Estimation of the time scale for ice volume records

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In order to predict future changes in the climate, good models are needed. The current trend is to build more complex models in order to simulate the 'real' world, while a 'good' model is not necessarily the most complex one. On the contrary, it only needs that complexity, which is supported by experimental measurements. It has to be able to describe all significant variation in the data, without modelling the stochastic measurement uncertainties. From this point of view, the problem of dating sedimentation records is approached and variations in global ice volume over the last million years are used as a case study. The history, hidden in the measured proxies is only revealed as function of a distance. The time series can be introduced by comparing the measured record with a model, containing time.

It will be shown that the time series can be constructed if a model with optimized parameters is provided. However, these parameters have to be optimized on the time series itself. So, is it principally possible to estimate the time base and model parameters? Are we stuck in a circular reasoning? To overcome this, the model and time scale are optimized simultaneously.

The strategy is illustrated on stable isotope measurements of Bassinot et al. [1994] and Waelbroeck et al. [2002]. The method developed here is able to tune the complexity, so that the maximum amount of information can be extracted from the noisy measurements. This results in precise time bases for both records and thus in defined termination dates of the ice ages, a comparison between the proposed models and estimates for the threshold parameters, determining the entering and existing of these ice ages.

References

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