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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "An inkling of the relation between the monofractality of temperatures and pressure anomalies" *by* A. Deliège and S. Nicolay

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First of all, we would like to thank the reviewer for taking time to carefully consider our manuscript. His remarks are constructive and surely help improving the paper. Please find below our comments and extra explanations regarding his concerns. The reviewer's comments are in italics.

- line 9 p. 1341: if the formula stated holds, what is the point of using the WLM rather than standard wavelet coefficients?

This is an interesting question. Initially, in the same spirit as in G. Parisi and U. Frisch, "On the singularity structure of fully developed turbulence" (in "Turbulence and predictability in geophysical fluid dynamics", pages 84-87, 1985), the standard wavelet

coefficients were used by Arneodo et al in "Wavelet transform of multifractals" (Physical Review Letters, 61:2281-2284, 1988). However, some technical difficulties arise for negative values of q in the computation of their equivalent of the function S (line 16). The wavelet transform modulus maxima and then the wavelet leaders method were introduced to overcome these problems, as mentioned in Jaffard, S. and Nicolay, S.: "Pointwise smoothness of space-filling functions".

- line 10 p. 1341: what is meant by "the right choice of ψ" ?

We can be more precise. We actually need a well-localised-in-time wavelet: theoretical results on that matter hold with Lemarié-Meyer and Daubechies wavelets. See e.g. Jaffard, S.: "Wavelet techniques in multifractal analysis" for mathematical details.

- the formula line 16 p. 1341 is not clear to me: on which coefficients is the sup take?

The notation $\sup_{j' \geq j} |W_\psi[f](j', k)|$ is the notation for $\sup\{|W_\psi[f](j', k)| : j' \geq j\}$. If we associate the coefficient $W_\psi[f](j, k)$ to the interval $\lambda_{j,k} = [2^{-j}k, 2^{-j}(k + 1)[$, then the supremum is taken on the coefficients associated to the intervals of the type $[2^{-j'}k, 2^{-j'}(k + 1)[$ that are included in $\lambda_{j,k}$ (see e.g. Jaffard, S. and Nicolay, S.: "Pointwise smoothness of space-filling functions").

-line 20 p. 1341: what is meant by "gives a good approximation"? such loose statements can be misleading. There are mathematical examples where the two quantities are very wide apart. Preferably, I would suggest either to drop this statement and only mention the linear case, which is the only one relevant here, and where the situation is totally under control; the other option is to go in details and state explicitly what is known to hold

This part could be more detailed. Theoretical results are known about this approach (see e.g. Jaffard, S.: "Wavelet techniques in multifractal analysis"). In particular, the Legendre transform of ω gives an upper bound of the spectrum of singularities:

$$d(h) \leq \inf_q \{qh - \omega(q)\} + 1$$

and the equality holds in many particular cases (e.g. self-similar functions). For more details, see e.g. Jaffard, S. “Multifractal formalism for functions part I: results valid for all functions” (SIAM Journal on Mathematical Analysis, 28:945-970, 1997) and Jaffard, S. “Multifractal formalism for functions part II: self-similar functions” (SIAM Journal on Mathematical Analysis, 28:971-998, 1997). Nevertheless, we did not feel the need to give too many technical details on that matter.

-p1344 line 5: I assume that LRC means “long range correlations”? if so, state it explicitly

Yes, we forgot to mention it.

-p1344 line 7-8: I am quite surprised by this assertion, since DFA often is presented as supplying an alternative way to perform multifractal analysis. Can you be a little more precise here?

Our sentence may well lack of accuracy. By “similarities”, we mean that both methods involve a structure/partition function: both methods are indeed inspired by the one of G. Parisi and U. Frisch, “On the singularity structure of fully developed turbulence” (in Turbulence and predictability in geophysical fluid dynamics, pages 84-87, 1985).

My main concerns are the statements lines 16-20 of page 1342: Concerning lines 16-17, I am not aware of any similar statement in the two books quoted (Mallat and Daubechies). I may have missed a point, but, if this result is indeed true, the authors should refer to a precise result, not just vaguely to two books. The second statement (lines 18-20) does not seem to follow from the first one, and no reference is given. The numerical experiments backing these results certainly are nice, but one verification on one example is not sufficient to back a general statement: They are, at best, illustrative. Since these arguments are the starting point of the whole method proposed, these concerns should be answered in a precise way.

Indeed, a reference is clearly missing, we apologize about this omission. The two ref-

erences in the text are there to bind the monofractal behaviour (cf. uniform Hölder spaces) with the Fourier spectrum. For an accurate reference about the surrogate data method, please see e.g. Foufoula-Georgiou, Roux, Arneodo and Venugopal: “The surrogates of a multifractal function destroy the long-range correlations due to phase randomization” (AGU meeting, Dec 2005). The surrogate data method has already been used in many published works (two of them are cited, see line 11). These references should also be added in a revised version of the paper.

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