

EGU21-2353

<https://doi.org/10.5194/egusphere-egu21-2353>

EGU General Assembly 2021

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Tropical Climate Variability and Coral Reefs - A Past to Future Perspective on Current Rates of Change at Ultra-High Resolution

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Climate change, in particular the rise in tropical sea surface temperatures, is the greatest threat to coral reef ecosystems today and causes climatic extremes affecting the livelihood of tropical societies. The combination of long-term global warming and interannual El Niño-related warm events has severely affected corals and coral reefs throughout the tropical ocean basins. Mass coral bleaching, a result of large-scale temperature stress, was first observed during the 1982/83 El Niño, and was followed by much more severe, global scale bleaching events during the El Niño years of 1997/98 and 2010, culminating in the most wide-spread and most destructive global bleaching episode to date, which lasted from 2014-2017. The interval between recurrent mass coral bleaching events driven by anomalously high sea surface temperatures is becoming too short for a full recovery of mature coral reef assemblages and will have dramatic effects on future coral reef growth. Assessing how future warming will change coral reef ecosystems and tropical climate variability is therefore of extreme urgency.

The recently established Priority Programme „Tropical Climate Variability and Coral Reefs – A Past to Future Perspective on Current Rates of Change at Ultra-High Resolution“ (SPP 2299; <https://www.spp2299.tropicalclimatecorals.de/>) of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) aims to enhance our current understanding of tropical marine climate variability and its impact on coral reef ecosystems in a warming world, by quantifying climatic and environmental changes during both the ongoing warming and past warm periods on timescales relevant for society. Ultra-high resolution coral geochemistry provides a tool to understand the temporal response of corals and coral reefs to ongoing climate and environmental change, to reconstruct past tropical climate and environmental variability and to use these data in conjunction with advanced statistical methods, earth system modelling and observed ecosystem responses for improved projections of future changes in tropical climate and coral reef ecosystems.

The Priority Programme is organised around three major research topics in order to fuel interdisciplinary collaboration among various disciplines: (a) Large-scale ocean, climate & environment reconstructions, (b) Coral & reef-scale response to current environmental stress, and (c) Climate, reef & proxy modelling – Climate & proxy advanced statistics. The strongly interdisciplinary Priority Programme will bring together expertise in the fields of climate,

environmental and ecosystem research in a sustainable manner, and aims to provide an ultra-high resolution past to future perspective on current rates of change to project how tropical marine climate variability and coral reef ecosystems will change in a warming world.