

A proposal of new paleoclimate reconstruction method based on the technique in signal processing field

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These days, the extreme weather which is getting severer toward human society can have been regarded as a part of the climate variabilities. However, we don't have enough understanding of climate variabilities, so that paleoclimate research has been progressed for the complementation of it.

Past researches about paleoclimate reconstruction using proxy data have many problems that they focused on only local matters and didn't consider unsteadiness of climate variabilities. This research aimed at quantitatively analysis of paleoclimate variabilities based on the long-term proxy data around the world with proper signal processing method. At first, I think much of unsteadiness of frequency and used Short-Time Fourier Transform(STFT). This method is useful for the wave that dominant frequency is changing as time goes. In addition to that, I proposed an algorithm, which can derive the dominant frequency from the STFT result automatically. As a result, I succeed a reconstruction of paleoclimate based on the signal processing and can not only get a climate variabilities that has been already shown in the previous studies but also reveal that each frequency with a different period has a original variabilities pattern. At the same time, in terms of a spatial correlation of proxy data that hasn't been enough analysed yet I define "spatial representativeness", which enables me to evaluate correlations quantitatively. This suggests localer adaptation of proxy data than past researches used, and lets me propose a concrete threshold that exclude accidental correlations. Second, I analysed a singularity intensity that shows an abrupt change quantitatively with a technique named "Time-MultiFractal Analysis"(TMF). TMF results suggest that variability patterns of same type proxy data are similar and related to historical events, so that TMF has a potential for a valid method for the paleoclimate reconstruction. The results of this research not only help reconfirmation of what a signal processing can do for the paleoclimate reconstruction but also become a fundamental of quantitative evaluation.

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