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Geoscientific Model Development Discussions

Interactive comment on "Mapping of satellite Earth observations using moving window block kriging" *by* J. M. Tadić et al.

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We thank the reviewer for their positive assessment of the manuscript and for their helpful comments, which helped to strengthen the presentation of the approach. In the text below, we include the reviewer's original comments in italics, while our responses are listed in regular font.

Reviewer: *The paper develops a methodology based on Gaussian process regression in order to interpolate missing data onto spatial-temporal grids. The paper is well-written and the idea is clearly presented. However, I think similar works have been proposed in the literature, for instance, what is the difference between your methodology and the next ones?*

- *Haylock, M. R.; Hofstra, N.; Klein Tank, A. M. G.; Klok, E. J.; Jones, P. D.; New, M.. A European daily high-resolution gridded data set of surface temperature and precipitation for 1950-2006. Journal of Geophysical Research: Atmospheres, Volume 113, Issue D20.*
- *Goovaerts, P.. Geostatistical approaches for incorporating elevation into the spatial interpolation of rainfall. Journal of Hydrology. Volume 228, Issue 1, p. 113-129.*
- *Haberlandt, Uwe. Geostatistical interpolation of hourly precipitation from rain gauges and radar for a large-scale extreme rainfall. Journal of Hydrology, Volume 332, Issue 1-2, p. 144-157.*

Authors: We wish to thank Reviewer 2 for pointing out to a necessity to underline the originality of the paper in a more clear way. While kriging per se is not a new method, the application of kriging to satellite data faces few specific challenges. These include, among others, (i) non-stationarity, (ii) large data volumes, and (iii) the need to provide estimates at resolutions different from the sampling footprint (i.e. change of support).

With regard to the specific references cited by the reviewer:

Haylock et al. (2008) used thin-plate smoothing splines and kriging of anomalies to produce estimates. The method proposed in the paper is not a best choice for kriging satellite data as it did not explicitly treat the problem of sampling down (reducing size of) too abundant datasets, the problem of non-stationary covariance, and the change of support problem. Authors explicitly referred to inability of providing estimates at different supports ('resolutions'), compared to a native one, on page D201109, line 9 ("Still, block kriging would be worth considering as a better estimation of areal means in future updates.").

Goovaerts (2000) similarly did not examine problem on non-statinaority and sub-sampling, and the focus of the paper was instead on incorporating observations of a

secondary variable in a multivariate extension of ordinary kriging ('cokriging').

Haberlandt (2007) presented two multivariate methods, kriging with external drift and indicator kriging with external drift, both of which are alternative approaches to cokriging for incorporating information on secondary variables into kriging. This is not the focus of our proposed approach.

Overall, therefore, although the papers cited by the reviewer do discuss kriging within the context of environmental applications, the specifics of the approaches are far removed from the goals of the work presented here, as described in the manuscript.

Reviewer: *Some of the results in the current literature show that kriging (and even more, cokriging) cannot be used in practical scenarios owing to the lack of correlations between components such as elevation and precipitation:*

• *Daly, Christopher; Neilson, Ronald P.; Phillips, Donald L. A Statistical- Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. Daly, Christopher; Neilson, Ronald P.; Phillips, Donald L. Journal of Applied Meteorology, vol. 33, Issue 2, pp.140-158*

what do you say about this?

Authors: This statement does not directly apply to our method/paper as we do not use any secondary data (as in co-kriging or kriging with an external drift). The "correlations between components" noted by the reviewer refers to the correlation between the primary variable or interest (precipitation in the reviewer's example, XCO_2 and SIF in our applications) and a secondary variable (elevation in the reviewer's example, but no such secondary variable is used in our applications).

Reviewer: *"In figure 2 and 5, the values in the colorbars are very small, what is the*

range of those values?"

Authors: We increased font size on color bars in Figures 1, 2 and 3, per request.

Interactive comment on Geosci. Model Dev. Discuss., 7, 5381, 2014.