Temperature correlations between the eastern tropical Pacific and Antarctica during the past 230,000 years

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How do tropical sea surface temperatures (SSTs) warm and cool during glacial-interglacial cycles? The prevailing hypothesis is that they do so in response to radiative forcing by CO_2. An alternative hypothesis is that they reflect the temperature of intermediate water masses set in high latitudes and transmitted to the tropics with ocean circulation. Here, evidence is presented from the eastern tropical Pacific (ETP) in support of the second hypothesis. A 230,000 year SST stack has been constructed from Mg/Ca records in five sites from the ETP. This Mg/Ca stack is shown to correlate well with Antarctic air temperatures from the EPICA Dome-C ice core on both orbital and millennial timescales. The temperature synchronization between Antarctica and the ETP is especially clear during interglacial stage 5e and the 5e-5d glacial transition, during which temperature in both regions cooled with a substantial lead over CO_2. This result suggests that tropical SSTs and Antarctica are synchronized largely by ocean linkages via intermediate and mode waters from the Southern Ocean, rathern than by CO_2 forcing. More broadly, assuming that the 5e-5d lead of temperature over CO_2 is a global feature, it imposes a need for a CO_2-independent glacial inception mechanism. It is proposed that cooling begins with Milankovitch forcing of the Northern Hemisphere and is tramsmitted globally by injection of a colder North Atlantic Deep Water (NADW) into the deep sea. The northern cooling signal is passed on to NADW-derivative water masses forming in the Southern Ocean, and is globalized as these spread to the major ocean basins. In this view ocean circulation is the critical climatic globalizer during glacial inceptions. However, this mechanism cannot operate in reverse during glacial terminations because of the more sluggish deep ocean circulation in glacial periods, suggesting that CO_2 is a key climatic forcing during deglaciations.