Assessment of Sr/Ca ratio in coral skeleton as a high-precision SST proxy with high temporal resolution

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In tropical regions coral skeletons provide several useful proxies for the analysis of past climatic changes, and among them one of the most precise proxies for SST is Strontium/Calcium (Sr/Ca) ratio. Analysis of Sr/Ca ratios in the coralline aragonite taken from a large *Porites* colony growing continuously since 1778 in the eastern coast of Philippine was carried out to reconstruct variability of sea surface temperatures (SSTs) during 50 years with high time resolution (bi-weekly to monthly)
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We examined signal recording ability of skeletal Sr/Ca ratios from several viewpoints. First, we carried out the calibrations in two different ways. By comparing Sr/Ca ratios with available SST data [IGOSS-NMC-SST (1981˜), we obtained the following equation [Sr/Ca (mmol/mol) = -0.0803 T (degrees of Celsius) + 11.05]. To enhance time resolution, we performed more frequent analysis with 0.4 mm interval, which is equivalent to 2 weeks and found good agreements between SST and Sr/Ca ratio in shorter time scale than month.Another equation was obtained [Sr/Ca(mmol/mol)= -0.0798 T (degrees of Celsius) + 11.01]. There was slight difference (˜0.2 degrees of Celsius) between two calibrations. Omitting one outlier from the former calibration gave a calibration with better correlation [Sr/Ca(mmol/mol)=-0.0789 T (degrees of Celsius) + 11.01]. Second, we examined the robustness of the calibrations between different growth axes and between different parts of the growth axis.Generally, we found no significant difference excluding minor disagreement between Sr/Ca thermometry and SST records, which might be caused by the difference of IGOSS-NMC-SSTs and the local temperatures around the coral.Finally, we investigated other factors' influences on Sr/Ca ratios(ex: extension rates, salinities). But, there was no factor affecting significant influence on Sr/Ca ratios other than SST.

Having obtained the valid calibration, we performed SST reconstruction during past 50 years. The coral record suggested an increase of tropical SST from 1950s to 1990s, which is considered to be consistent with the ongoing global warming. In additi
on, we compared the fluctuation of d18OSW calculated from Sr/Ca ratios and d18Ocoral with instrumental records (salinities, precipitations) and found correlations among them. We recognized the following tendency relating Monsoon, ENSO and frequency
of Typhoon on the coral records.

- Cold winter correlated with strength of winter Monsoon
- Drought and warm winter in El Nino years
- Heavy rainfall and cold winter in La Nina years
- Sharp decline of SST influenced by frequent Typhoons