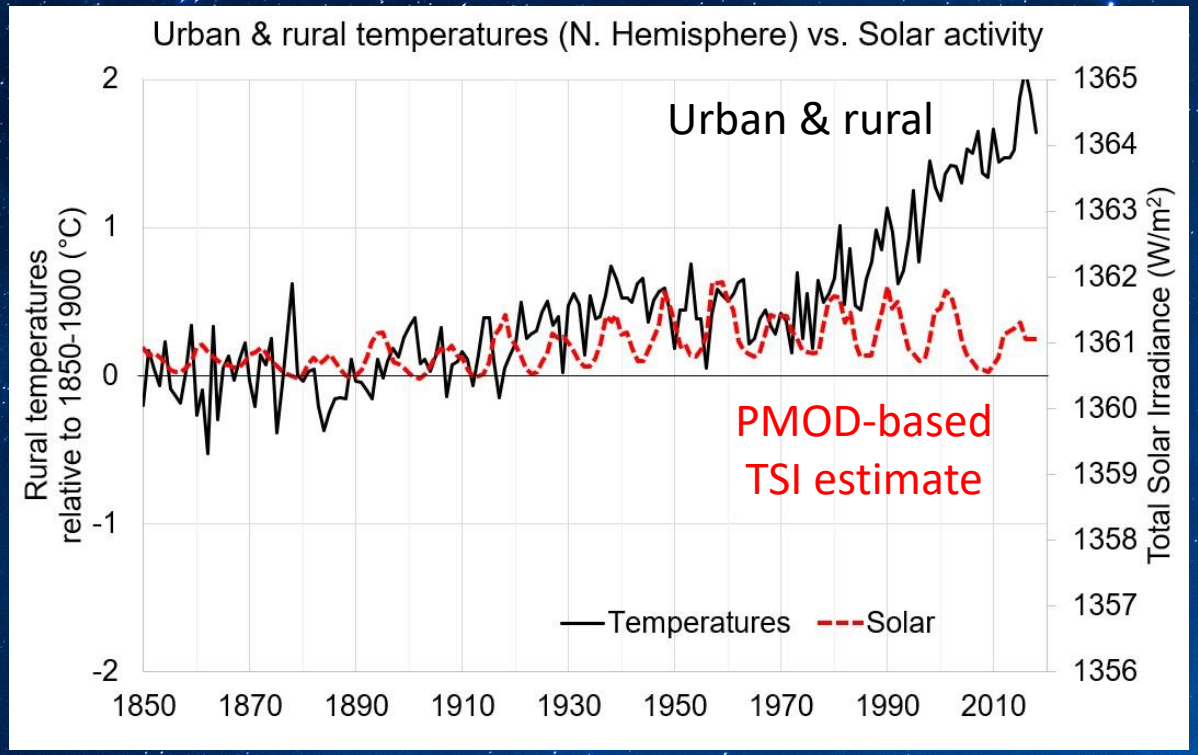
- ACRIM implies TSI is more than just sunspots. Therefore, need multiple solar proxies (>5 here)
- The Sun becomes a major player

Was the IPCC's "mostly human-caused" claim valid?



- The IPCC insists that urbanization bias is less than 10%. Therefore they include all stations (urban **and** rural)

Was the IPCC's "mostly human-caused" claim valid?

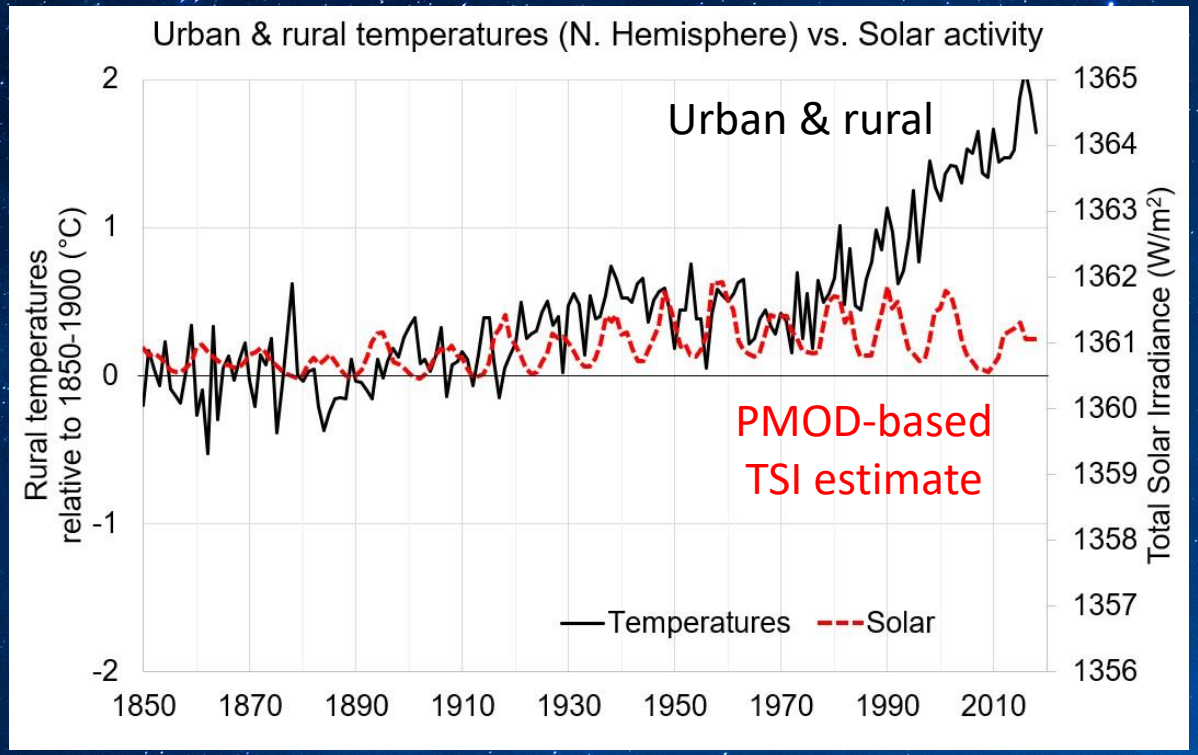


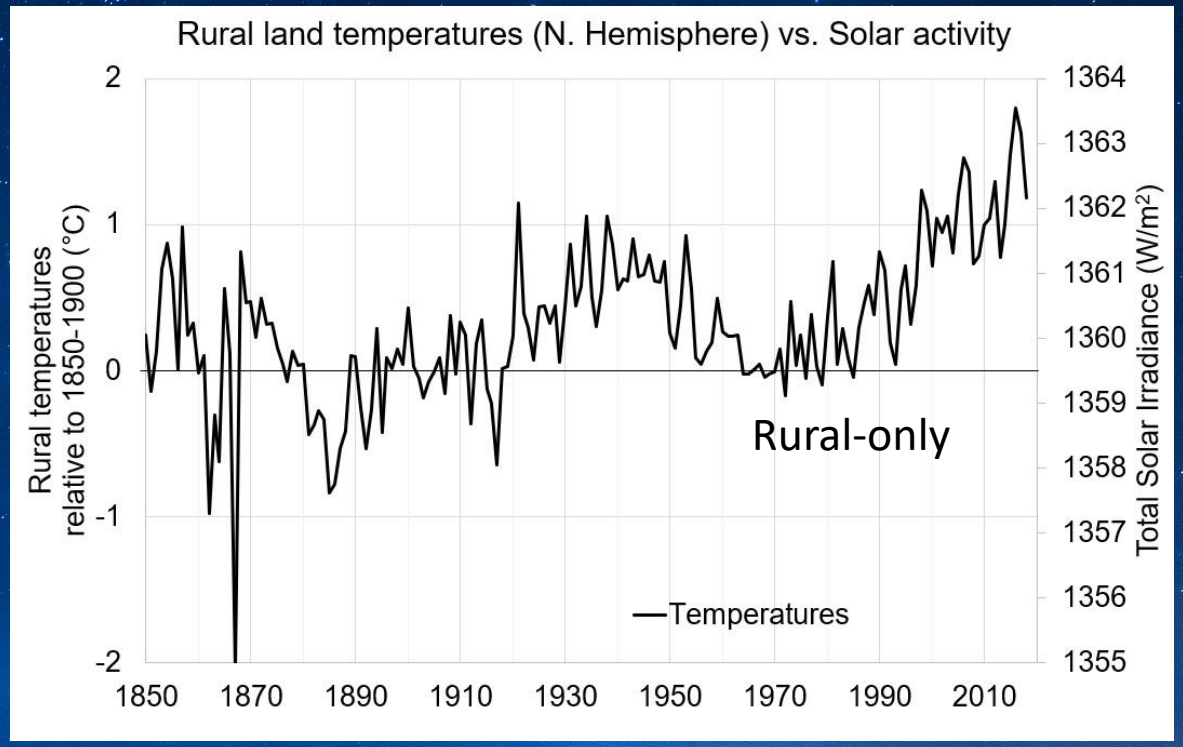
- The IPCC insists that the PMOD-based TSI estimates are largely correct. The models contributing to AR6 only considered the above TSI estimate

- Therefore IPCC concluded that the observed warming was NOT natural.

- Human-caused warming is "unequivocal"!!!

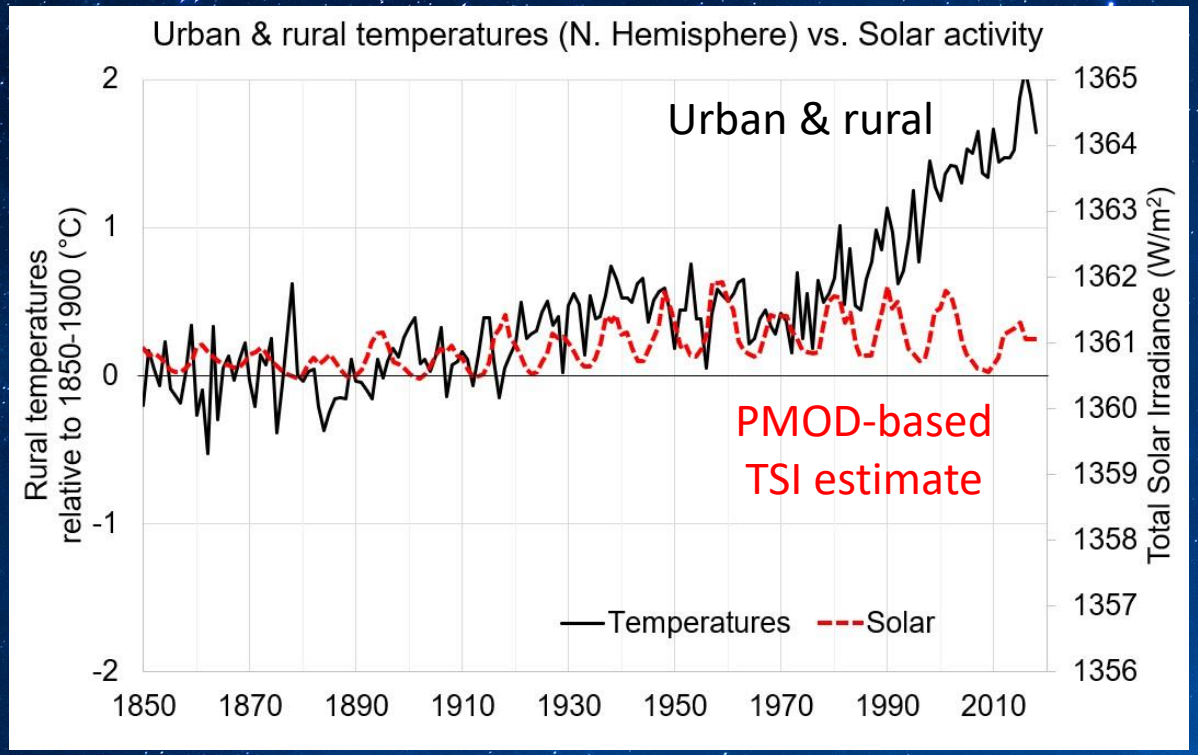
Was the IPCC's "mostly human-caused" claim valid?

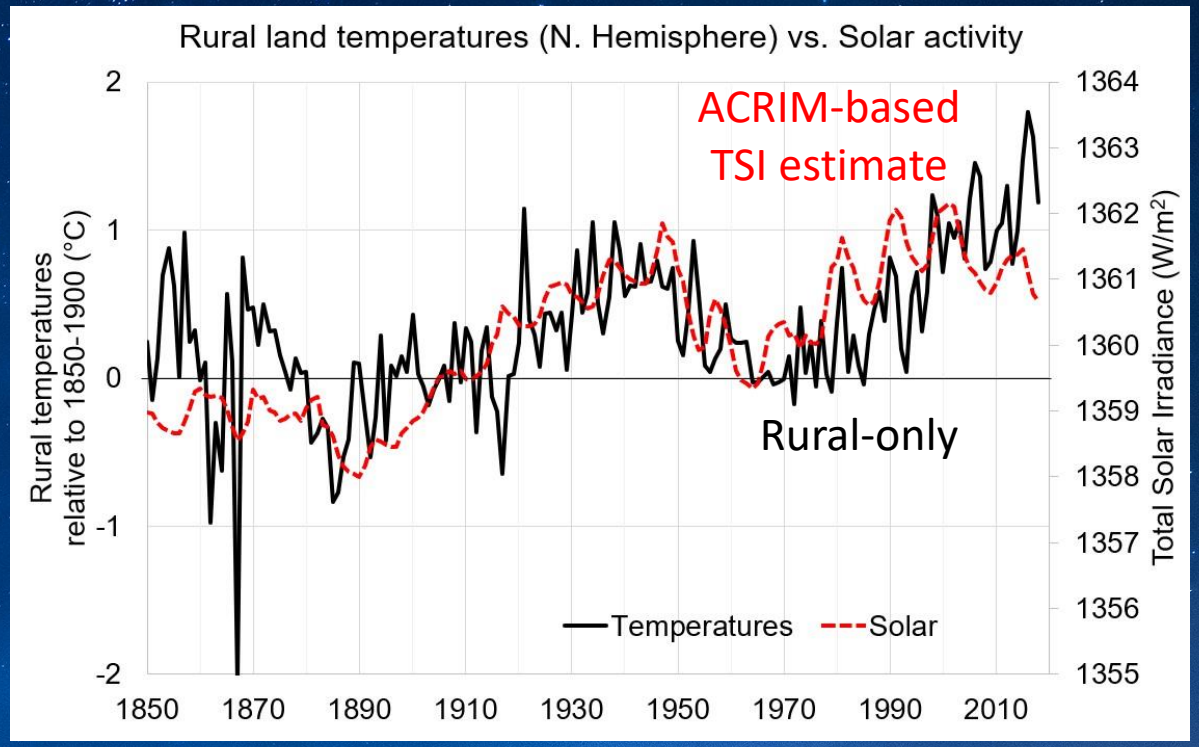




- But, what if they had used our rural-only time series instead?
- And used an ACRIM-based TSI?

Was the IPCC's "mostly human-caused" claim valid?





- They could have reached the opposite conclusion! That is, global warming is mostly-natural!

- But, what if they had used our rural-only time series instead?
- And used an ACRIM-based TSI?

CERES publications (2018 to present) – note we only discussed two of these papers today!

1. Velasco Herrera, Soon, Knoška et al. (2022). "The New Composite Solar Flare Index from Solar Cycle 17 to Cycle 24 (1937 – 2020)". Solar Physics 297, 108.
2. Dingley, Connolly, Connolly and Soon (2022). "A comparison of different metrics for analyzing the troposphere/stratosphere transitions using high-resolution ozonesondes". Environmental Science Proceedings, 19, 14.
3. Qiu et al. (2022). "The interplanetary origins of geomagnetic storm with Dstmin≤−50 nT during solar cycle 24 (2009–2019)", Advances in Space Research, 70 (7), 2047-2057.
4. Velasco Herrera et al. (2022). "Long-Term Forecasting of Strong Earthquakes in North America, South America, Japan, Southern China and Northern India with Machine Learning", Frontiers in Earth Science, 10.
5. Velasco Hererra, Martell-Dubois, Soon et al. (2022). "Predicting Atlantic hurricanes using machine learning". Atmosphere 13 (5), 707
6. **O'Neill, Connolly, Connolly, Soon et al. (2022). "Evaluation of the homogenization adjustments applied to European temperature records in the Global Historical Climatology Network dataset". Atmosphere 13(2), 285**
7. Velasco Hererra, Soon, et al. (2022). "Past and future of wildfires in Northern Hemisphere's boreal forests". Forest Ecology and Management 504, 119859
8. Connolly, Connolly, Soon et al. (2021). "Analyzing atmospheric circulation patterns using mass fluxes calculated from weather balloon measurements: North Atlantic region as a case study". Atmosphere 12(11), 1439
9. **Connolly, Soon, et al. (2021). "How much has the Sun influenced Northern Hemisphere temperature trends? An ongoing debate." Research in Astronomy and Astrophysics, 21, 131.**
10. Zhao, Soon and Velasco Herrera (2021). "Holocene millennial-scale solar variability and the climatic responses on Earth", Universe, 7, 36.
11. Qiu, Wang, Soon et al. (2021). "Sporadic sodium layers: A possible tracer for the conjunction between the upper and lower atmosphere", Atmospheric Chemistry and Physics, 21, 11927–11940
12. Zhao, Soon and Velasco Herrera (2020). "Evidence for solar modulation on the millennial-scale climate change of Earth", Universe, 6, 153.
13. Liu et al. (2020). "Dynamic of Tridacna spp. population variability in northern SCS over past 4500 years derived from AMS 14C dating", Science of the Total Environment, 748, 141359.
14. ÓhAiseadha et al. (2020). "Energy and climate policy — An evaluation of global climate change expenditure 2011–2018". Energies, 13, 4839.
15. Connolly, Connolly, Carter and Soon (2020). "How much human-caused global warming should we expect with business-as-usual (BAU) climate policies? A semi-empirical assessment". Energies, 13, 1365.
16. Heredia et al. (2019). "Searching for solar-like interannual to bidecadal effects on temperature and precipitation over a Southern Hemisphere location"/ Journal of Atmospheric and Solar-Terrestrial Physics, 193, 105094.
17. Connolly, Connolly, Soon et al. (2019). "Northern hemisphere snow-cover trends (1967-2018): A comparison between climate models and observations". Geosciences, 9(3), 135.

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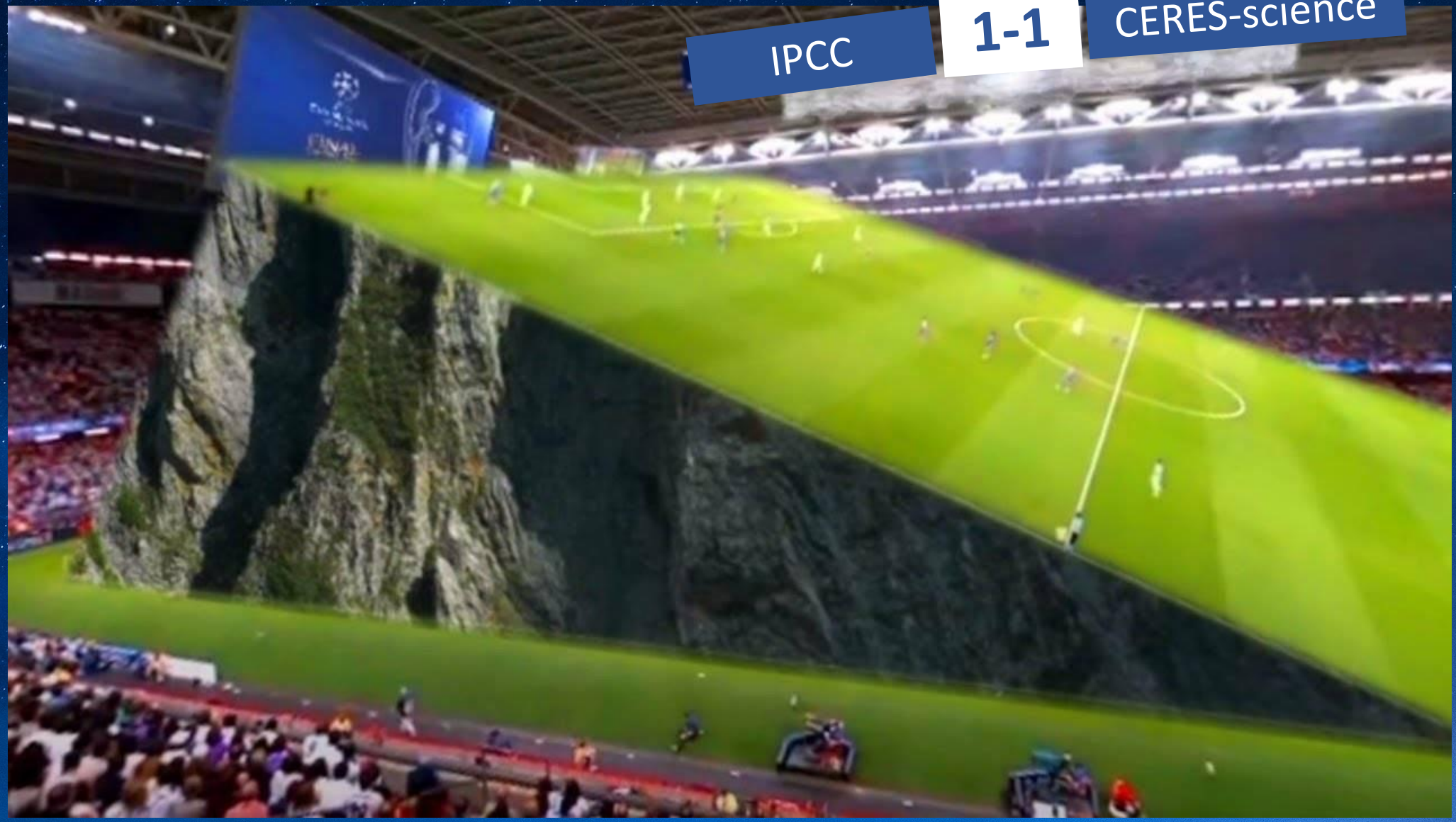
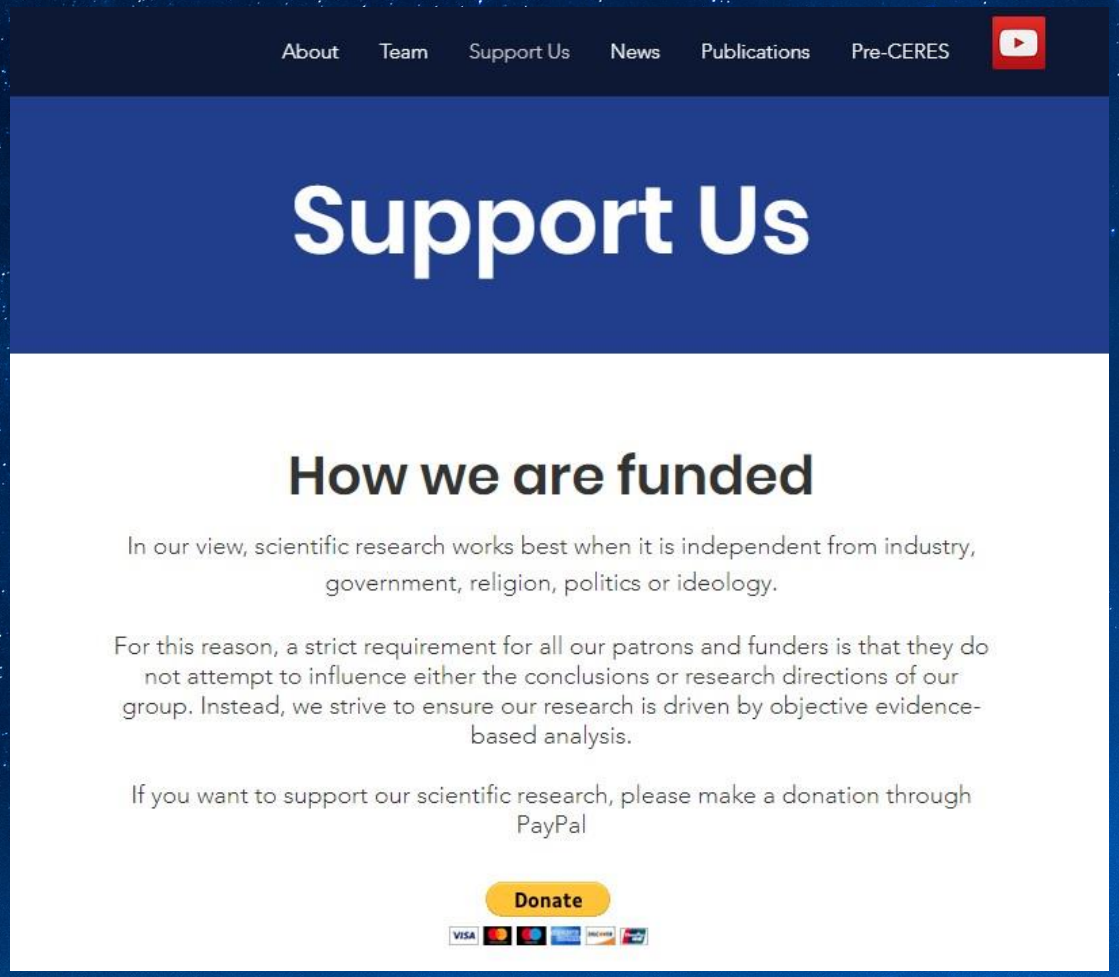
- IPCC considered Connolly et al. (2019) for their latest AR6 report.
- They misleadingly implied that we agreed with AR5!
- Connolly et al. (2019) was showing that the computer models used by AR5 got snow cover trends wrong for all 4 seasons
- AR6 apparently didn't get a chance to consider any of our more recent work …
- Maybe in AR7? (due 2027-28?)

How would you like to be playing at this slanted field?



Visit **www.ceres-science.com** to learn more about our work and to help us!



- If you think we are doing good work, you can support our efforts by making a donation at www.ceres-science.com or www.supportceres.com
- **Our funding comes from donors like you that want us to actually follow science** instead of "Following The Science ™" like the IPCC
- So, if you can donate $10, $100 or more, you will be helping **science rather than Anthony Fauci!**
- Or, simply spread the word about our work and our efforts!

EXTRAS

Is the IPCC interested in genuine science?

IPCC: "Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the objective of the IPCC is to provide governments at all levels **with scientific information that they can use to develop climate policies**." – IPCC "About the IPCC" page, https://www.ipcc.ch/about/

Me: Genuine scientists like myself are more interested in looking at **ALL the science**, not just politically useful "scientific information" and other "factoids"

Background to Climategate

- Up until 2011, the CRU (headed by Prof. Phil Jones) refused to share their temperature dataset with others.

- E.g., in response to a request for the data by Warwick Hughes, Jones said, *"Even if WMO agrees, I will still not pass on the data. We have 25 or so years invested in the work. Why should I make the data available to you, when your aim is to try and find something wrong with it."*

- By late 2009, a blogger, Steve McIntyre discovered that Jones was sharing the data with other scientists – just not with skeptics! He asked for the data under the Freedom Of Information Act (FOIA). And was refused.

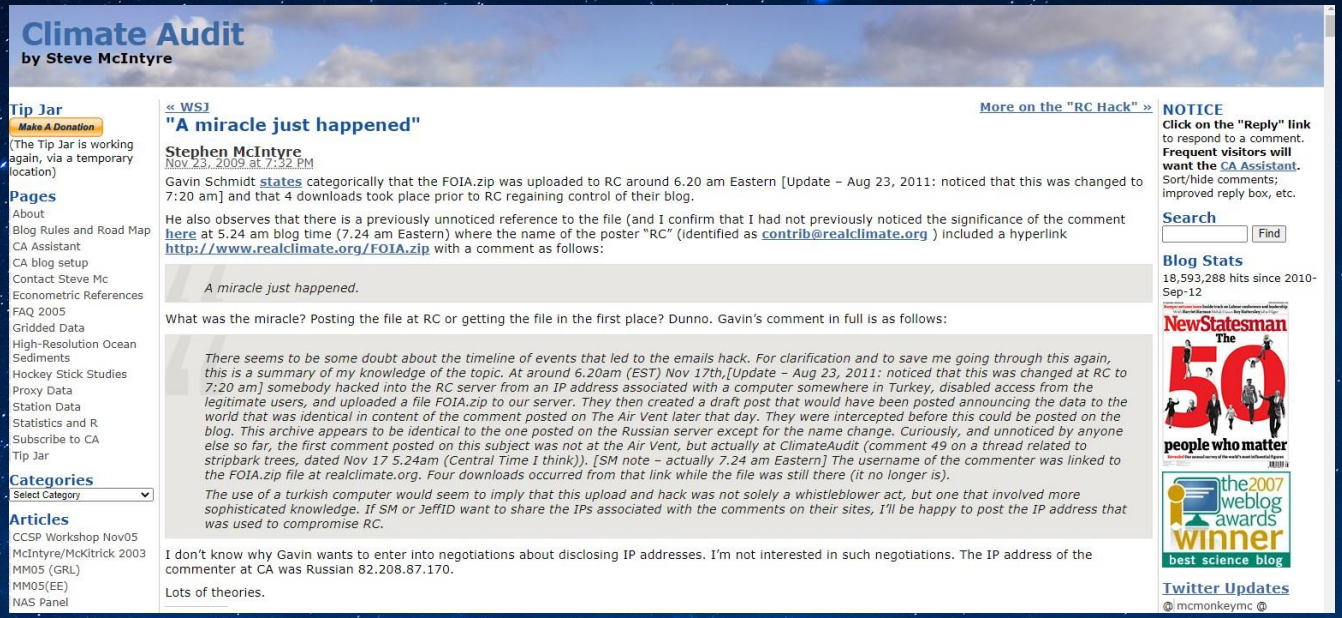
- Someone seems to have been outraged by this and pseudonymously released a huge collection of CRU e-mails.

Date: Mon, 21 Feb 2005 12:12:22 +0000
From: Phil Jones To: "xxxxxxx@iinet.net.au"
Subject: Re: WMO non respondo

Warwick,
Hans Teunisson will reply. He'll tell you which other people should reply.
Hans is "Hans Teunissen" .

I should warn you that some data we have we are not supposed top pass on to others. We can pass on the gridded data – which we do. Even if WMO agrees, I will still not pass on the data. We have 25 or so years invested in the work. Why should I make the data available to you, when your aim is to try and find something wrong with it. There is IPR to consider.

You can get similar data from GHCN at NCDC. Australia isn't restricted there.
Several European countries are. Basically because, for example, France doesn't want the French picking up data on France from Asheville. Meteo France wants to supply data to the French on France. Same story in most of the others.
Cheers
Phil



Climate Audit
by Steve McIntyre

Tip Jar
Make A Donation
(The Tip Jar is working again, via a temporary location)

Pages
About
Blog Rules and Road Map
CA Assistant
CA blog setup
Contact Steve Mc
Econometric References
FAQ 2005
Gridded Data
High-Resolution Ocean Sediments
Hockey Stick Studies
Proxy Data
Station Data
Statistics and R
Subscribe to CA
Tip Jar

Categories
Select Category

Articles
CCSP Workshop Nov05
McIntyre/McKitrick 2003
MM05 (GRL)
MM05(EE)
NAS Panel

« WSJ
More on the "RC Hack" »

"A miracle just happened"

Stephen McIntyre
Nov 23, 2009 at 7:32 PM

Gavin Schmidt states categorically that the FOIA.zip was uploaded to RC around 6.20 am Eastern [Update – Aug 23, 2011: noticed that this was changed to 7:20 am] and that 4 downloads took place prior to RC regaining control of their blog.

He also observes that there is a previously unnoticed reference to the file (and I confirm that I had not previously noticed the significance of the comment here at 5.24 am blog time (7.24 am Eastern) where the name of the poster "RC" (identified as contrib@realclimate.org) included a hyperlink http://www.realclimate.org/FOIA.zip with a comment as follows:

> *A miracle just happened.*

What was the miracle? Posting the file at RC or getting the file in the first place? Dunno. Gavin's comment in full is as follows:

> *There seems to be some doubt about the timeline of events that led to the emails hack. For clarification and to save me going through this again, this is a summary of my knowledge of the topic. At around 6.20am (EST) Nov 17th,[Update – Aug 23, 2011: noticed that this was changed at RC to 7:20 am] somebody hacked into the RC server from an IP address associated with a computer somewhere in Turkey, disabled access from the legitimate users, and uploaded a file FOIA.zip to our server. They then created a draft post that would have been posted announcing the data to the world that was identical in content of the comment posted on The Air Vent later that day. They were intercepted before this could be posted on the blog. This archive appears to be identical to the one posted on the Russian server except for the name change. Curiously, and unnoticed by anyone else so far, the first comment posted on this subject was not at the Air Vent, but actually at ClimateAudit (comment 49 on a thread related to stripbark trees, dated Nov 17 5.24am (Central Time I think)). [SM note – actually 7.24 am Eastern] The username of the commenter was linked to the FOIA.zip file at realclimate.org. Four downloads occurred from that link while the file was still there (it no longer is).*
>
> *The use of a turkish computer would seem to imply that this upload and hack was not solely a whistleblower act, but one that involved more sophisticated knowledge. If SM or JeffID want to share the IPs associated with the comments on their sites, I'll be happy to post the IP address that was used to compromise RC.*

I don't know why Gavin wants to enter into negotiations about disclosing IP addresses. I'm not interested in such negotiations. The IP address of the commenter at CA was Russian 82.208.87.170.

Lots of theories.

NOTICE
Click on the "Reply" link to respond to a comment. Frequent visitors will want the CA Assistant. Sort/hide comments; improved reply box, etc.

Search
Find

Blog Stats
18,593,288 hits since 2010-Sep-12

New Statesman The 50 people who matter

the 2007 weblog awards winner best science blog

Twitter Updates
@ mcmonkeymc @

- These e-mails shined a light behind the scenes of the CRU scientists and the other climate scientists they collaborated with. The CRU scientists and many of those in the e-mail discussions were heavily involved in the IPCC reports.

- Many in the public were shocked when they discovered how the behaviour of these scientists was often very unscientific and the emails often showed co-ordinated efforts to suppress the work of scientists that had different perspectives (I was apparently one of the scientists whose work was been actively suppressed).

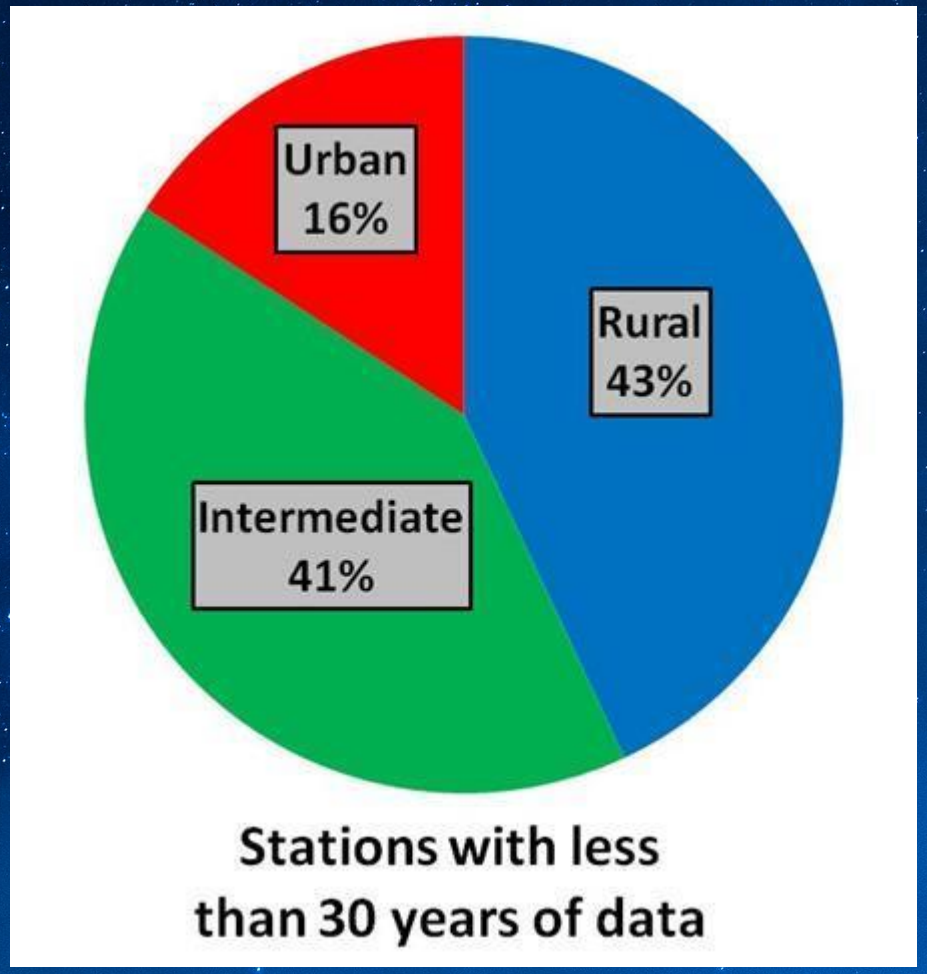
- The revelations of these e-mails came to be known as **Climategate**

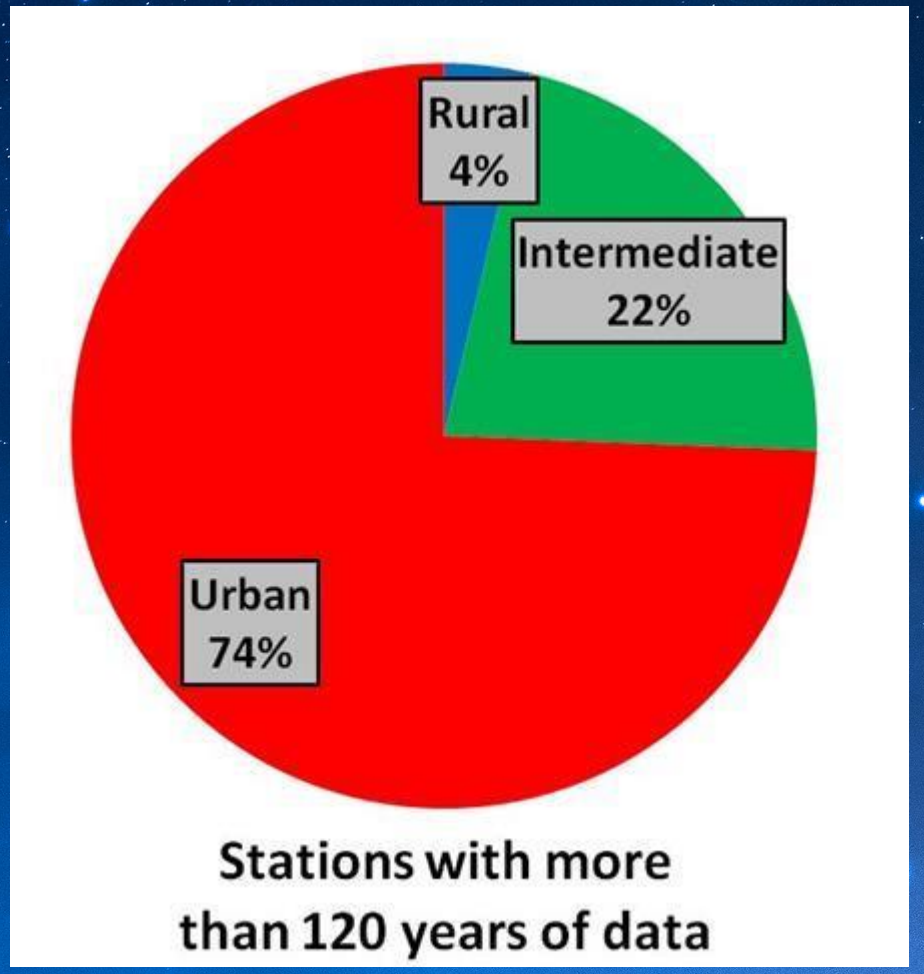
The Urban Heat Island (UHI) problem

- Connolly & Connolly's analysis for the contiguous U.S. was fairly straightforward and clean because NOAA's contiguous U.S. component of the Global Historical Climatology Network (GHCN) dataset has a very large number of temperature records from both urban and rural areas with almost continuous data back to 1895.
- This was a result of the Cooperative Observer Program (COOP) that began in 1890.
- However, for the rest of the world, the problem is a LOT harder!
- Before the invention of automatic weather stations (in the 1980s), staffing and maintaining a long-term weather record in an isolated rural location for many decades was a LOT harder than in a big city.
- Hence, most of the longest and most complete temperature records are in urban areas. And most of the rural records only have a few decades of data and/or large data gaps

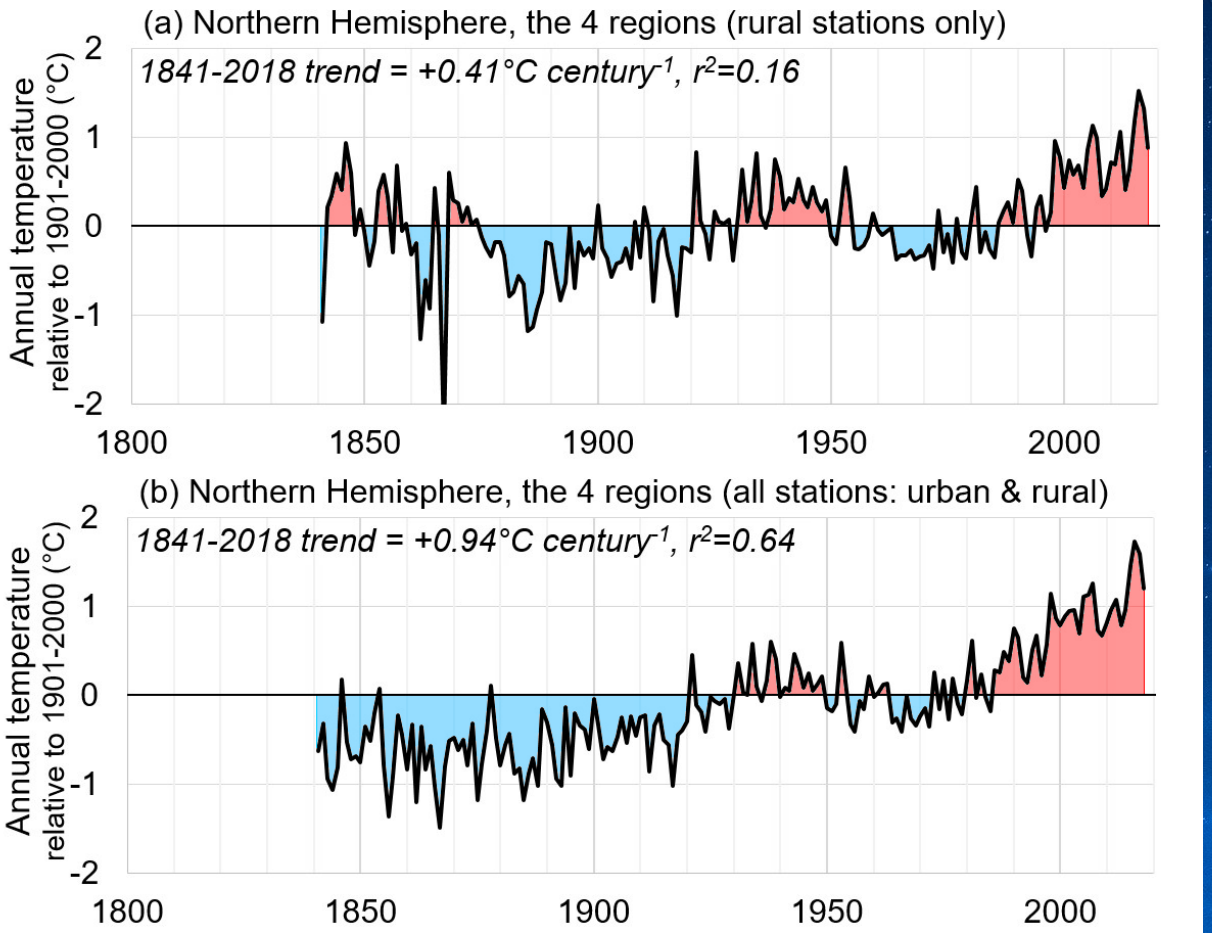
The Urban Heat Island (UHI) problem

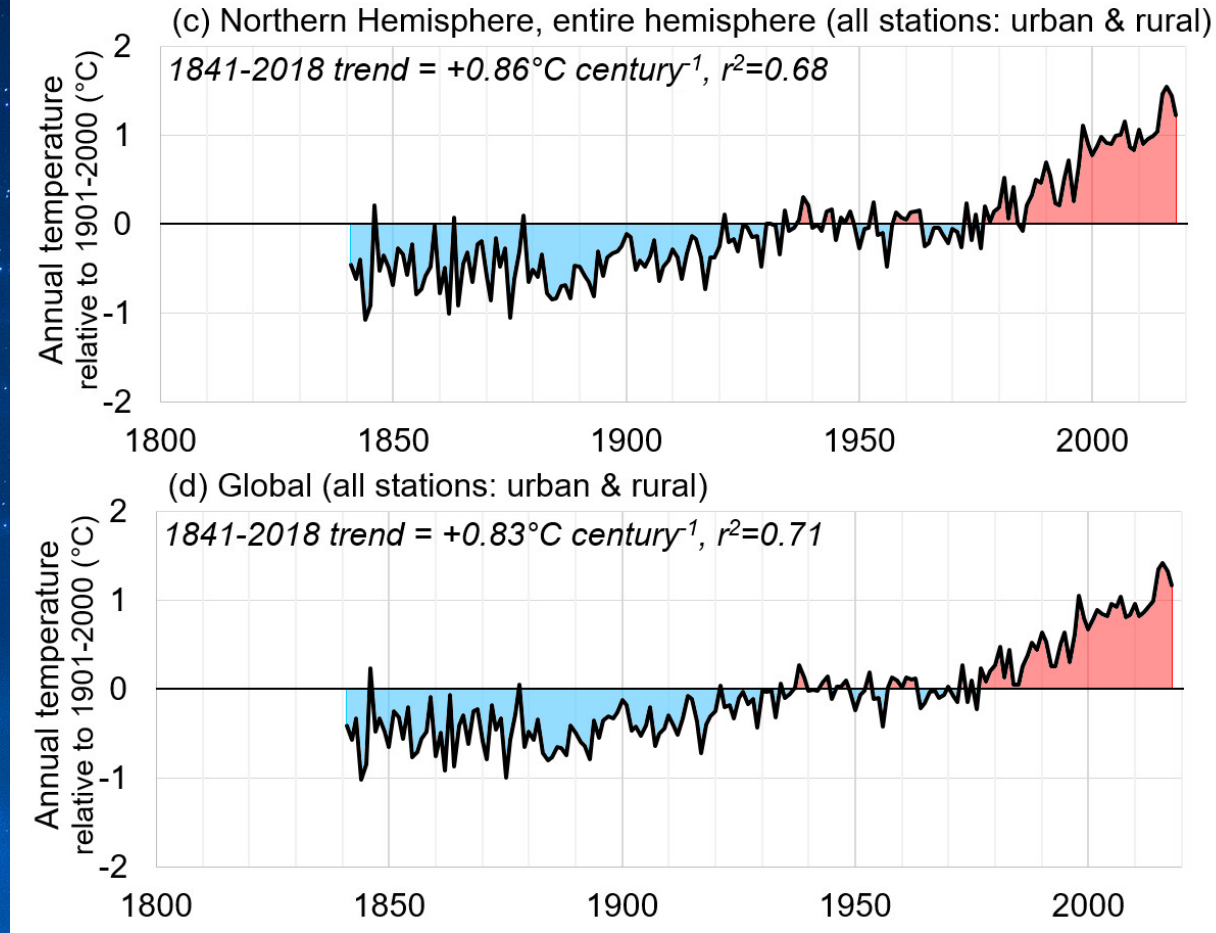
Breakdown of **non-U.S.** stations in GHCN **version 3** (we'll discuss version 4 later)





Were our 4 regions unusual?





Were our 4 regions unusual?

*Yes, **slightly** more warming than rest of globe, **but not much** – compare (b) to (c) and (d)*