Atmos. Chem. Phys. Discuss., 8, S1370–S1372, 2008
www.atmos-chem-phys-discuss.net/8/S1370/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gap filling and noise reduction of unevenly sampled data by means of the Lomb-Scargle periodogram" *by* K. Hocke and N. Kämpfer

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Received and published: 7 April 2008

Dear Reviewers,

We thank you for your critical and constructive reviews which are encouraging us to work on the optimization of the programs and the article.

Response to Reviewer 1: ———————— 1) Yes, we will extend the supplements (adding program and data sets for the other figures) 2) We will also provide a scanned pdf-file of the Hocke (1998) article as supplement material in ACP. The article was a 'letter contribution' to Annales Geophysicae. and is not available online. Since Annales Geophysicae is a free access journal, we guess that there will be no problem with copyright. 3) The optimal use of the algorithm possibly differs depending on the char-

acteristics of the data set. For example we tried rain precipitation data, and the result was bad since the rain series consisted more of spikes than of sine waves. We agree that it would be good to add a paragraph with our experiences and practical advises, and thank the reviewer for indication of the most interesting questions. As in case of FFT, we would recommend the use of a Hamming window. However the reconstruction result at the begin and the end of the data segment are of minor quality (as Reviewer 1 noted). So one should use the middle part of the reconstructed segment for gap filling. Subsequent shifting of the Hamming window to the next position of the time series can provide the missing values at the edge of the former data segment.

The question for the role of the amount of missing data is good and noted by both reviewers. We will study the literature and hope that this question has already been answered. It would be fine to have at least one error bar for the reconstructed series. The error bar should take into account the amount of missing values and the goodness of the fit. We work on this topic and try to find a solution.

Minor remarks: ———— - there was a confusion with 'n' and 'N'. We agree with Reviewer 1 that n=N and we will only use 'N' in the revised version. Thank you!

- the choice of t_1=0 is important for the phase spectrum. Usually a phase spectrum (e.g., from FFT) is ugly and noisy (the phase of a spectral component with zero amplitude seems to be arbitrary). In addition 'phase unwrapping' is difficult. We do not know why but if the time reference point is selected in a good manner then phase unwrapping is not required, and the phase spectrum looks smooth and nice like in Hocke (1998)

-t_ave has been overtaken from the program by Press et al. who use mathematical tricks to speed up the trigonometric calculations

- an oversampling factor is good for enhancing the spectral resolution and this may give in some cases a better reconstruction result if the frequencies of the dominant spectral components are closely approached. But of course we should think about a more quantitative answer and we will check it by numerical tests

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- the confidence levels are determined as multiples of the standard deviation of the time series (in the revised version we provide more information)

Response to Reviewer 2: ———————— 1. "t_1=0 ?" is answered above 2. we will intensively look for an answer of the 'permitted amount and lengths of gaps' for a Lomb-Scargle spectrum.

Revision will take some weeks. Thank you again!

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4603, 2008.