Observational constraints on the first indirect aerosol effect

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Acknowledgements

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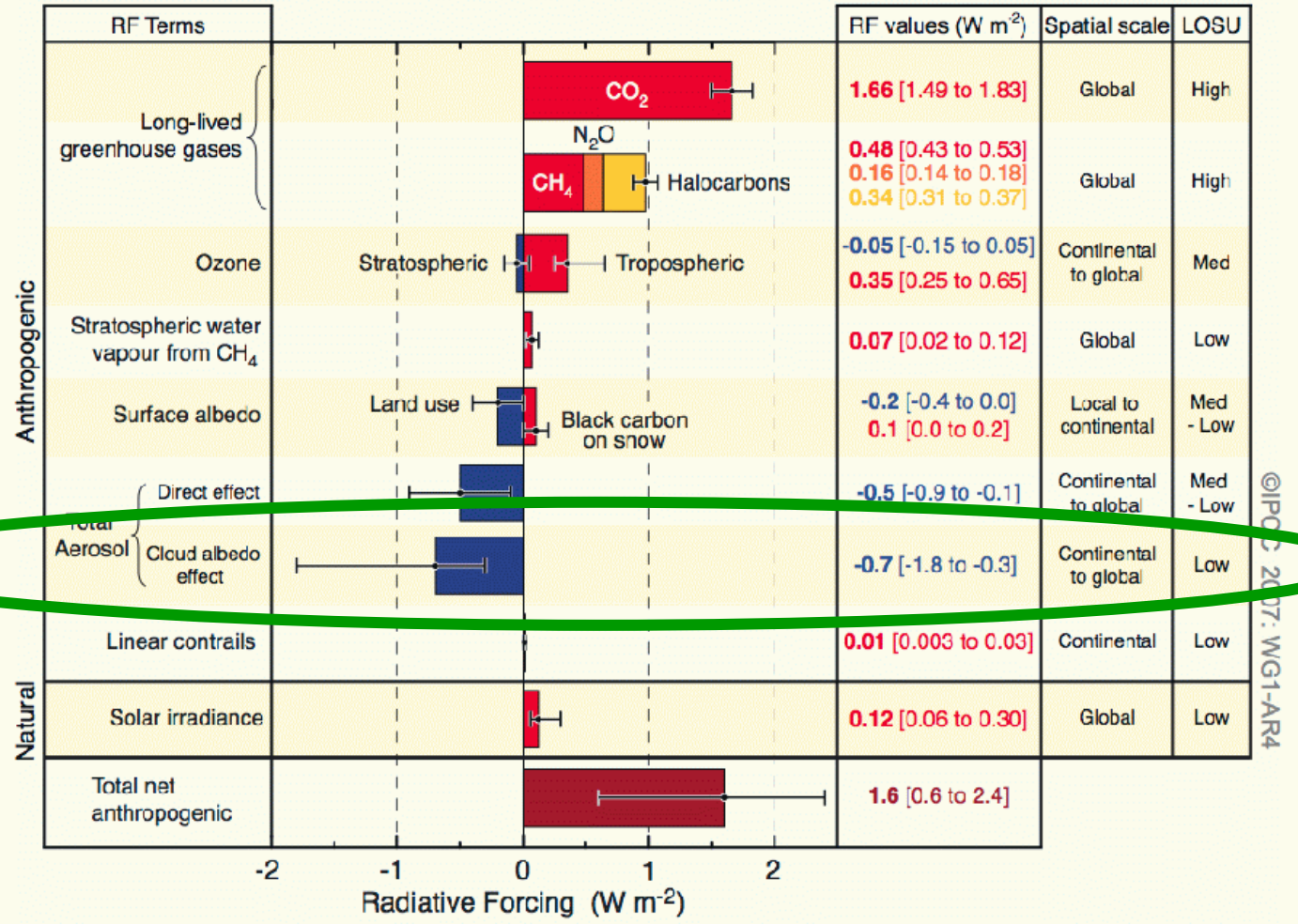
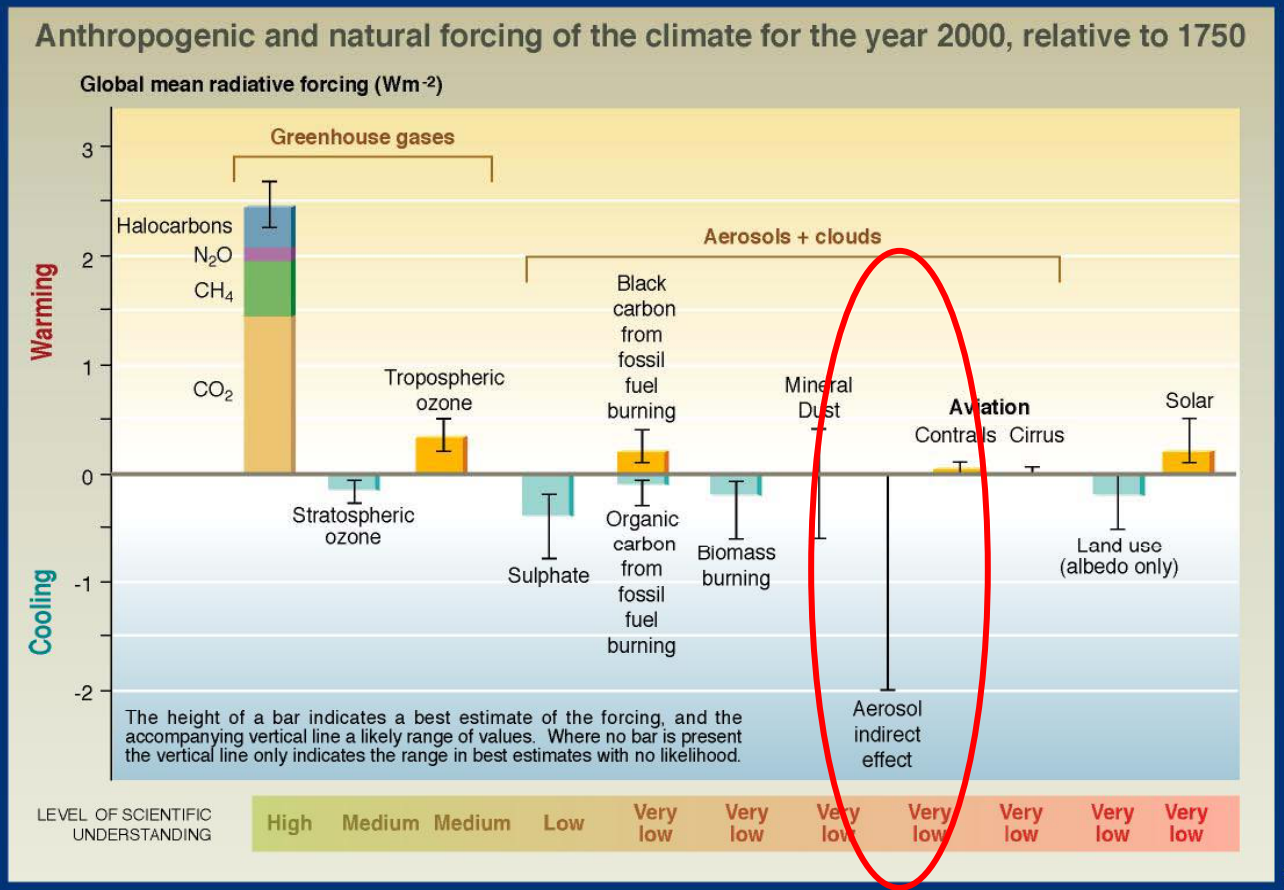
Chris O'Dell	UW-Madison	Diurnal cycle of LWP
Amato Evan	UW-Madison	Diurnal cycle of CF
Brent Maddux	UW-Madison	} Data
Lori Borg	UW-Madison	} Data

Radiative Forcing Components



IPCC 2007



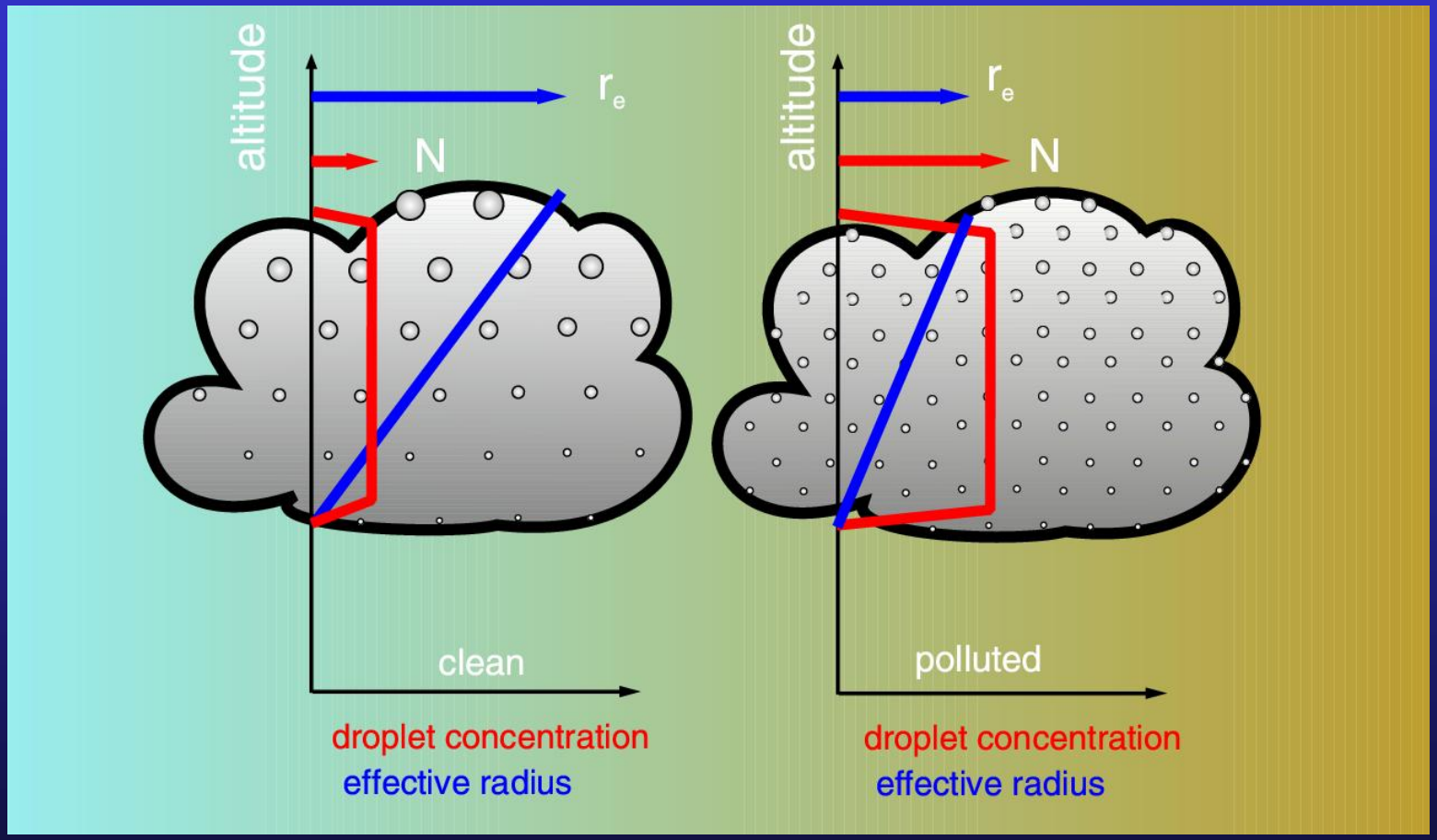
SYR - FIGURE 2-2

IPCC | INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

WMO UNEP

IPCC 2001

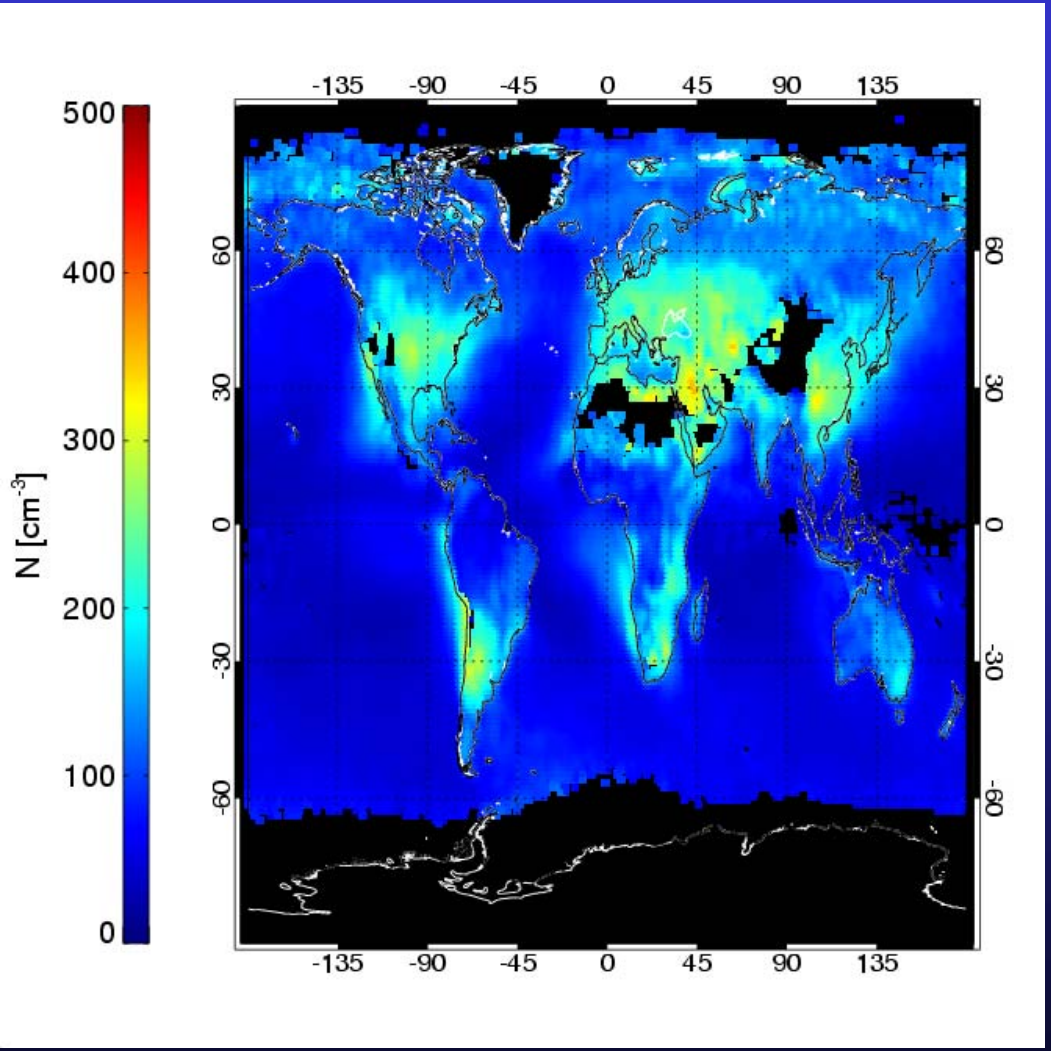
Microphysical changes due to pollution



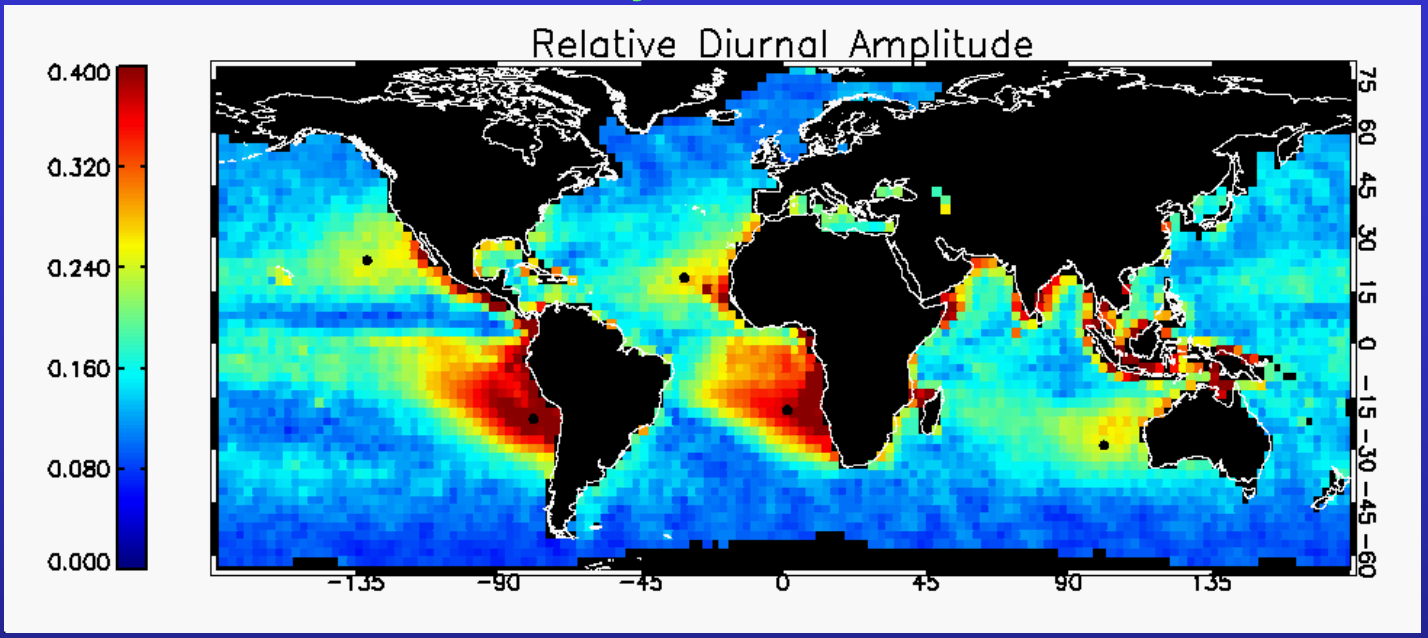
Data

- Cloud liquid water path diurnal cycle (O'Dell et al., 2007, J Climate, in press)
- Cloud fraction diurnal cycle (ISCCP)
- Cloud droplet number concentration (CDNC) (MODIS, Bennartz, 2007, JGR)
- Aerosol & fine mode fraction (used as proxy for natural background fraction of CDNC)
-

Cloud droplet number concentration from MODIS

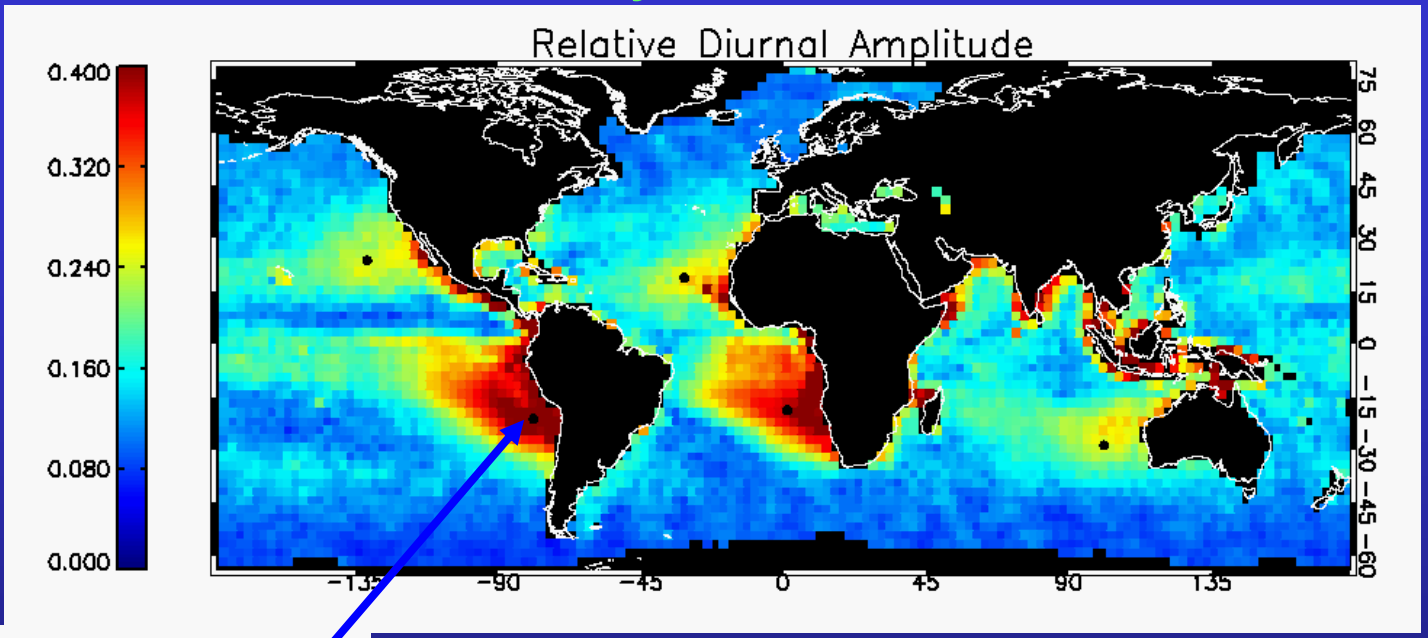


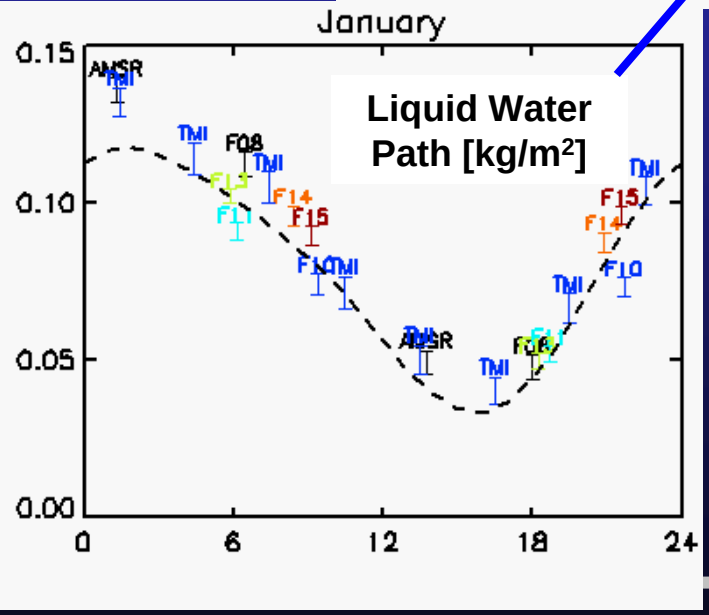
The diurnal cycle of clouds



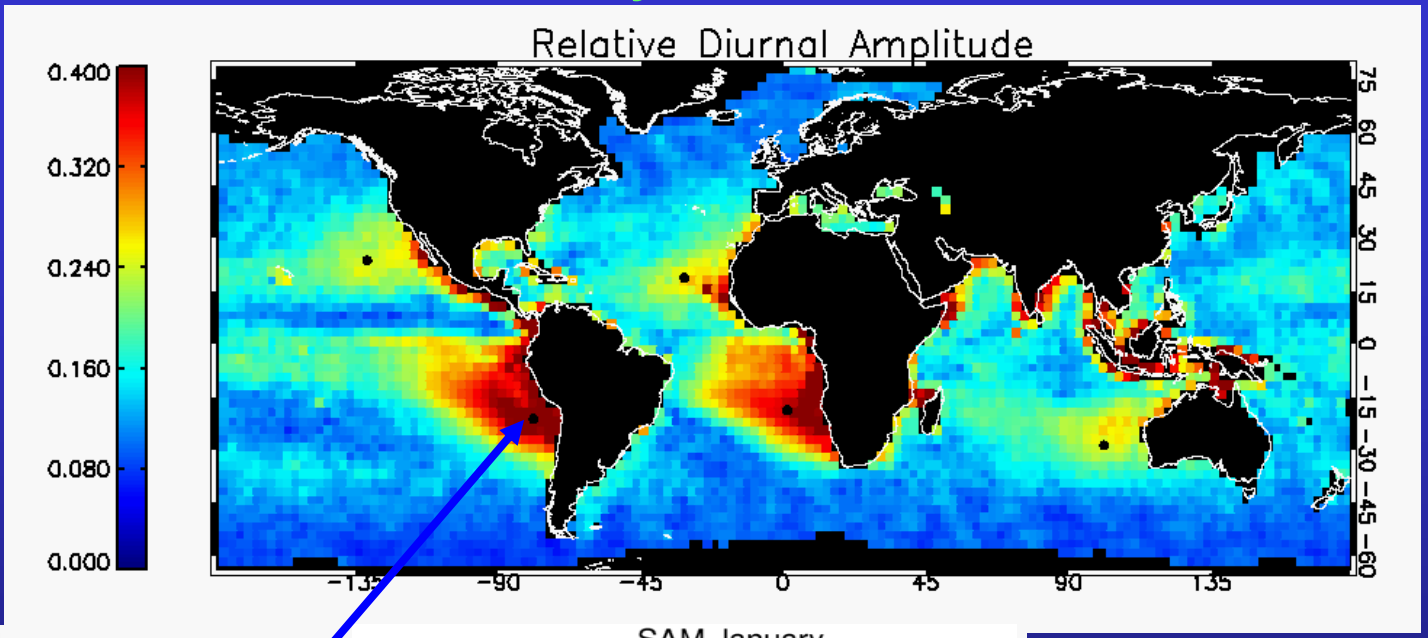
Local Time [hours]

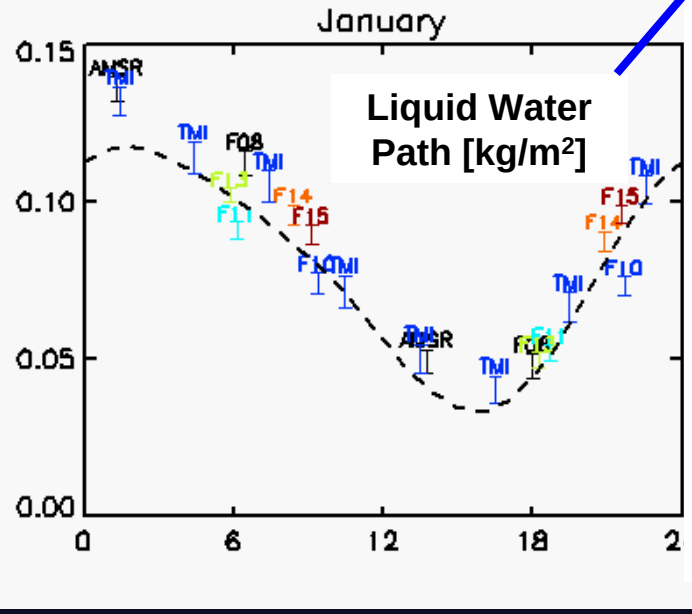
The diurnal cycle of clouds

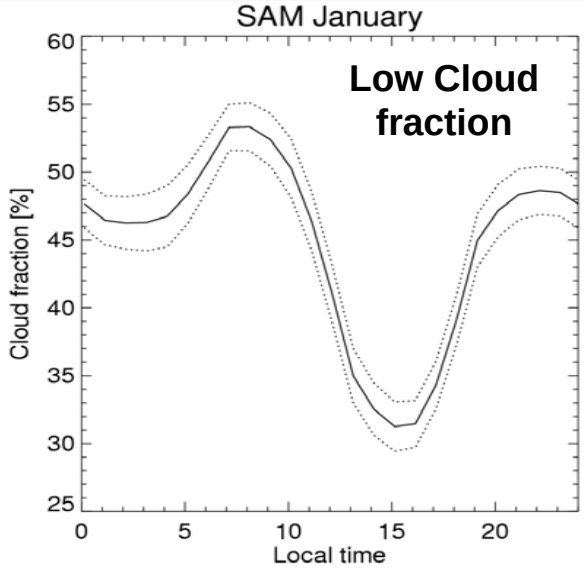




The diurnal cycle of clouds

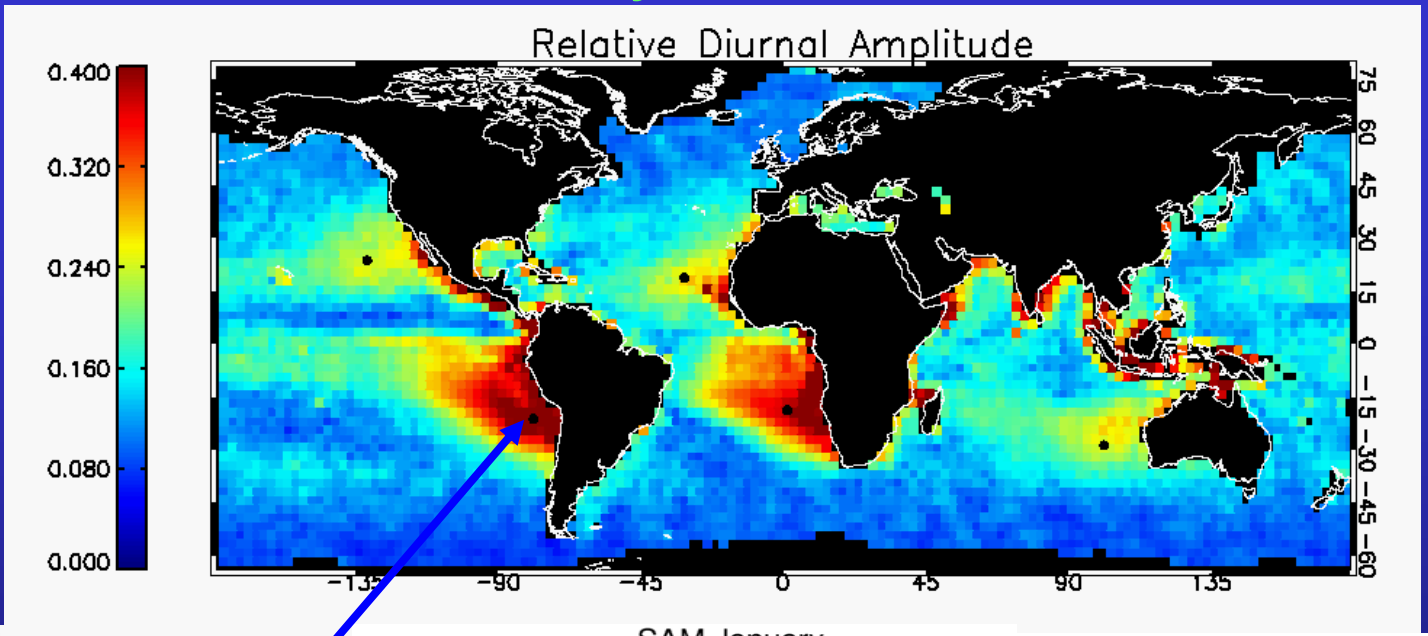


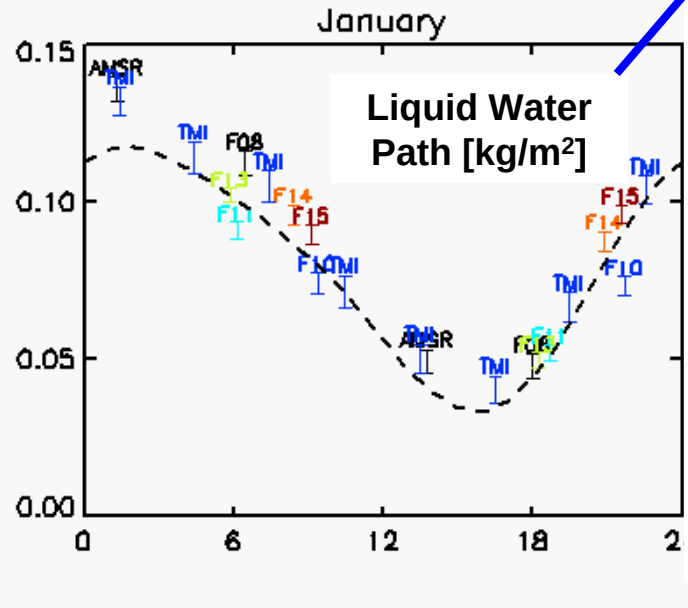


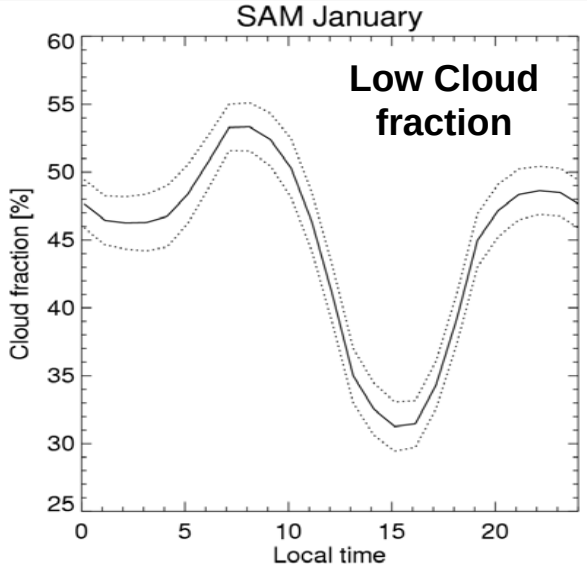


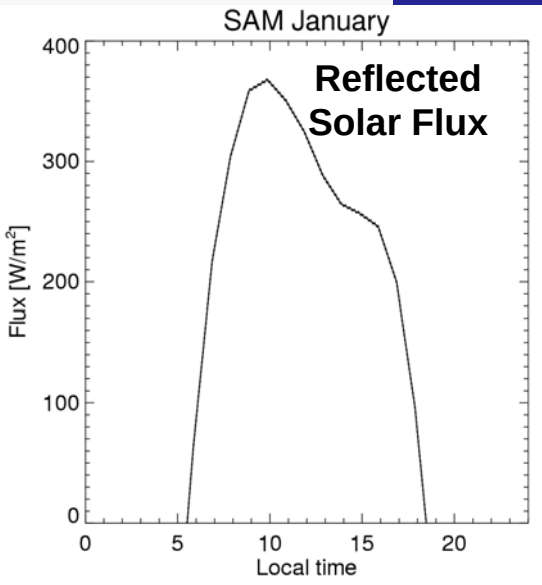
Local Time [hours]

The diurnal cycle of clouds



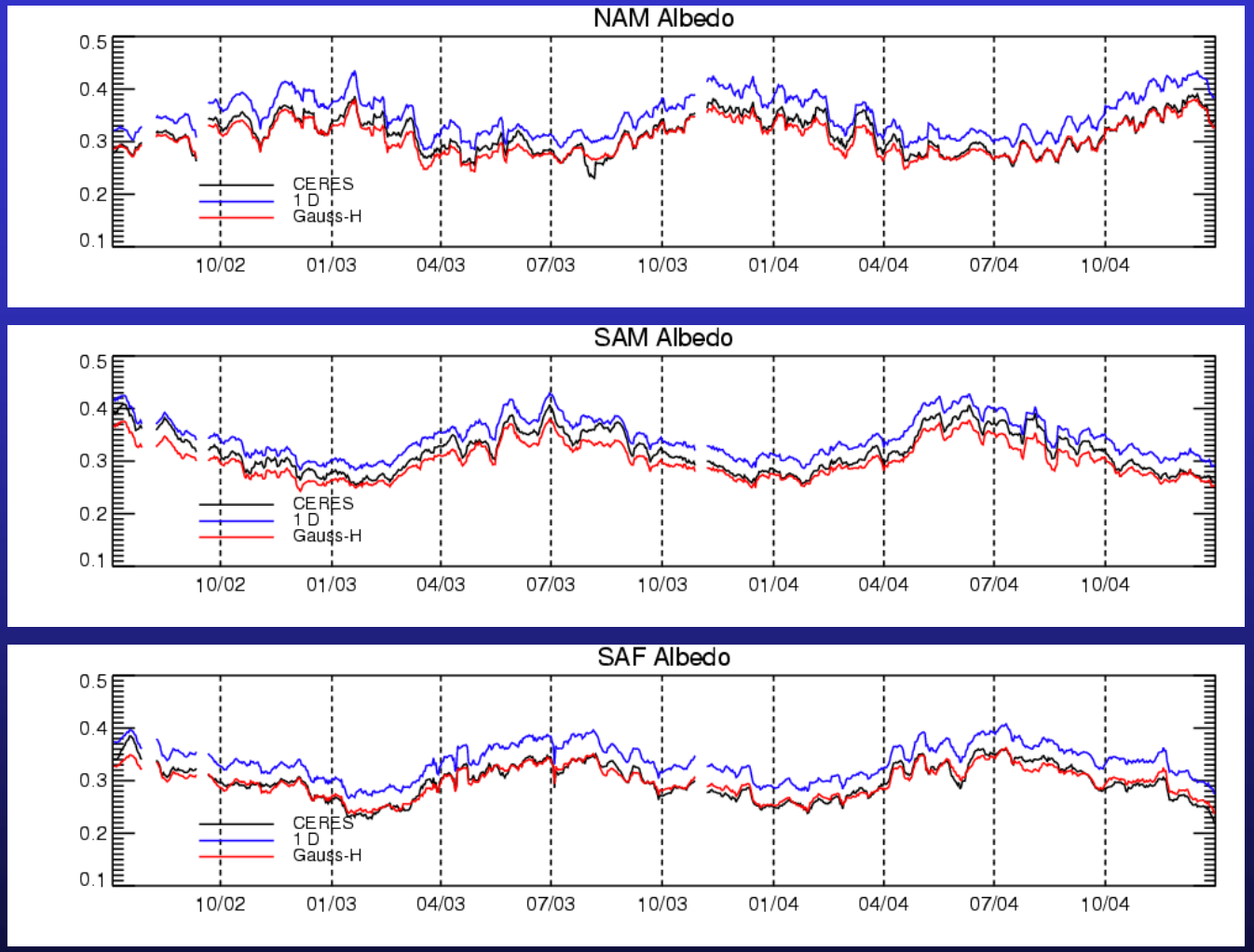




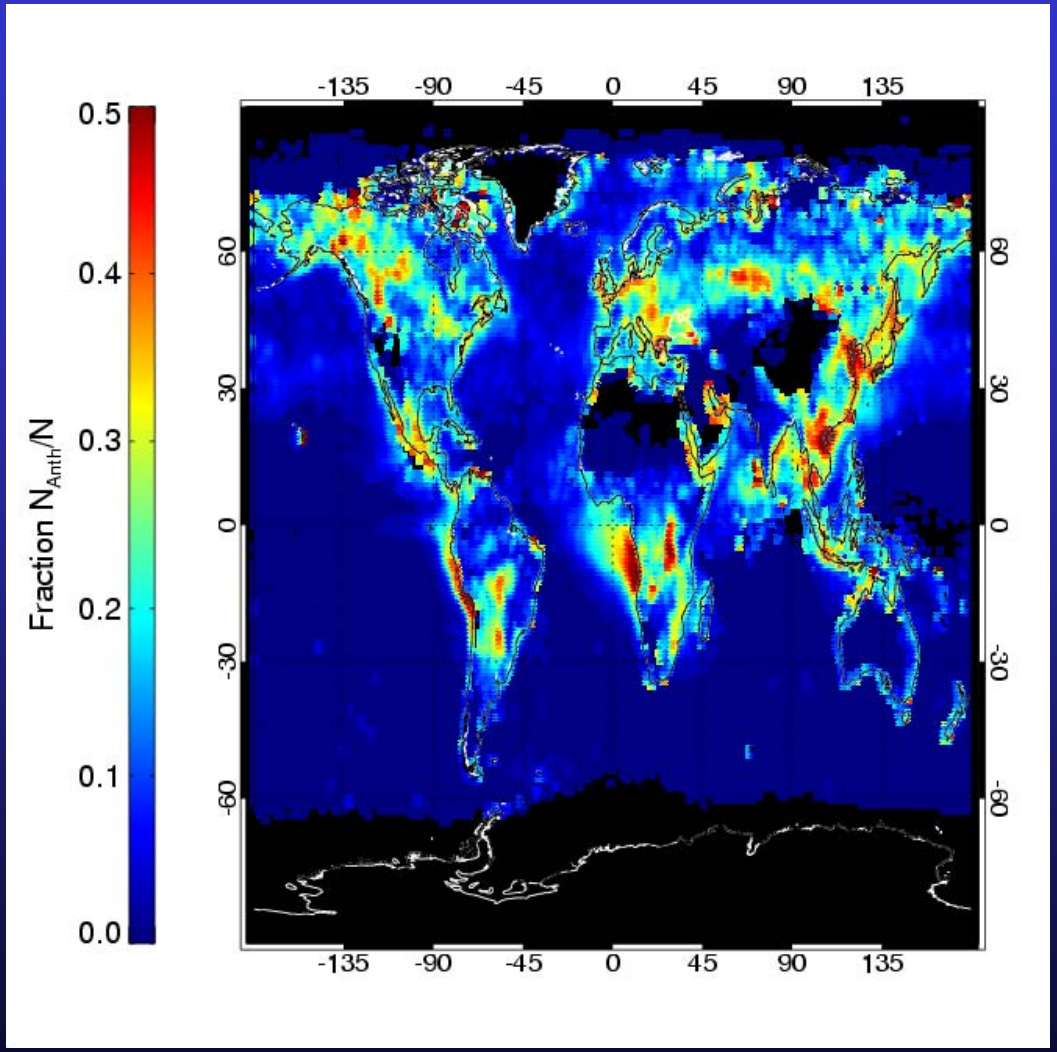


Local Time [hours]

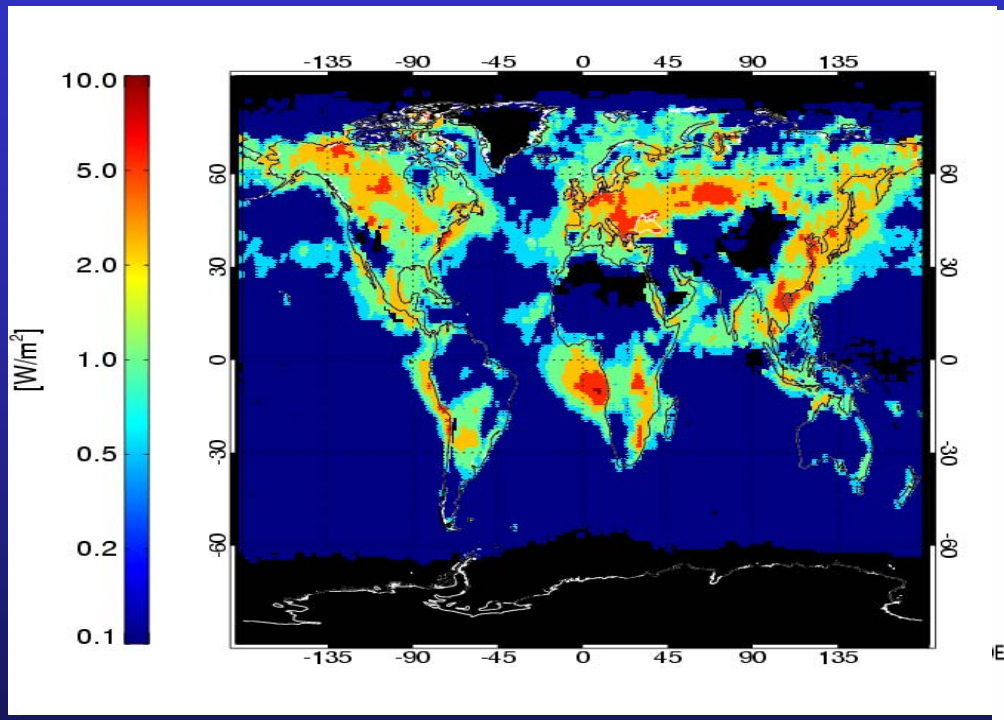
How does our albedo compare to observations (CERES)?

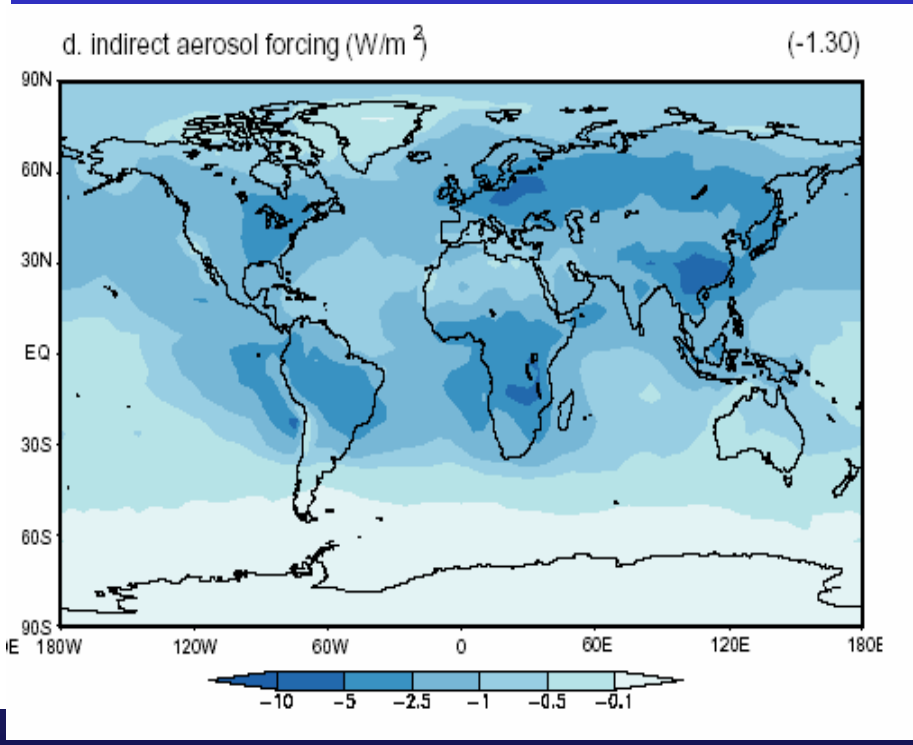


Anthropogenic fraction: Note: This is a **proxy**



IAE

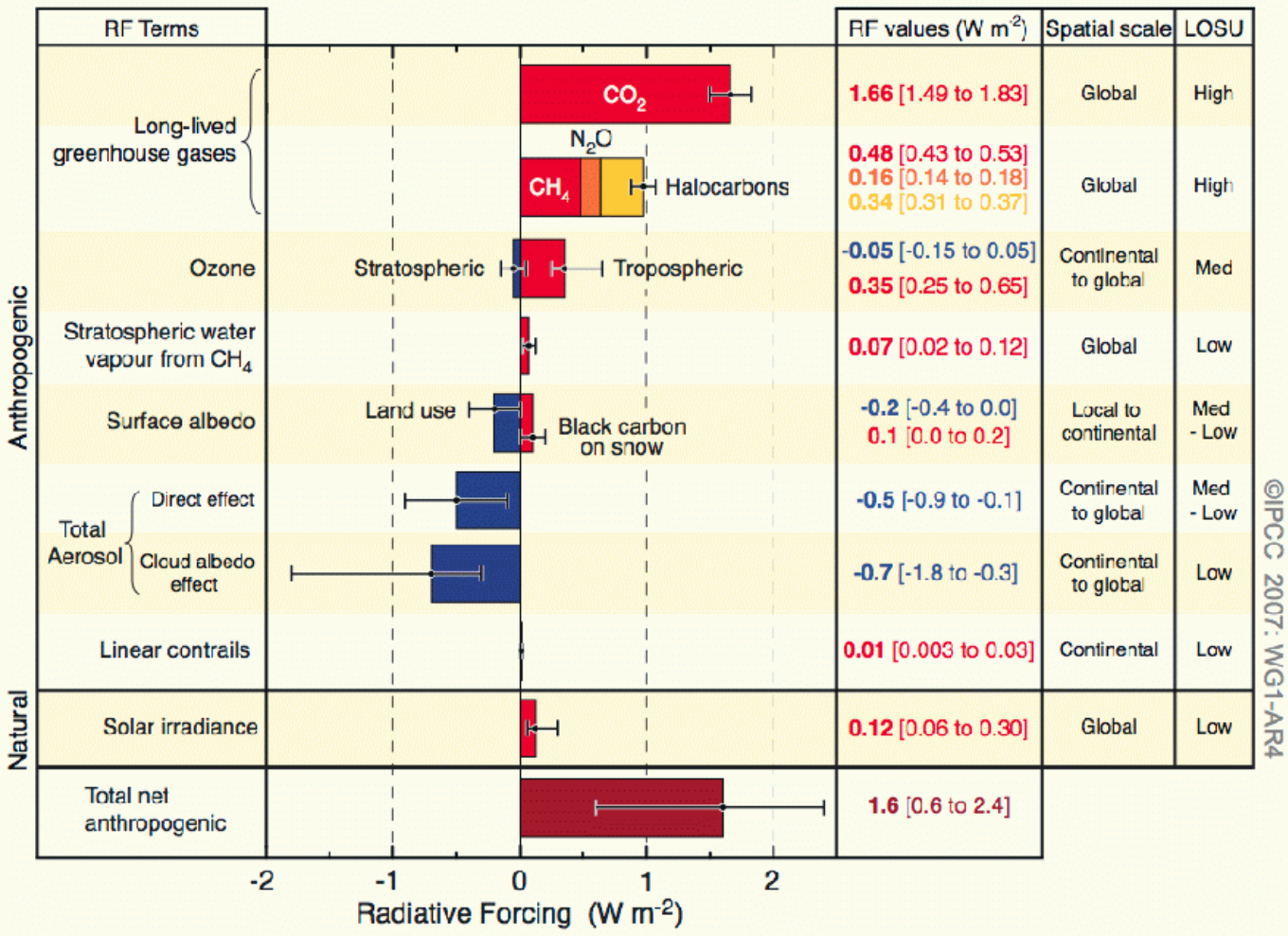




This study

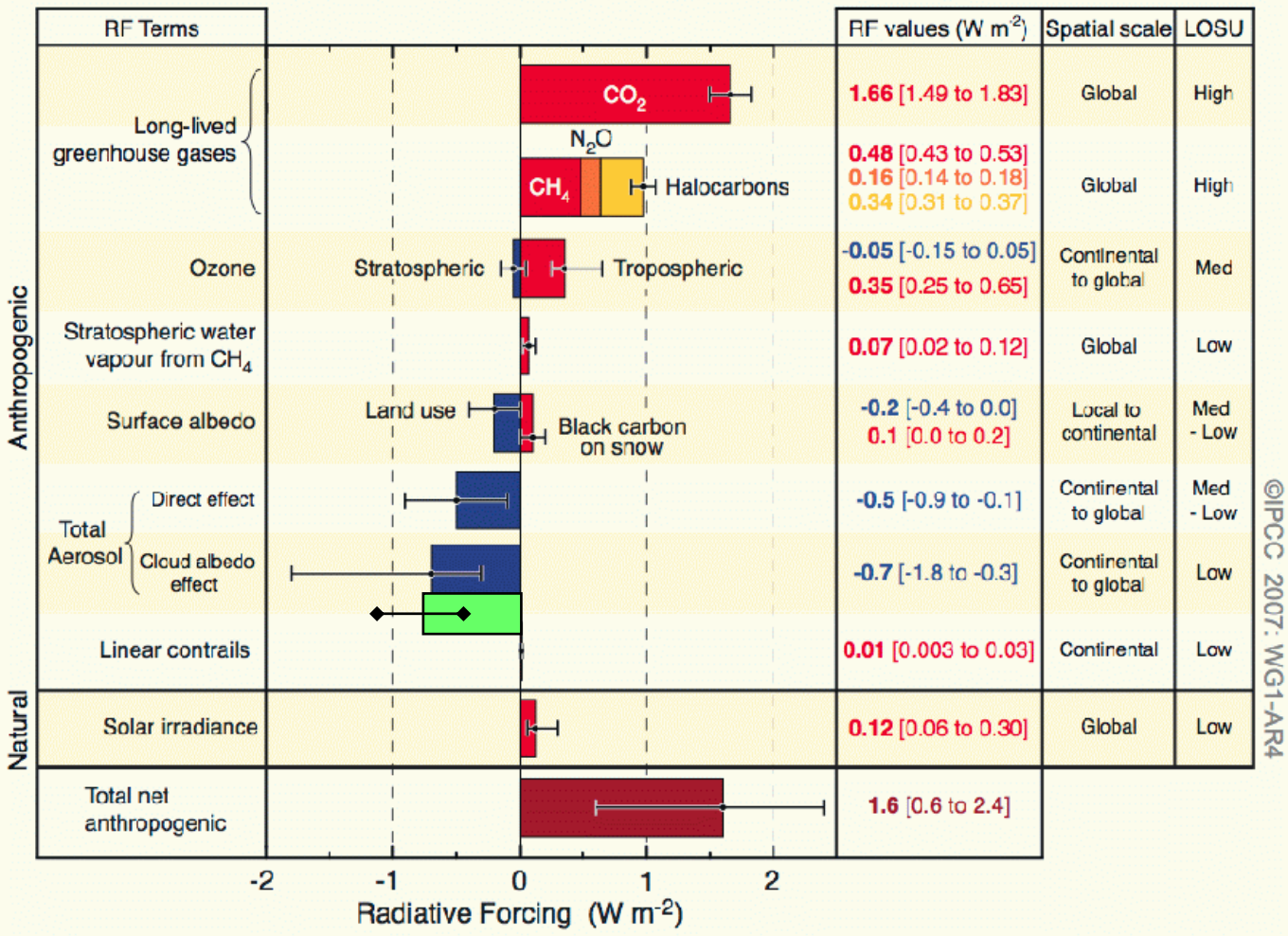
(Chen and Penner, 2005, ACP)

Conclusions



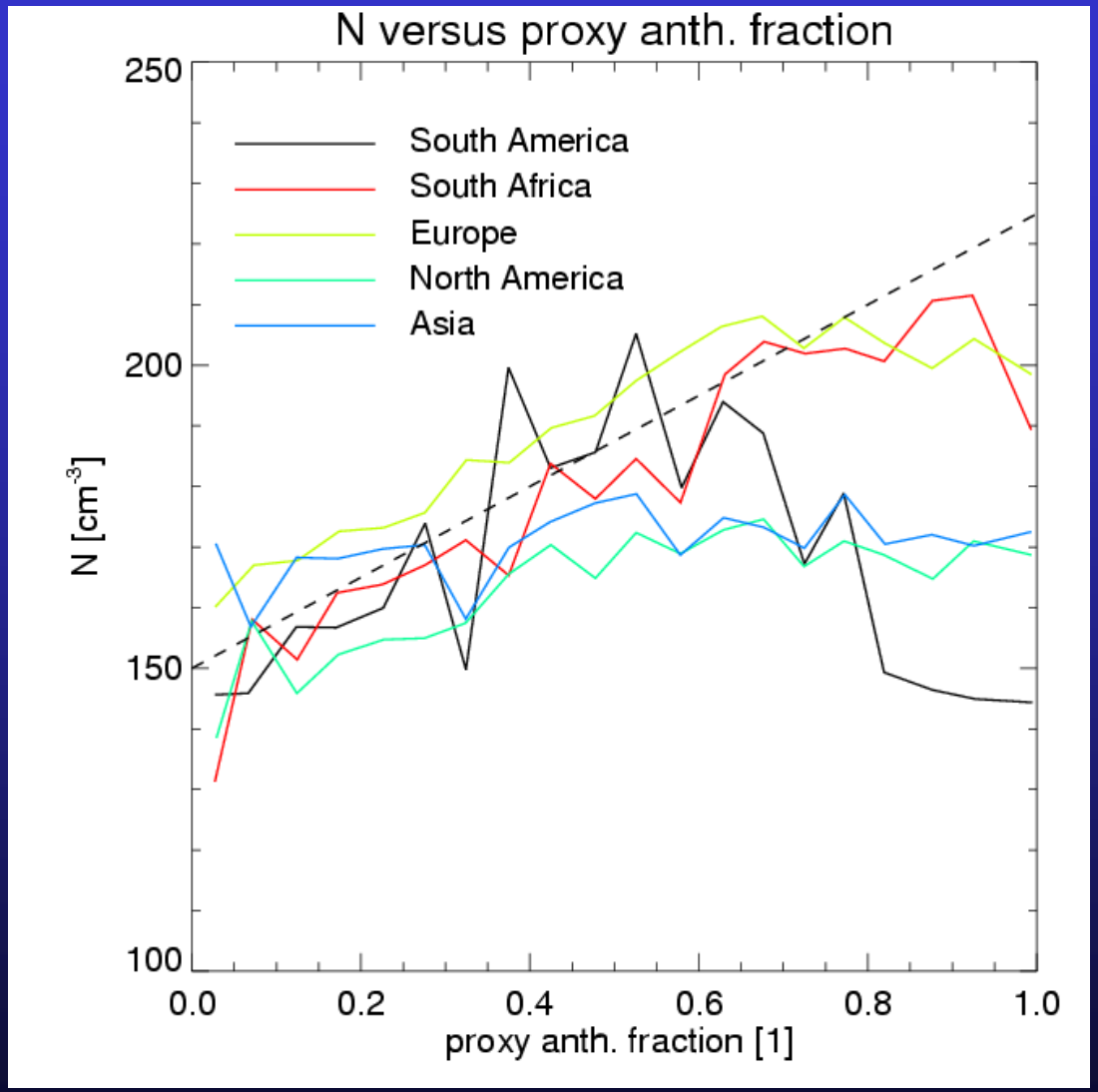
IPCC 2007

Conclusions



IPCC 2007

Land



N to first order a function of anthropogenic aerosol optical thickness

Different behavior for different continents at high anthropogenic fraction

Ocean

$$N = 20 + 35 \cdot \left[\left(\log_{10} \left(c_{chlorophyll} \right) + 2 \right) \geq 0 \right] + 104 \cdot \frac{\tau_{anth,proxy}}{\tau}$$