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Hydrology and Earth System Sciences
Discussions

Interactive comment on "An Extended Kriging method to interpolate soil moisture data measured by wireless sensor network" *by* Jialin Zhang et al.

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Thanks for your review. The comments and suggestions are very helpful. Here, I give some quick explanations to several short questions that I didn't elaborate clearly in the paper. For the others, I will reply as soon as possible after further analysis.

1. specific comment (4):

It is not entirely clear how the variogram fitting was conducted and whether an automatic or manual approach was used for this. What exactly is shown in Figs. 2, 3, 4 and 5? Are these average experimental semivariograms or the experimental semivariograms of a specific time step? Figure 2 can be omitted.

Reply:

As the number of WSN nodes installed in study area are limited, the node amount is insufficient to gather robust statistics in the process of semivariogram fitting. Thus, we used a soil moisture map of the study area to obtain sampling data. The soil moisture map was derived from the airborne hyperspectral datasets of CASI/TASI, acquired on July 10, 2012.

In the calculation, we sampled 9000 points from the soil moisture map as the sampling data for semivariogram fitting. To reduce the error, the spatial/spectral distance was divided into ten bins. We averaged the semivariance values of each bin as the final semivariance value of each distance. As the amount of the sampling data was insufficient when the spatial/ spectral distance was increased up to a certain extent, its average semivariance value was not stable. Therefore, these invalid data were removed before semivariogram fitting. For example, we only used the data when h<=4000 m in the fitting process in Fig. 3. Figure 4 shows the valid average semivariance data after manual exclusion. The color of each grid in Figs. 3 and 4 presents its average semivariance value.

In the process of semivariogram fitting, the nugget value and sagitta value were calculated by automatic approach, and the range distance was set by manual approach.

As the sampling data were acquired from the soil moisture map mentioned above, the experimental semivariograms correspond to the time of the soil moisture map. In this manuscript, we assume that the derived semivariograms can be applied to all the dates of interpolation.

2. specific comment (5):

It is not sufficiently described how the interpolation was performed. The 5 min WSN measurements were aggregated to daily estimates of soil moisture, but only five clearsky satellite images were available for specific days. Did you apply the ordinary kriging and Extended Kriging interpolation only for these five time steps? The performance curves (Figs. 10 and 11) show more than five sampling points. Theoretically,

all days of the investigation period need to be interpolated. Is it possible to apply this method for days without satellite information, for instance by using averaged spectral variables? This might be particularly interesting for the implementation of temperature data.

Reply:

As only five clear-sky satellite images were available for specific days, we supposed that the satellite images would not change much in a few days. In this way, for days without satellite images, we applied the available satellite image with nearest date to their interpolation. Thus, we could obtain the interpolation results in continuous time series.

3. Minor technical correction (1):

What is the reason for the tilted perspective or the masking of the borders in the maps of Figs. 6 and 7? Simple two-dimensional plots might be a better solution. I recommend preparing Fig. 1 in a consistent way, i.e. use the same masking. What is the background color shading in Fig. 1?

Reply:

The reasons for the masking of the borders in maps of Figs. 6 and 7 are as follows: (1) WSN nodes in the study area distributed within the borders of Fig. 6; (2) there are no land surface temperature data outside the borders of figure 6. Thus, we finally used the same masking for all the interpolation results.

The image shown in Fig. 1 was obtained from HJ satellite, combined by band 3(RED), band 4(NIR) and band2(GREEN).

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