Mid-Holocene El Niño-Southern Oscillation revisited

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Several key climate models support a reduction in El Nino-Southern Oscillation (ENSO) variability in response to mid-Holocene insolation forcing (e.g. Clement *et al*. 1996; Otto-Bleisner *et al*. 2003), but the paleoclimate data typically taken as validation of these model responses are relatively scant. Given the importance of assessing the sensitivity of tropical Pacific climate to external climate forcing, it is critical to amass more direct obesrvations of ENSO variance during the mid-Holocene. Previous work highlights the potential to reconstruct ENSO variability with exceptional fidelity using fossil corals from the central tropical Pacific (Evans *et al*. 1999; Cobb *et al*. 2003).

Here we present four new monthly-resolved records of ENSO variance from fossil corals that grew 6 thousand years ago (6kybp) in the heart of the ENSO region. The fossil corals were collected from beached coral heads located on Fanning Island (4N, 160W), and range from 25-70 years in length. Coral oxygen isotopic composition ($\delta^{18}O$) provides a high-fidelity proxy of ENSO variability in Fanning corals, as evidenced from high correlations between the 20th century modern Fanning coral $\delta^{18}O$ record (Nurhati *et al*. 2009) and the NINO3.4 SST index (R=0.75). The fossil corals were thoroughly screened for diagenetic artifacts using XRD, SEM, and thin sections. Collectively, the 6kybp Fanning fossil corals document a range of ENSO variability similar to that observed during the 20th century. However, the overall amplitude and frequency of interannual variability is somewhat reduced with respect to late 20th century variability. We apply a suite of statistical analayses to the fossil coral ENSO reconstructions to determine if there are significant differences between the 6kybp ENSO actiivty and that of the 20th century.

Measurements of halogen oxides and speciated mercury at a coastal site in Pensacola, FL

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An increasing body of evidence suggests that atmospheric halogens, marked largely by the presence of BrO and IO, are ubiquitous components of the lower troposphere in coastal and oceanic areas. The role of halogen chemistry in mercury oxidation in mid-latitude coastal regions remains uncertain. Recent experimental and theoretical studies have indicated that atmospheric mercury oxidation initiated by atomic Br may have been underestimated. Synergistic effects of the iodine compounds can be expected: this effect arises from additional halogen-atom formation from IO radicals interacting with BrO radicals to enhance atomic Br and atomic I concentrations; little is known about the possible direct or indirect roles I atoms may play to oxidize mercury. Finally, other reactive trace gases, such as NO_2, CH_2O and $C_2H_2O_2$, can suppress the oxidation of Hg by converting bromine-radicals into chemically inert reservoir species. Here we present data from several months of MAX-DOAS measurements of IO, BrO, O_4, NO_2, CH_2O and $C_2H_2O_2$ in parallel with measurements of speciated mercury (Hg^0, Hg^{2+}) that are currently being conducted along the U.S. Gulf Coast. Our results represent the first co-located measurements of halogen oxides with speciated mercury in this region. We discuss our data in context of the sources of halogens that currently being debated: (1) entrainment from the free troposphere, (2) sea-salt mediated air-surface exchange in the marine boundary layer, and (3) biogenic releases.