Climate: A whirlwind tour

Open Seminar Series, Department of Physics

Aditya Narayanan [1]

Department of Ocean Engineering
IIT Madras

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[1] adityarn@gmail.com

Climate change

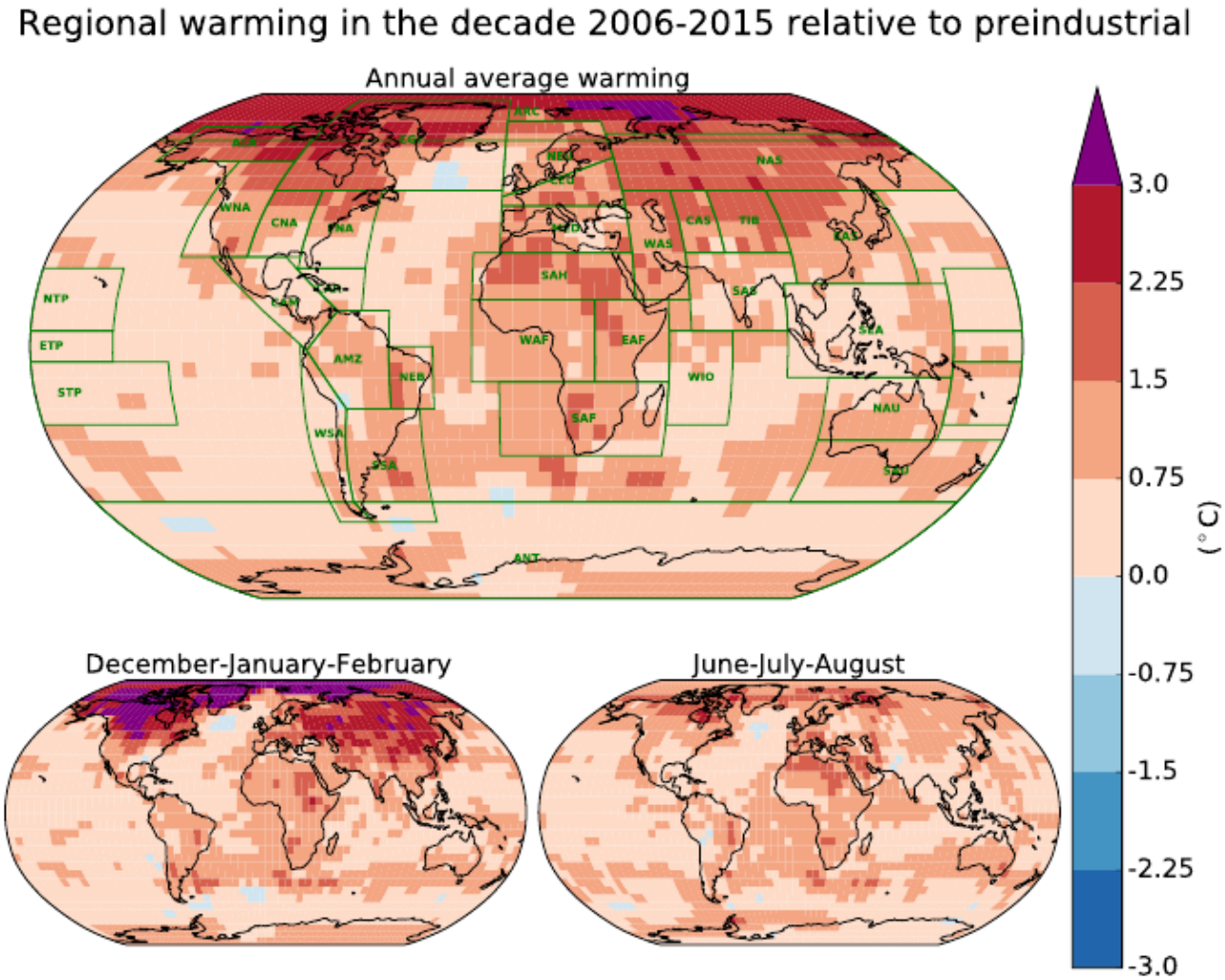

Figure 1 : Temperature change (2005 - 2015) with respect to pre-industrial (1850-1900). Source: *IPCC SR15, 2018.*

Historical CO_2 levels

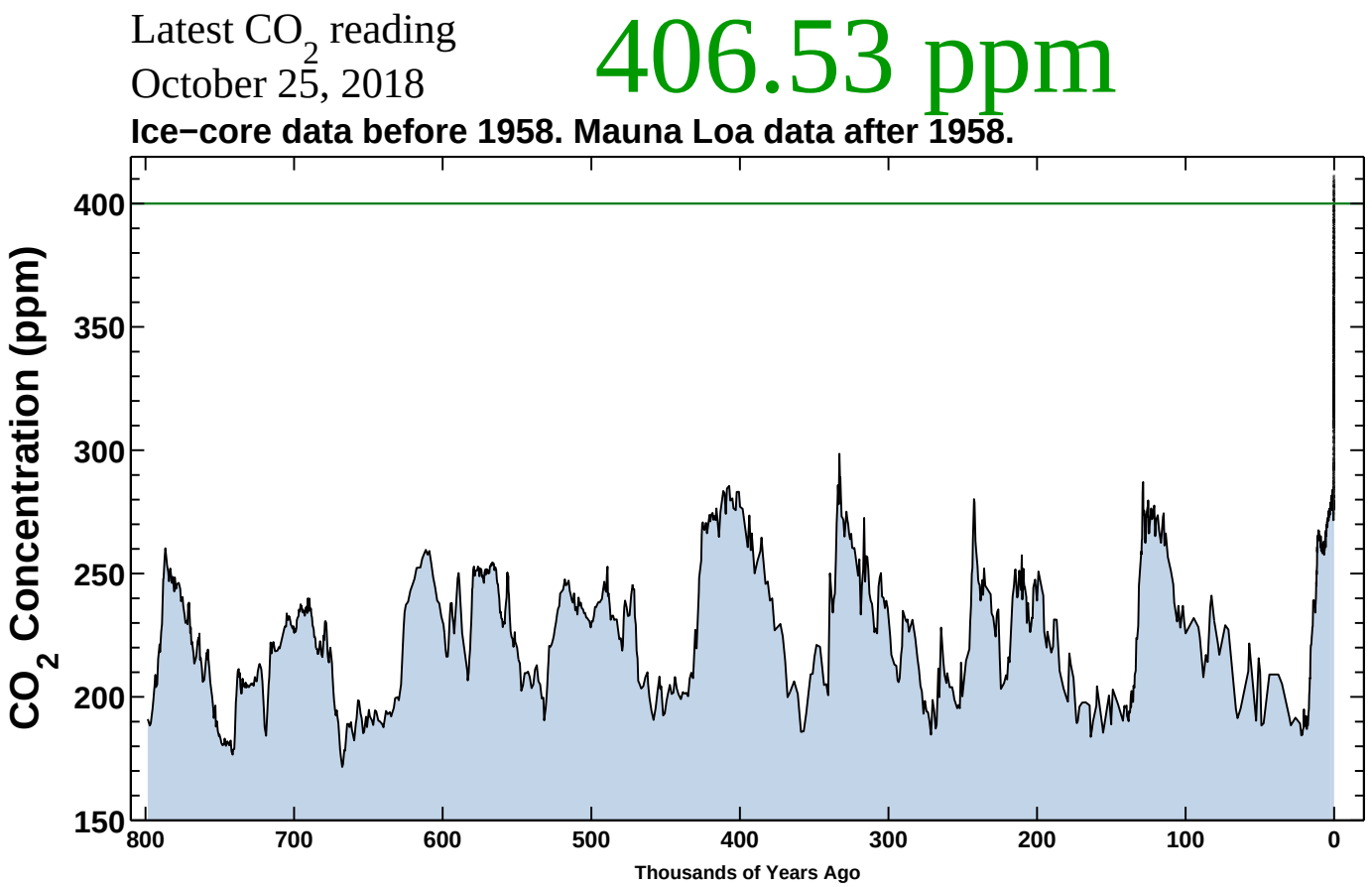

Figure 2 : Historical CO_2 levels. Source: *Scripps, UCSD*

Palaeo record

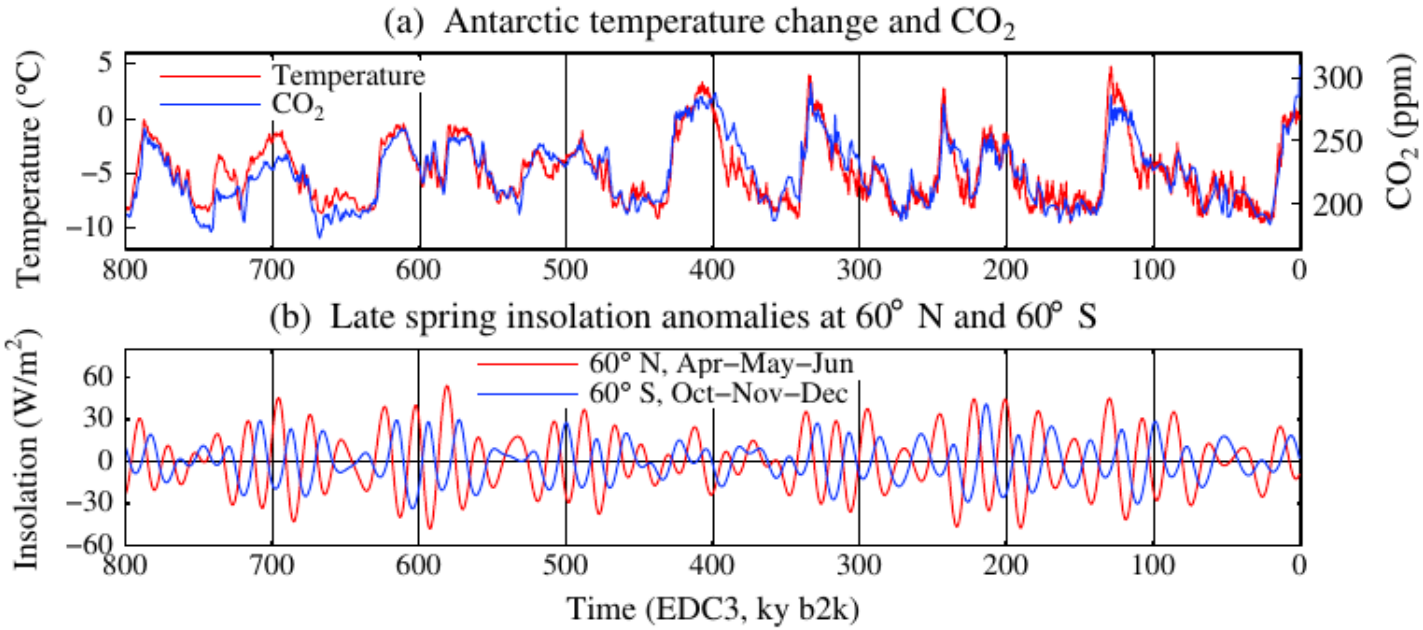

Figure 3 : (**a**) Antarctic (Dome C) temperature anomaly relative to 10kya, CO_2 levels (Lüthi et al., 2008); (**b**) Insolation anomalies.

Source: (Hansen et al., 2016)

Radiative forcing

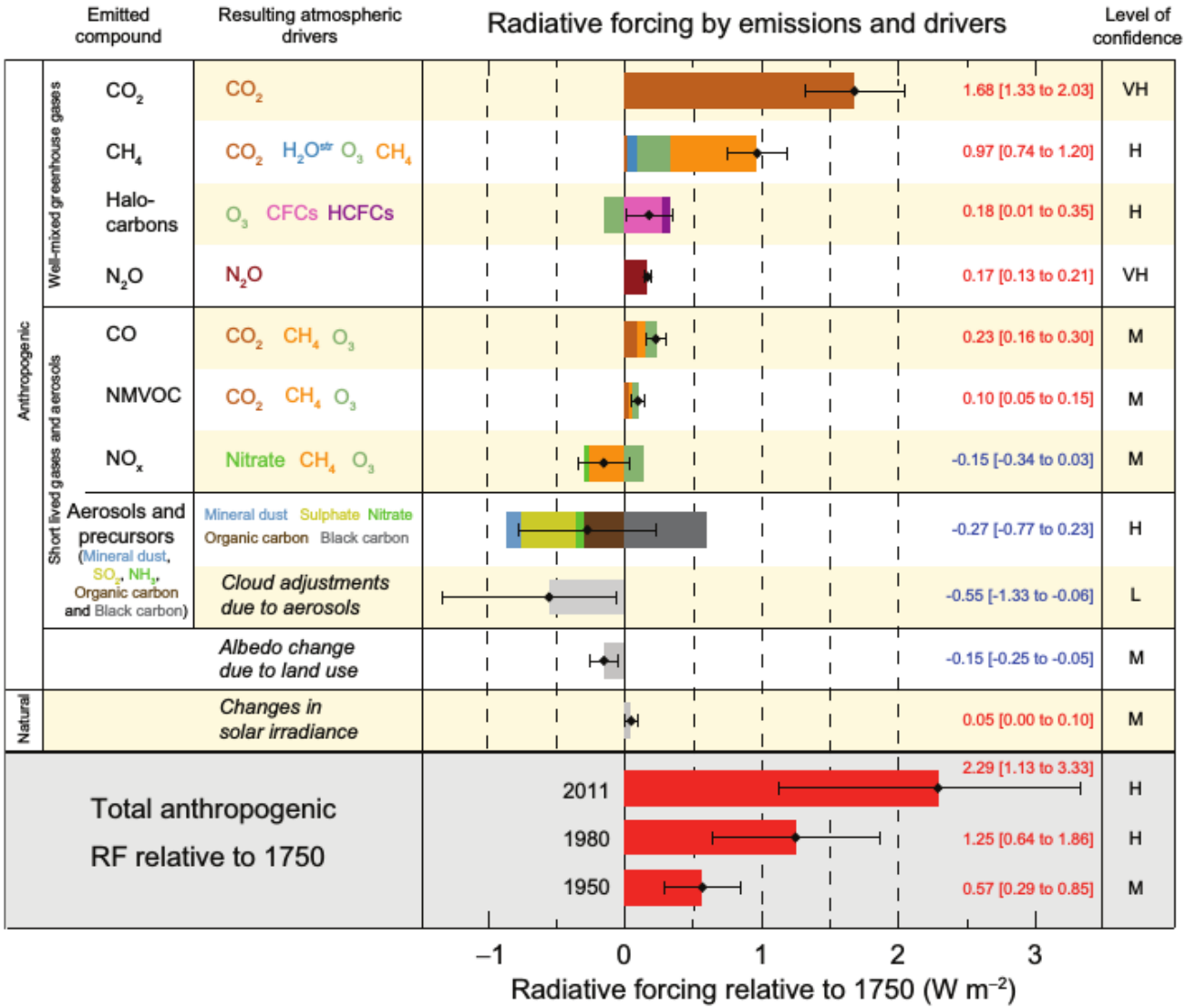

Figure 4 : Radiative forcing. Source: IPCC-WG1, 2013

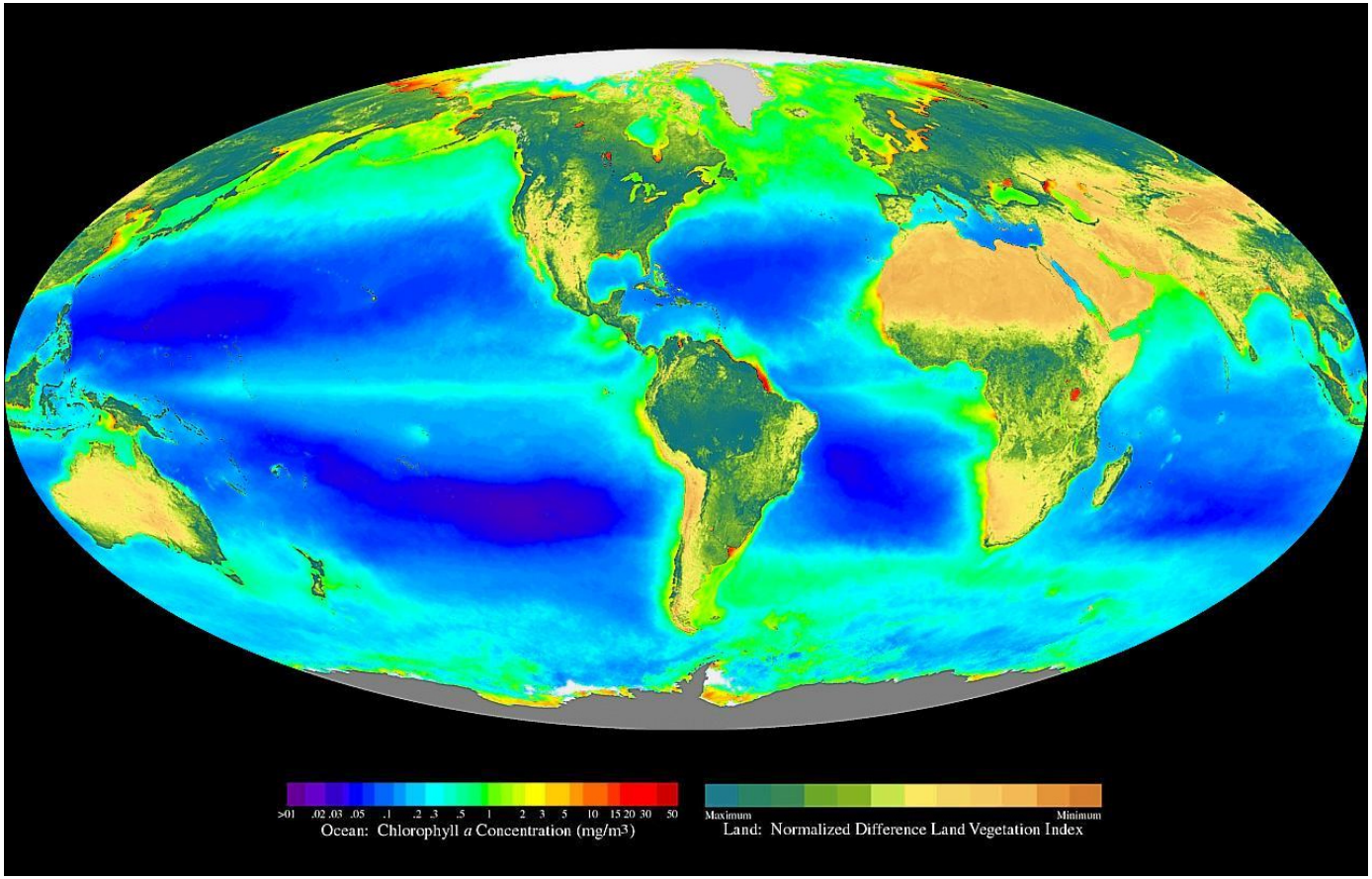

Figure 5 : Abundance of photosynthesizing organisms. Source: NASA, GSFC (SeaWiFS)

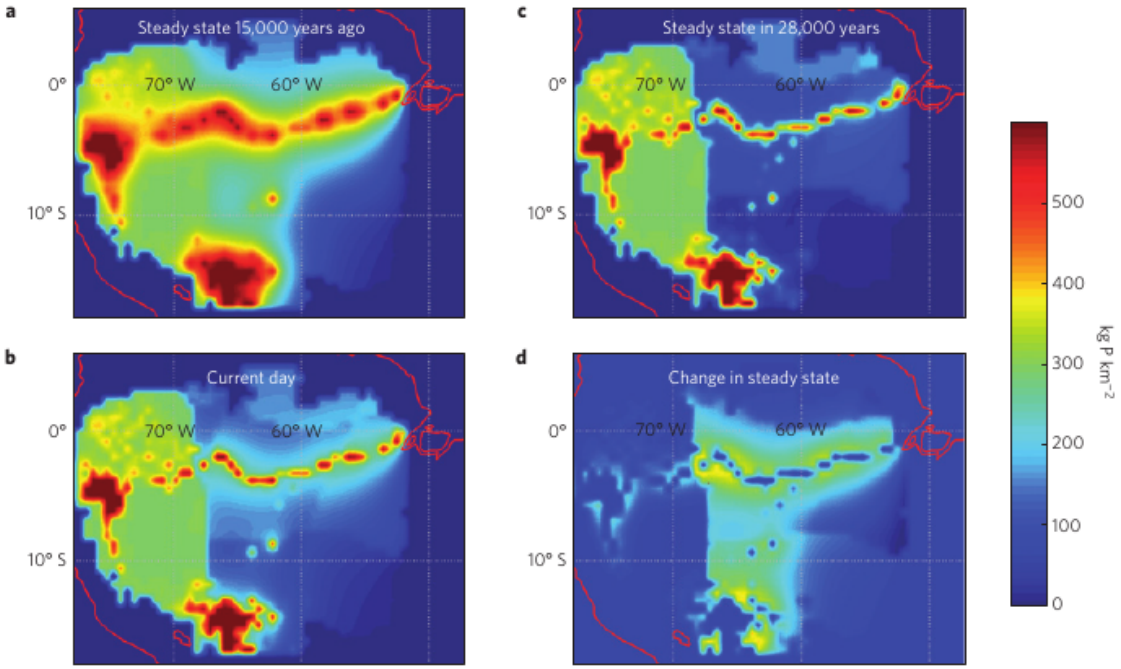

Figure 3 | Map showing changing ecosystem P concentrations in South America due to megafauna extinctions. a, The steady-state estimate of P concentrations in the Amazon basin before the megafaunal extinctions with a lateral diffusivity $\Phi_{excreta}$ value of 4.4 km^2 yr^{-1}. **b**, The current-day estimate of P concentrations 12,000 years after the extinctions with current animals and a $\Phi_{excreta}$ value of 0.027 km^2 yr^{-1}. **c**, Estimated P concentrations in the Amazon basin 28,000 years in the future. **d**, The difference between the pre- and post-extinction equilibrium (**a** and **c**).

Table 1 | Average $\Phi_{excreta} * \alpha B$ (km^2 yr^{-1}) for each continent calculated for modern species and modern plus extinct species.

	North America	South America	Australia	Eurasia	Africa
Number of species extinct	65	64	45	9	13
Mean weight of extinct animals (kg)	846	1,156	188	2,430	970
Modern $\Phi_{excreta} * \alpha B$	13,876	12,934	21,804	21,779	265,621
Modern + extinct fauna $\Phi_{excreta} * \alpha B$	140,716 (±38,000)	283,854 (±81,000)	48,250 (±8,000)	118,349 (±29,000)	324,848 (±18,000)
Percentage of original	10% (±2%)	5% (±1%)	45% (±6%)	18% (±4%)	82% (±4%)

Bottom row is the percentage of the original $\Phi_{excreta} * \alpha B$ remaining. The error represents an uncertainty in extinct species distribution of 30%.

Figure 6 : Source: (Doughty et al., 2013)

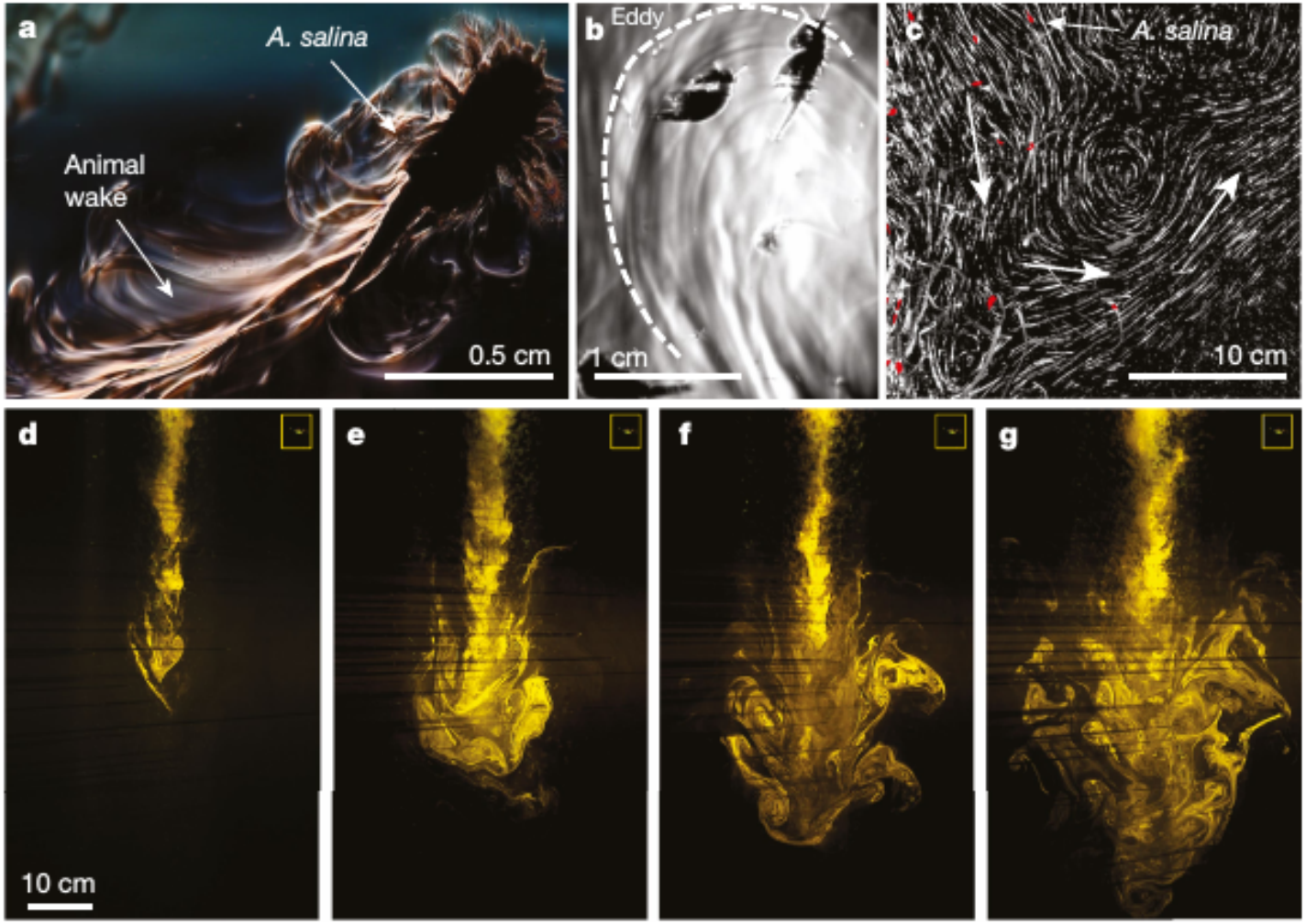

Figure 7 : Flow visualization of diffusion caused by the vertical migration of A. Salina (brine shrimp). $\kappa_{eff}/\kappa_{mol} \approx 10^3$ Source:

(Houghton et al., 2018)

Thermohaline circulation

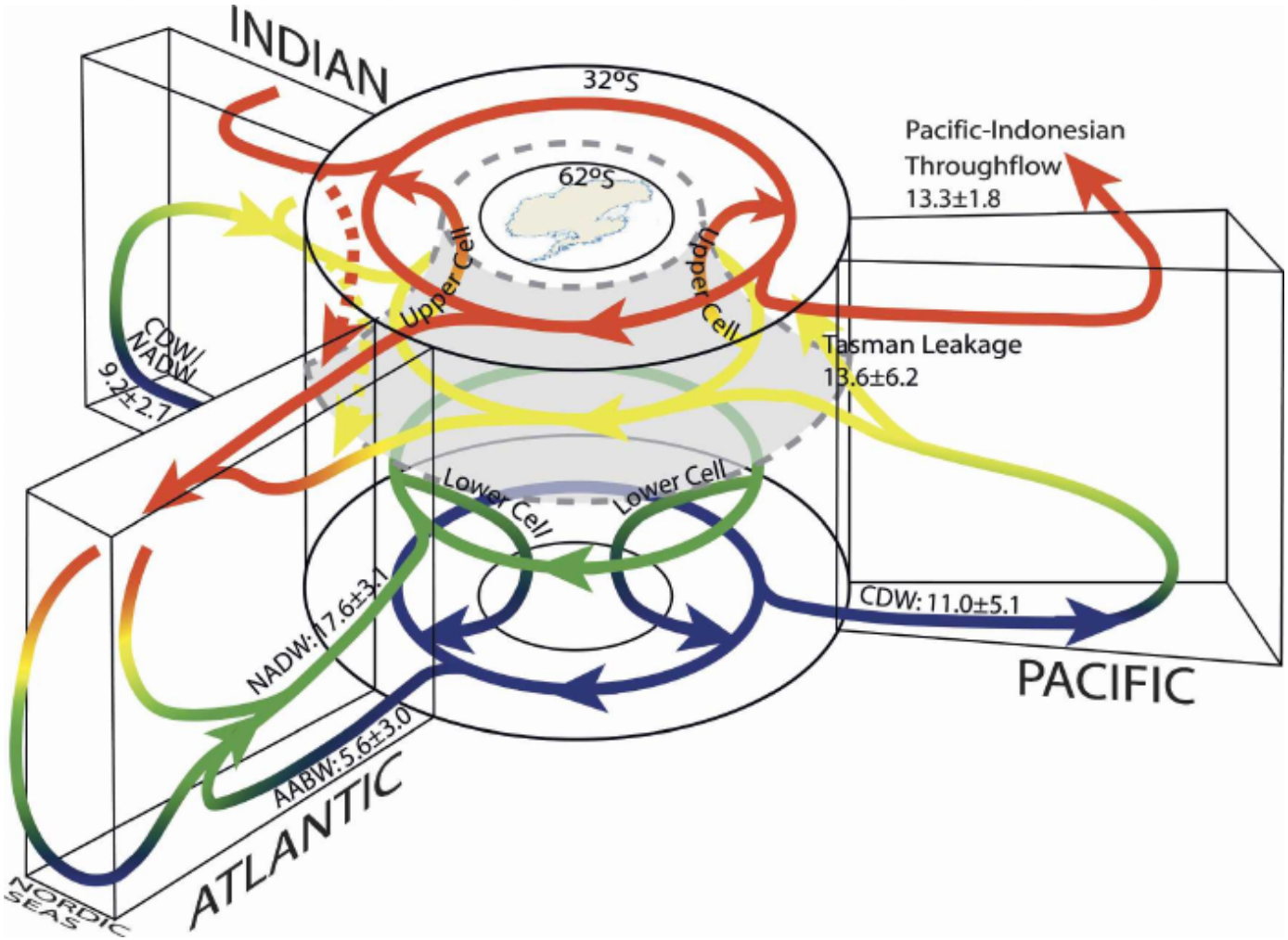

Figure 8 : Global thermohaline circulation source: Lumpkin and Speer, 2007 (Lumpkin and Speer, 2007)

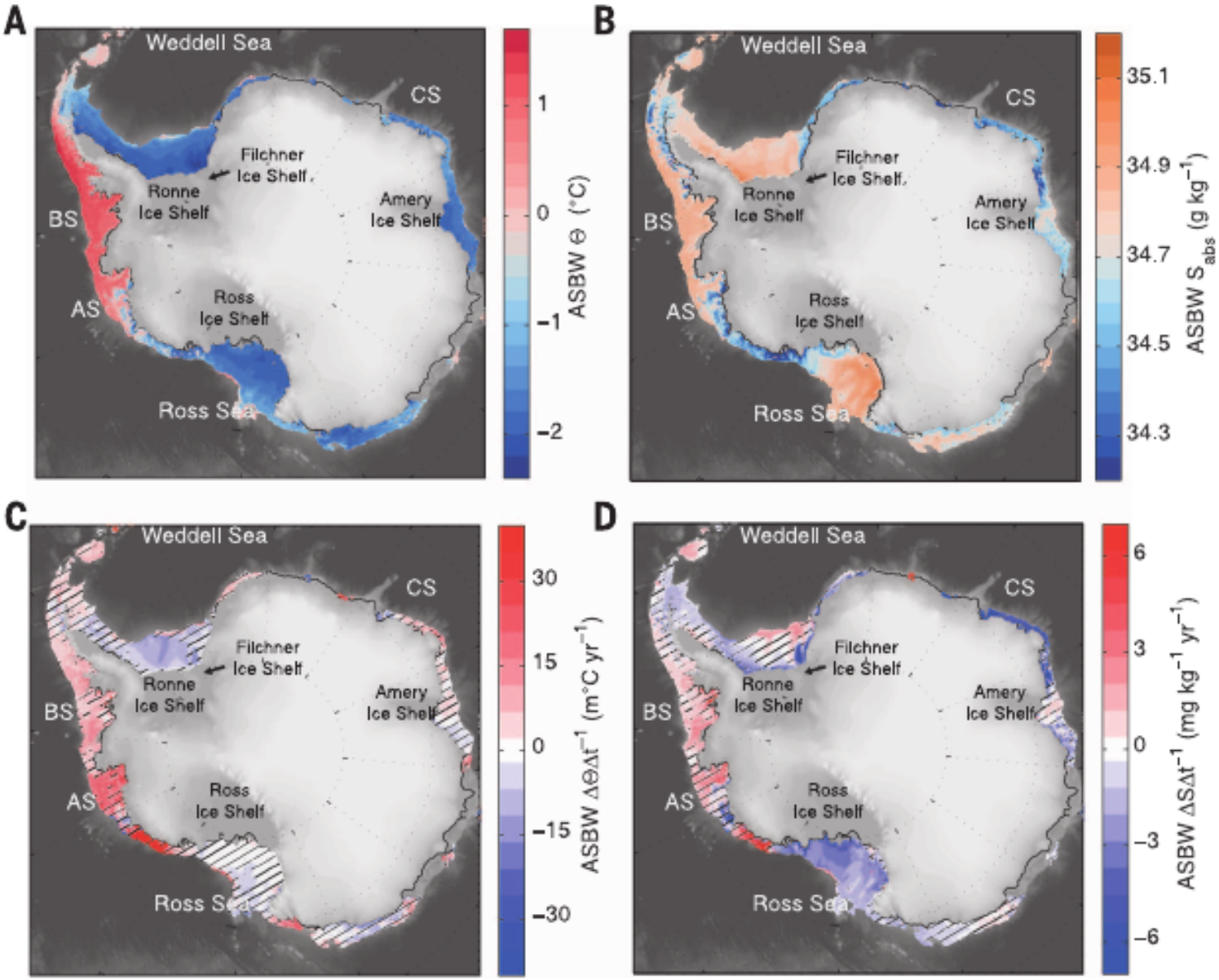

Figure 9 : Antarctic shelf sea bottom water properties and trends.

Source: (Schmidtko et al., 2014)

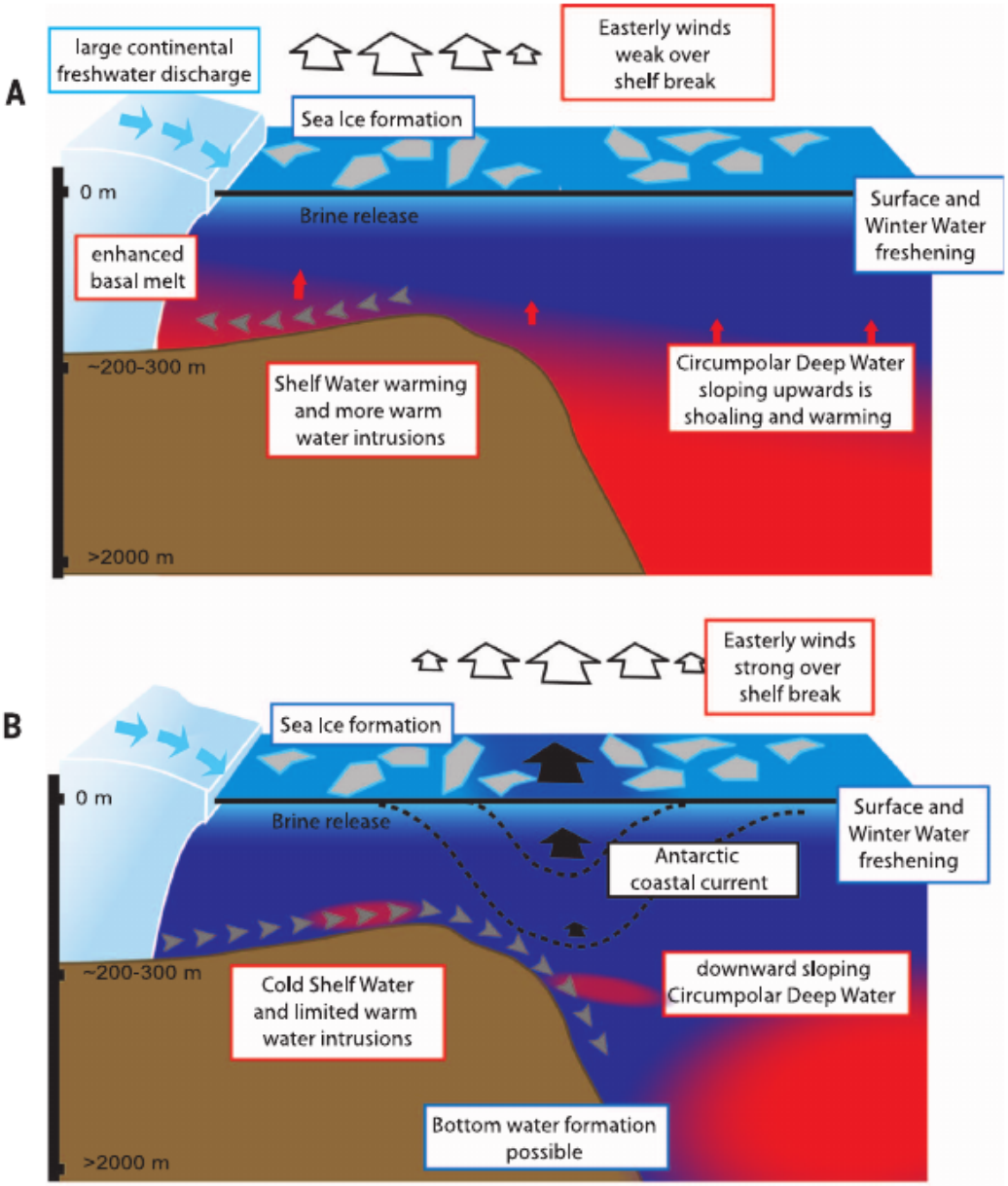

Figure 10 : Mechanisms of ocean currents warming the continental ice shelves of the Antarctic. Source: (Schmidtko et al., 2014)

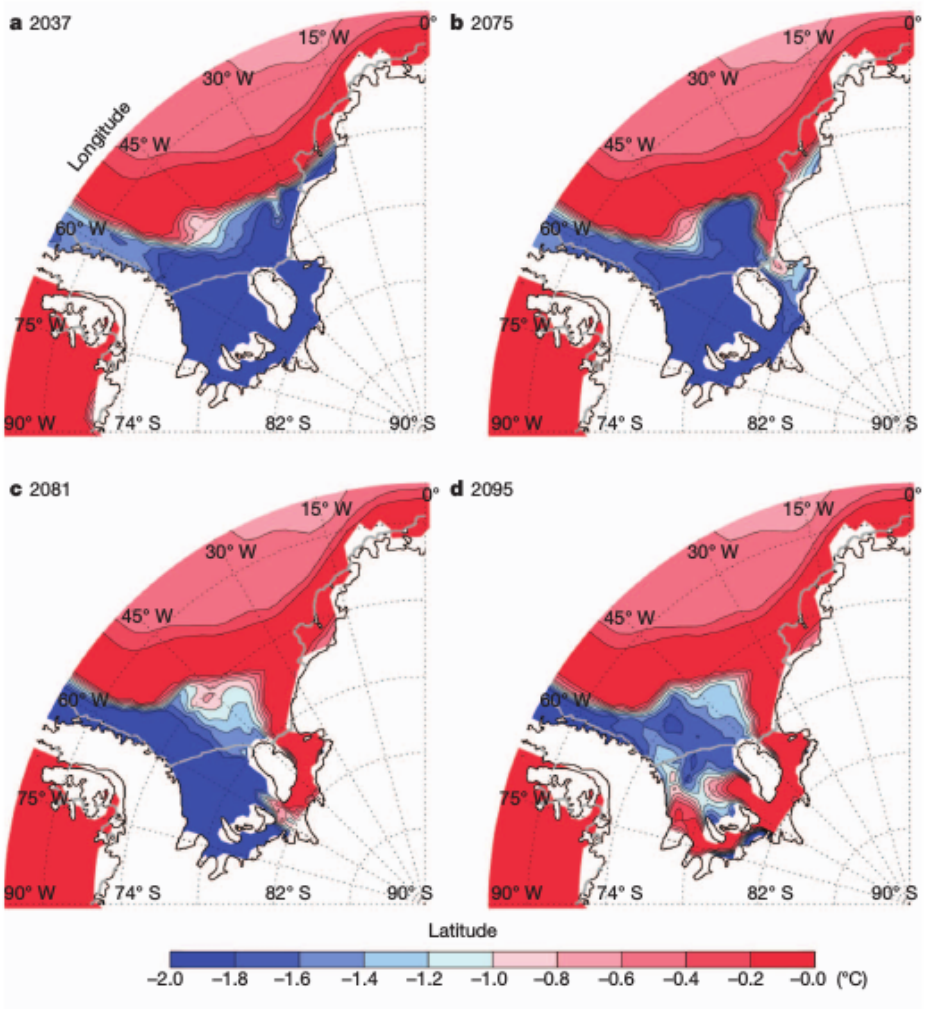

Figure 11 : Modelling the future shelf bed of the Weddell Sea.

Source: (Hellmer et al., 2012)

Reference I

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