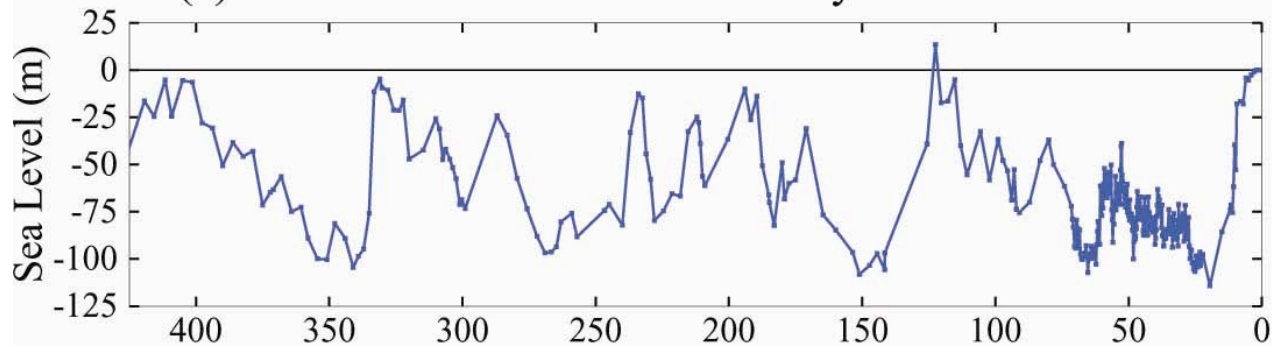


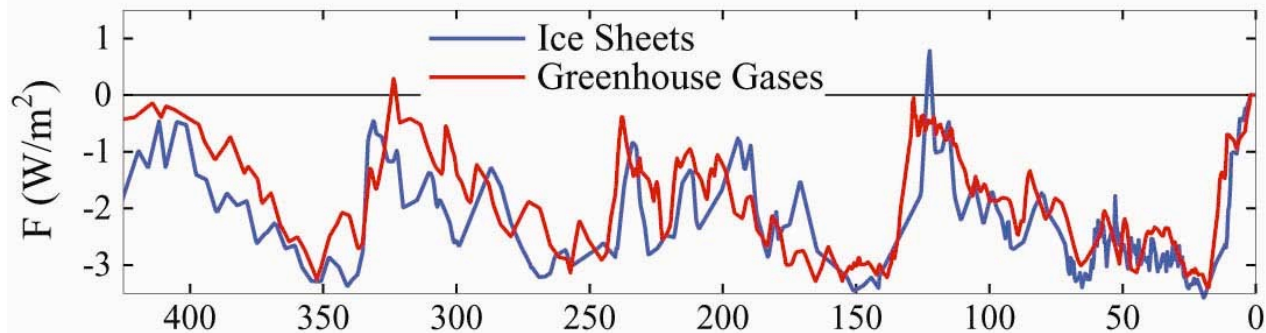
**Why the Arctic is at risk and  
why non-CO2 pollutants could  
be making a big difference?**

**Jim Hansen, Director, Goddard  
Institute of Space Studies**

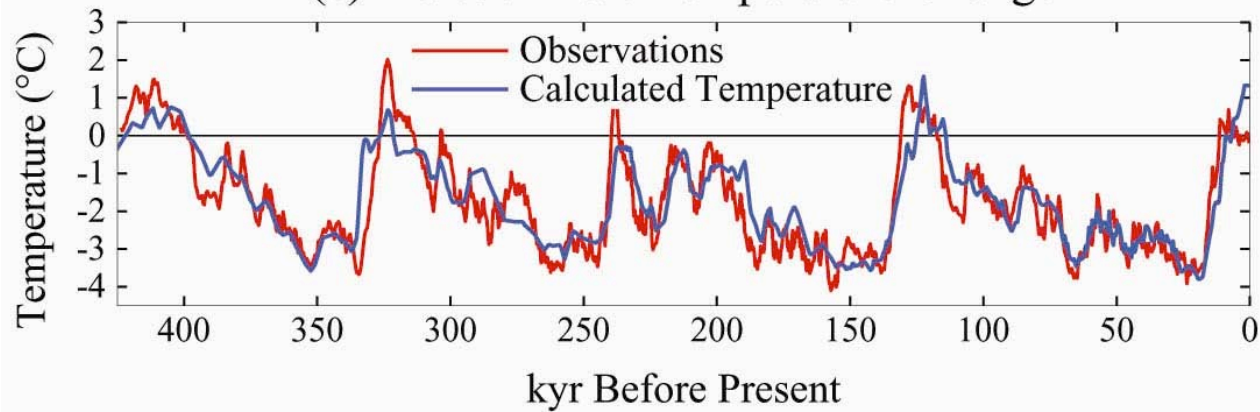
(a) Sea Level from Red Sea Analysis of Siddall et al.



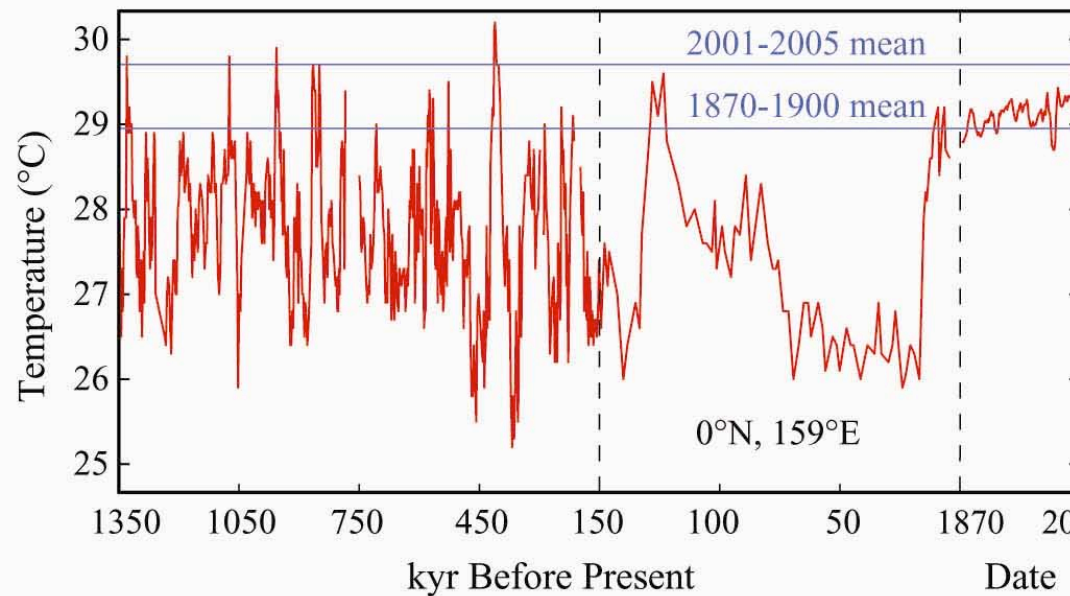
(b) Climate Forcings



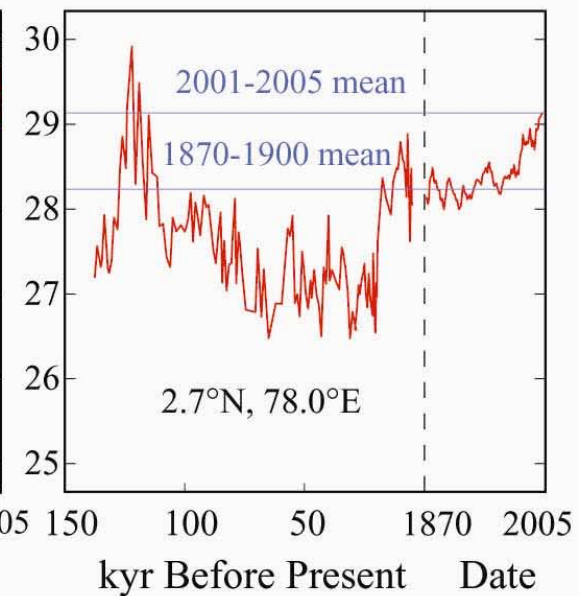
(c) Paleoclimate Temperature Change



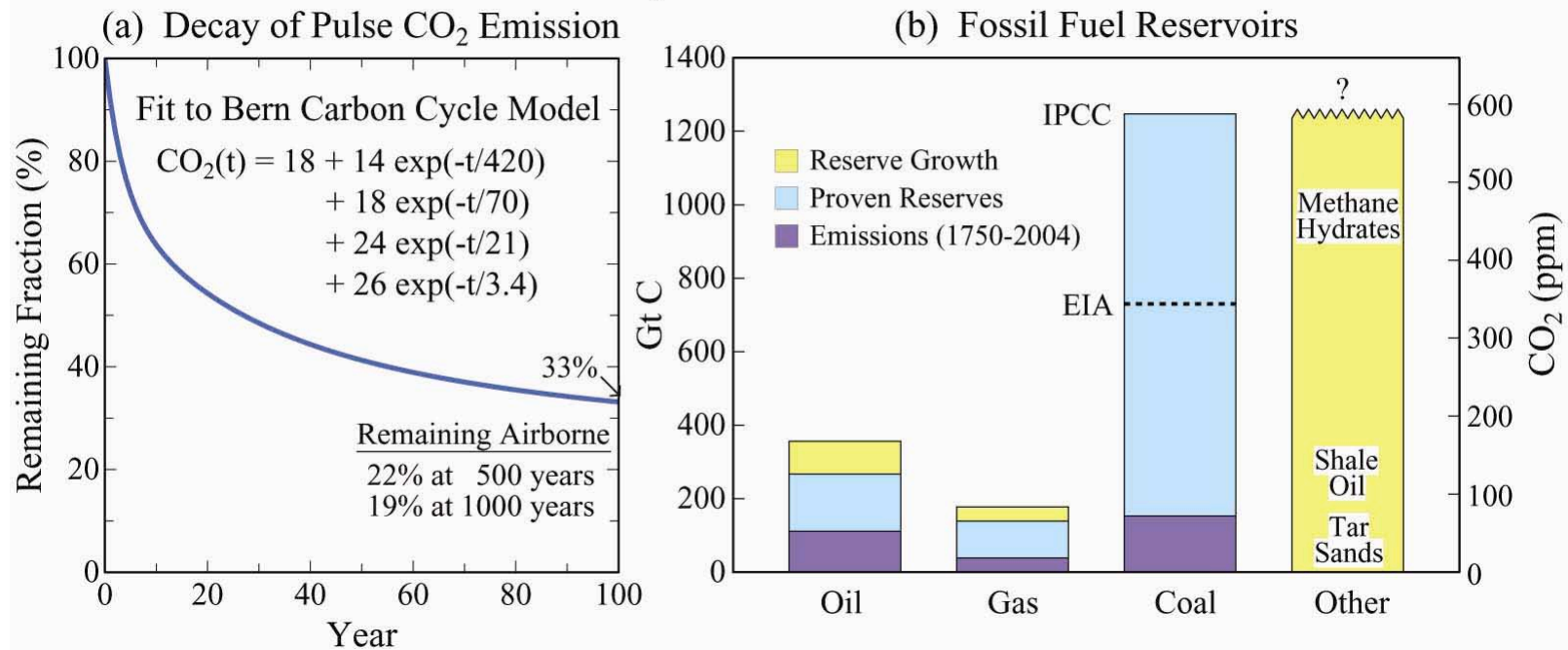
(a) Western Equatorial Pacific SST: 1.35 Million Years



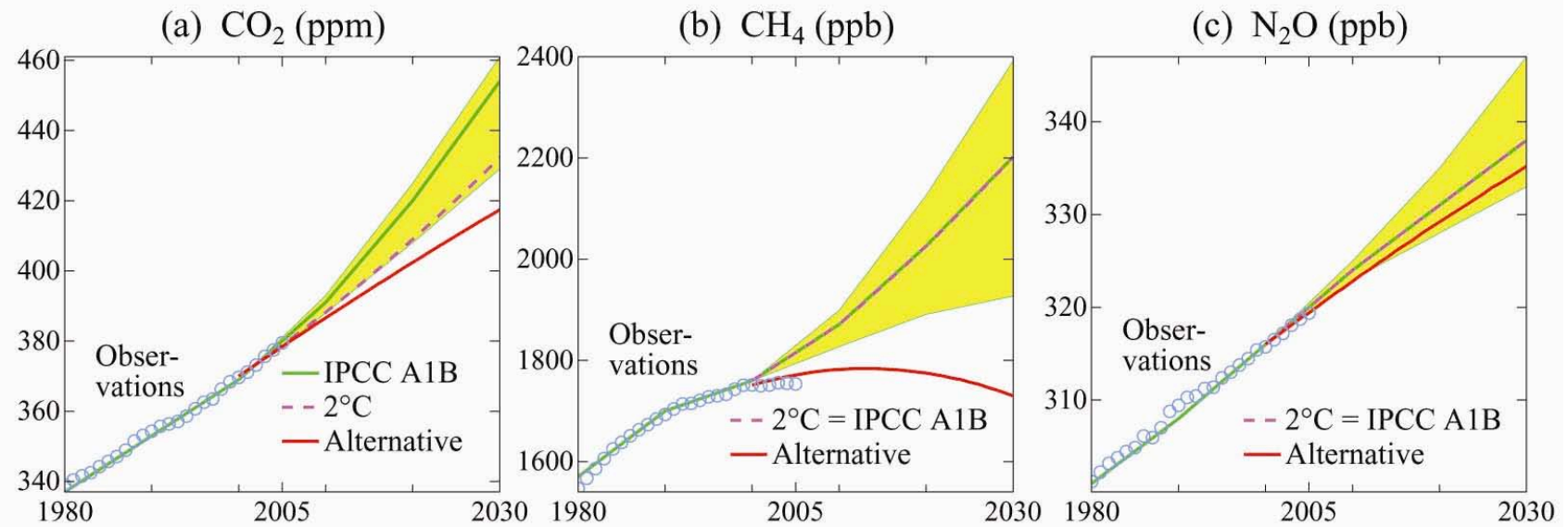
(b) Indian Ocean SST



## Carbon Cycle Constraints

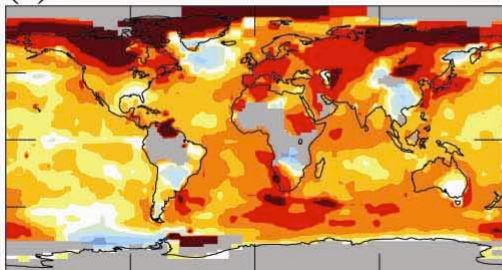


## Well-Mixed Greenhouse Gas Mixing Ratios

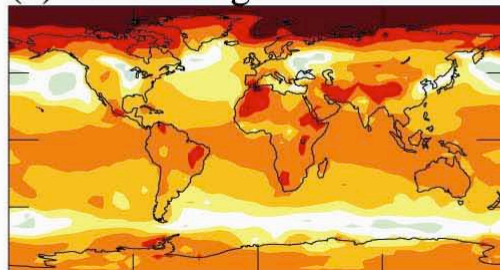


# 1880-2003 Surface Temperature Change (°C)

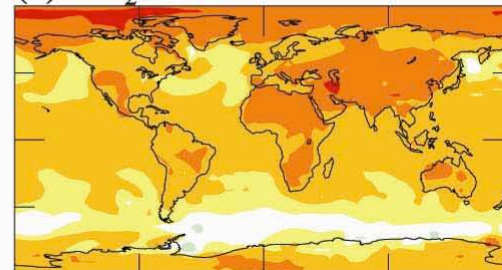
(a) Observations .60



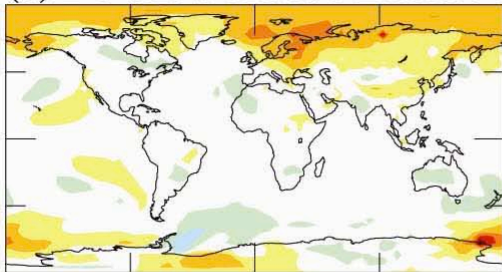
(b) All Forcings .55



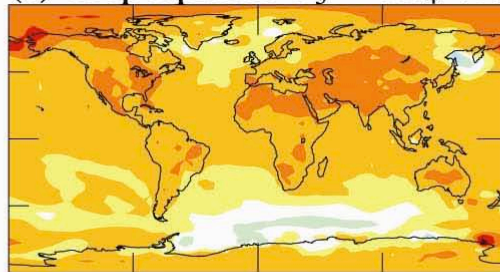
(c) CO<sub>2</sub> .43



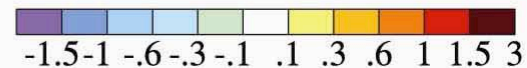
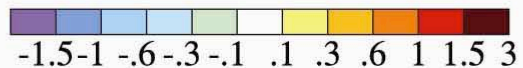
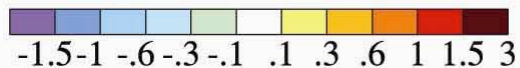
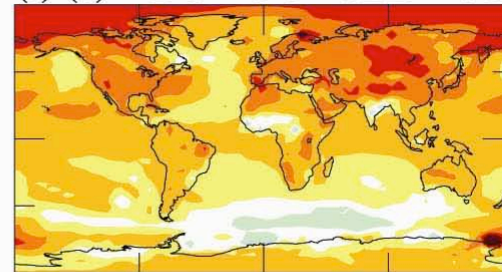
(d) BC Snow Albedo Effect .04



(e) Tropospheric O<sub>3</sub> + CH<sub>4</sub> .40



(f) (e) + BC + OC + AIE .42



Effective 1750-2000 Forcings with Primary Indirect Effects

