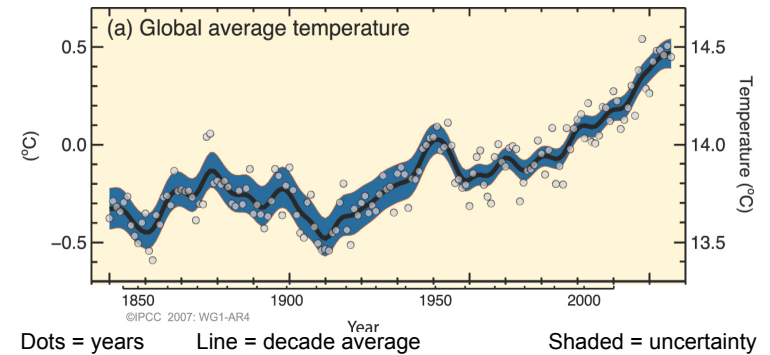


Trends in 20th Century Climate

- Material taken from the most recent IPCC report
 - Found here: www.ipcc.ch (click on “Publications and Data”)
 - What is the IPCC?
- Global Trends
- Regional Trends
- Pacific Northwest
- Summary

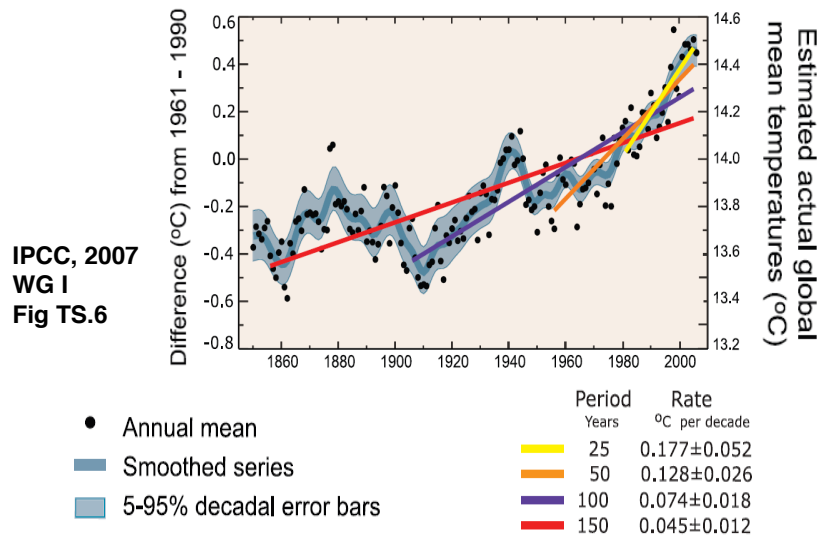
Global Annual Average Temperature



- The global annual averaged surface temperature has risen about 0.85°C (1.5°F) in the past 100 years
- The past decade is the warmest in the instrumental record

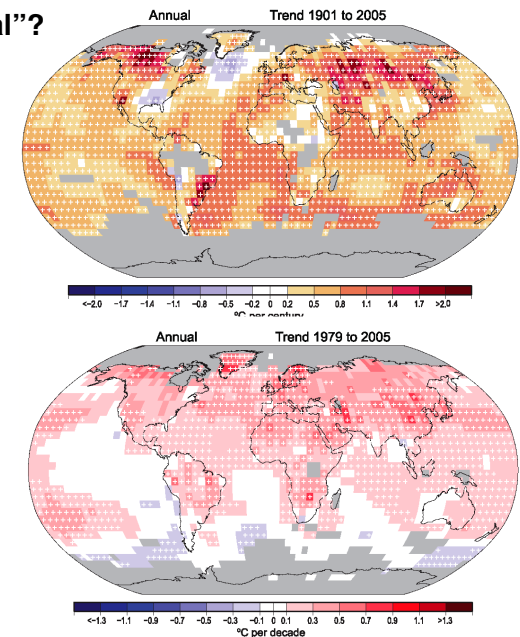
IPCC Fig SPM3

The warming trend is accelerating



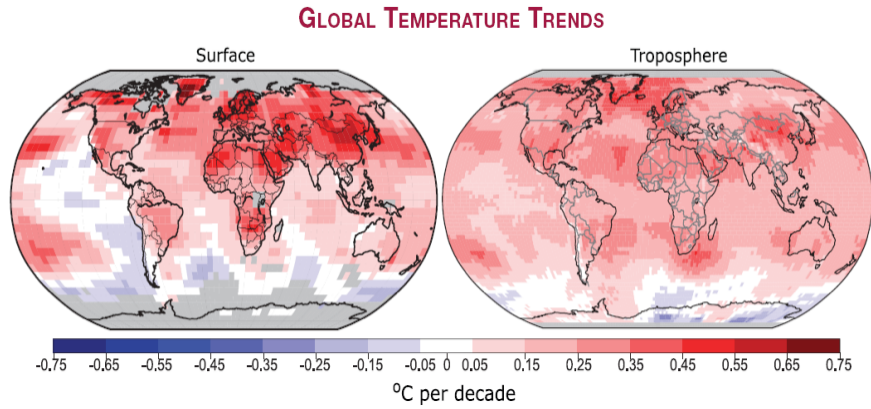
Is the warming "Global"?

IPCC, 2007, WG I, Fig 3.9: Patterns of linear warming trends for the surface air temperature for the periods (top) 1901-2005 and (bottom) 1979-2005.



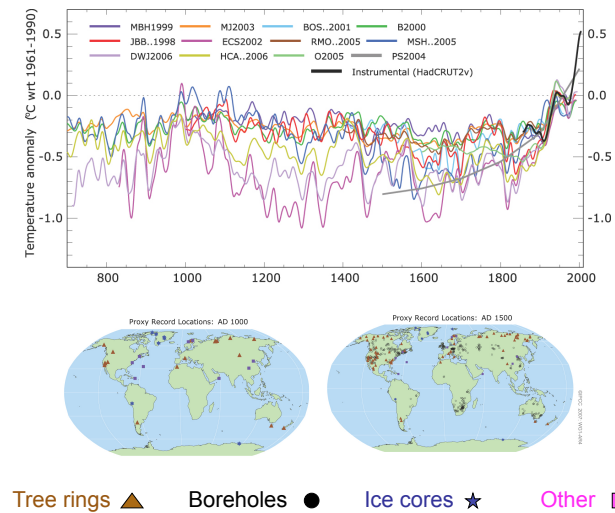
Yes, although enhanced over land and in northern extratropics (as expected)

Warming extends above the surface



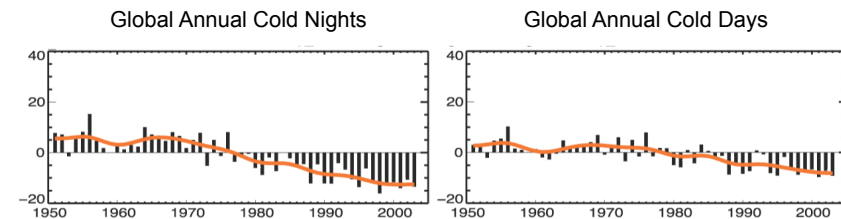
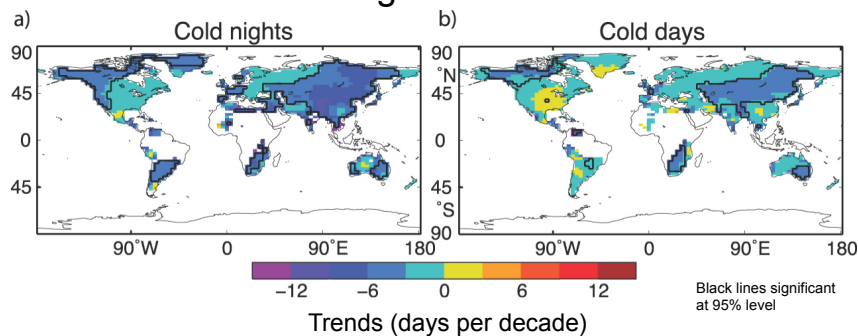
IPCC, 2007, WG I, Fig TS.6: Patterns of linear warming trends over the period 1979-2005 for the surface (right, from thermometers) and lower atmosphere (left, from satellite).

Northern Hemisphere annual average surface temperature

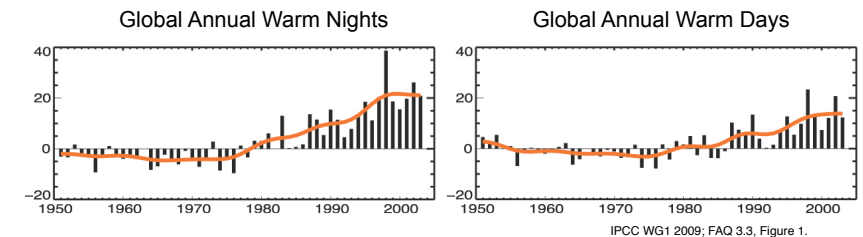
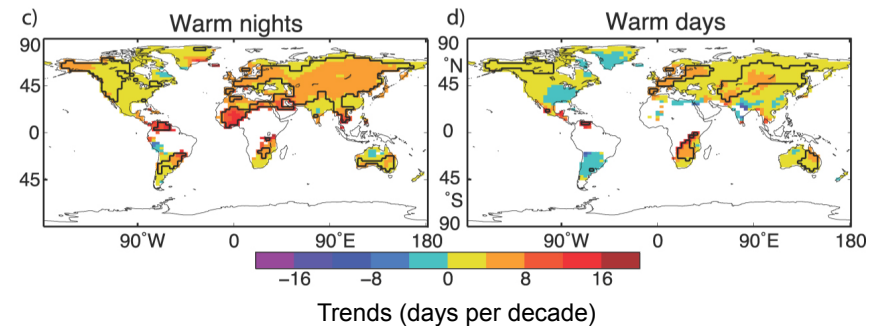


IPCC 2007 TS.20

Decreasing Extreme* Cold

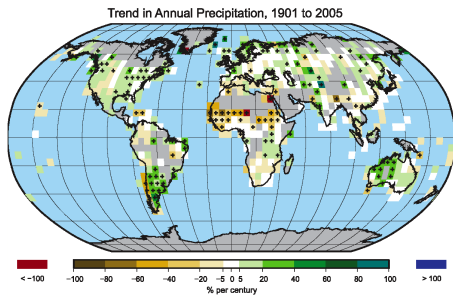


Increasing Extreme* Warmth



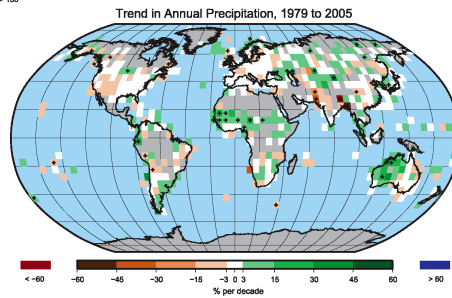
IPCC WG1 2009; FAQ 3.3, Figure 1.

Trends in Annual Land Precipitation

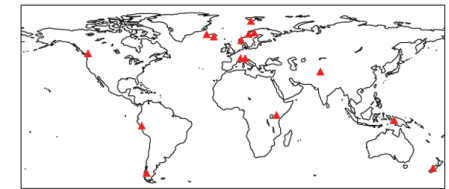
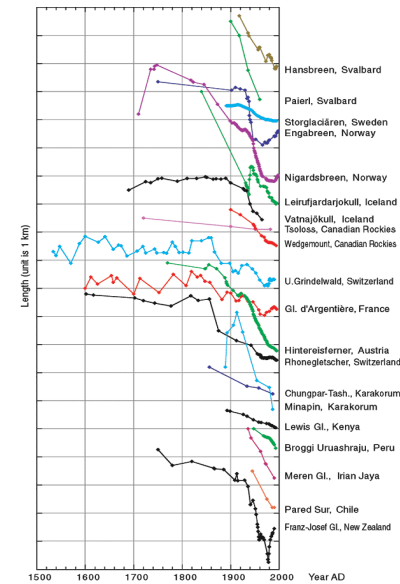


Trend for 1901 to 2005 (left, % per century) and 1979 to 2005 (bottom, % per decade). The percentage is based on the means for the 1961 to 1990 period.

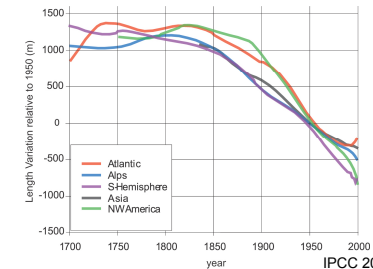
Areas in grey have insufficient data to produce reliable trends. Trends significant at the 5% level are indicated by black + marks.
IPCC WG1 2007 Figure 3.13.



Changes in Glacier Length 1500-2000

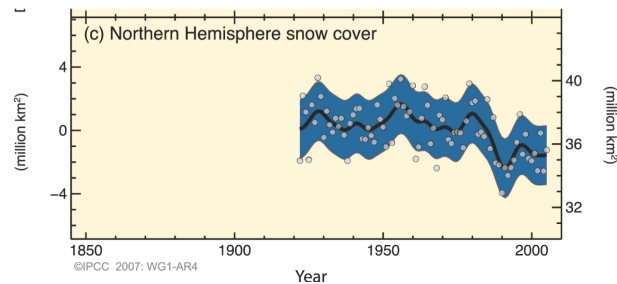


Most glaciers around the world are receding



IPCC 2007 Fig4.13

Northern Hemisphere Snow Cover



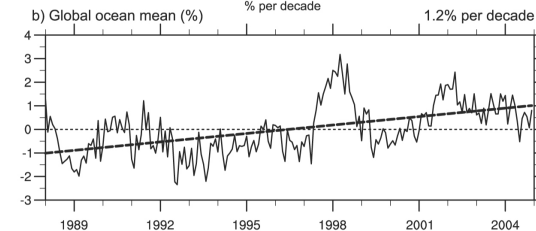
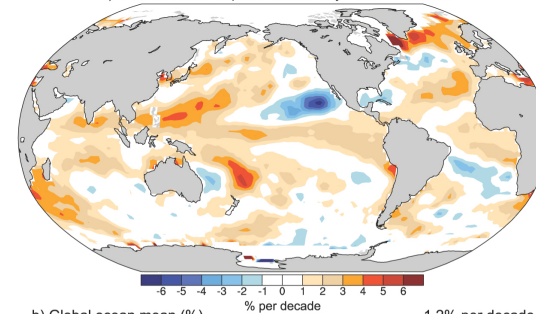
Snow cover has decreased by 7.5% since 1922.

Shaded areas show 95% uncertainty levels.
Zero represents the 1961-1990 average.

IPCC Fig SPM3

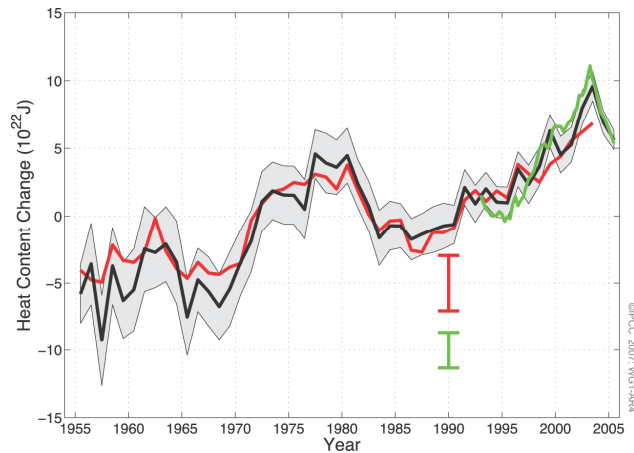
Atmospheric Water Vapor

a) Column Water Vapour, Ocean only: Trend, 1988-2004



IPCC Fig TS.8

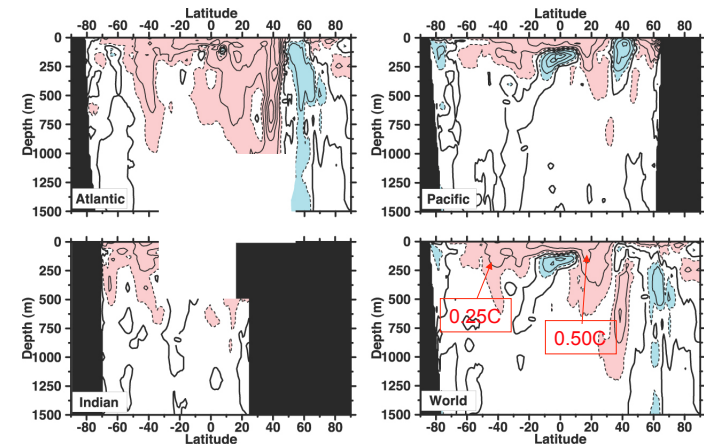
Global Ocean Heat Content (0-700m)



- Solid lines are three independent estimates (95% confidence interval in grey)

IPCC Fig TS.16

Change in upper ocean temperature (1955-2003)



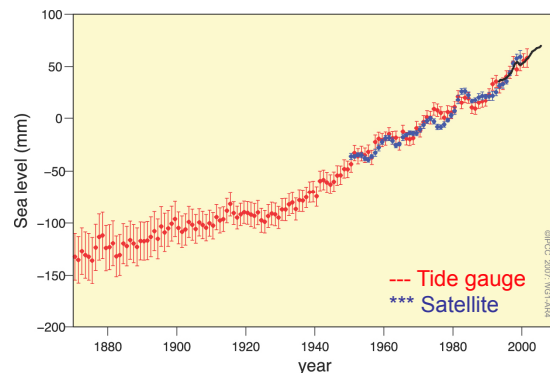
Trends in ocean temperature (averaged east-west) from 1955-2003

warming > 0.125°C

cooling < 0.125°C

IPCC 2007 Fig 5.3

Global Sea Level Rise



- At least half of the rise since 1960 is due to thermal expansion
- The remaining is due to melting glaciers and ice caps

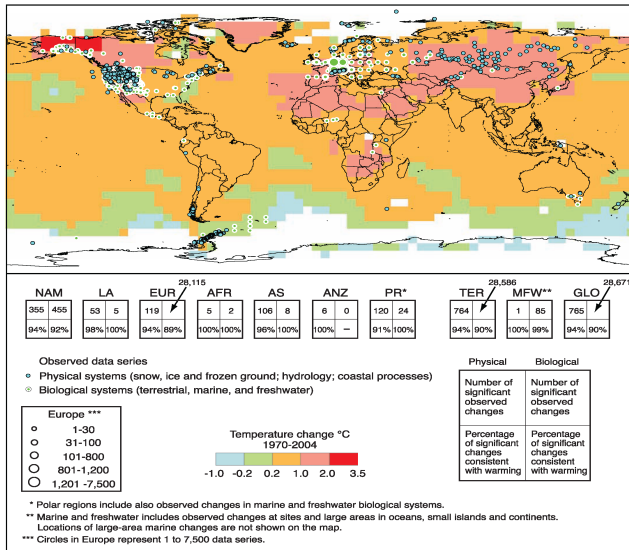
IPCC Fig TS.18

Other signs of (global) warming

- melting mountain glaciers
- rising sea level (due to warming and ice-melt)
- timing of seasonal events
 - e.g. earlier thaws, later frosts
- thinning and disappearing Arctic sea ice
- species range shifts (poleward and upward)
- earlier blossom dates for hundreds of species

Observed changes in physical & biological systems

NAM North America
LA Latin America
EUR Europe
AFR Africa
AS Asia
ANZ Ausie/NZ
PR Polar Regions
TER Terrestrial
MFW Marine/Fresh W
GLO Global (All)



Of the changes seen in
>29,000 data sets, 89%
are in the direction
expected as a response
to warming

IPCC 2007 WG2 Fig TS.1

Other signs of (global) warming

- melting mountain glaciers
- rising sea level (due to warming and ice-melt)
- timing of seasonal events
e.g. earlier thaws, later frosts
- thinning and disappearing Arctic sea ice
- species range shifts (poleward and upward)
- earlier blossom dates for hundreds of species

Every one of these data sets can be questioned.
Taken together, the totality of evidence of global warming
over the past Century is quite convincing.

Trends in 20th Century Climate

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- Warming seen over all land and ocean regions
– More in higher latitudes than in tropics; more over land than water

