Revisiting the Modern Analogue Technique

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Summary. One of the most widely adopted methods to obtain quantitative estimates from fossil assemblages is the Modern Analogue Technique (MAT). MAT is based on the comparison of a fossil assemblage with a set of modern samples through the computation of a distance measure. The paleoenvironmental estimates are obtained from the mean value of environmental parameters measured at the location of the most similar modern assemblages. A meaningful analysis of fossil assemblages requires the data to be expressed in the form of relative abundances. Therefore, it seems logical to develop a MAT consistent with the statistical approach for the COmpositional DAta (CODA). CODAMAT is developed by taking the Aitchison distance measure between compositions which is equivalent to euclidean distance between logratio centered compositions. CODA analysis requires the data to be strictly positive. The replacement of existing zeros was carried out by adopting a Bayesian approach to the zero replacement, based on a posterior estimation of the parameter of the multinomial distribution with Jeffreys and Uniform priori. The selection of a proper number of modern analogues was handled with a multiple approach by considering the Proxies correlation matrix, Standardized Residual Sum of Squares, Mean Squared Distance and threshold distance values. A check of the validity of CODAMAT approach for the estimation of summer and winter sea surface temperatures on modern conditions was carried out by means of leave-one-out validation. CODAMAT was then applied to the planktonic foraminiferal assemblages of a core previously analysed with a traditional MAT approach.

Key words: Modern analogues, Aitchison distance, logratio transformation

References

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