ATTACHMENT A

1) Pleistocene variations in CO2 and climate:

Stott, L., A. Timmermann, and R. Thunell (2007), Southern Hemisphere and Deep-Sea Warming Led Deglacial Atmospheric CO2 Rise and Tropical Warming, Science, 318, 435-438, doi:10.1126/science.1143791.

Hönisch, B., N. G. Hemming, D. Archer, M. Siddall, and J. F. McManus (2009), Atmospheric Carbon Dioxide Concentration Across the Mid-Pleistocene Transition, Science, 324(5934), 1551-1554, doi:10.1126/science.1171477.

These two papers show that on glacial-interglacial timescales, climate and CO_2 (carbon dioxide) are closely coupled, and both are related to another climate influence, namely changes in the earth's orbit. These data, and other results like these, suggest that CO_2 on these time scales acts as a feedback to make the climate sensitive to changes in the earth's orbit. These papers do not specifically address the question of recent anthropogenic global warming, but provide refined estimates of the correlation and timing of CO_2 and climate through glacial-interglacial cycles of the Pleistocene.

2) Ice-sheet and glacier mass balance:

Davis, C. H., Y. Li, J. R. McConnell, M. M. Frey, and E. Hanna (2005), Snowfall-Driven Growth in East Antarctic Ice Sheet Mitigates Recent Sea-Level Rise, Science, 308(5730), 1898-1901, doi:10.1126/science.1110662.

Johannessen, O. M., K. Khvorostovsky, M. W. Miles, and L. P. Bobylev (2005), Recent Ice-Sheet Growth in the Interior of Greenland, Science, 310(5750), 1013-1016, doi:10.1126/science.1115356.

These two papers argue that there has been some ice sheet growth in the interiors (far inland) of Greenland and Antarctica. This process is understandable and indeed predicted by some climate change models as a short-term response to warming. This is the so-called "snowgun" effect. Far inland, ice sheet growth is limited not by the fact that it is warm but by the fact that it is so dry that generally little snow falls. If the oceans adjacent (or even far away) from the ice sheets warm, they can feed more moisture to cold inland regions where the moisture then falls as snow. Because the inland regions are so cold, further warming would be required to melt the snow and ice once it has precipitated out.

Howat, I. M., I. Joughin, and T. A. Scambos (2007), Rapid Changes in Ice Discharge from Greenland Outlet Glaciers, Science, 315(5818), 1559-1561, doi:10.1126/science.1138478.

This paper presents estimates of variability in mass-loss from two outlet glaciers in Greenland, stating that there is year-to-year variability. The paper simply says the overall mass balance of the ice sheet can vary rapidly, but takes no position on AGW.

Vincent, C., E. Le Meur, D. Six, M. Funk, M. Hoelzle, and S. Preunkert (2007), Very high-elevation Mont Blanc glaciated areas not affected by the 20th century climate change, J. Geophys. Res., 112(D9), D09120, doi:10.1029/2006jd007407.

Vincent et al. point out that most European Alpine glaciers have been shrinking over the past few decades, using evidence from their own and other's work. However the very highest-altitude glaciers on Mont Blanc do not seem to be shrinking. They note that the mass-balance of glaciers (ie, whether they are growing or shrinking) in such settings depends not only on temperature, but also on snowfall The authors do cite 1°C of warming in the Alps over the 20th Century, but do not take a specific position on its cause.

3) Medieval Warm Period:

Broecker, W. S. (2001), Was the Medieval Warm Period Global?, Science, 291(5508), 1497-1499, doi:10.1126/science.291.5508.1497.

Broecker reviews the evidence for a period in Medieval times that may have been warmer than present. His interpretation is that a variety of proxy records "from all continents suggest the existence of a Medieval Warm Period." He concludes "I consider this evidence sufficiently convincing to merit an intensification of studies aimed at elucidating Holocene climate fluctuations, upon which the warming due to greenhouse gases is superimposed." The existence of a Medieval Warm Period argues neither for or against recent warming being due to manmade greenhouse-gas emissions, and Broecker's conclusion implicitly accepts the interpretation that recent warming is due at least in part to greenhouse gases.

4) Solar variability:

Braun, H., M. Christl, S. Rahmstorf, A. Ganopolski, A. Mangini, C. Kubatzki, K. Roth, and B. Kromer (2005), Possible solar origin of the 1,470-year glacial climate cycle demonstrated in a coupled model, Nature, 438(70695), 208-211, doi:10.1038/nature04121.

Rosing, M. T., D. K. Bird, N. H. Sleep, and C. J. Bjerrum (2010), No climate paradox under the faint early Sun, Nature, 464(7289), 744-747, doi:10.1038/nature08955.

Shaviv, N. J. (2008), Using the oceans as a calorimeter to quantify the solar radiative forcing, J. Geophys. Res., 113(A11), A11101, doi:10.1029/2007ja012989.

These three papers argue for some level of variable solar forcing of climate on a range of time scales, from decades to hundreds of millions of years. Braun et al. argue for a possible solar forcing of the apparent 1470-year cycles in North Atlantic climate of approximately 60,000 to 10,000 years before present, but they do not comment on AGW in the modern context.

Rosing et al. suggest that lower reflectivity of the Earth’s surface played a stronger role than greenhouse gases in maintaining a habitable surface during the early Precambrian (billions of years ago) when the sun was probably fainter than at present. They argue for higher greenhouse gases (mainly CO_2 and methane) during this period of Earth history though not as high as other studies had suggested. Rosing et al. do not comment on AGW.

Shaviv’s analysis explores mechanisms by which changes in solar radiation might be amplified to produce cyclic changes in ocean heat content. His estimates of the feedbacks, he suggests, could help to produce a better estimate of the sensitivity of the climate to radiative forcing. Shaviv does not take a position in this paper for or against the AGW hypothesis.

The idea that the sun has played, and will continue to play, some role in changing climate, is not new, nor is it disputed by most climate researchers However solar variability during the 20th and early 21st Centuries does not appear to have been sufficient by itself to drive the changes in global temperature understood from climate data.

4) Emissions policies:

Pielke, R., G. Prins, S. Rayner, and D. Sarewitz (2007), Climate change 2007: Lifting the taboo on adaptation, Nature, 445(7128), 597-598, doi:10.1038/445597a.

Prins, G., and S. Rayner (2007), Time to ditch Kyoto, Nature, 449(7165), 973-975, doi:10.1038/449973a.

These papers are not about climate science, but address policies aimed at controlling emissions of greenhouse gases. Both articles proceed from the authors’ premise that AGW is occurring, but argue that the world’s governments’ policy responses are flawed. Pielke et al. make the case that mitigation (through limitations on emissions and/or sequestration) have failed. They suggest we will need to put some effort into adaptation into AGW already made inevitable by our cumulative emissions so far and the emissions likely to continue to grow in coming decades in their view.

Prins and Rayner contend that the cap and trade mechanism of the Kyoto protocol has failed to limit emissions and argue for increased research and development spending on non-fossil-fuel energy technology.

5) Climate data biases:

McKitrick, R. R., and P. J. Michaels (2007), Quantifying the influence of anthropogenic surface processes and inhomogeneities on gridded global climate data, J. Geophys. Res., 112(D24), D24S09, doi:10.1029/2007jd008465.

This paper argues that the 1980-2002 trends in global land temperatures have been overestimated because of biases introduced by non-climate factors, such as urban “heat island” effects. These authors’ interpretation of their own analysis is that there has been warming over that 22-year period, though less than in other syntheses. They do not take a position on the causes of that warming, but note that any attribution to climate forcing (solar, greenhouse, dust, etc.) should take into account possible non-climate biases.

6) Climate sensitivity:

Schwartz, S. E. (2007), Heat capacity, time constant, and sensitivity of Earth's climate system, J. Geophys. Res., 112(D24), D24S05, doi:10.1029/2007jd008746.

Schwartz uses analyses of ocean heat content to contend that the sensitivity of the climate system to greenhouse gas forcing may be less than the sensitivity range adopted by syntheses such as the Intergovernmental Panel on Climate Change (IPCC). Schwartz does not contend that there is no AGW, but his estimates of climate sensitivity and total GHG forcing over the 20th Century do differ from those of the IPCC summary. The issue of climate sensitivity to processes such as greenhouse-gas enrichment and the strength of possible feedbacks in the climate system, is a topic of active research and debate in climate science. Schwartz’s analysis would imply a lower sensitivity of the climate system to greenhouse gases than other studies, but does not constitute an “anti-AGW” argument in and of itself.