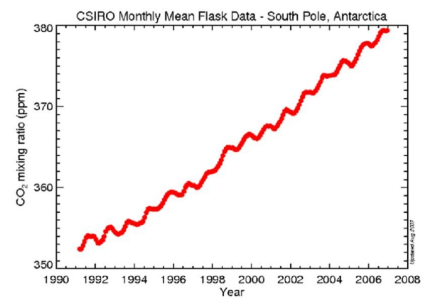
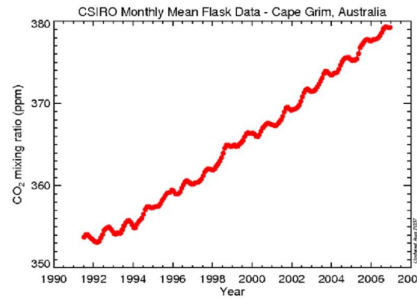
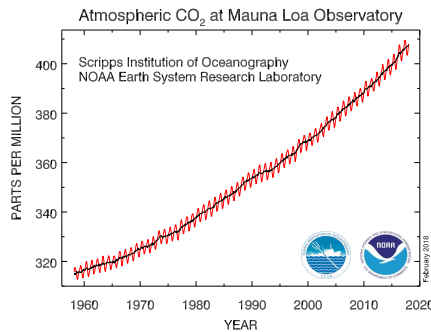


Climate Change: How do we know what we know?

How do we know atmospheric carbon dioxide (CO₂) is increasing?

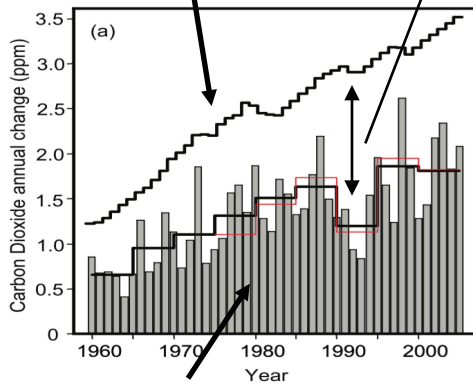
Measurements from around the globe *all* show an increase of roughly 2 ppmv/yr.



How do we know these CO₂ increases are human-caused?

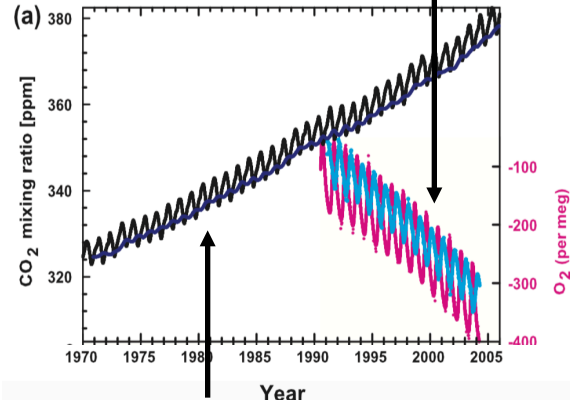
- Fossil-fuel burning accounts for the observed CO₂ increase.
- Oxygen (O₂) is simultaneously decreasing, consistent with a combustion source.

CO₂ produced by fossil fuel burning CO₂ uptake by land and ocean



Observed atmospheric CO₂ increase

Decreasing O₂ from combustion



Increasing CO₂ from combustion

Notes

- CO₂ measurement image from <https://scripps.ucsd.edu/programs/keelingcurve/2013/05/20/why-scientists-still-collect-co2-in-flasks/>
- CO₂ data are from <http://cdiac.ess-dive.lbl.gov/trends/co2/csiro/>. CO₂ concentrations are measured in parts per million by volume (ppmv). A concentration of 280 ppmv (the preindustrial value) means that 0.000280 of any given volume of air is occupied by CO₂.
- Comparison between fossil fuel CO₂ and atmospheric increase from [Denman et al. \(2007\)](#) (IPCC AR4 WG1 Ch.7). Comparison of CO₂ and O₂ trends is from [Forster et al. \(2007\)](#) (IPCC AR4 WG1 Ch.2)
- For more see nadirjeevanjee.com/lectures