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Biogeosciences Discussions

Interactive comment on "Investigating the effect of historical treatments on wheat yield over multiple spatial frequencies" *by* A. E. Milne et al.

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We would like to thank the referee for their constructive and helpful comments. Below are responses to the comments and suggestions, which we hope will satisfy the criticisms raised. A revised version of the paper is appended as a supplementary file.

Response to Referee 2

1a. The paper does not state that one of the objectives of the paper is to study the effects of the fertiirrigagtion on the melon crop. The abstract (line 1-2) and introduction (line 58-61) state that the objective of the study is to show how the MODWT can be used to investigate how wheat yield data reflect known historical treatments at different spatial frequencies. The introduction does say that the data result from two consecu-

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tive experiments and that in the first the effect of different fertirrigation treatments are explored, and this is where I think the confusion comes from. The first experiment did aim to investigate the effects of fertirrigation treatments but the results of this study (published in Castellanos et al. 2010) are not of central interest here. The point of interest is the carry over effects of this experiment in the form of nitrogen a residual. We have tried to make this clearer in the text.

1b. Figure 3a is Wheat biomass, this is now clearer in the text and in the Figure caption. We show and discuss the complete set of wheat biomass data, it was only practically possible to harvest and analyse a single transect. We are sure the referee appreciates the effort involved in collecting and analysing the 158 samples discussed.

1c. Figure 1 does show the plot layout for both experiments, but arguably only the top 9 plots through which the transect runs are relevant. We have compressed the figure and have explained in the caption that only part of the split plot experimental layout is shown.

2. The figure was presented so that treatment order reflected that across the transect. We have re-ordered the figure as suggested.

3. The study presented here is intended as an example of how wavelet techniques can be used to understand the dominant factors that effect soil properties across a range of spatial frequencies. We could have sown and harvested wheat across all of the melon experiment subplots and then we could have done an ANOVA type analysis on the data, but this would have only given information on the residual effects at plot scale. We were interested in the effect at a range of frequencies because of the potential interest from precision agriculture on carry-over effects. This kind of analysis required an intensive study across a transect, (we have tried to make this clearer in the text). The wavelet analysis shows that the main contribution to variation is at low frequencies which correspond to the fertirrigation treatments (something clear from the data) and allows us to quantify this variation. It also shows and quantifies a notable contribution

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to variation at a frequency corresponding to the melon positioning. As well as this, the correlation between the variables can be partitioned across the scales allowing us to get a better understanding of the effect of the melon crop and nitrogen treatment on the wheat plant weight.

4a. The formulae for Daubechies extremal phase filter with two vanishing moments is well documented and so we did not feel it necessary to repeat it in the text. A reference is given (line 173).

4b. The method of choosing the best basis was explained in the text, but we have now made it clearer by including the formulae for the cost function (line 186 — 188).

5. The size of the plots is between 7.5 and 16.5 m so the lower frequency effects of the nitrogen will predominantly be seen in the packets that span these scales, namely the three low frequency packets which together nominally correspond to the interval of periods 8–32 m. Words to this effect are in the text (lines 258–260).

6. A consequence of this type of intensive investigation is that we only have a limited number of nitrogen replications, but despite this shortcoming we have shown strong relationships at the frequencies that correspond to the nitrogen application.

7. The peak in Figure 7c is relatively small compared to the lower frequency peaks that we attribute to the nitrogen treatments. However it is distinct and coincident with the frequency range associated with the melon crop so worth comment.

Small Comments:

We have followed the referee's advice on Figure 3.

We have chosen to leave Figure 6 as it is as we feel adding Figure 4a would over complicate it.

We have stated that the dotted lines are confidence intervals in Figure 7 and 8. It was too messy to put in the periods as well as frequency so we added a note on how to

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convert between to two for the reader (line 222).

Interactive comment on Biogeosciences Discuss., 7, 2143, 2010.