Science as a solution to global problems

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3RD Cycle Degrees, Bologna Process
Helsinki 30 September, 2008

Aerosols in the Atmosphere: from the Ozone Hole to Climate Change

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Aerodyne Research

Boston College

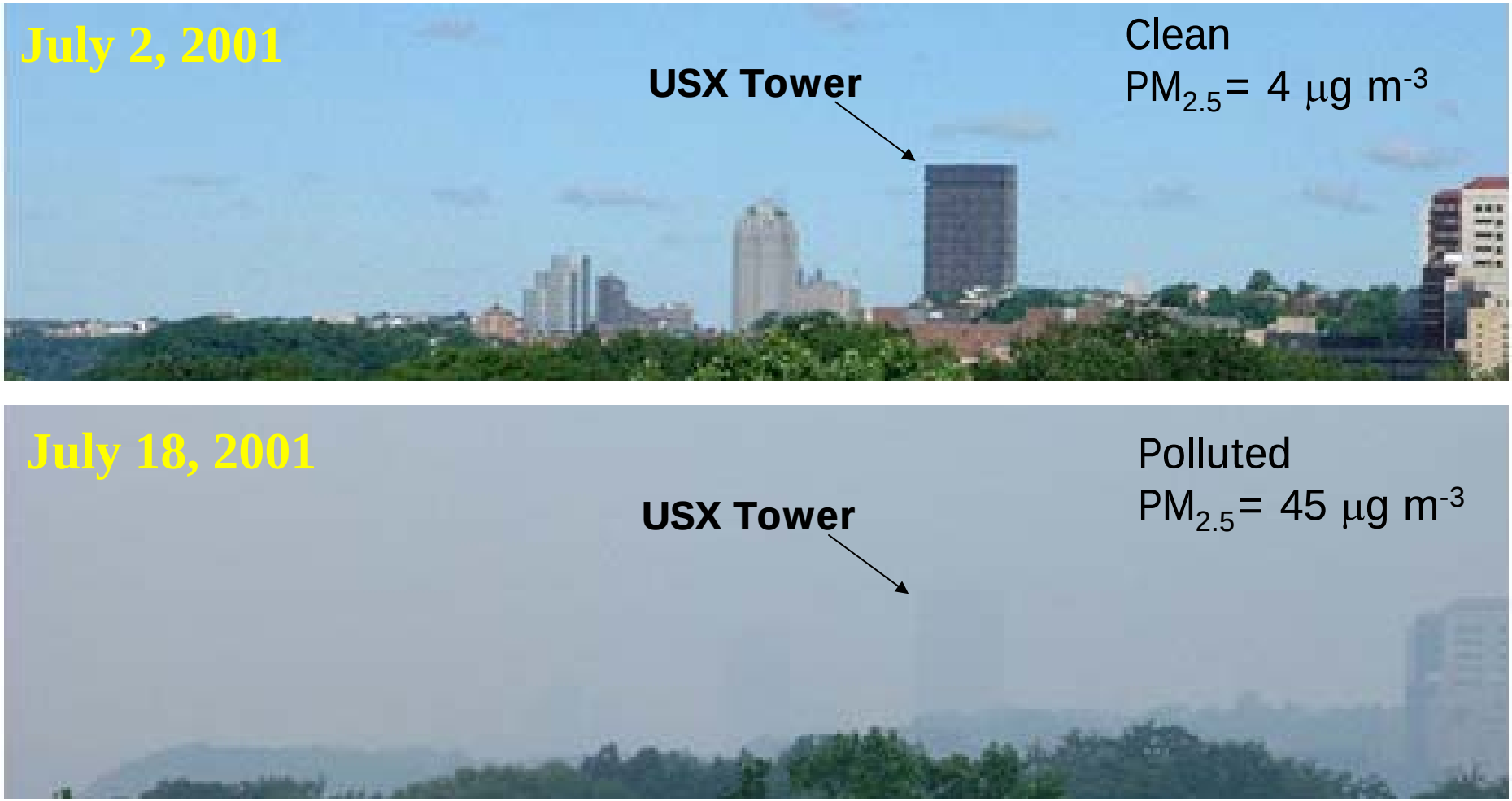
University of Colorado

Harvard University

University of Manchester

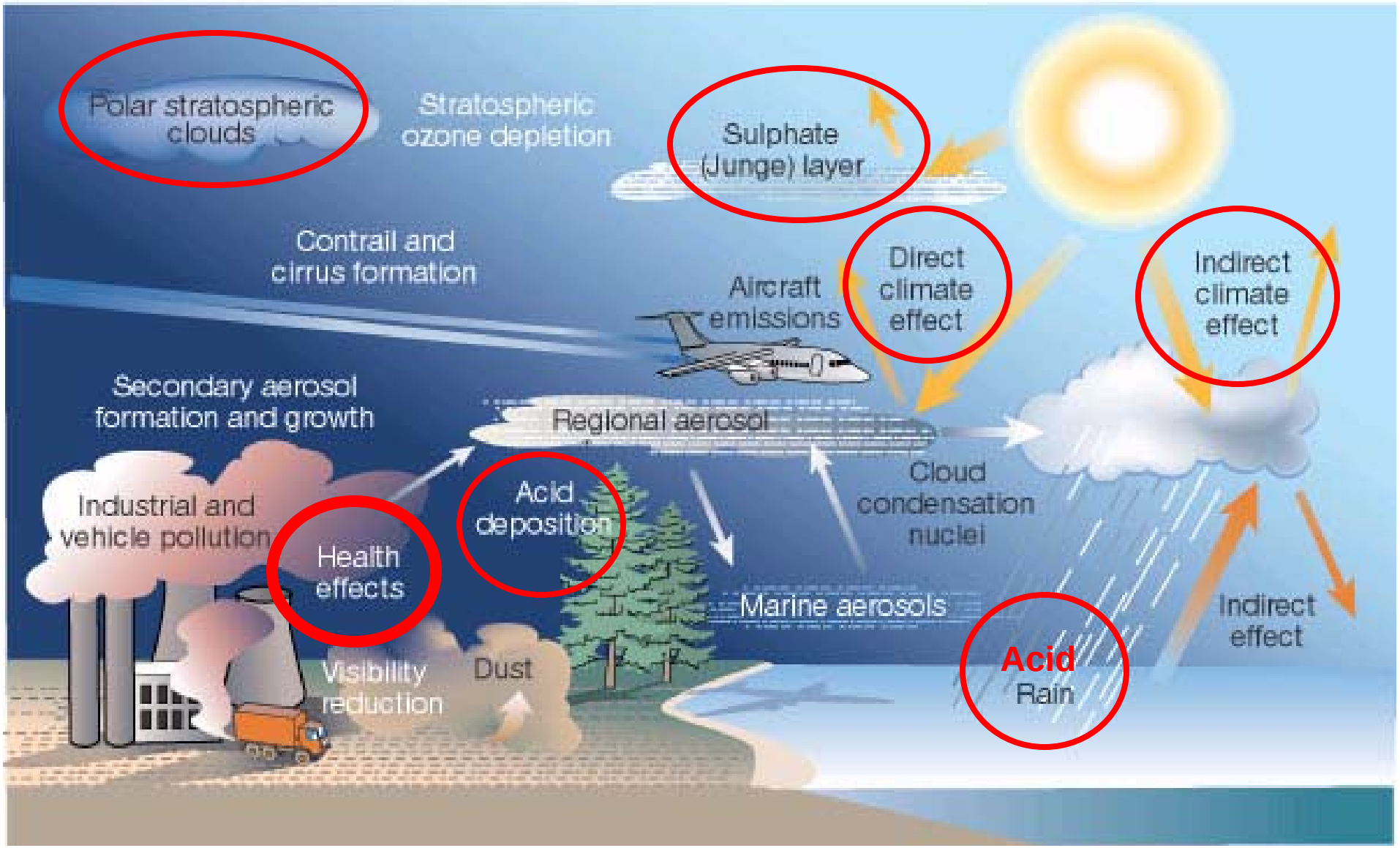
Peking University

Aerosol Impact on Visibility



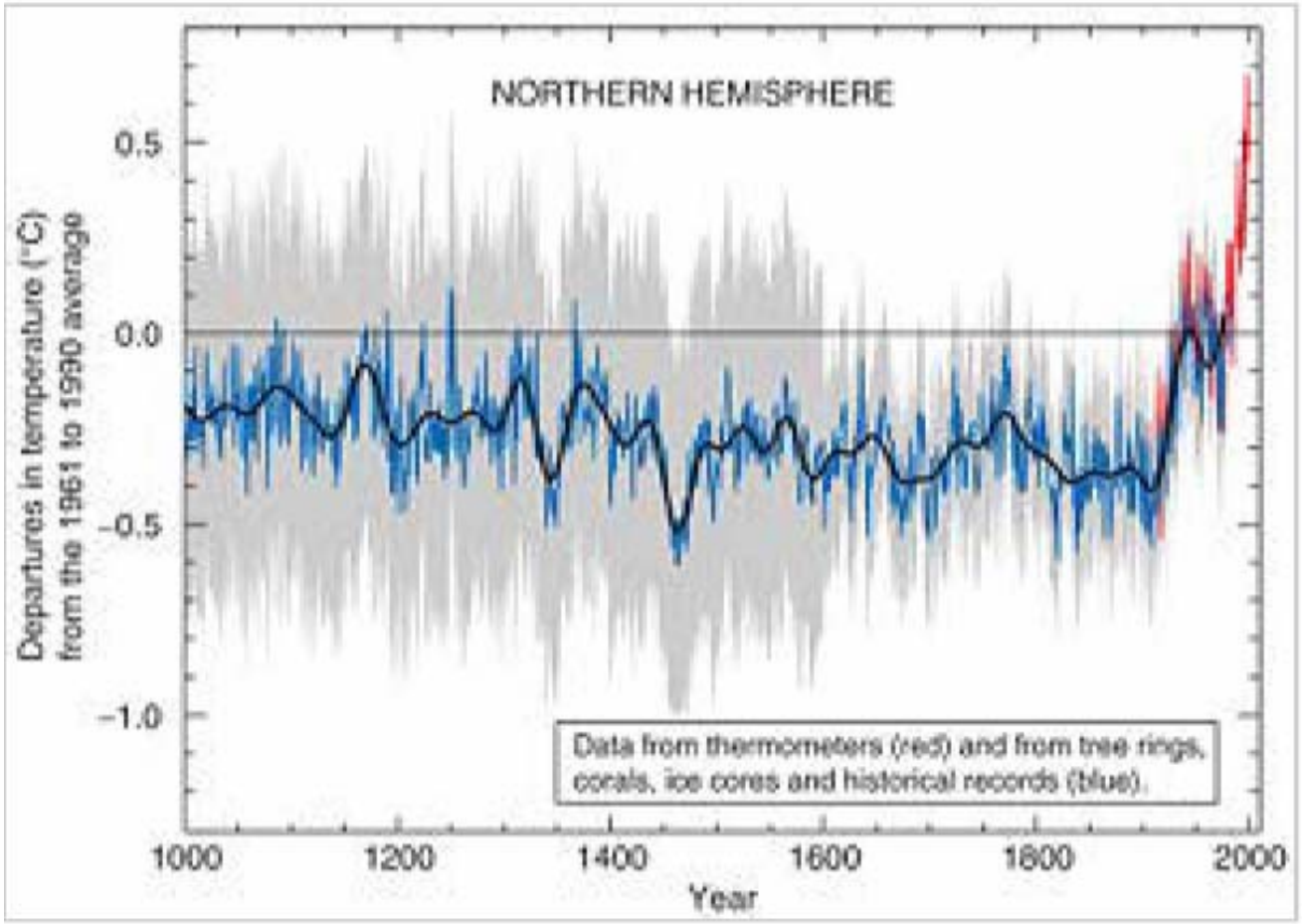
Taken from same location, same time of day in Pittsburgh (at PAQS main site)

Aerosols in the Atmosphere



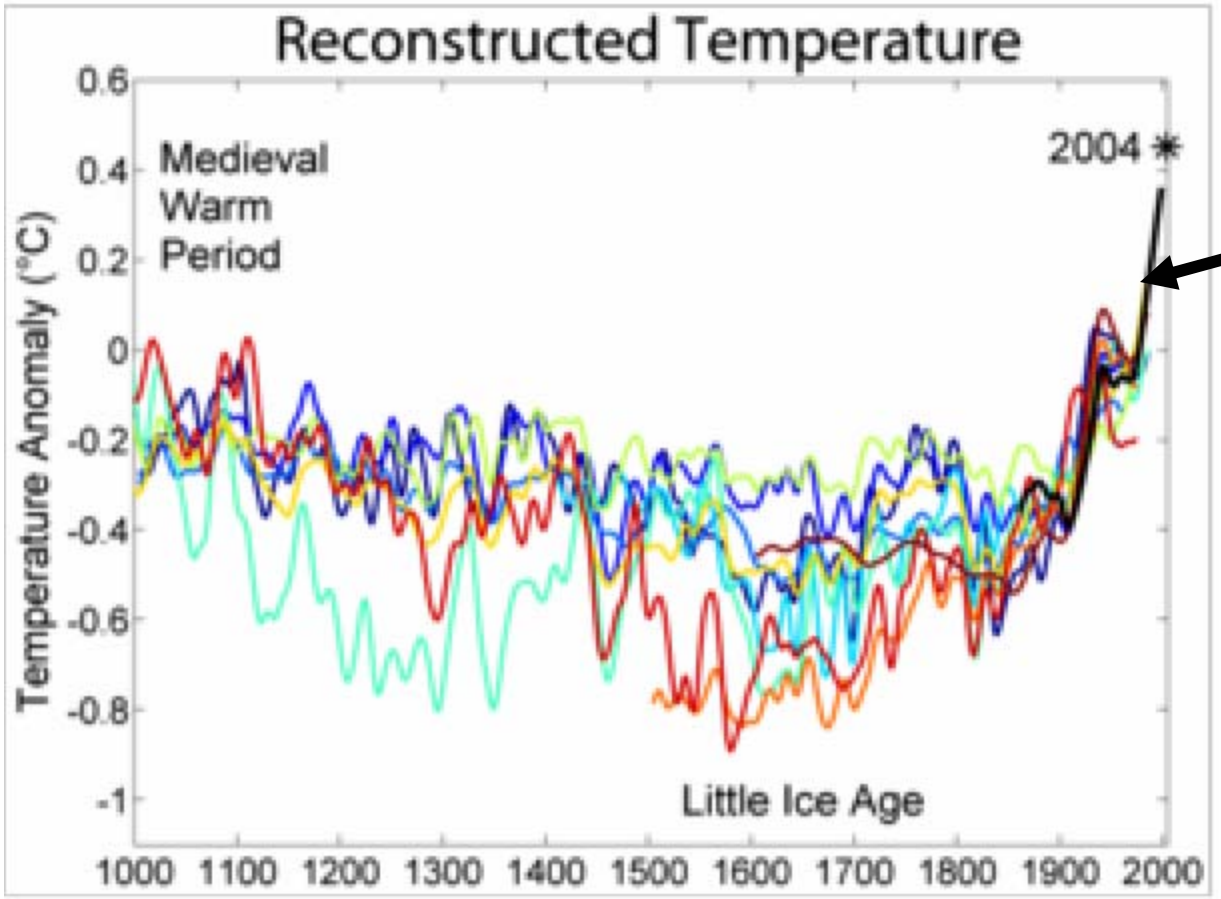
C.E. Kolb, Nature, 2002

Average Global Temperature: *the last 1000 years*



The " Hockey Stick "

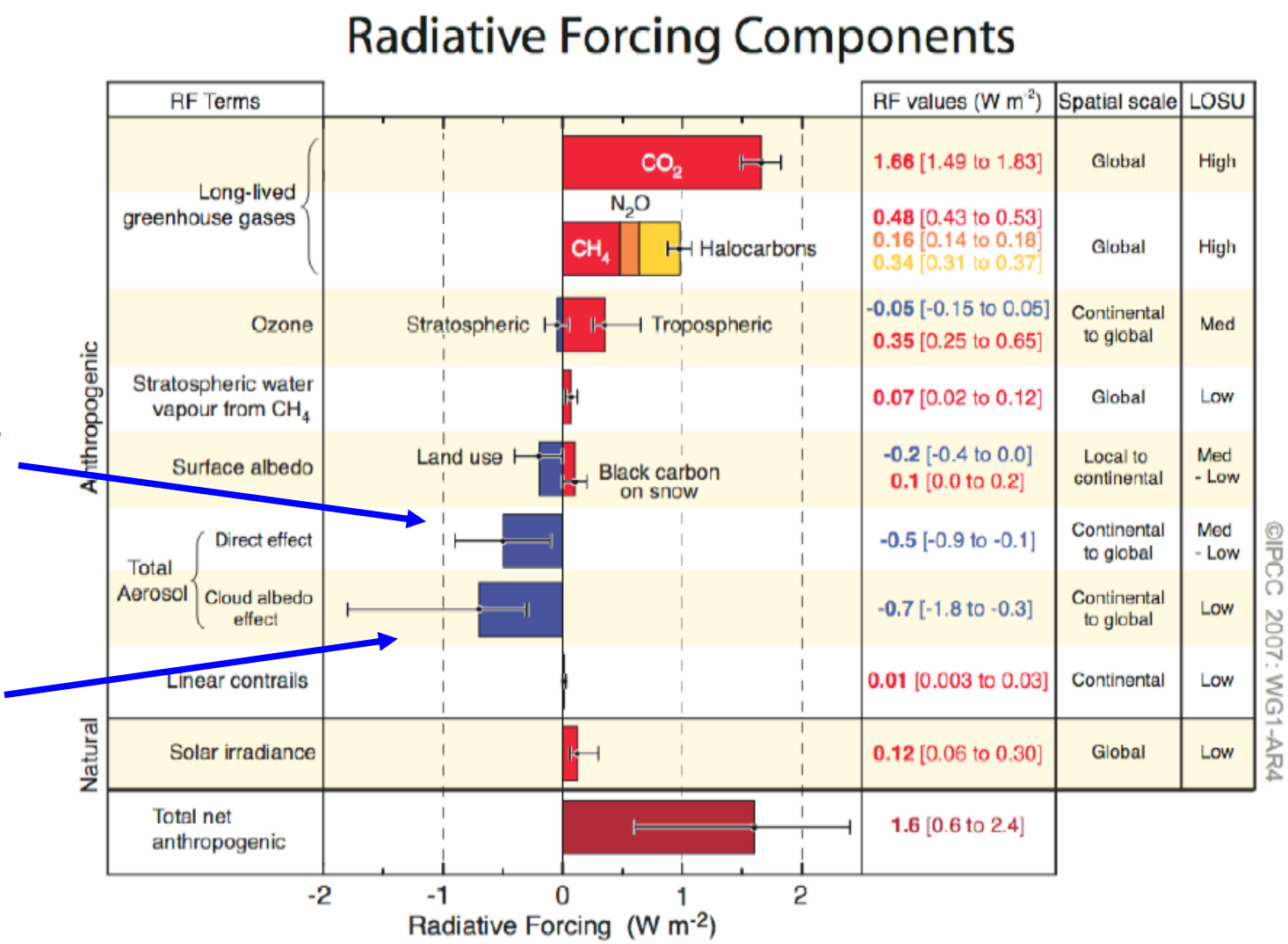
Historic temperatures reconstructed by many international research groups



Measurement last 200 years

Tree rings, ice cores, other proxies

Climate Change 2007: The Physical Science Basis

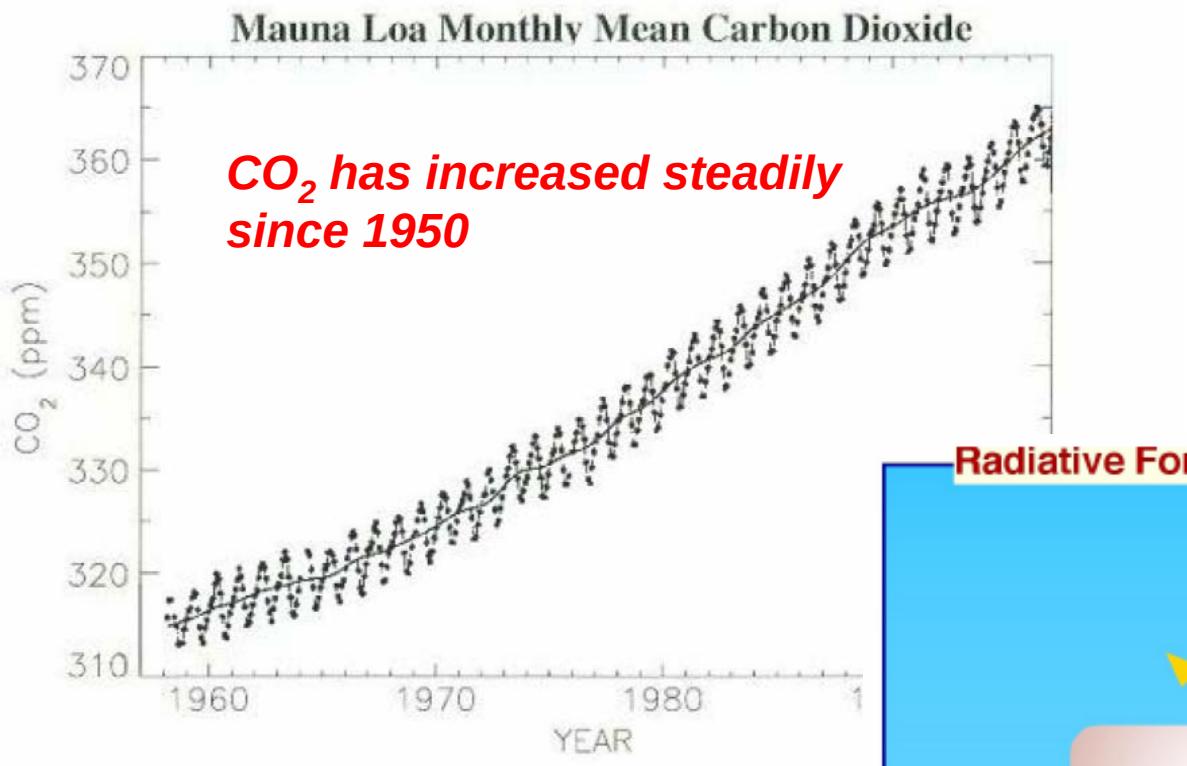


Direct Aerosol Scattering

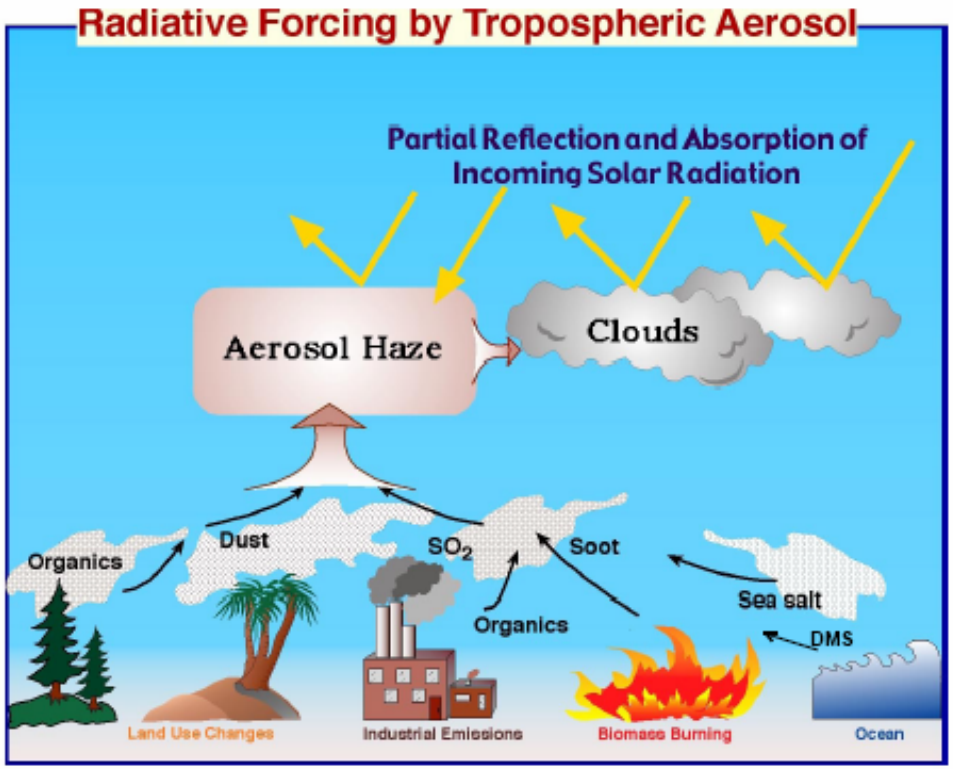
Indirect Cloud Effects

Aerosols are "saving us" from global warming

Greenhouse gases *vs* Aerosol "dimming" of the sun

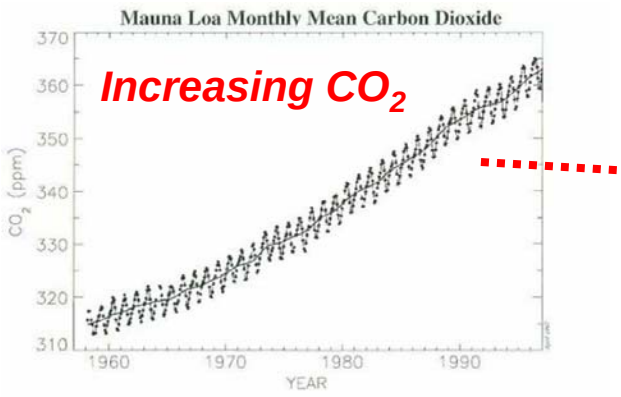


CO_2 has increased steadily since 1950

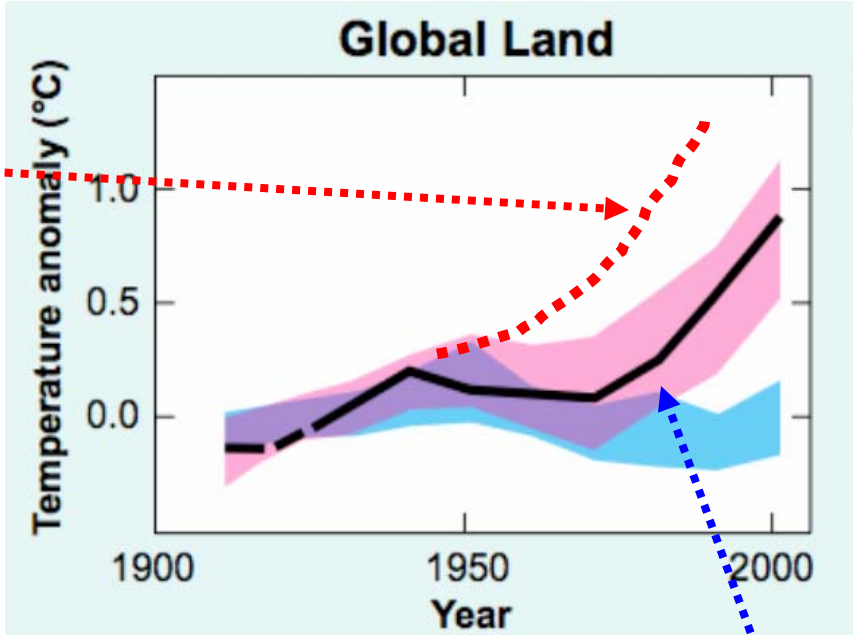


Aerosol emissions have also increased since 1950

1995: Tropospheric Aerosol Effects "fix" global warming models

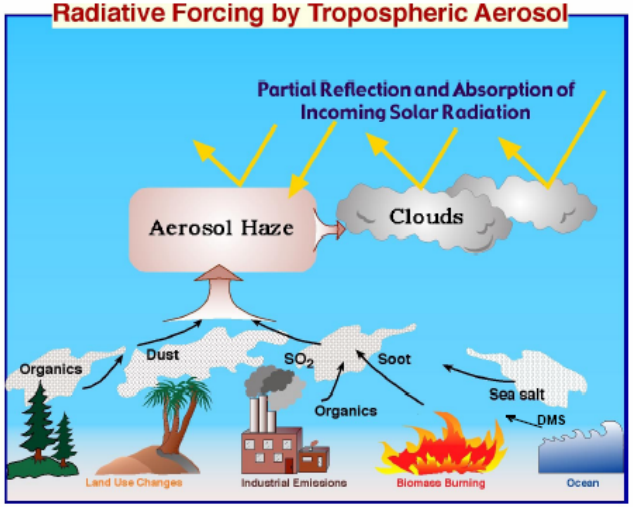


Increasing CO_2

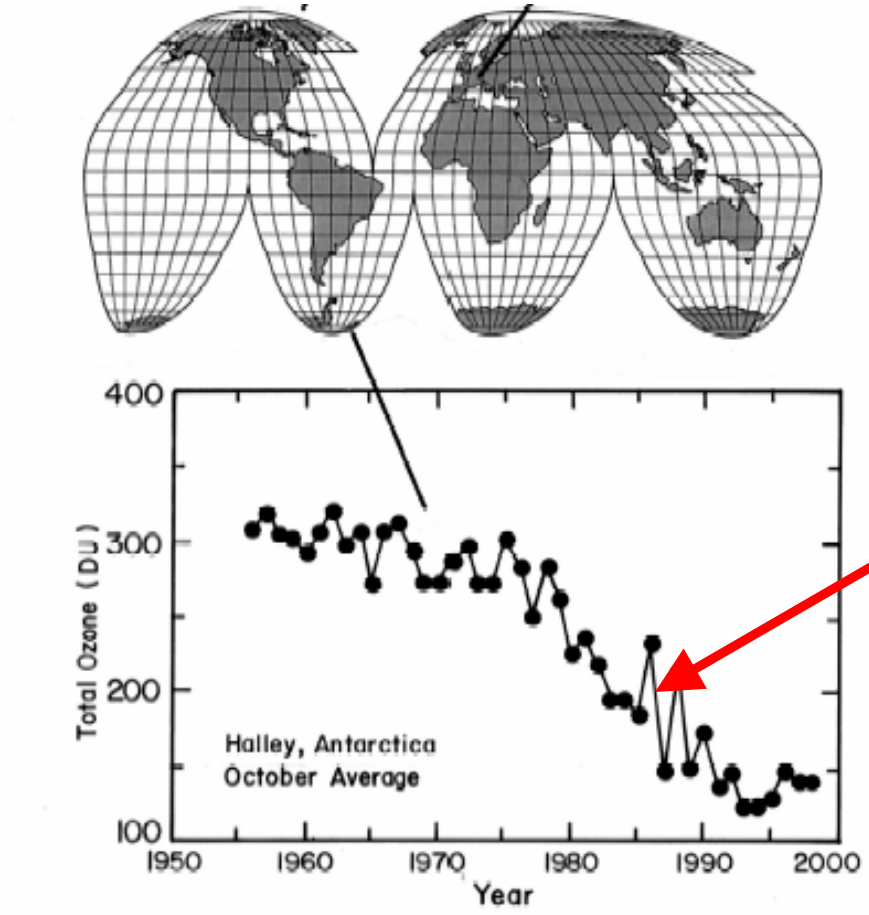


Lag in observed temperature rise

Aerosol dimming



Aerosols are indeed "saving us"



Global effect

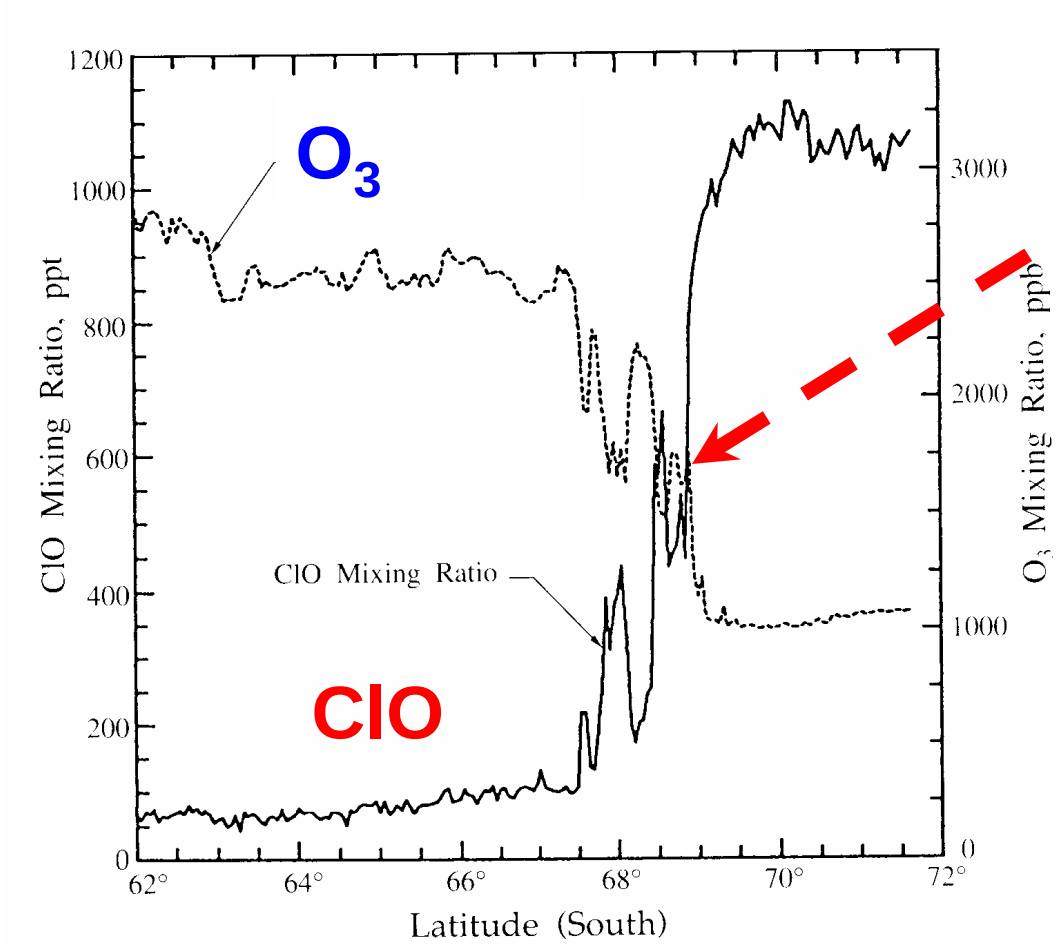
Why ??

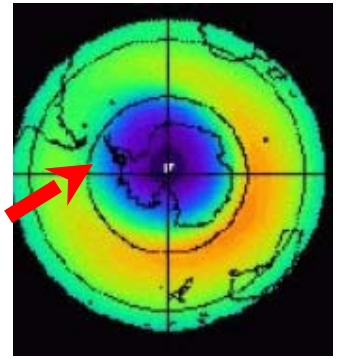
In 1985, the ozone hole was "discovered"
(i.e. published)

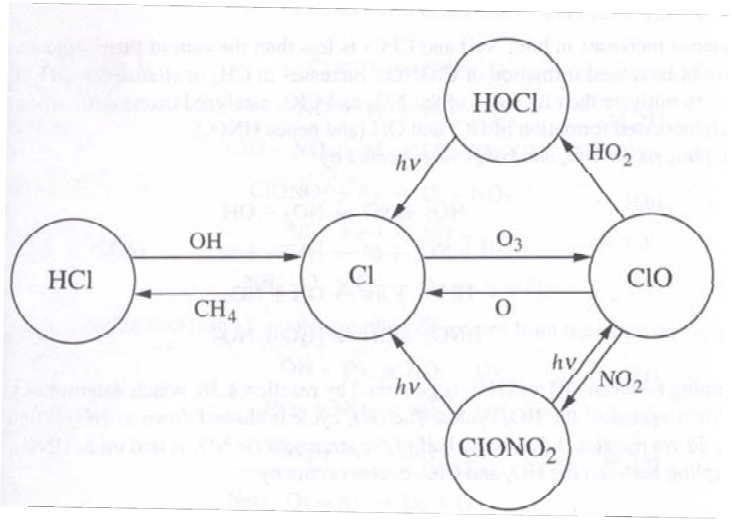
Ozone sondes,
Halley bay, since 1954

Joe Farman et al, 1985

1987: NASA ER-2 Flies to South Pole







Polar Stratospheric Clouds (PSCs)

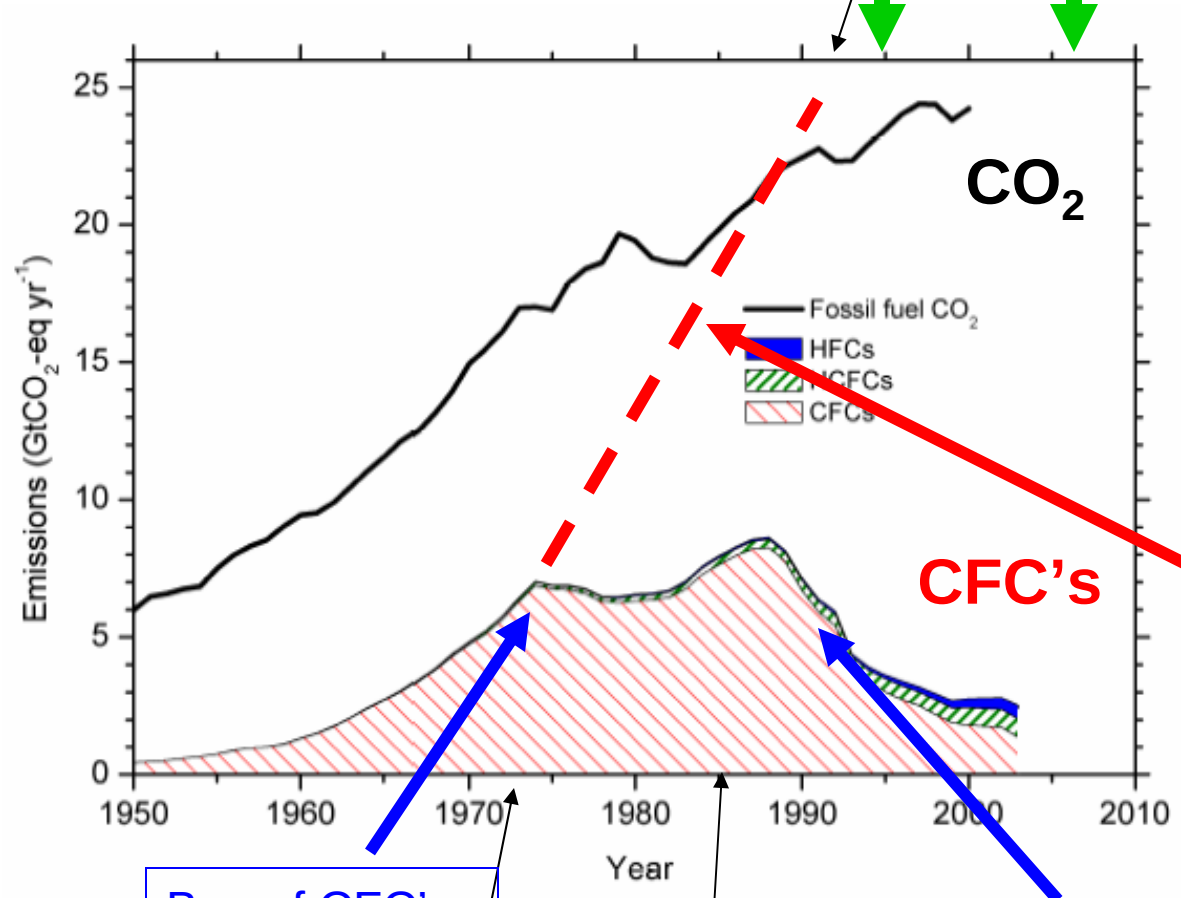
Anti-correlation of O_3 and ClO

as predicted by Molina and Rowland, 1974

Green house gases

(Kyoto Protocol)
1992

Nobel Prizes



FUTURE CO_2 ???

NO CFC Restrictions

Ban of CFC's in spay cans

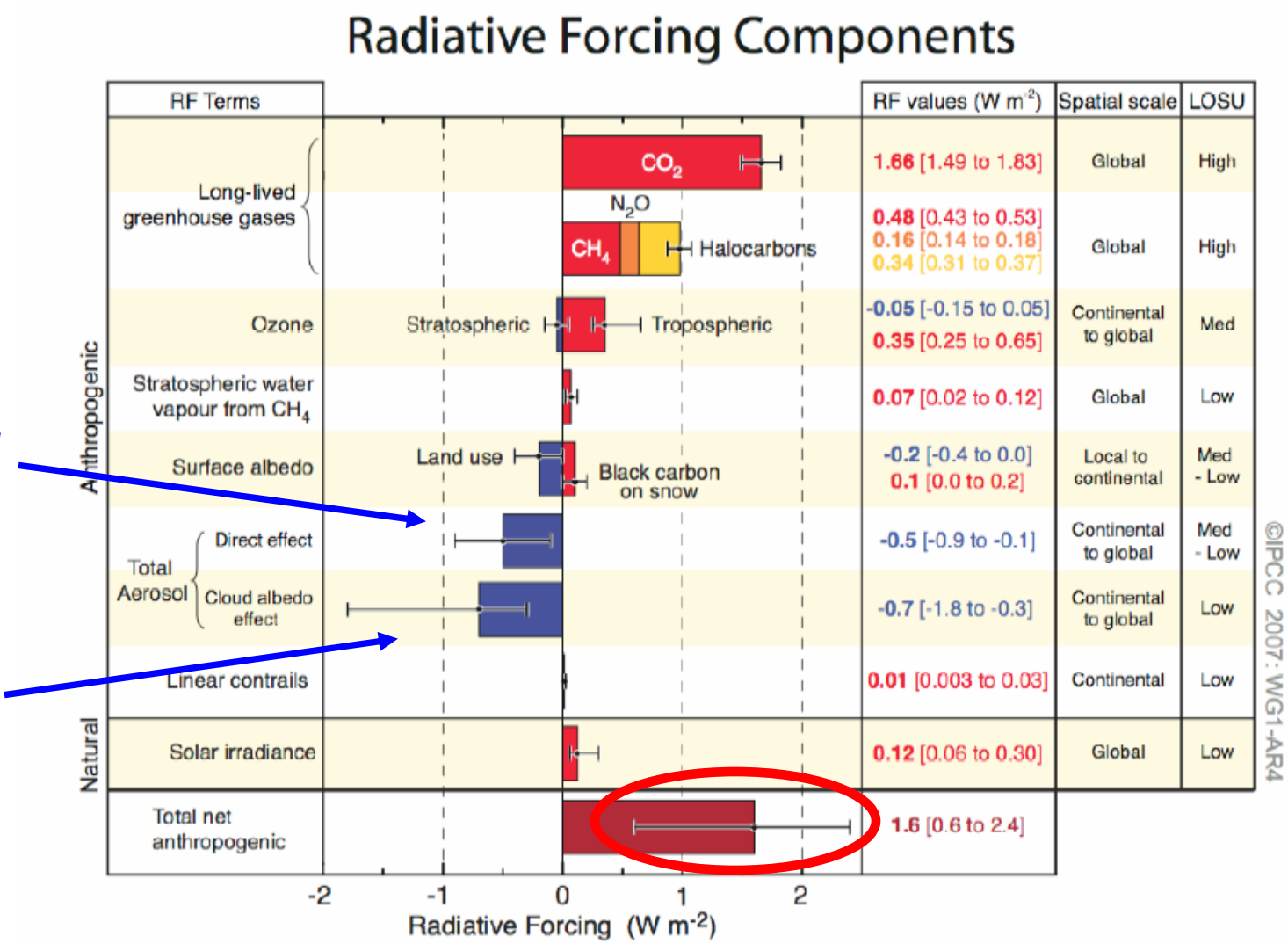
Molina & Rowland (1974)

Ozone Hole (1985)

Complete CFC Ban

Montreal Protocol

Climate Change 2007: The Physical Science Basis



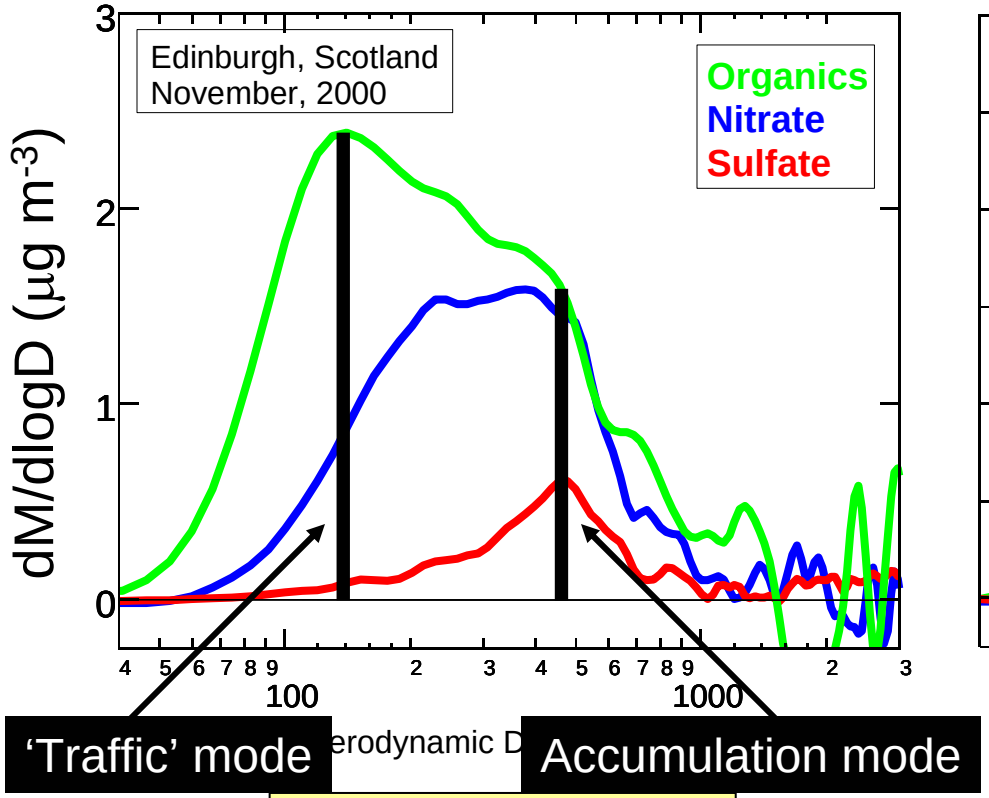
Direct Aerosol Scattering

Indirect Cloud Effects

Most uncertainty associated with aerosol effects

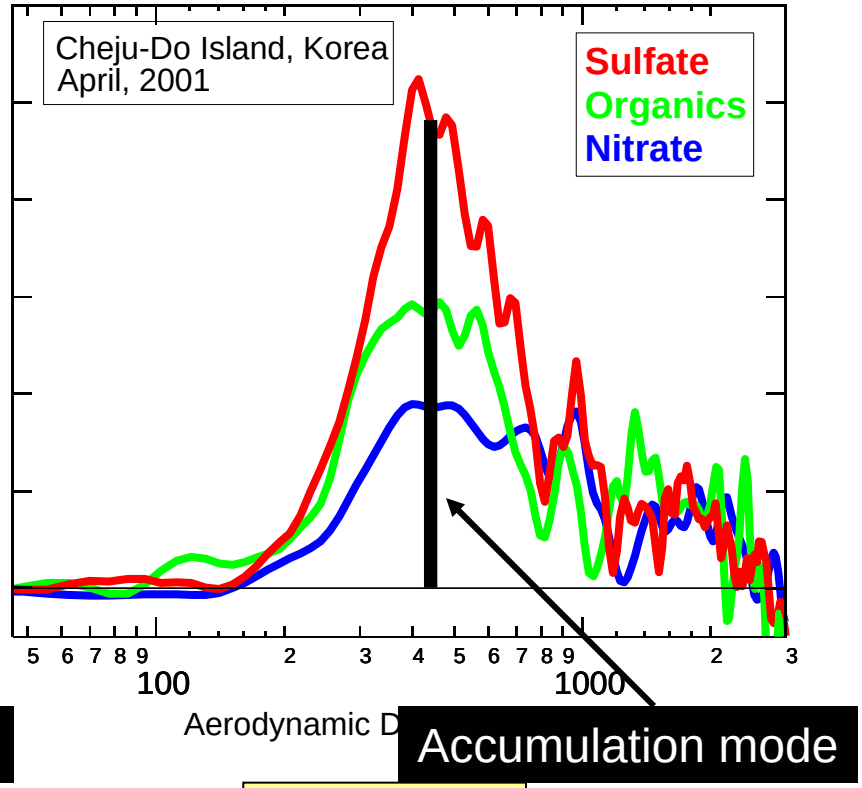
Observed *Mass* Distributions

Urban Site *Bi-modal*
Local Sources



Scotland *SASUA-3*

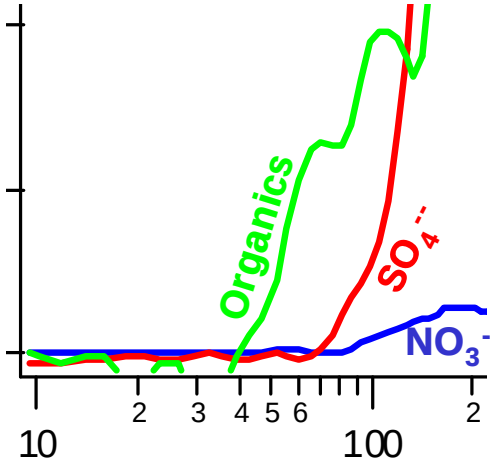
Remote Site *Mono-modal*
Aged-Transported



ACE ASIA

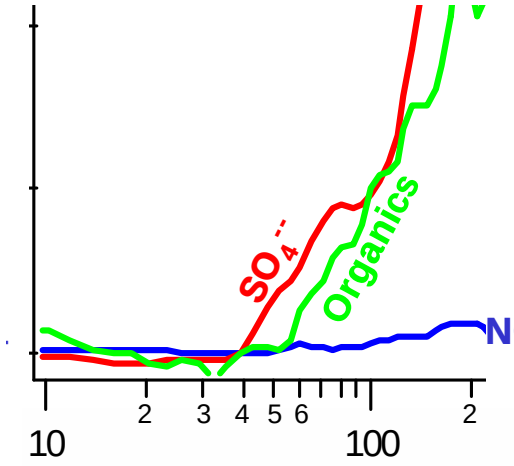
Allan, Alfarra et al. (U. Manchester)

Why am I here?



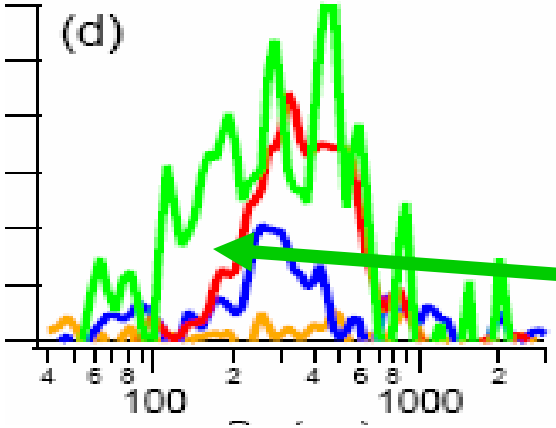
2001:

Diesel Soot



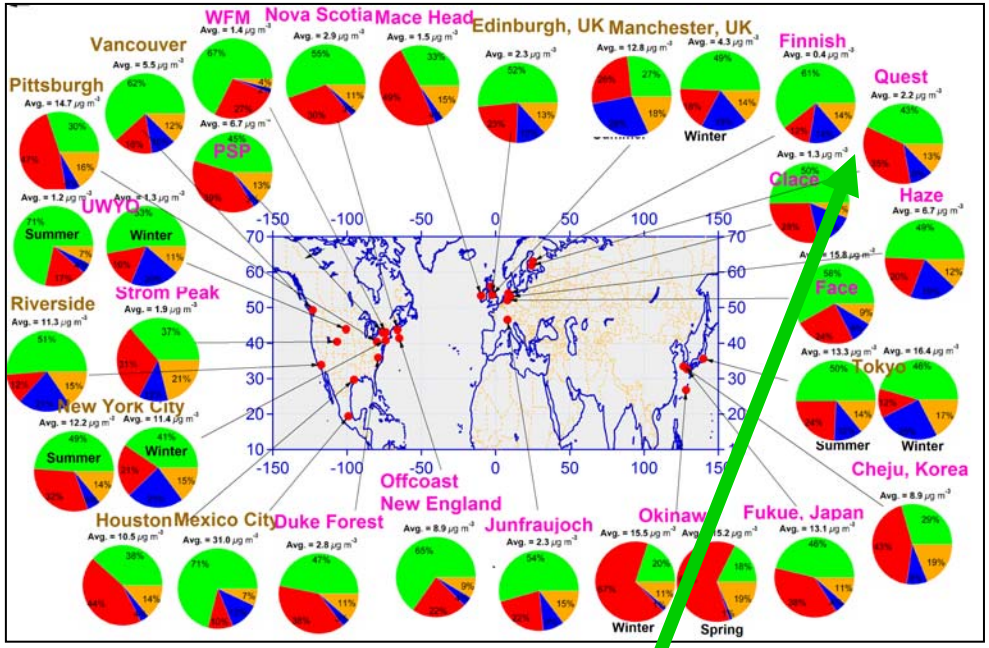
2002:

Anthropogenic Sulfate



2003:

“Natural” Biogenic Carbon

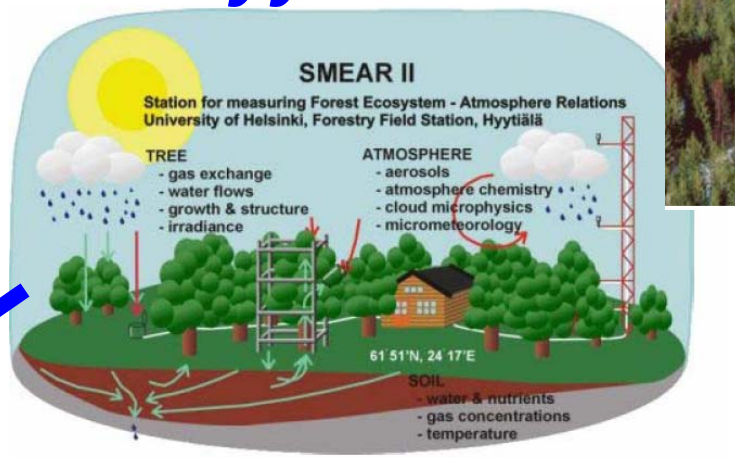


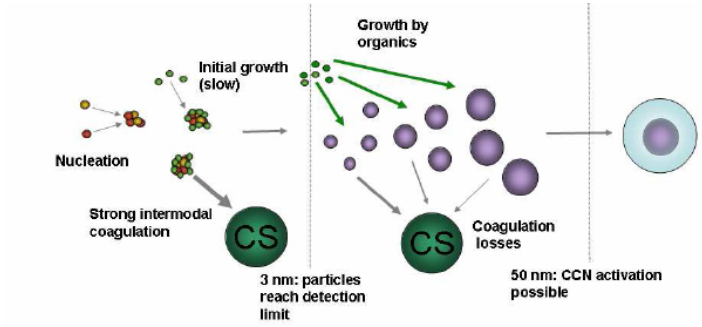
Global Aerosol Budget ?

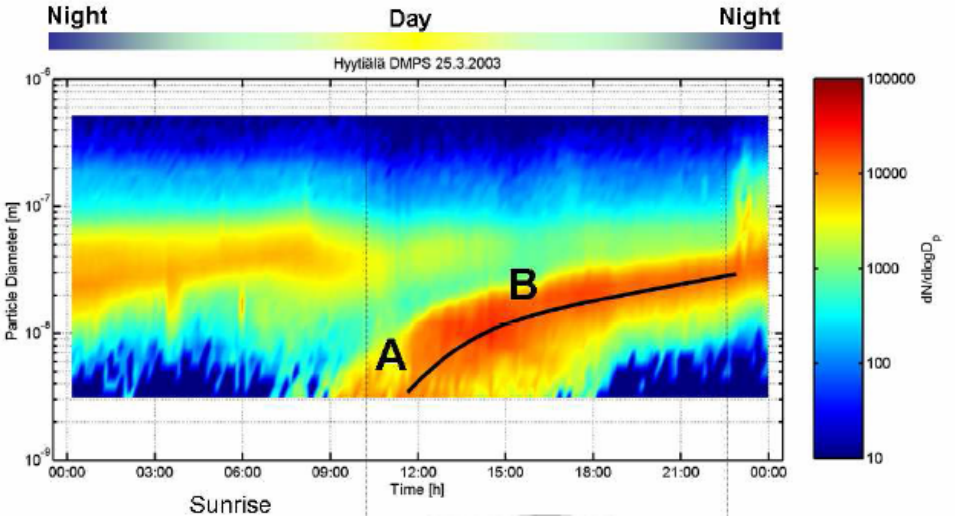
FINLAND

Why I wanted to come

Hyytiälä







"perfect banana curve"

How did I get here?

FiDiPro Professor: Dr Douglas Worsnop, Aerodyne Research Inc. (USA)
Dr Douglas Worsnop is regarded as a world-leading scientist in the field of atmospheric aerosols. He is especially experienced in conducting complex field experiments.

Research project: The project studies the importance of aerosol particles on climate change and on human health, with particular focus on the effect of biogenic aerosols on global aerosol load. Despite considerable efforts to analyse the chemical compounds behind formation and growth of freshly produced aerosol particles,

How I really got here ….

University of Helsinki

Prof. Markku Kulmala

Prof. Timo Vesala

Prof. Kaarle Hämeri

University of Kuopio

Prof. Kari Lehtinen

Prof. Ari Laaksonen

Finnish Meteorological Institute

Dr. Yrjö Viisanen

Dr. Risto Hillamo

Why I am really here ….

Thank You