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Separating Climate Variability and Non-Climate Noise in Proxy Records - A case study on replicate marine sediment records

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To describe earth's former and predict the expected future climate in a general way we need to understand at least two basic characteristics of the distribution of earth's temperature, its mean state and its temporal and spatial variance of temperature. There is some confidence in the projection of the mean state but the characteristics and changes of climate variability, especially on multi-decadal and longer time-scales are less known.

To characterize climate variability on these time scales, the instrumental record is too short. Climate proxies such as oxygen isotopes from foraminifera retrieved from marine sediments provide long records but do not exclusively carry information about the climate signal of interest. The decomposition of proxy time series into climate and non-climate components is challenging and depends on the adequate representation of the major involved biological and physical processes influencing the record. But even with a reasonable representation of the combined processes as fluctuations in proxy seasonality, bioturbation and errors in the age model, a proxy record still appears as the combination of these effects.

As a proxy record is only a single representation of this sum of effects we work on replicate measurements as a tool to characterize and separate the variability components. We therefore analysed oxygen isotopes and Mg/Ca in replicated measurements from the same sample, in replicated samples from the same sediment layer and in nearby sediment cores spanning the Holocene.
If we compare two records the relation of them will determine the commonness of the underlaying processes. As records for example come from the same core or from cores of nearby located sites, they share the same climate signal. In the case they are from the same core they also share the errors in the age model and the time uncertainty introduced by bioturbation. Combining different types of replicates allows us the analyse the effect of different combinations of shared and independent errors.

The first two cores that we work on come from about 10 km apart located sites in the Indonesian Sea. GeoB 10054-4 was drilled in a water depths of 1076 meters, at longitude of 112°40.10'E and latitude 8°40.90'S and its average sedimentation rate was estimated as 20 cm/kyears. GeoB 100537 was drilled in a water depths of 1372 meters, at longitude 112°52.30'E and at latitude

8°40.56’S and its average sedimentation rate is estimated as 45cm/kyears.

In the presentations we will show first results of the analysis of intra core and inter core variability.