Evidence for global warming

**Observed** temperatures and trends
Atmospheric CO₂ and temperature rise

280 ppm

360 ppm
Surface temperature at different latitudes
Observed temperature anomalies  Sep 2009
Winter temperatures since 1880

Greenhouse gases most likely to warm the winter
50 years of Arctic temperatures

The past decade is the warmest in history
2000 years of Arctic temperatures

Start of Industrial Rev.
Total heat content of the Earth

Most of the added heat absorbed by the oceans
Increase in ocean heat content 1951-2005

Figure 4
Change in ocean heat content since 1951 (observations - black line) with uncertainties (in grey shading), relative to the ocean heat content in 1961.
Arctic Sea Surface Temperatures
August 2007 to 2009

August Mean

2007

Alaska

Russia

2008

2009

August Anomaly relative to 1982-2006 mean

T (°C)

-2.5 -2.0 -1.5 -1.0 -0.5 0.5 1.0 2.0 3.0 4.0

NSIDC courtesy Mike Steele, University of Washington
Area of sea ice in the Arctic Ocean

Northern Hemisphere Extent Anomalies Nov 2009

1979-2000 mean = 11.3 million sq km

slope = -4.5(+-1.1) % per decade
Arctic Sea Ice Extent
(Area of ocean with at least 15% sea ice)

Area of Arctic sea ice

Extent (millions of square kilometers)

Jul Aug Sep Oct Nov

2009 2007 1979–2000 Average

National Snow and Ice Data Center, Boulder CO

27 Oct 2009
Green is old ice (multi-season)
Thickness of sea ice in the Arctic Ocean

Median 1981-2000

February 2009
Melting of the Greenland ice cap

- Graph showing maximum melt extent (10^6 km^2) from 1980 to 2000, with a trend line indicating increasing melt.
Mass of Greenland ice cap

Rapidly accelerating
Mass of the Antarctic ice cap

Rapidly accelerating
Glacier ice volume change

Eurasia (Siberia)

Everywhere else
Mass of glaciers worldwide

30 reference glaciers & all glaciers
Acceleration of sea-level rise

Two main factors:
- melting glaciers,
- heating of ocean water
Observed and projected sea-level rise

- Observations from tide gauges
- Projected
Global climate change

The question becomes,

*If this doesn’t convince you, what would?*
To summarize: Global climate change

The important points:

Global warming is REAL

HUMANS have caused this episode of global warming

Action MUST be taken ... quickly

The potential effects are many and negative

The solutions will not be painless

The consequences of inaction will be worse

Most solutions REQUIRE changing habits

We’re all in this together
Interview with a former health-insurance executive

Bill Moyers Journal
PBS  July 2009

Wendell Potter tells Bill Moyers why he left his successful career as the head of Public Relations for CIGNA, one of the nation's largest health insurers.

"I didn't intend to [speak out], until it became really clear to me that the industry is resorting to the same tactics they've used over the years, and particularly back in the early '90s, when they were leading the effort to kill the Clinton plan."
Temperature anomaly, high latitude North

2000-2009 is even warmer