**Biogeosciences
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Interactive comment on "A comparison of methods for smoothing and gap filling time series of remote sensing observations: application to MODIS LAI products" *by* S. Kandasamy et al.

Anonymous Referee #4

Received and published: 10 April 2013

This paper compares a number of smoothing and gap filling methods applied to the MODIS Leaf Area Index product for a range of plant functional types and a range of realistically simulated cloud and noise conditions. The paper is thorough, well written and presents its findings in a well thought out manner. There is also confirmation of some behaviour that I would intuitively expect but have not seen presented elsewhere: for example the observation that less noisy LAI profiles produce better estimates of phenological dates. Overall I think this is a solid contribution to the literature in this field and should be published in Biogeosciences.

There are a small number of additional points that I think should be addressed but I

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Discussion Paper

do not think any reprocessing or new experiments are required, just some additional discussion for the benefit of the reader.

1) The use of the spatial dimensions to help with smoothing and gap filling data is becoming more common and this has not been considered here. There has been a lot of interest recently within the image processing community about the Discrete Cosine Transform. Its application to very large data sets has been demonstrated using satellite data (see Wang et al. reference below). Even considering only the temporal dimension DCT is still an excellent gap filling and smoothing tool and so I am surprised it isn't one of the methods examined in this paper.

The authors should add a short paragraph to the discussion to introduce the idea that spatial data is a possible source of information to help improve gap filling. They should refer to the DCT and the Wang et al. paper.

Wang, Guojie, et al. "A three-dimensional gap filling method for large geophysical datasets: Application to global satellite soil moisture observations." Environmental Modelling & Software 30 (2012): 139-142.

2) It is important to keep in the mind of the reader that the techniques used are specific implementations of more general procedures. This important because it means that the results may not be as general as they appear. An example is that for several of the techniques parameters are set using "trial and error" and held constant for all experiments, where as in fact better results may have been achieved in different scenarios by optimising these parameters (for example only using 1 eigenvector and a 40 day window in the ICSSA). Consequently the conclusions drawn are not actually referring the technique itself, but the combination of the technique and parameters chosen. Because the method of choosing the parameters is not made explicit (and, I assume, involves a certain level of subjectivity) the discussion and conclusion seem more general than I believe they really are. In practice many smoothers use techniques such as cross-validation to optimise their internal parameters.

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Discussion Paper

The authors should include more detail on what they mean by "trial and error" in the description of each technique and should also add a paragraph into the discussions to comment on how general the results are given the chosen parameters. The potential to optimise these parameters on a per-scenario basis should be at least alluded to in the discussion

A related issue is the way in which the Savitzky Golay Filter is referred to in the paper. The authors use a variant of this filter that fits to the top of the data envelope - but a basic implementation of the SGF does not do that. However the authors refer to this as the "SGF" throughout the manuscript, which could leave an unfamiliar reader with the impression that the SGF will induce biases if they apply it to their data. This is not the case.

The authors should rename the Savitzky Golay Filter from "SGF" to something else throughout the text to avoid confusion. They should also add a sentence in the conclusions to explain that other implementations of the filter would not exhibit the biases that this variant has shown in the results.

The following minor corrections should also be made:

p17058,l7: "phenology" -> "phenological"

p17058,l11: "Of the eight methods..." -> This whole sentence needs re-wording. Suggest: "Except ICSSA and EMD, all the other methods are commonly used for processing biophysical time series data."

p17058,l18: "resulting into" -> "resulting in"

p17058,l18: "shaky" -> I am unsure about the choice of word here, maybe "noisy" would be better.

p17060,l23: "trial and errors" -> "trial and error" (n.b. this need changing elsewhere too).

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Discussion Paper

p17061:l24: "method may be considered as well as based on curve ïňĄtting" -> suggest: "method may also be considered to be based on curve ïňĄtting"

p17064,l5: "12days" -> "12day"

p17066,l18: "simulate the missing data" -> I think this should be"simulate the gaps in the data", to "simulate missing data" implies generating the actual values, which is not what is intended here

p17067,l11: change "shaky"

p17069,l14: "fill the gaps" -> should this be "fill all of the gaps" ?

p17071,l29: "boxcompromise" -> "compromise"

p17072,l8: you refer to a parameter lambda here, but it is not mentioned by this name in sections 2.2.4.

Interactive comment on Biogeosciences Discuss., 9, 17053, 2012.