The Primacy of Observations in Climate Prediction

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The first International Panel on Climate Change (IPCC) report in 1990 characterized the uncertainty of the equilibrium climate sensitivity to a doubling of carbon dioxide (CO_2) as being in the range 1.5-4.5 K. The fifth IPCC report in 2013 states the same range of 1.5-4.5 K, despite great progress in our understanding of many aspects of our contemporary climate and that of the ice ages. The difficulty lies in the magnitude of feedbacks and in the time scales over which they operate. Many feedbacks are still unknown. A few examples of carbon cycle - climate feedbacks will be presented. Climate predictions over several decades and longer can serve to show what is currently considered somewhat plausible. Our global civilization is carrying out multiple simultaneous experiments with our planet. Only high-quality observations of the changes as they unfold, and of human behavior, allow us to make discoveries about how the climate system really works. Not making these observations now will limit future generation's understanding of climate, and future models will be the worse for it.

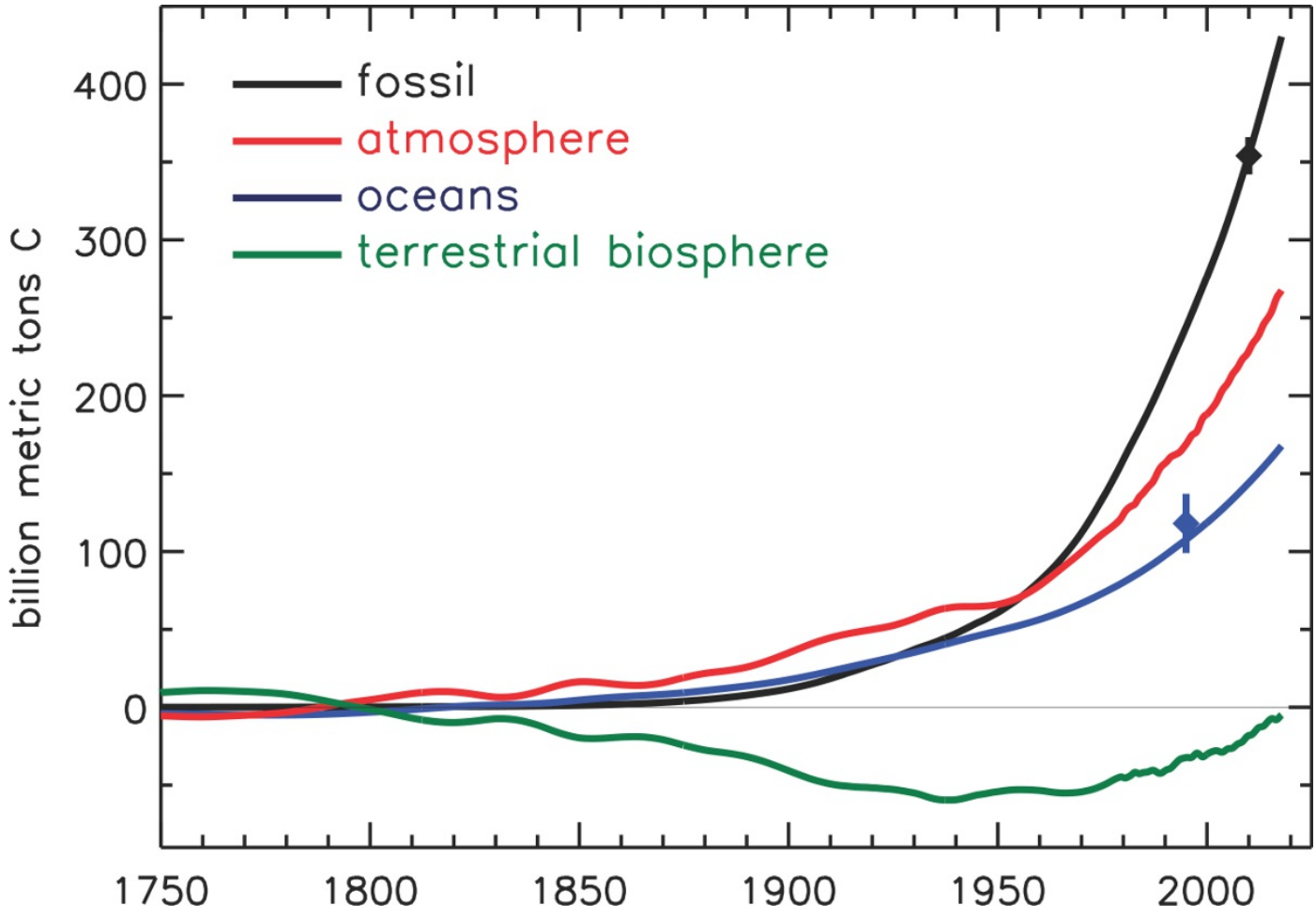

Figure 1. Known cumulative fossil fuel emissions and observed global atmospheric increase (zero corresponds to the pre-industrial value 280 ppm). An empirical model of air-sea CO_2 exchange calculates cumulative CO_2 uptake by the oceans, with parameters chosen to fit ocean obsevations (blue diamond in 1994) as well as the rate of uptake during the last two decades based on atmospheric oxygen/nitrogen observations. Net changes in global terrestrial biomass follow from the mass balance of the other three terms.