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Supplement of

Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous

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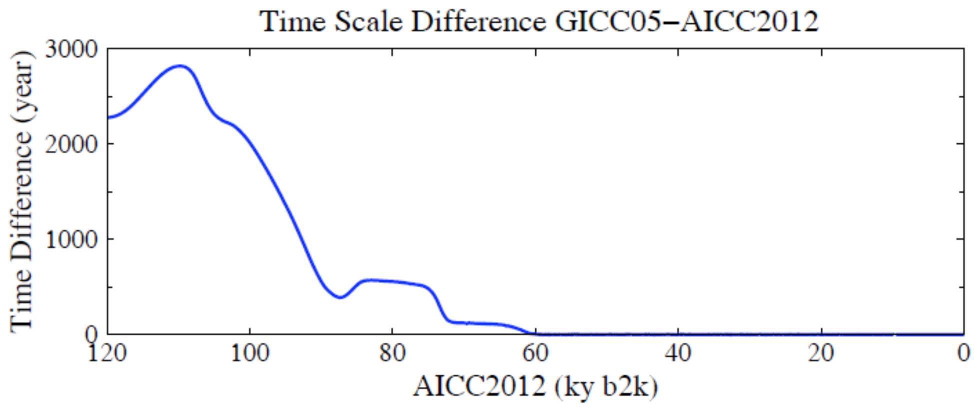

Fig. S1. Difference between the GICC2005modelext and AICC2012 time scales (Bazin et al., 2013; Veres et al., 2013; Rasmussen et al., 2014; Seierstad et al., 2014).

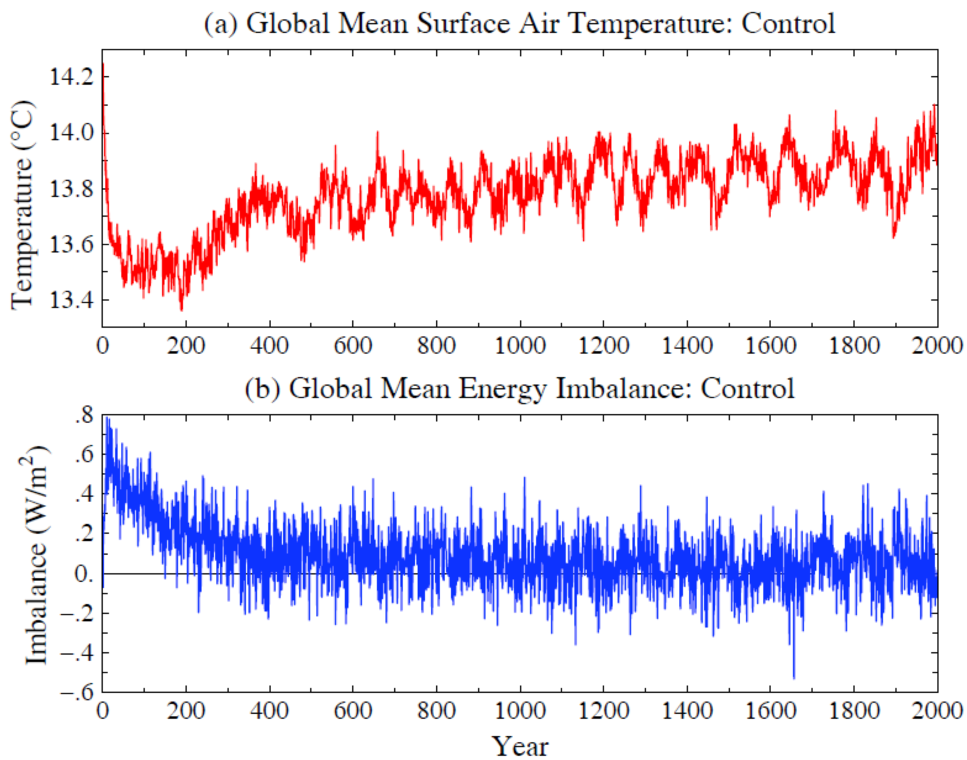

Fig. S2. Surface air temperature and planetary energy imbalance in the control run.

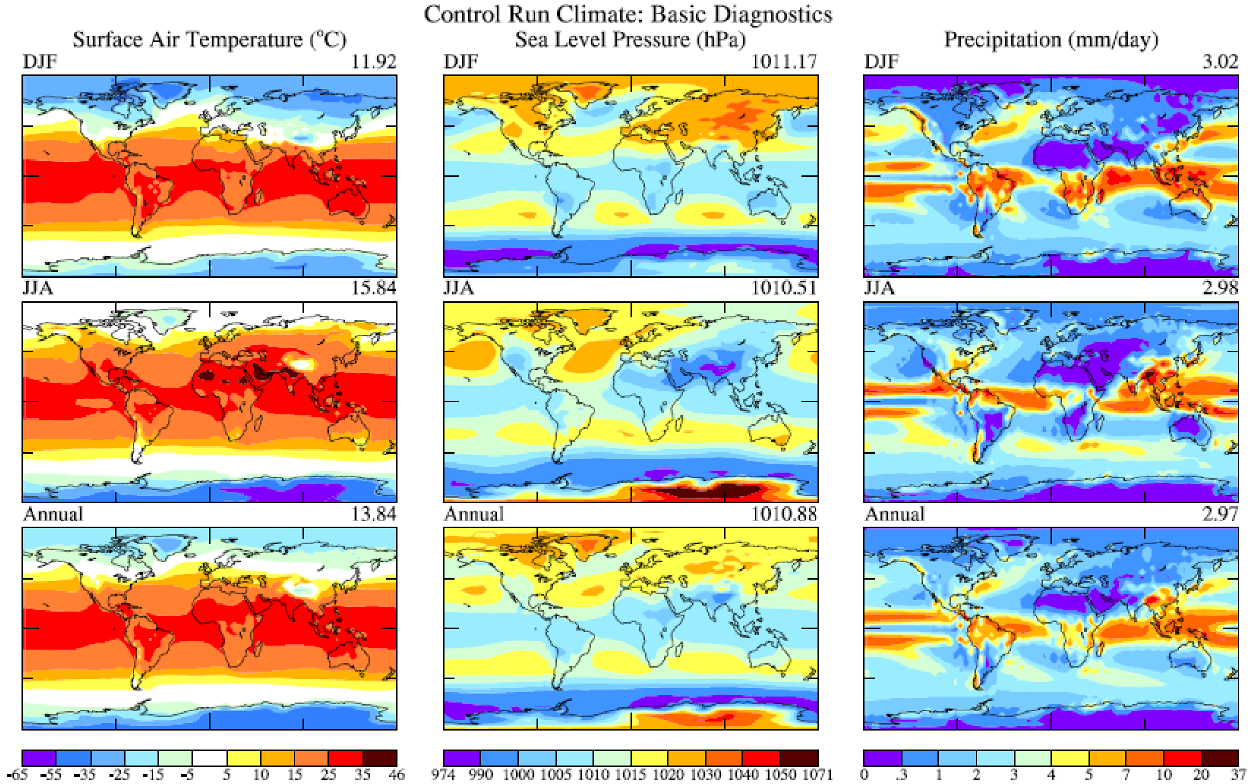

Fig. S3. Surface air temperature (left), sea level pressure (center) and precipitation (right) in Dec-Jan-Feb (upper row), JJA (middle row) and annual mean (lower row) in the climate model control run.

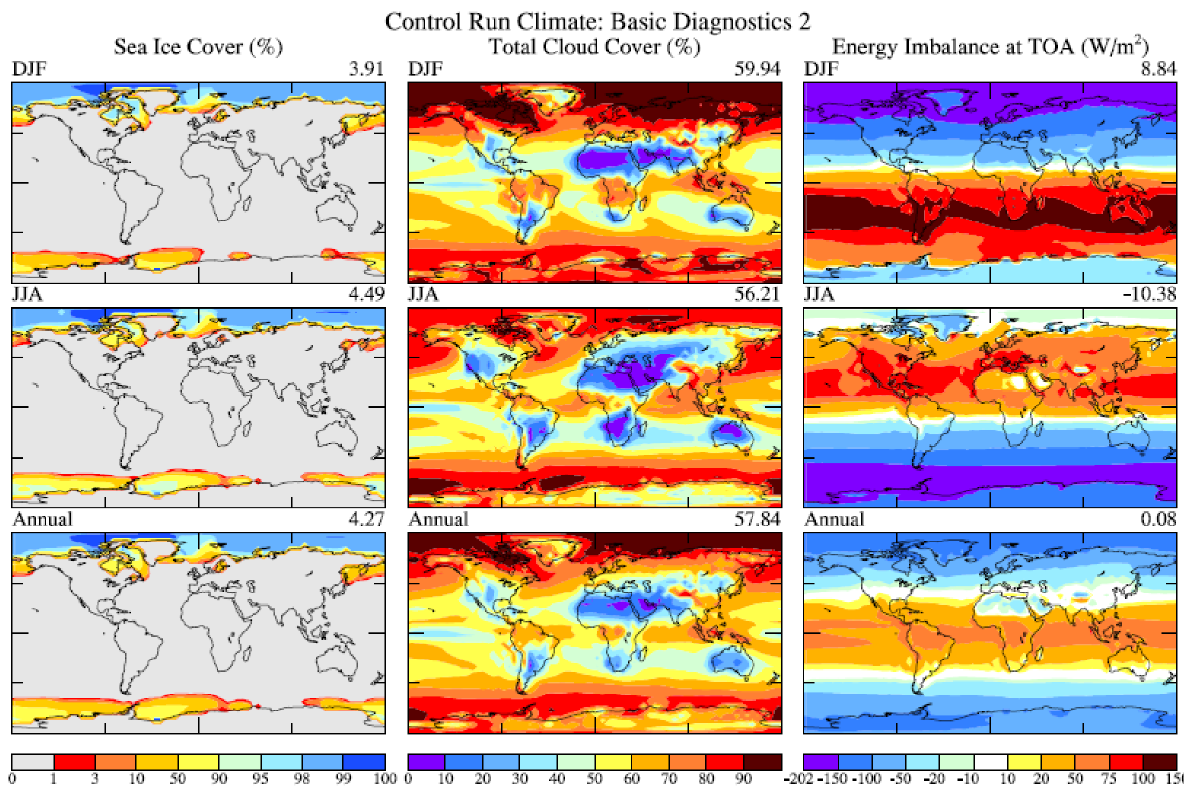

Fig. S4. Sea ice cover (left), cloud cover (center) and top of atmosphere energy imbalance (right) in Dec-Jan-Feb (upper row), JJA (middle row) and annual mean (lower row) in climate model control run.

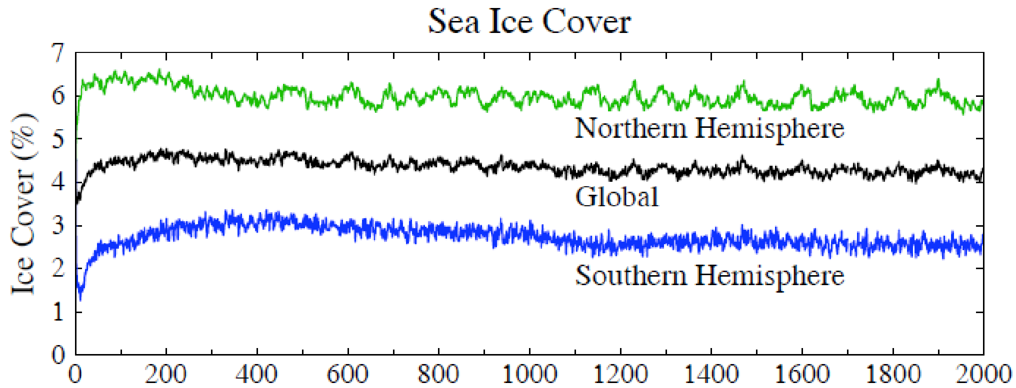

Fig. S5. Hemispheric and global sea ice versus time in the control run.

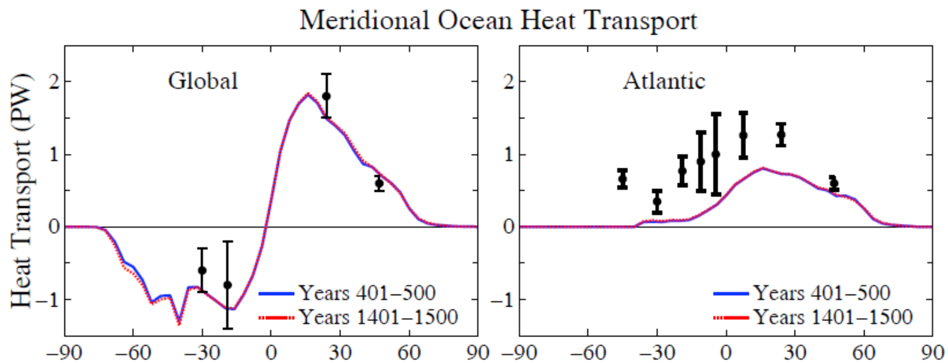

Fig. S6. Poleward transport of heat by the ocean in 5th and 15th centuries of the control run. Observational estimates (black dots with error bars) are from Ganachaud and Wunsch (2003).

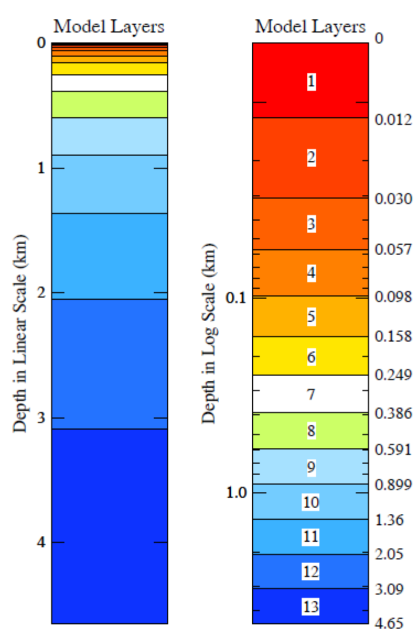

Fig. S7. Layer depths in ocean model.

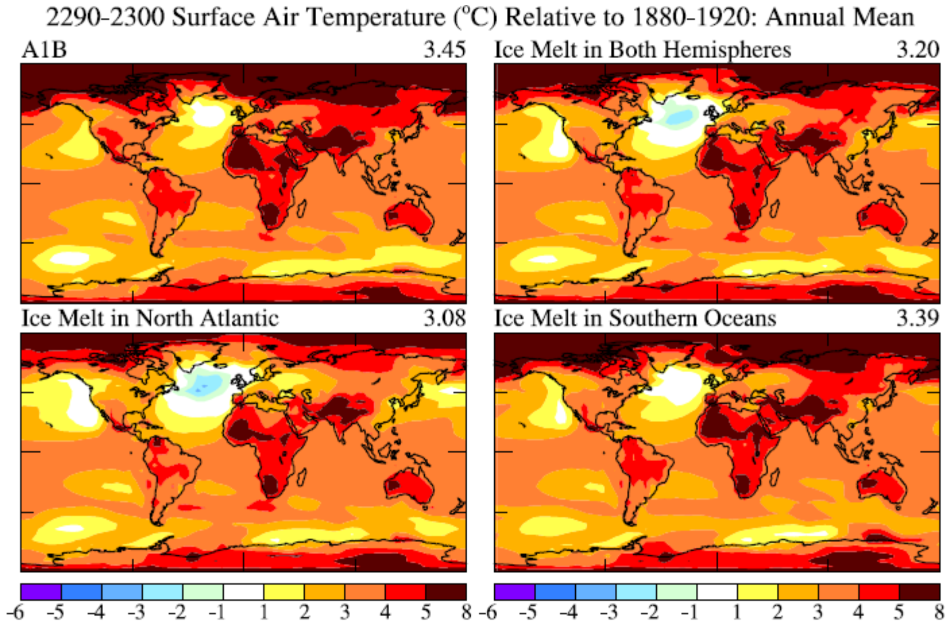

Fig. S8. Surface air temperature change relative to 1880-1920 in 2290-2300 for the four climate forcing scenarios shown in Fig. 11.

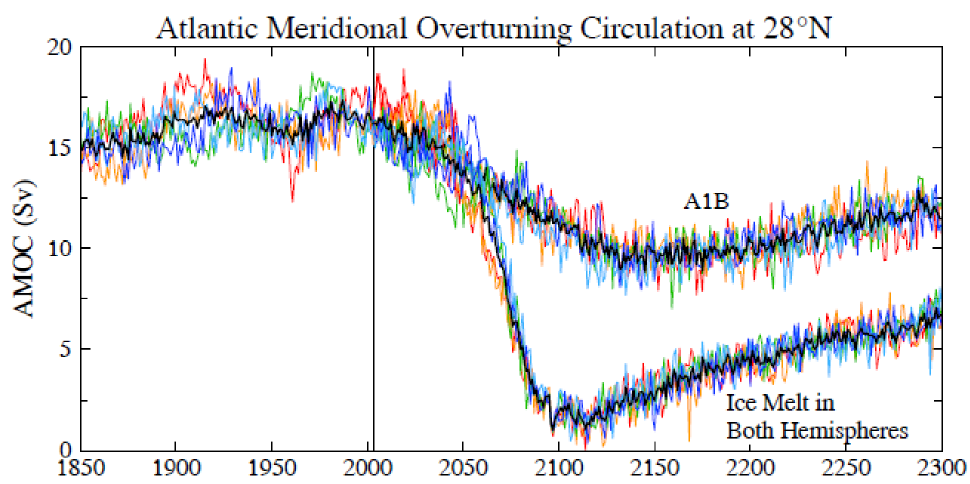

Fig. S9. AMOC strength at 28N in five ensemble members and their mean (heavy black line) for the A1B GHG scenario and for that scenario plus ice melt in both hemispheres with 10-year doubling time reaching a maximum 5 m contribution to sea level.

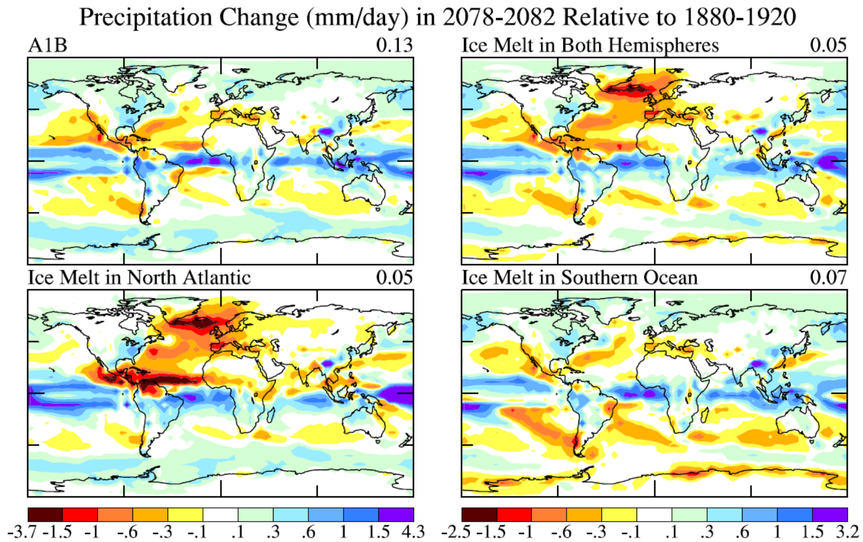

Fig. S10. Precipitation change in 2078-2082 for the same four scenarios as in Figs. 9 and 11.

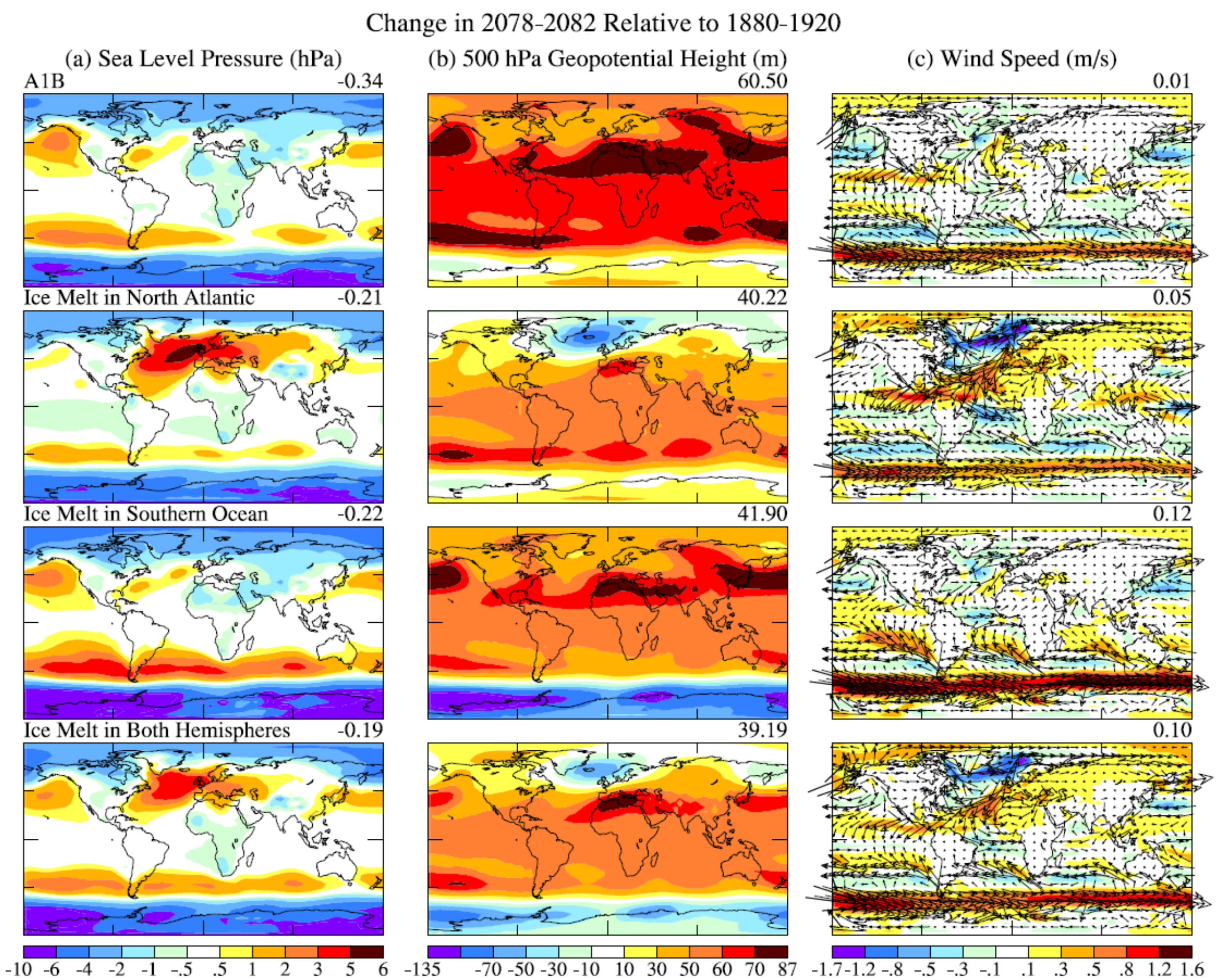

Fig. S11. Change in 2078-2082, relative to 1880-1920, of the annual mean **(a)** sea level pressure, **(b)** 500 hPa geopotential height, and **(c)** wind speed, for the same four scenarios as in Fig. 9.

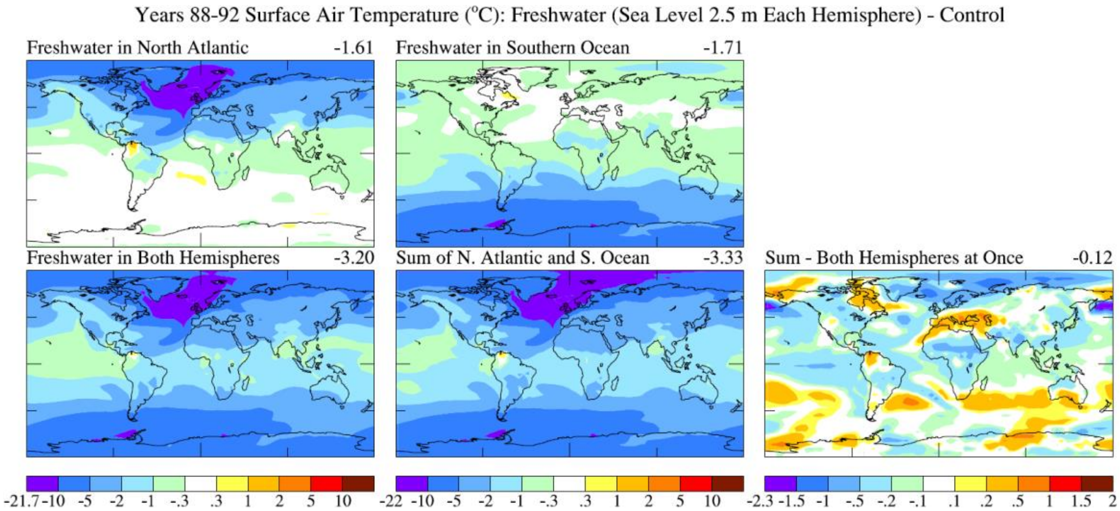

Fig. S12. Surface air temperature change in pure freshwater experiments at time of peak cooling (years 88-92) in three experiments with 2.5 m freshwater in each hemisphere. The sum of responses to the hemispheric forcings is compared with the response to forcing in both hemispheres in the bottom row.

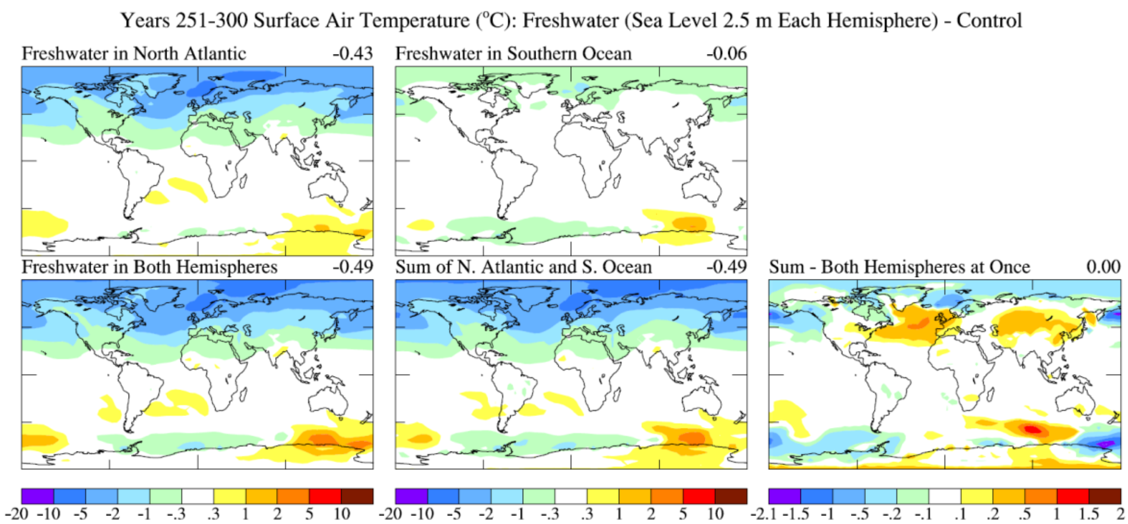

Fig. S13. Same as Fig. S12, but for years 251-300.

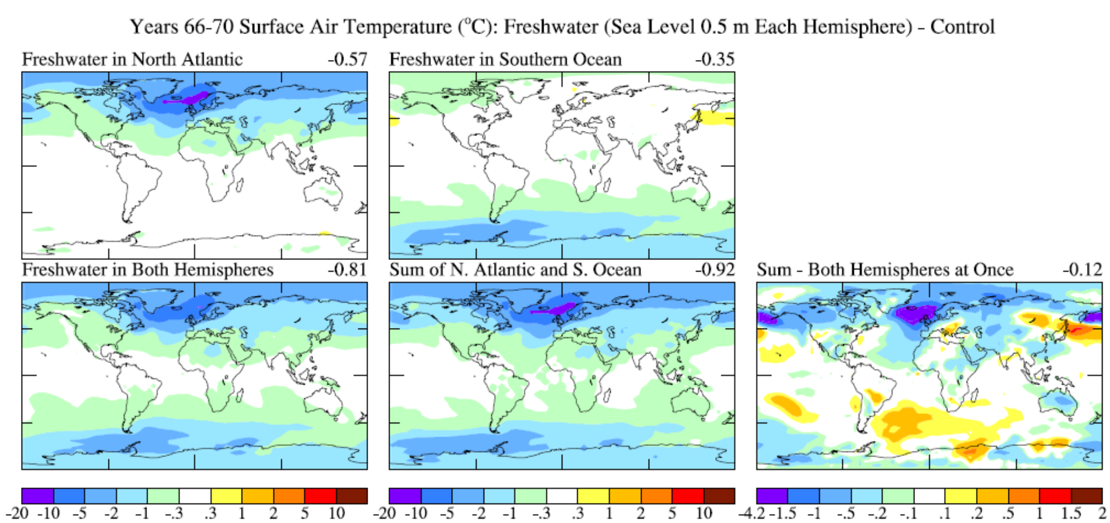

Fig. S14. Same as Fig. S12, but for hemispheric freshwater inputs of 0.5 m at years 66-70.

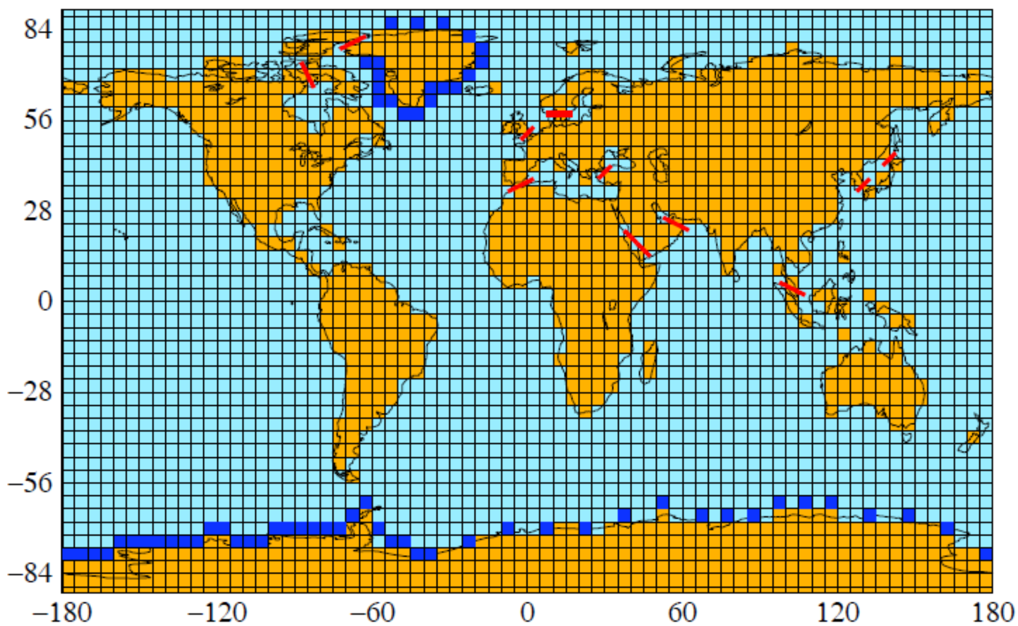

Fig. S15. Climate model grid. Dark blue gridoxes are locations of freshwater insertion. Red lines mark the 12 straights connecting ocean gridboxes.

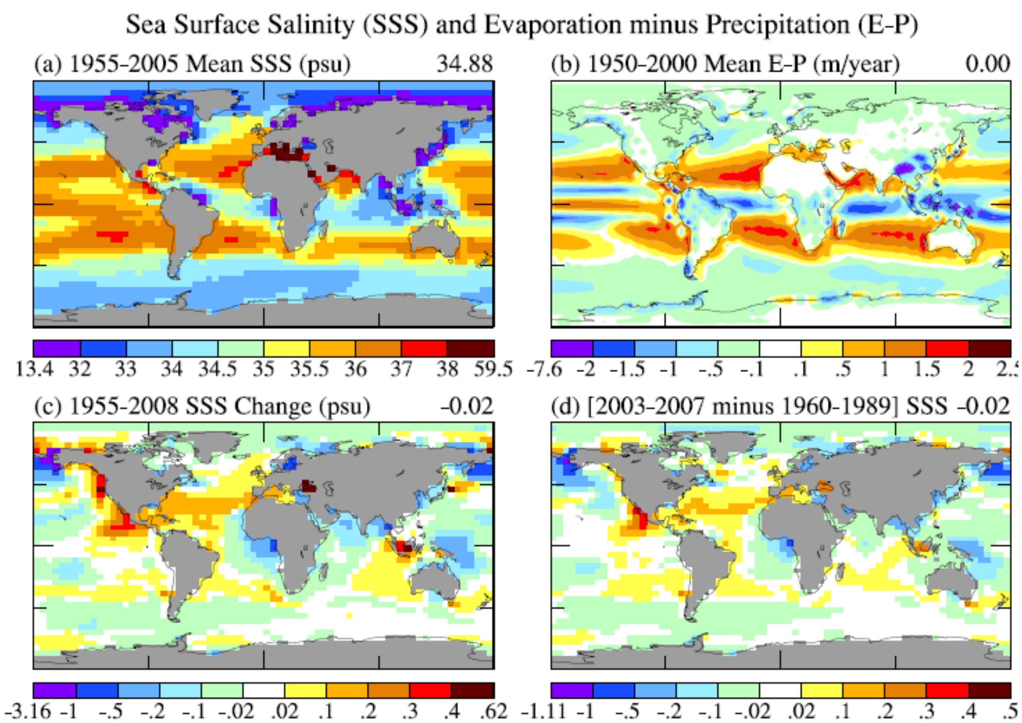

Fig. S16. Simulated sea surface salinity (a), evaporation minus precipitation (b), and change of salinity (c, d), the periods being chosen to allow comparison with observations, as discussed in the text.

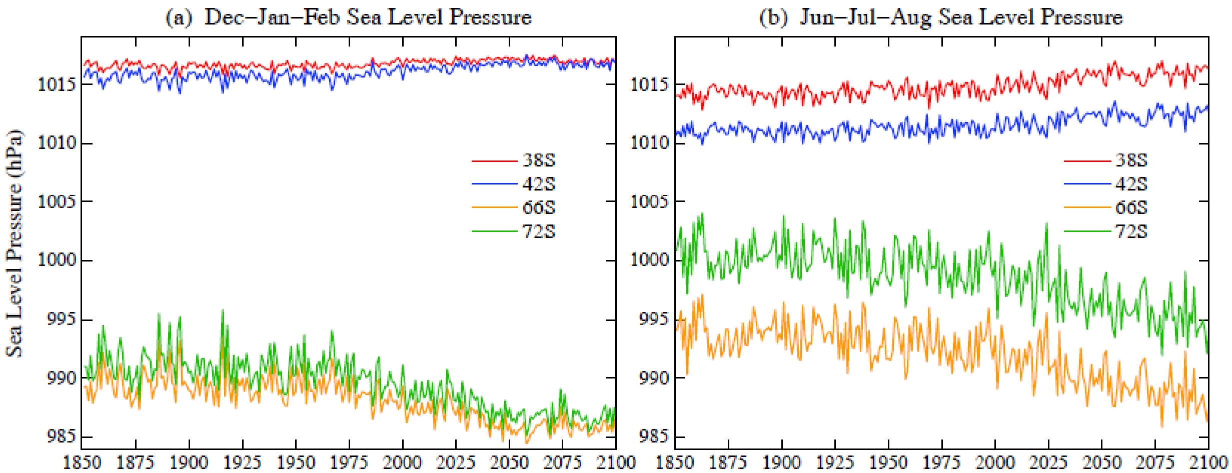

Fig. S17. Sea level pressure at four latitudes in (a) Dec-Jan-Feb and (b) Jun-Jul-Aug. The model is driven by the "modified" forcings that include ice melt reaching the equivalent of 1 m sea level by mid-century.

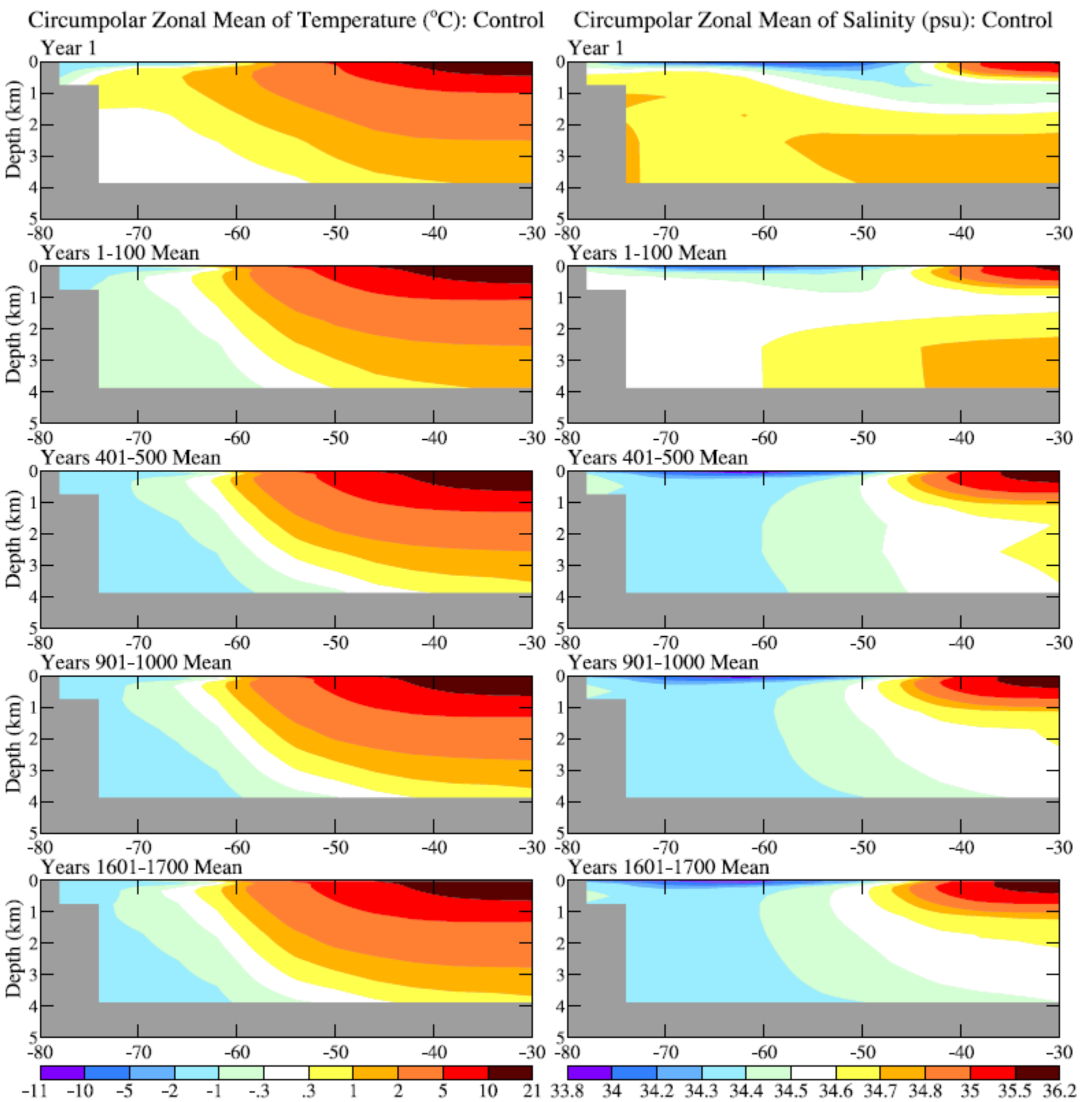

Fig. S18. Ocean temperature and salinity in the control run.

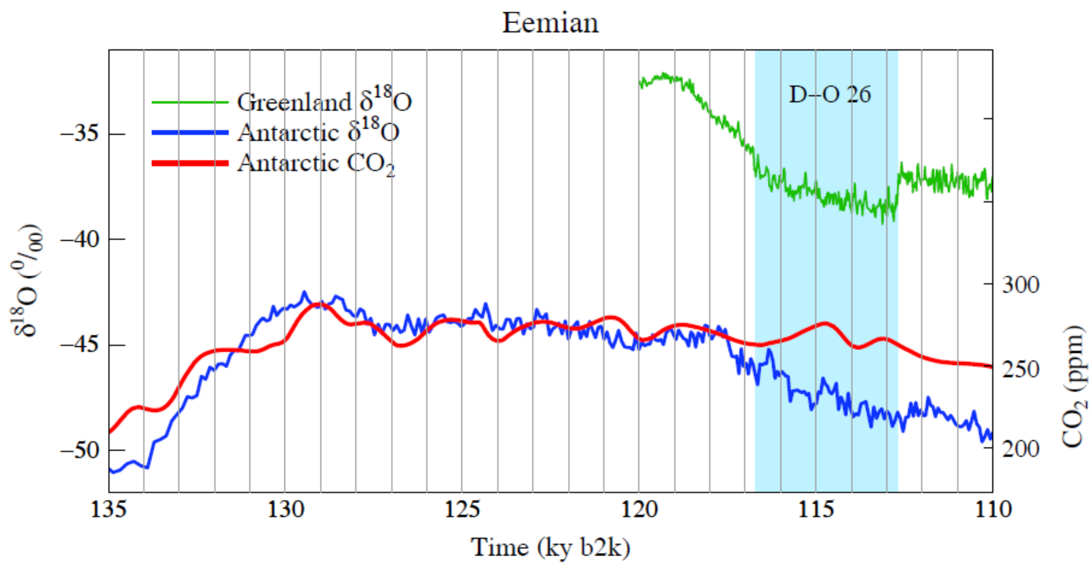

Fig. S19. Expansion of data from Fig. 24b,c. CO_2 increases during D-O 26 lag Antarctic temperature rises by 1500-2000 years.

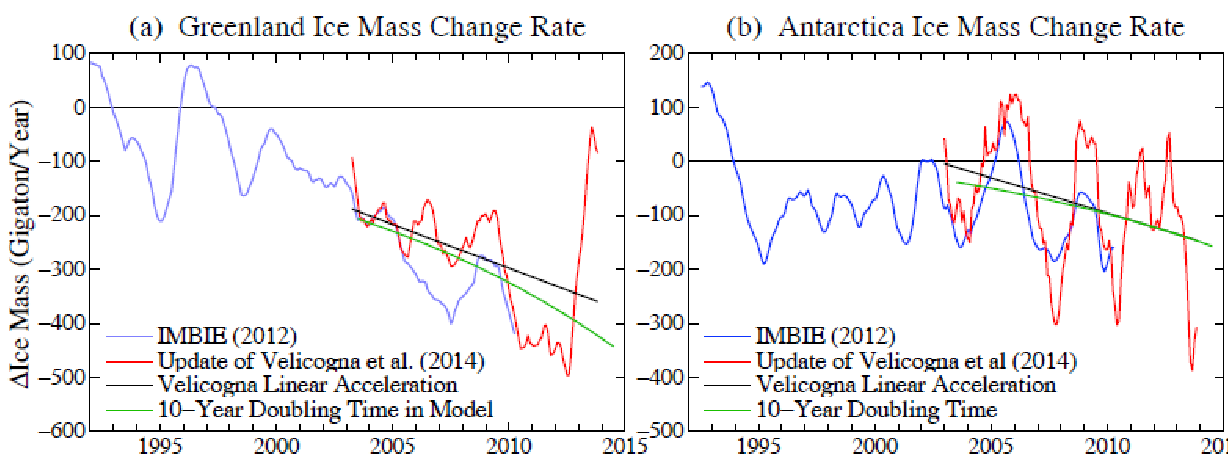

Fig. S20. Greenland and Antarctic ice mass change rates. Data from Velicogna et al. (2014) Shepherd et al. (2012), and http://imbie.org/ (IMBIE = Ice Sheet Mass Balance Inter-comparison Exercise).

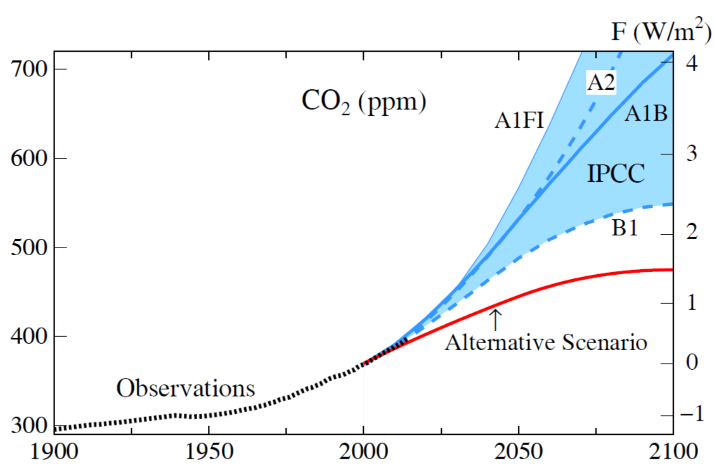

Fig. S21. Observed CO_2 amount and scenarios for the 21st century (update of Hansen et al., 2007c). The "Alternative Scenario" has peak CO_2 475 ppm in 2100, when global warming reaches 1.6°C relative to 1880-1920.

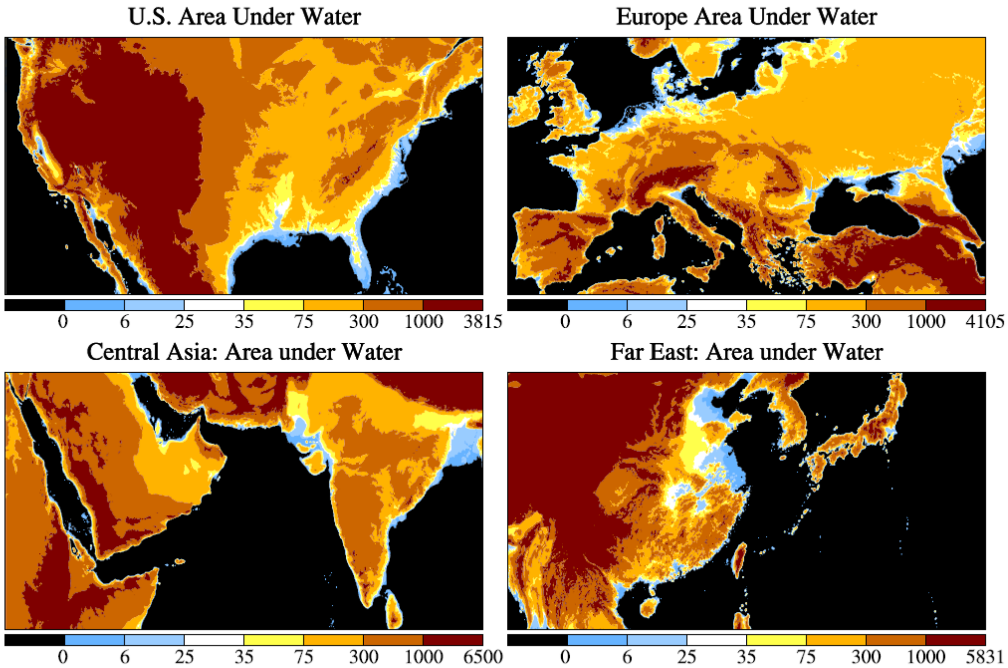

Fig. S22. Areas (light and dark blue) that nominally would be under water for 6 and 25 m sea level rise.

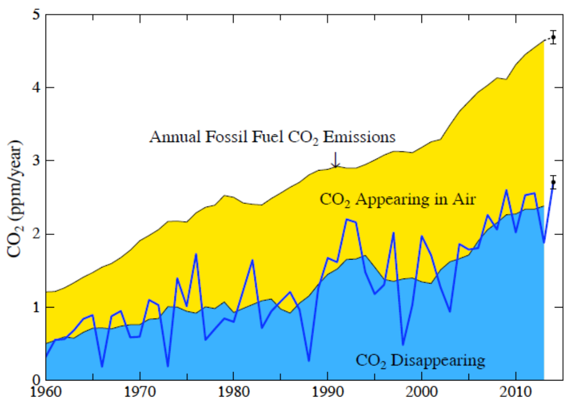

Fig. S23. Global fossil fuel CO_2 emissions (top curve). Measured CO_2 increase in air is the yellow area. The 7-year mean of CO_2 going into the ocean, soil and biosphere is blue (5- and 3-year means at the end; dark blue line is annual). 2014 global emissions estimate as 101% ±2% of 2013 emissions. CO_2 emissions from Boden et al. (2013) and atmospheric CO_2 from P. Tans (www.esrl.noaa.gov/gmd/ccgg/trends) and R. Keeling (www.scrippsco2.ucsd.edu/).

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