Geophysical Research Abstracts, Vol. 9, 05020, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05020

A null hypothesis for millennial scale variabilty

E.J. Steig

University of Washington, Department of Earth and Space Sciences, Seattle, WA, USA (steig@ess.washington.edu)

A basic challenge to developing a theory of millennial-scale climate variability is in separating the internal variability from the forced variability in paleoclimate observations. It is suggested that stochastic forcing of constant magnitude represents an appropriate null hypothesis. The implicit assumption is often made that the magnitude of the variability is largely a function of the magnitude of the forcing. For example, the large magnitude and long duration of warm interstadial periods following Dansgaard-Oeschger warming events is believed to be a consequence of large forcing events in the North Atlantic region - i.e. buoyancy forcing of the thermohaline circulation due to catastrophic iceberg discharges. Similarly, the millennial-scale variability in the Cariaco basin record is taken to be a forced response to changes in the North Atlantic. However, these ideas are difficult to evaluate without an independent estimate of the magnitude of independent variability in the records. How much variability would be expected at Cariaco, for example, in the absence of any forcing from the North Atlantic? To address this, one can compare the variability during the glacial period with the variability in the Holocene. It is found that most of the well dated Quaternary paleoclimate records can be well represented by a simple statistical model with the same magnitude of stochastic forcing ("white noise") in both glacial and interglacial climates. Although the variance is generally greater during the glacial, this can be attributed to a longer characteristic response timescale, e.g. as would be expected from an overall more sluggish ocean circulation. Thus, the magnitude of variability is governed not by the magnitude of the forcing, but by the character of the response. This tends to support the null hypothesis. It is important to note that these results are not inconsistent with evidence for the global nature of millennial-scale climate variability during last glacial periods. They do, however, have implications for the mechanisms involved.