

Dealing with Climate Myths

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Abstract: Many scientists understand that climate change has a sociopolitical aspect, but some scientists are unwilling to address the issue lest they be perceived as political themselves. Nevertheless, when we scientists find climate myths, I think it is our duty as scientists to be willing to debunk them. This poster exhibits some myths and contrasts them with the science.

Myth 1: Earth's temperature isn't rising (i.e., global warming is a myth).

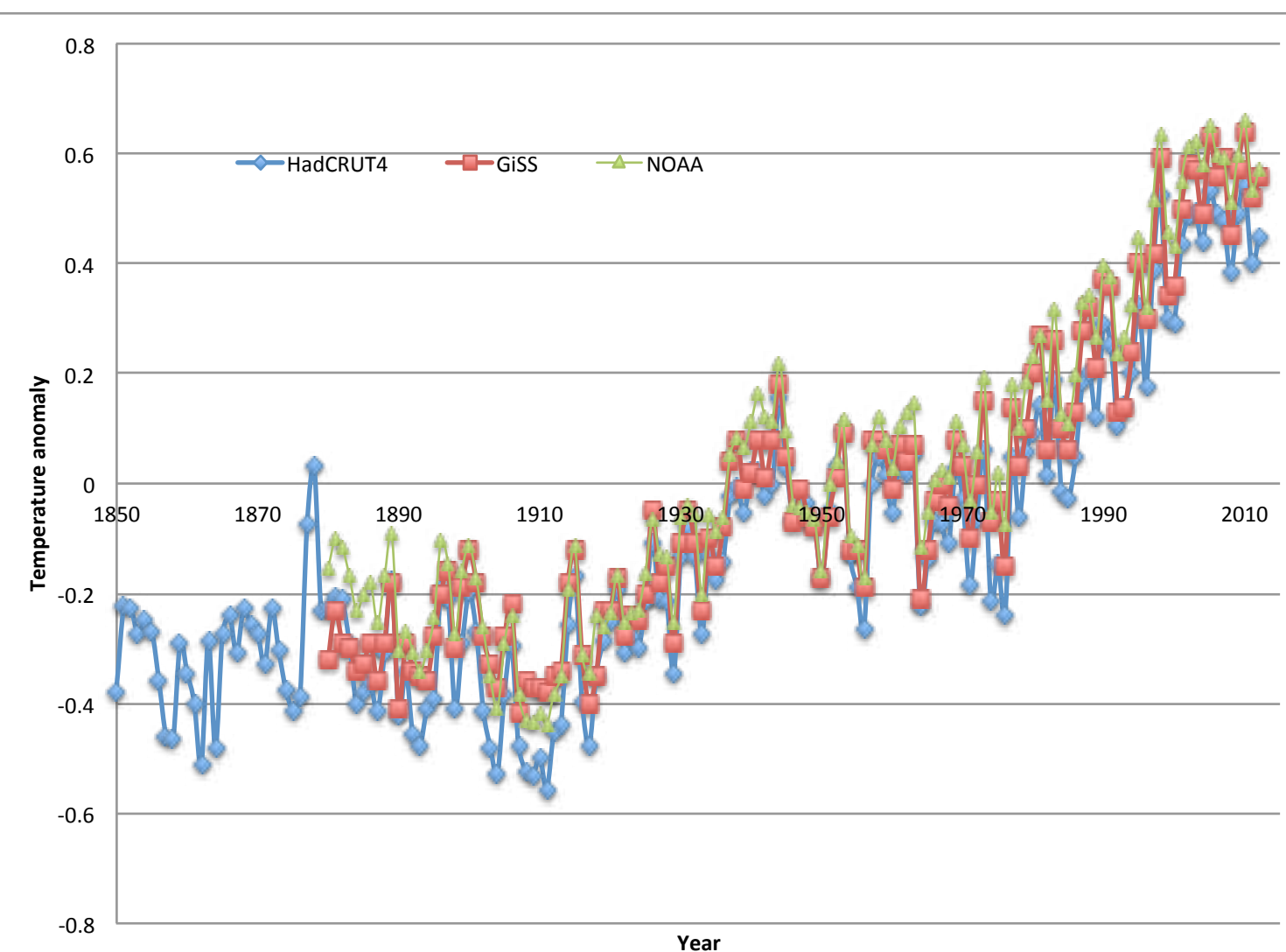


Figure 1. Global temperature anomaly history according to the three databases, Hadley Centre-Climate Research Unit fourth temperature series, Goddard Institute of Space Sciences, and National Oceanic and Atmospheric Administration. (left)

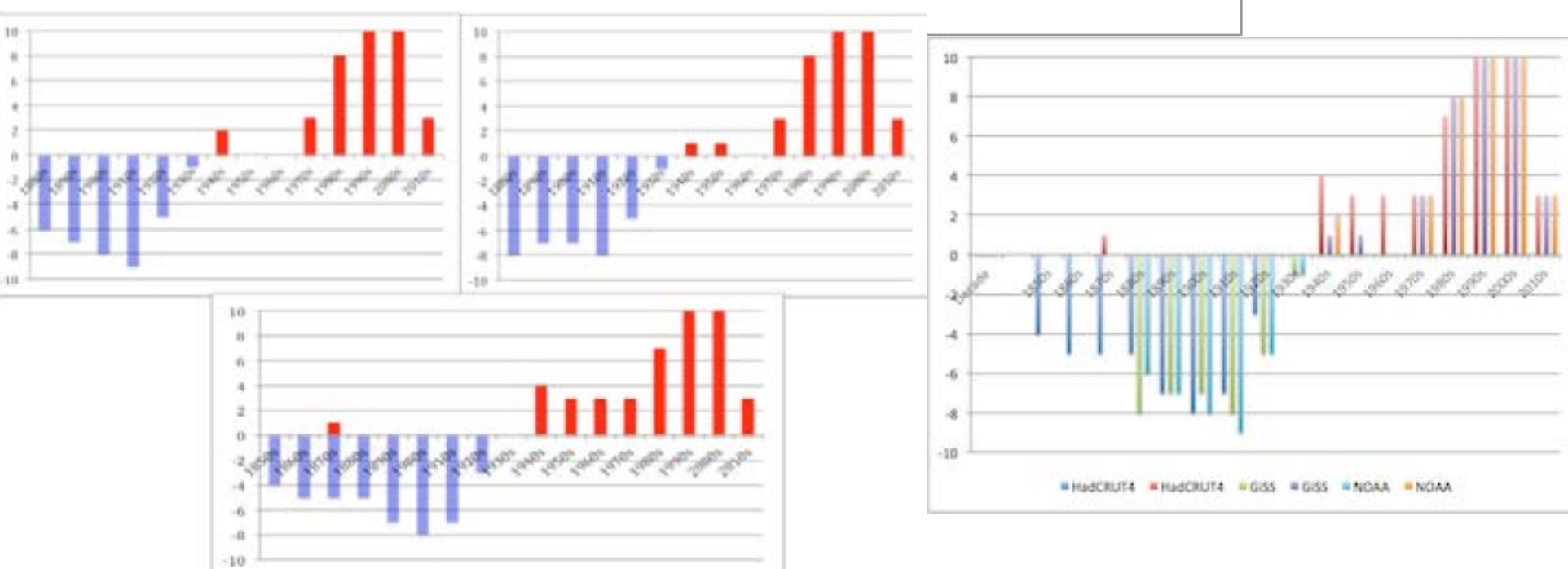


Figure 2. Decadal monthly anomalies, 27% rule. NOAA, upper left; GISS, upper right; HadCRUT4, lower left. Red: warmest 27% of years; Blue: coldest 27% of years. Agreement among global T databases. (lower right)

Myth 2: Human carbon emission has nothing to do with Earth's temperature.

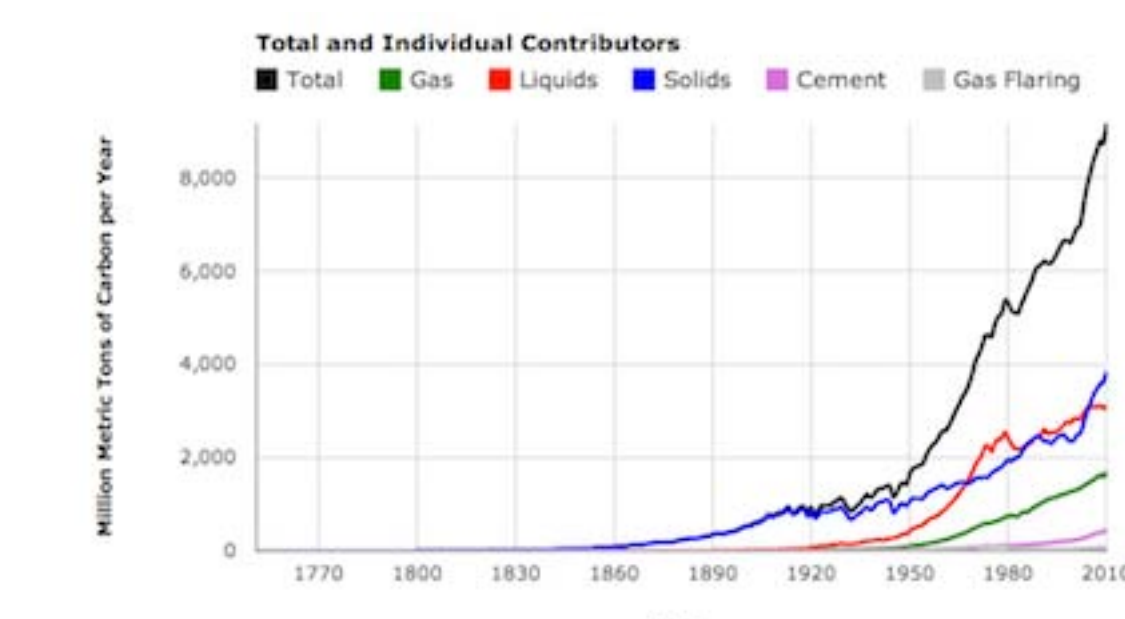


Figure 3. Carbon dioxide global emissions, 1751-present. Data from T. A. Boden and R. J. Andres, Carbon Dioxide Information Analysis Center, ORNL and G. Marland, Research Institute for Environment, Energy, and Economics, Appalachian State University. (left)

Figure 4. C isotope emissions with human "fingerprint." Data from Boden, Andres, and Marland, op. cit. (below left)

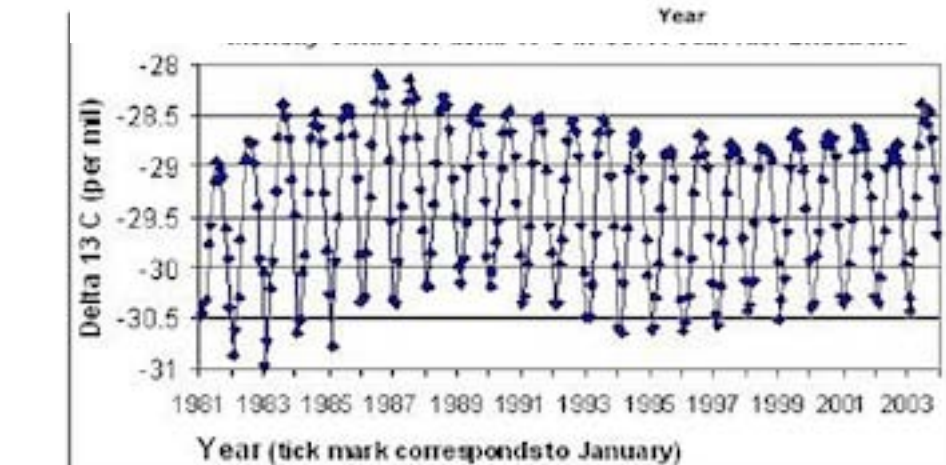
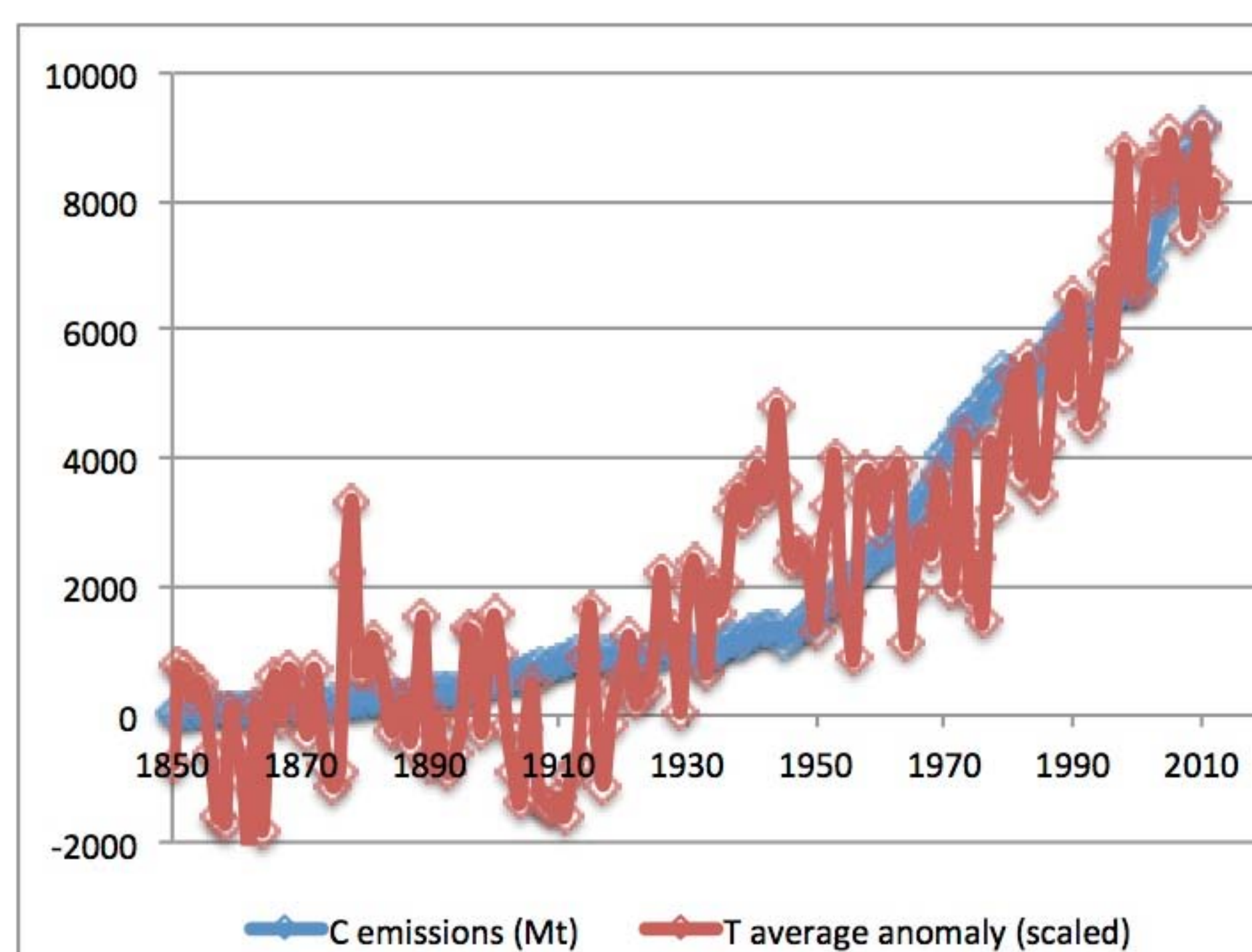


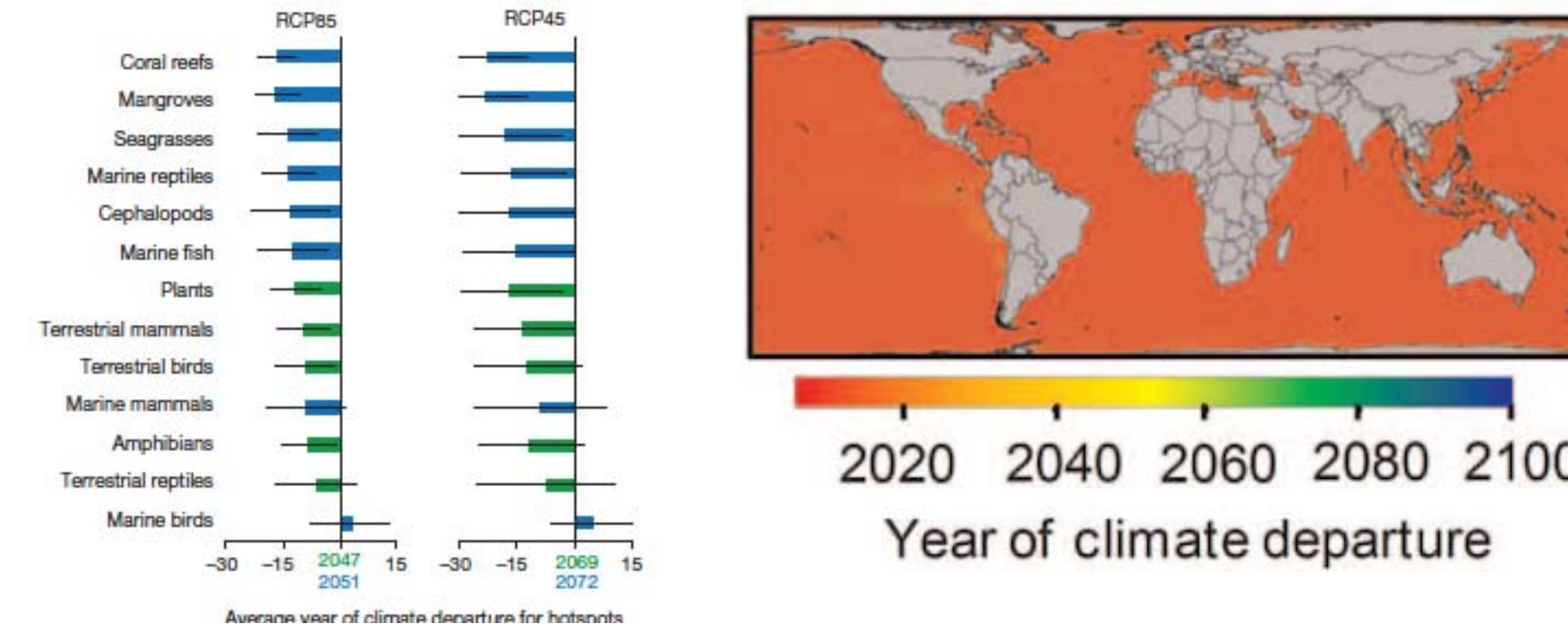
Figure 5. CO₂ emissions (Fig. 3) and averaged temperature anomaly, HadCRU, GISS, NOAA, 1850 to present. Scale factor: 3000 +10000 * av. T anomaly. (next column, top)

These isotopes in Fig. 4 are signals of ancient concentrations, and cannot come from agriculture or burning of present-day sources of carbon. Thus, they must result from our burning of fossil carbon stores.



Myth 3. Humans are too puny to affect an entire planet.

This must seem ridiculous to most scientists; it is too obvious to cause comment, ever since Revelle and Suess (1) explained in 1957 that humanity is presiding over an "unplanned experiment" with the massive release of carbon dioxide on Earth. However, too many people have repeated this myth to me to ignore it. A recent paper by Mora et al. in *Nature* (2) states that they created "a new index of the year when the projected mean climate of a given location moves to a state continuously outside the bounds of historical variability under alternative greenhouse gas emissions scenarios. Using 1860 to 2005 as the historical period, this index has a global mean of 2069 (±18 years s.d.) for near-surface air temperature under an emissions stabilization scenario and 2047 (±14 years s.d.) under a 'business-as-usual' scenario." Their Fig. 3 shows the projected dates of climate departure of global hotspots. Further, their Supplemental Figure 2 segment e shows that ocean pH has already passed into uncharted territory compared to the 1860-2005 period.



According to the caption for Fig. 3 of Mora et al., "These plots indicate the difference between the average year in which the climate exceeds bounds of historical variability for each hotspot and the estimated global averages." As can be seen in the ocean diagram, the limit was already exceeded. It is clear that we "puny" humans have affected the entire ocean and are affecting the planet in a big way.

Myth 4. We don't have to reduce carbon emissions until we reach the 2 °C limit, or trillionth tonne, because scientists can make the problem go away.

This myth depends on the great trust in science and technology to solve the problems we generate, but it is extremely unrealistic. Allen et al. (3) argue that we cannot exceed a trillion tonnes of cumulative emissions. They write "the integrals under these 'containment scenarios', or cumulative total carbon dioxide emissions over the entire 'anthropocene' period, are bounded. For integrals less than two trillion tonnes of carbon (Tt C) almost all emissions occur before 2200." They go on to write "This insensitivity to the timing of future emissions suggests we can define the Cumulative Warming Commitment (CWC) as the peak warming response to a given total in-

jection of CO₂ into the atmosphere following our best estimate of anthropogenic emissions to date and any future emissions pathway that is smooth, positive and ends in exponential decline. CWC provides a simple measure of climate system response to scenarios in which CO₂ concentrations peak and decline. Unlike ECS, CWC relates emissions right through to temperature, so a range on CWC also incorporates uncertainty in the carbon cycle." In a related paper (4), Meinshausen et al. find that "cumulative emissions up to 2050 and emission levels in 2050 are robust indicators of the probability that twenty-first century warming will not exceed 2 °C relative to pre-industrial temperatures." Both papers argue that the method of reduction and emission is irrelevant, but Steinacher, Joos, and Stocker (5) argue that "For any given likelihood of meeting a set of such targets, the allowable cumulative emissions are greatly reduced from those inferred from the temperature target alone. Therefore, temperature targets alone are unable to comprehensively limit the risks from anthropogenic emissions."

Myth 5. Irreversible means Unavoidable.

Earth's temperature may rise unavoidably for around 30 years even if emissions were to cease immediately, a phenomenon known as thermal inertia. In their *Science* paper (6), Matthews and Solomon note that despite this, the cessation of emissions can keep T below what is the consensus 2 °C level. They write: "If emissions were to cease abruptly, global average temperatures would remain roughly constant for many centuries, but they would not increase very much, if at all. Similarly, if emissions were to decrease, temperatures would increase less than they otherwise would have." They conclude the paper by writing "every increment of avoided temperature increase represents less warming that would otherwise persist for many centuries. Although emissions reductions cannot return global temperatures to preindustrial levels, they do have the power to avert additional warming on the same time scale as the emissions reductions themselves. Climate warming tomorrow, this year, this decade, or this century is not predetermined by past CO₂ emissions; it is yet to be determined by future emissions."

Myth 6. Emissions are due to everyone, so regulation of emissions can't solve the problem.

According to Heede (7), "A total of 914 billion tonnes of CO₂-equivalent (Gt CO₂e) has been traced to 90 international entities based on analysis of historic production records dating from 1854 to 2010." Additionally, he finds that "cumulatively, emissions of 315 GtCO₂e have been traced to investor-owned entities, 288 GtCO₂e to state-owned enterprises, and 312 GtCO₂e to nation-states."

Myth 7. Climate scientists disagree about whether humans have caused warming.

This myth has been busted many, many times. S. Arrhenius (8), working on an idea originating with Fourier (9) in the 1820s and expanded on by Tyndall (10) in the 1860s, did the calculations for the effect of carbon dioxide on global temperatures. Various authors (11) have shown consensus at above the 90% level.

The reality of global warming is irrefutable (12, 13). We cannot allow the popular myths supported by "deep pocket" organizations (14) whose financial future depends on doing nothing about the situation to prevail.

References

1. R. Revelle and H. E. Suess, "Carbon dioxide exchange between atmosphere and ocean and the question of an increase of atmospheric CO₂ during the past decades." *Tellus IX*, 1 (1957).
2. C. Mora et al., "The projected timing of climate departure from recent variability." *Nature* **502**, 183-187 (2013).
3. M. R. Allen et al., "Warming caused by cumulative carbon emissions towards the trillionth tonne." *Nature* **458**, 1162-1166 (2009).
4. M. Meinshausen et al., "Greenhouse-gas emission targets for limiting global warming to 2 °C." *Nature* **458**, 1158-1161 (2009).
5. M. Steinacher, F. Joos, and T. F. Stocker, "Allowable carbon emissions lowered by multiple climate targets." *Nature* **499**, 197-201 (2013).
6. H. Damon Matthews and S. Solomon, "Irreversible does not mean unavoidable." *Science* **340**, 438-439 (2013).
7. R. Heede, "Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010." *Climatic Change* **122**, 229-241 (2014).
8. S. Arrhenius, "On the influence of carbonic acid in the air upon the temperature of the ground." *Philosophical Magazine* **41**, 237-276 (1896).
9. J. Fourier, "Remarques générales sur les températures du globe terrestre et des espaces planétaires." *Annales de Chimie et de Physique* **27**, 136-67 (1824). J. Fourier, "Mémoire sur les températures du globe terrestre et des espaces planétaires." *Mémoires de l'Académie Royale des Sciences* **7**, 569-604 (1827).
10. J. Tyndall, "On the absorption and radiation of heat by gases and vapours, and on the physical connexion of radiation, absorption, and conduction." *Philosophical Transactions of the Royal Society of London* **151**, 1-36 (1861).
11. N. Oreskes, "The scientific consensus on climate change." *Science* **306**, 1686 (2004). P. T. Doran and M. K. Zimmerman, "Examining the scientific consensus on climate change." *Eos* **90**(3), 22-23 (2009). W. R. L. Anderegg et al., "Expert credibility in climate change." *Proc. Natl. Acad. Sci.* **107**, 12107-12109 (2010). S. Rosenberg et al., "Climate change: a profile of US climate scientists' perspectives." *Climatic Change* **101**, 311-329 (2010). D. Ding et al., "Support for climate policy and societal action are linked to perceptions about scientific agreement." *Nature Clim. Change* **1**, 462-466 (2011). R. Vautard and P. Yiou, "Robustness of warming attribution." *Nature Clim. Change* **2**, 26-27 (2012). S. Lewandowsky et al., "The pivotal role of perceived scientific consensus in acceptance of science." *Nature Clim. Change* **3**, 399-404 (2013). J. Cook et al., "Quantifying the consensus on anthropogenic global warming in the scientific literature." *Environ. Res. Lett.* **8**(2), 024024 (2013).
12. G. J. Aubrecht, "Ten reasons to give credence to anthropogenic climate change." in M. Fatih Taşar, ed., *Proceedings of the World Conference on Physics Education 2012* (Ankara, Turkey: Pegem Akademi, 2014), p. 297-318.
13. G. J. Aubrecht, "Energy, climate, science, and sense." *Lat. Am. J. Phys. Educ.* **6**, Supp. 1, 78-82 (2012).
14. N. Oreskes and E. M. Conway, *Merchants of doubt* (New York: Bloomsbury Press, 2010). R. J. Brulle, "Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations." *Climatic Change* **122**, 681-694 (2014).