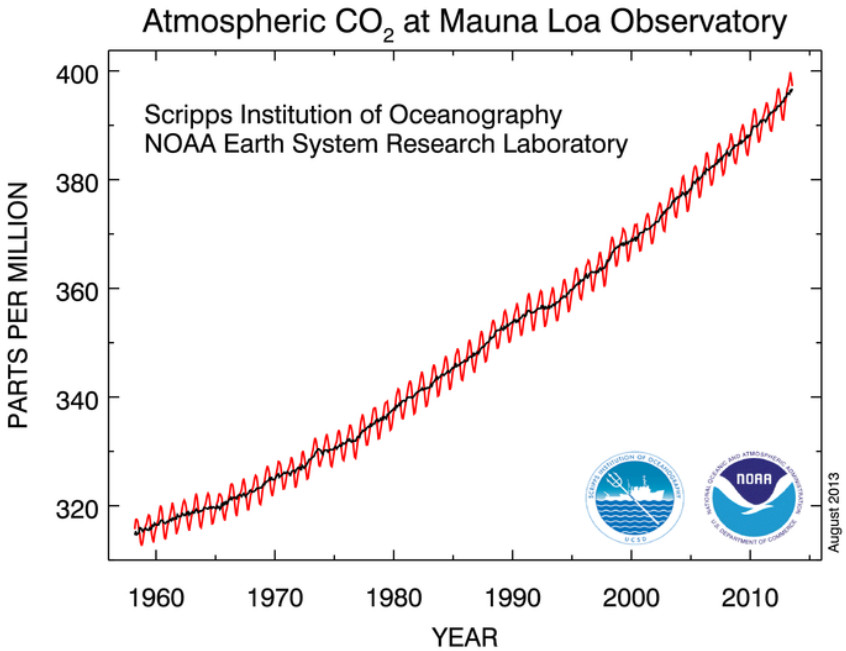
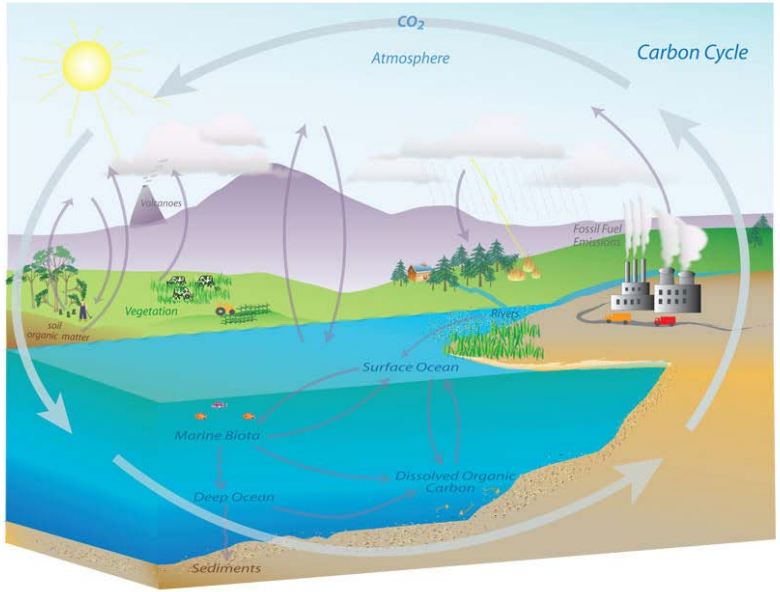
Atmospheric CO_2 and Civilization



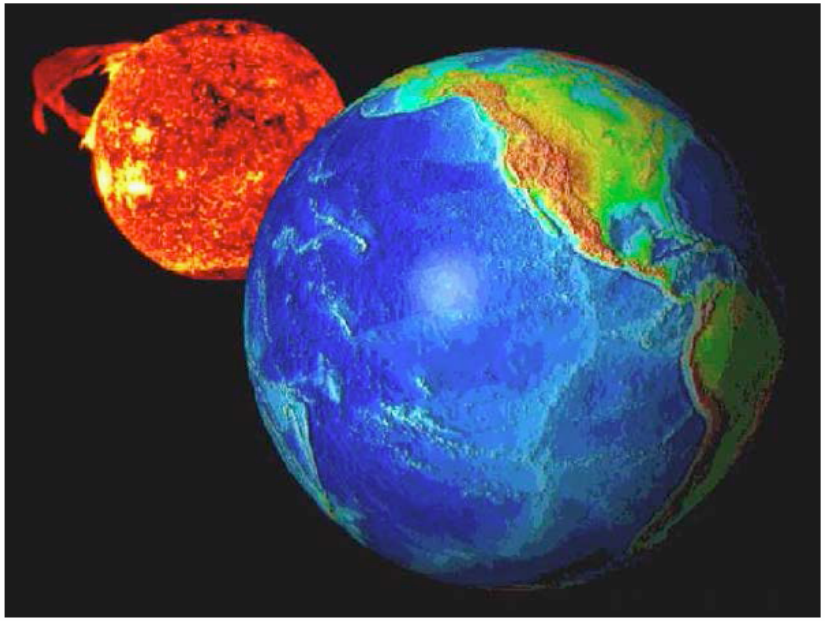


http://www.esrl.noaa.gov/gmd

James H. Butler

[1]*Global Monitoring Division, NOAA/ESRL Boulder, CO, USA*

Back to the basics…



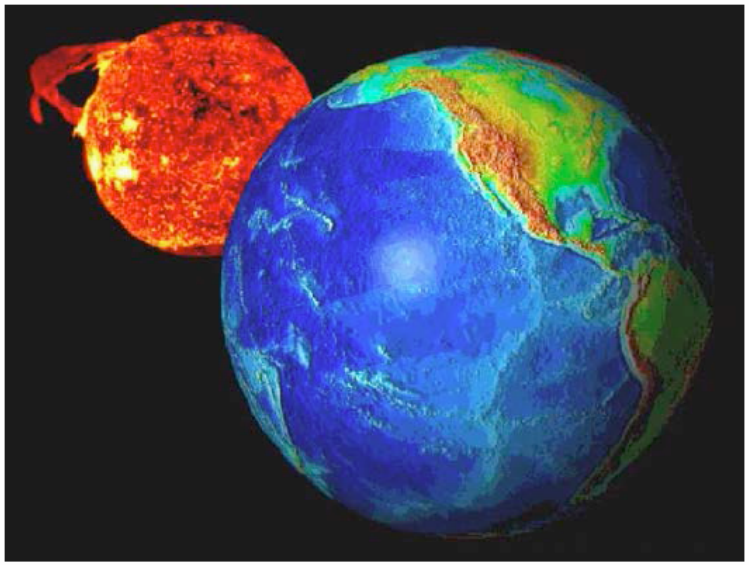
(Slide courtesy of Jim White, INSTAAR)

Simple physics: *Global* climate depends on three factors

- How much energy we get from the sun
- How much of that energy is reflected back to space (aerosols, ice, etc.)
- Amount of greenhouse gases

OK, then…

If we add *lots** of greenhouse gases to the atmosphere, the Earth will warm.



To expect otherwise denies simple physics… and the next time you feel the urge to deny simple physics, try denying gravity…

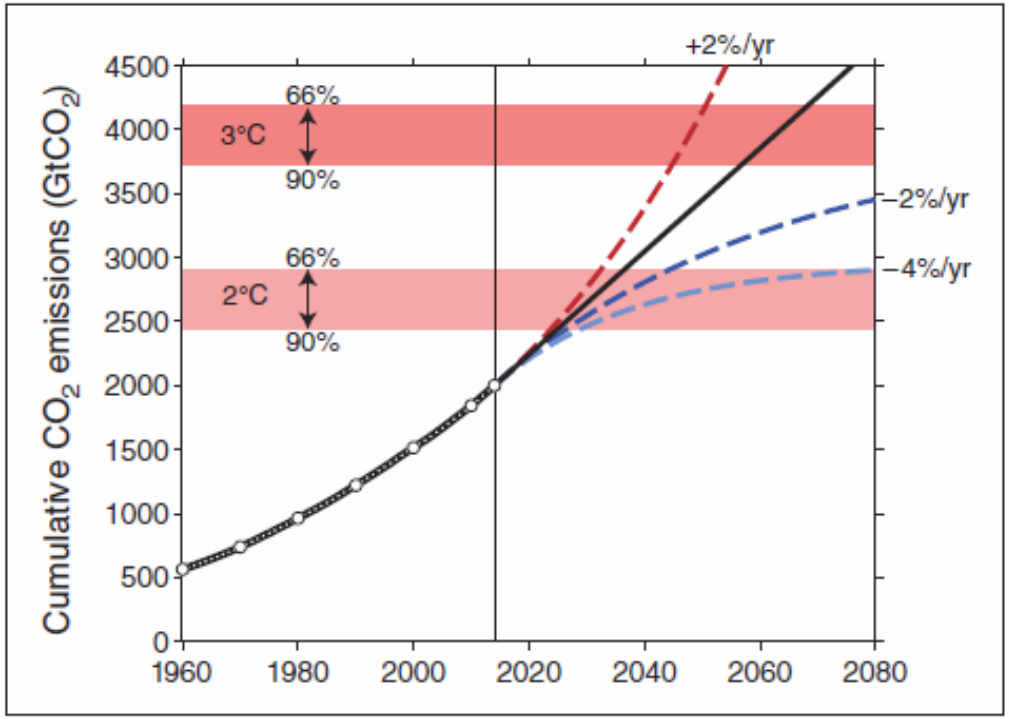
* Lots: 30% more CO_2 and N_2O, triple CH_4

(Slide courtesy of Jim White, INSTAAR)

Something to think about

"CO_2 emissions are rising at a rate that could raise global temperature 2º C above preindustrial values within about 20 years and 3º C by midcentury"

-- *Jackson et al., 2015*

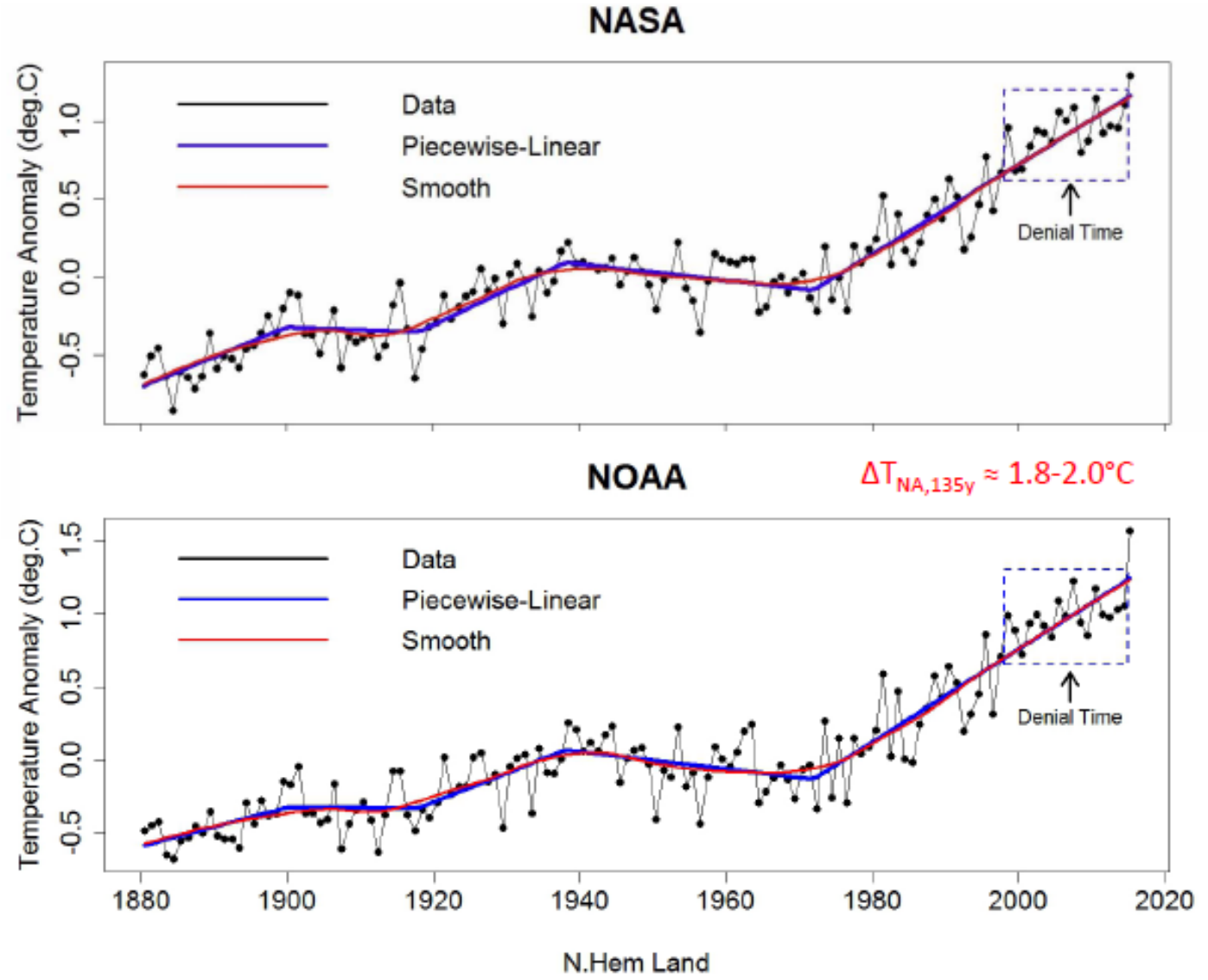


- 2º C global average = 6º C average over continents . . .
- (For US audience, that's ~11º F average over continents)
- 3º C global = ~9º C continental <u>average</u> (~16º F)

GHGs, Butler et al.

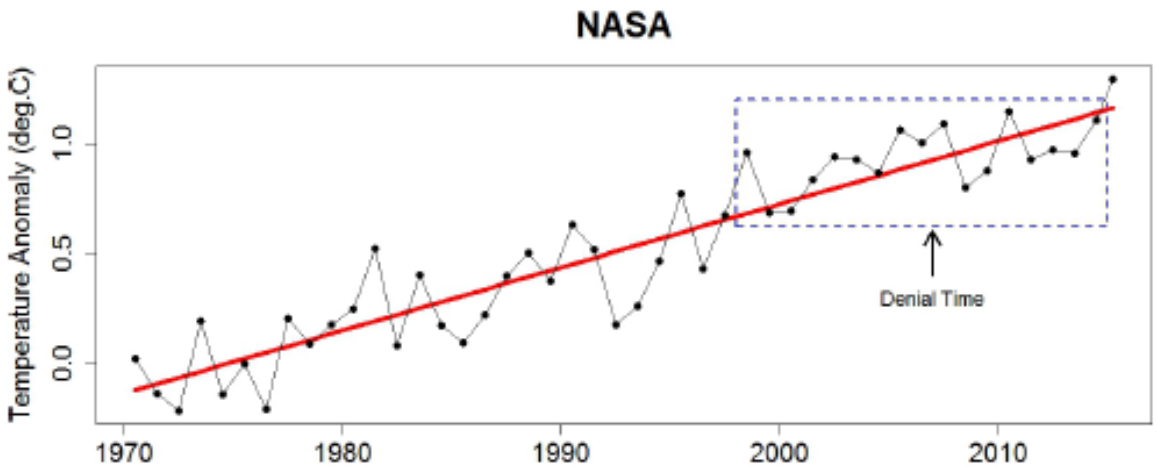
Backup slides for Q&A

N. Hemisphere Land Temperature
1880-2020

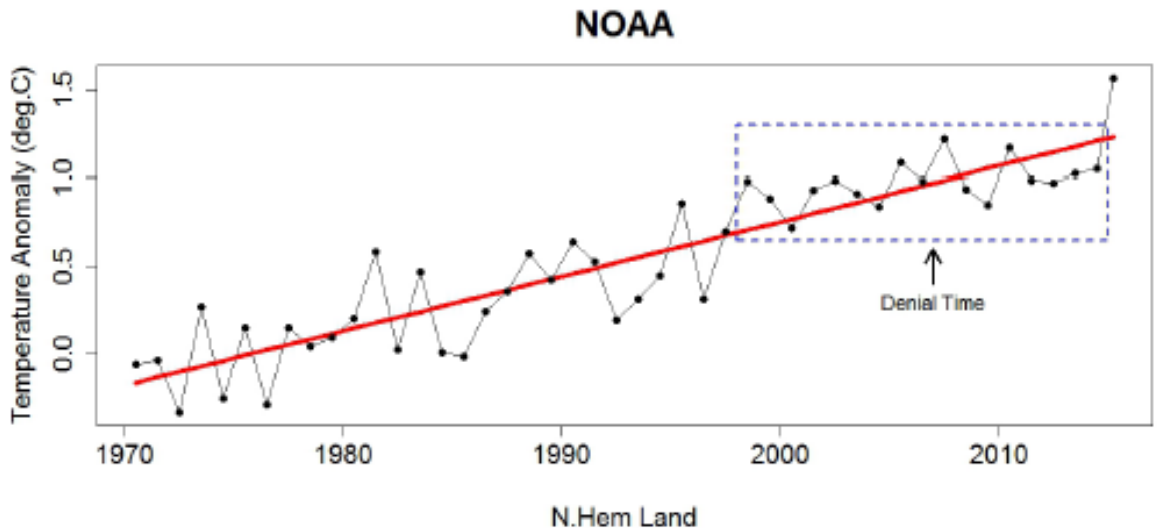


GHGs, Butler et al.

N. Hemisphere Land Temperature
1880-2020

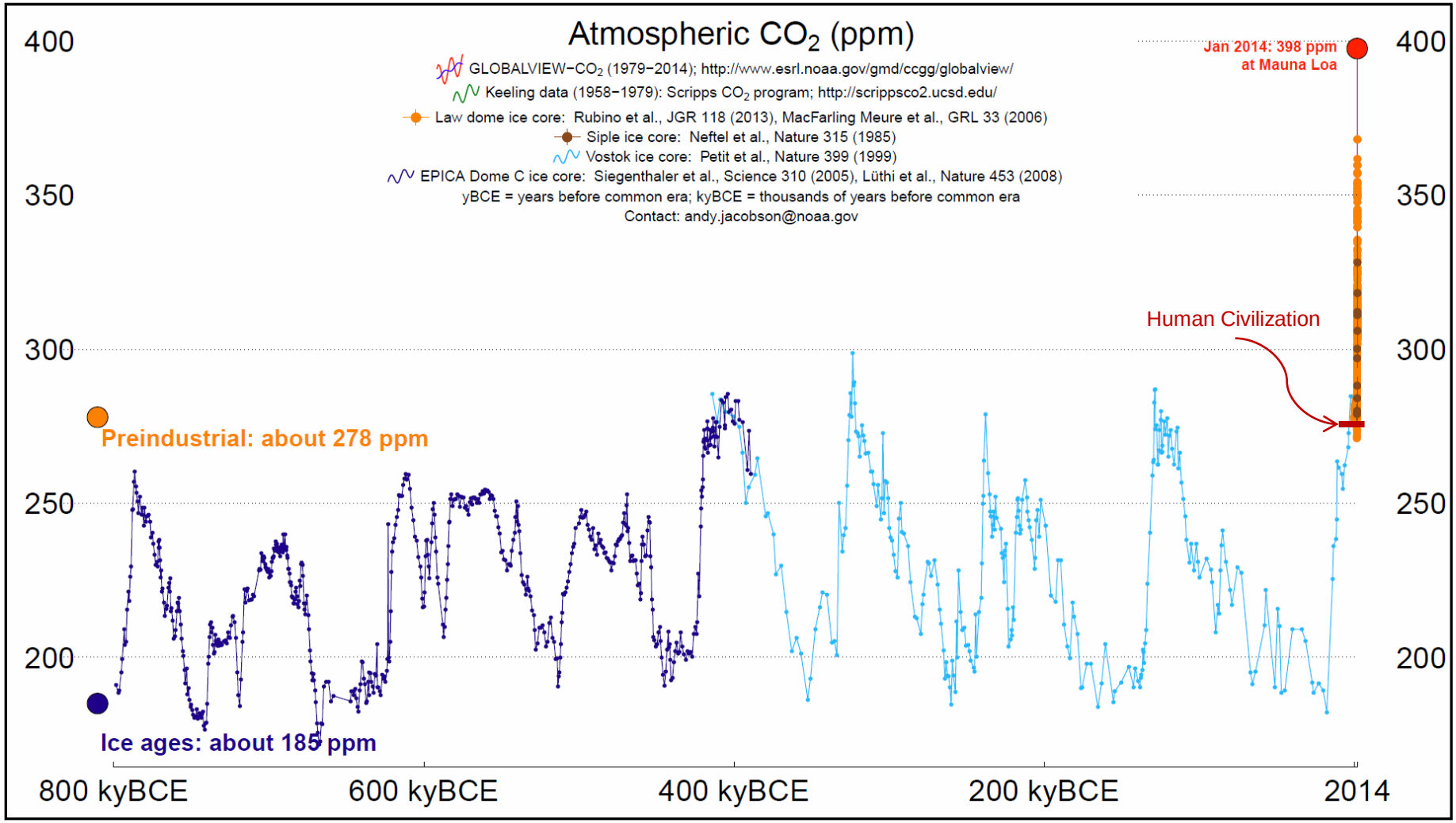


$\Delta_{TNA,45y} \approx 1.2°C$



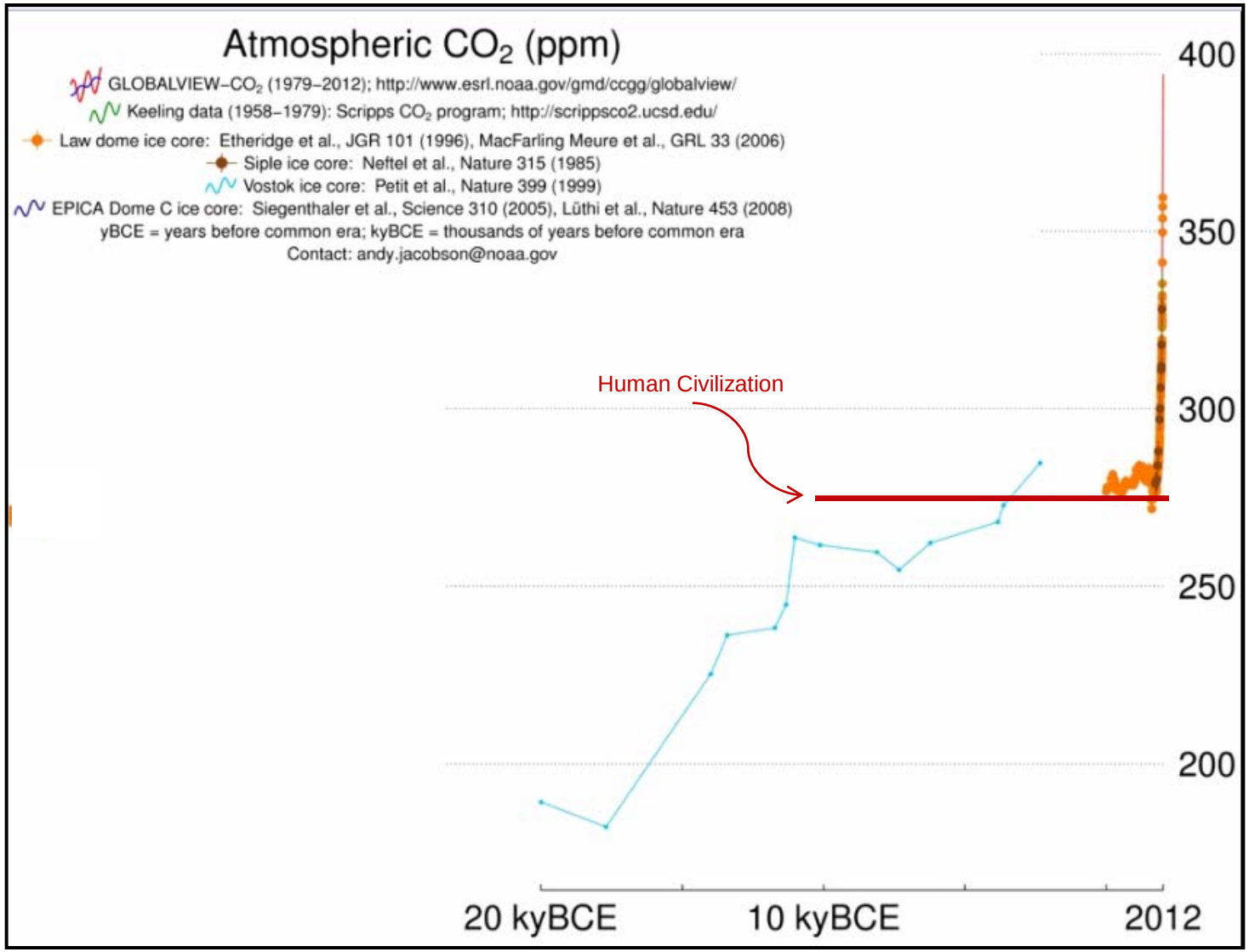
$\Delta_{TNA,45y} \approx 1.3°C$

GHGs, Butler et al.



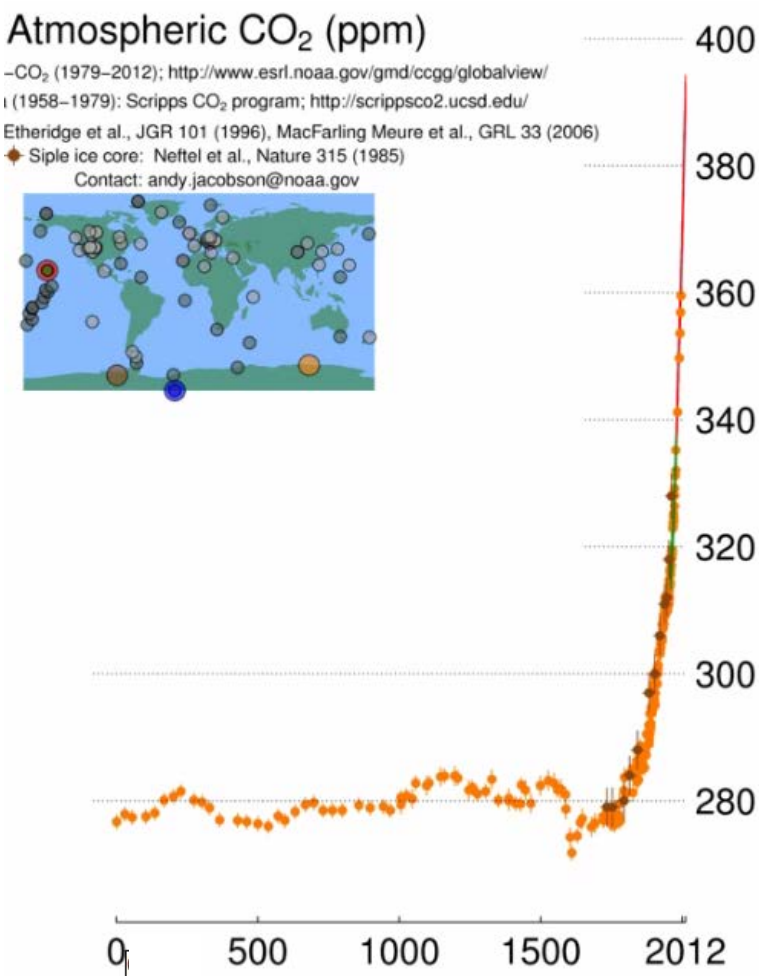
GHGs, Butler et al.

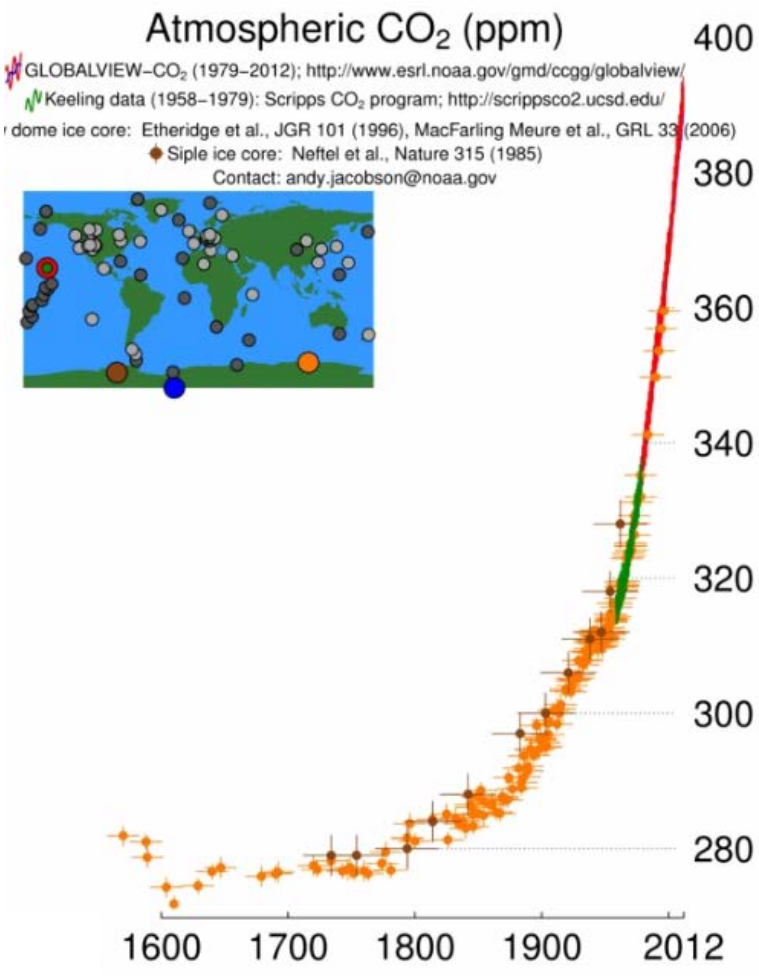
A stable climate for ~10,000 years



GHGs, Butler et al.

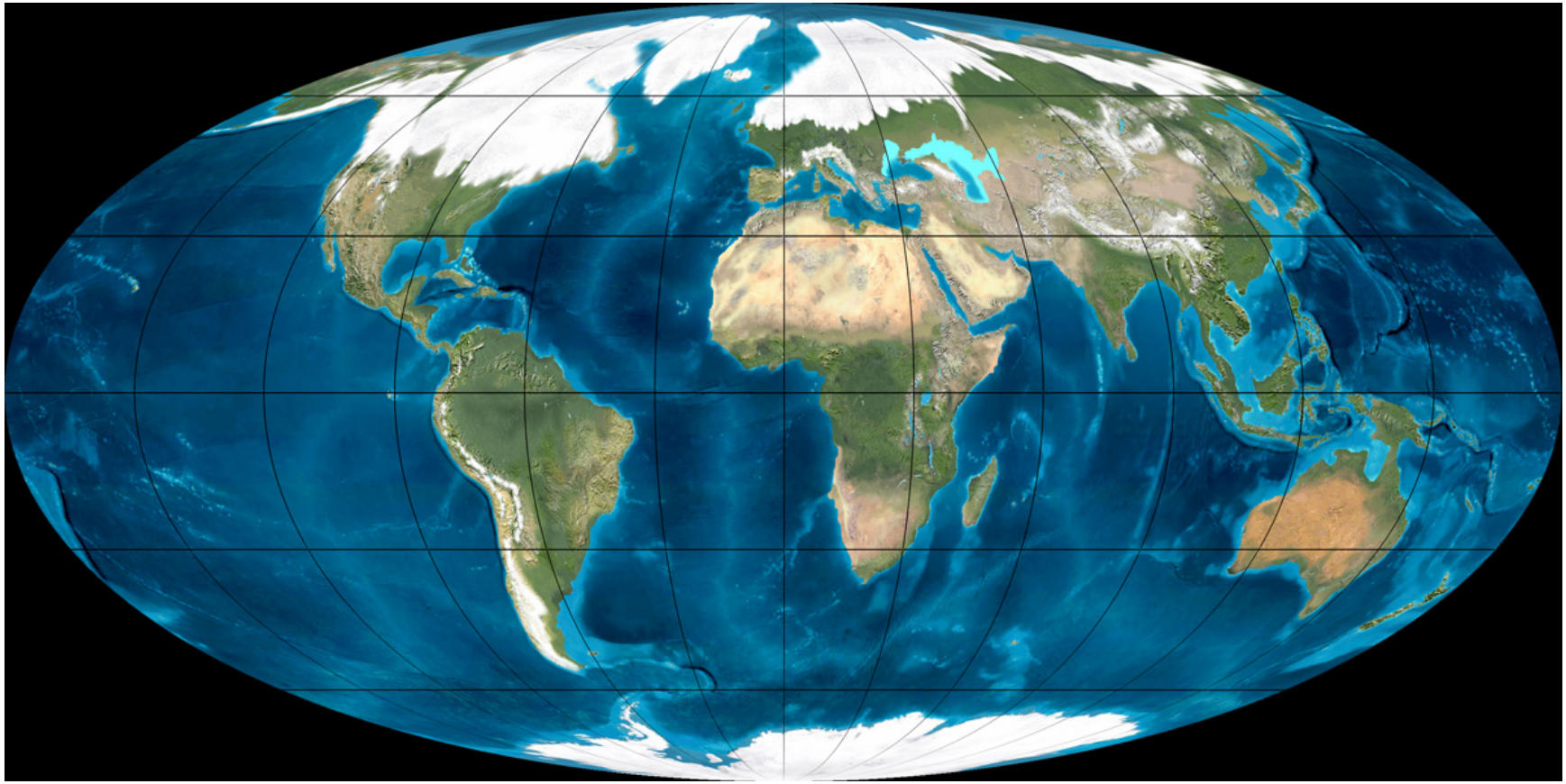
The recent human impact





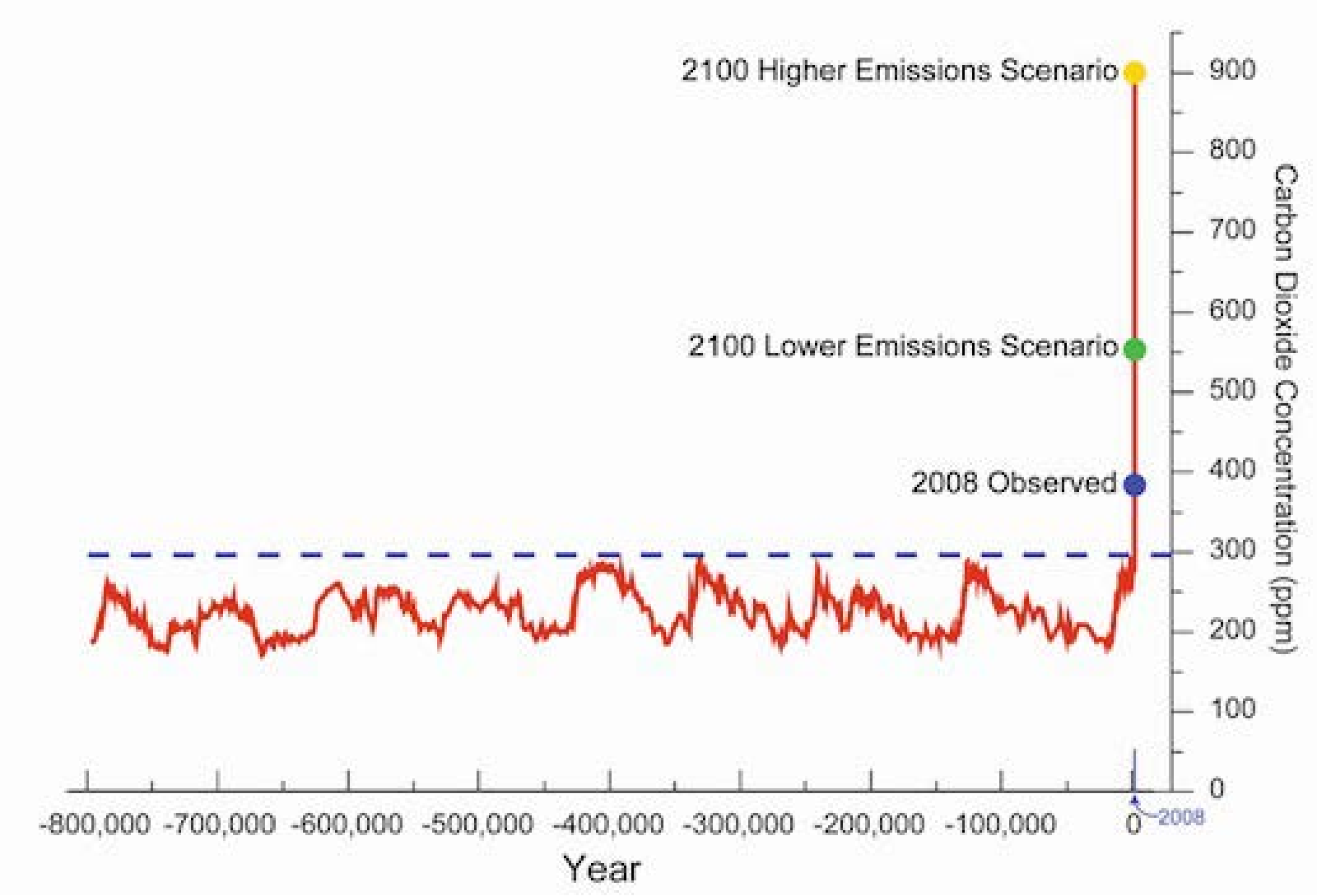
GHGs, Butler et al.

Last ice age (20kya)



What difference does 100 ppm make?

So, will we address emissions?



GHGs, Butler et al.