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Interactive comment on "Identification of the accretion rate for annually resolved archives" *by* F. De Ridder et al.

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Thank you for your comments on this paper.

Construction of the accretion rate: the method is not at all restricted to the annual periodicity in the proxy record, but this is often the most pronounced one. For this reason, we have focused on this kind of periodicity. On the other hand, we have tried to keep the time base model as flexible as possible (and thus also the accretion rate). This flexibility is accomplished by using a variable number of Spline basis functions (b in equation (3)). So, the method does not take any prior knowledge about the variations in accretion rate into account. Depending on the quality of the data (signal to noise ratio, e.g.) and on the sampling rate, intra-annual variations in the time base will be significant. This is an important consequence of the statistical model selection criteria: even if intra-annual variations in accretion rate have occurred, it is possible that they do not occur in the modeled time base, because e.g. the data are too noisy.

Dates and spectra: I agree with you that we usually do not know in advance if a record will be periodic. On the other hand, spectral analysis cannot be performed, because we lack an x-grid (time base), which is mandatory for a discrete Fourier transform. So, if we would like to follow this kind of strategy, we will get stuck in circular reasoning: to get the spectral content, we need the time base and to get the time base, we have to assume periodicity, which can be checked in the spectral content. Both problems are related. In order to break this reasoning, both, the spectral content and time base have to be estimated simultaneously. This is precisely what we propose to do: from a different point of view this method can be seen as a spectral analysis for periodic data with an unknown time base. In addition, it is able to detect if no periodicity is present. In that case, the MDL criterion will select a model with h=0 (without any periodic content).

Frequency modulations: it can be possible that certain records consist of frequency modulations, which are significantly above the noise level. Suppose for example that a record is periodic, but that the frequency differs from year to year, which can be caused for example by a longer winter (spring does not start at the same day every year!). In such case, the frequency modulation will be processed as a perturbation of the time base and will not be noticed. However, at this moment I see hardly any workable alternative: how can an investigator detect frequency modulation if the time base is unknown? Only if additional information about the time base is available, like growth bands, such information can be implemented in the model for the time base as additional constraints. In that case it is possible to identify a time base for periodic signals with frequency modulations. However, I hope you agree that such an approach falls outside the scope of this paper.

Multi-proxy data: it is very well possible to change the signal model to one for multiple proxies and one time base, although this has not yet been implemented. Note finally, that frequency modulation could be detected if multiple proxies are used, each with their specific signal model.

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