



Coral calcification and reef development under natural disturbances

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Corals are impressive ecosystem engineers shaping and influencing tropical shallow water environments through their complex carbonate framework. Calcification a key physiological process determining coral growth and reef development, is highly dependent on constant environmental conditions, especially temperature, aragonite saturation and pH. However, not in all reef areas such constant and stable conditions can be found. Coral reefs located in the Andaman Sea off the western Thai coast are subjected to large amplitude internal waves (LAIW), which induce strong oscillations in several physical and chemical environmental parameters and hence, offer the possibility to study the influence of fluctuating conditions on coral reefs. Characteristics of these oscillations as well as reef framework development have been studied on reefs of five islands, which are exposed to LAIW along their western sides and LAIW-sheltered on their eastern sides. LAIW reach these shallow water reef areas all year round, however, strongest fluctuations were recorded during the dry season (November to May) with temperature drops of up to 8°C and pH values ranging from 8.22-7.90. Several (up to 12) sudden changes in environmental conditions can occur during a day, which differ in intensity and duration. Salinity, pH and oxygen are well correlated with changes in temperature and thus, temperature variability calculated as degree days cooling (DDC) was used as proxy for the complex set of environmental variability. This proxy enabled us to combine frequency and intensity of disturbances in one value and allowed for ranking each study location according to the severity of LAIW disturbances. Framework height was found to be clearly reduced in areas exposed to LAIW compared to the complex three-dimensional carbonate framework in the LAIW-sheltered reefs. Moreover, it showed a strong linear correlation with DDC ($R_{sqr}=0.732$, $p=0.007$) indicating the negative effect of pulsed disturbances on coral reef development. LAIW are a ubiquitous phenomenon especially in tropical oceans where coral communities exposed to these internal waves may offer a unique possibility to study in situ the effect of several cumulative stressors on coral- and reef development, as well as the consequences for the whole reef community.