

Interactive comment on “Three novel copula-based bias correction methods for daily ECMWF air temperature data” by Fakhreh Alidoost et al.

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Review: hess-2017-93 - Alidoost et al

This paper has potential but disappoints. The purpose is to interpolate 1-day ahead forecasts of temperatures predicted by ECMWF, corrected by the contemporaneous observations in an agricultural region in Iran. 6 copula-based methods of interpolation are compared in a cross-validation exercise in a leave-one-out procedure using the 5 gauges. It turns out that one of the new methods is better than the other 5 procedures.

I have several qualms about the paper.

1. only 5 temperature station data are used although there is a hint that there are

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others. 2. only 60 days in March and June of the year 2014 are used - why not use a whole year or more?

3. 3rd degree polynomials are individually fitted to each day's 5-station data-set. Why not pool them by month? The altitude of each station varies slightly, but quantile comparisons between gauge and ECMWF values would sort that out. Having obtained the monthly values, parameters of suitable probability distributions could then be smoothly fitted to the whole.

4. the mathematical description of the copula fitting is not well done - I gave up trying to unscramble the explanation in Section 2.3 and took the results for granted.

My recommendation is to return the paper for a rewrite treating the issues I have raised above. Then it will likely be valuable.

I am listing the comments I made in the paper by page and line [e.g. 2:19] in the space below my name.

Geoff Pegram

23 March 2017

Comments on the paper, returned herewith:

1:16 why only 2 months of daily temperature data? why not precipitation? Please justify. Also, from tables 5 & 6 and from figures 6 & 7, the best method by far was the Quantile Search construct, should be included in the abstract and introduction

2:1; 'specifically used'; by whom?

2:7; 'Recently ... data.'; Reference?

2:8-9; 'conditional ... data'; where is 'here'? who is doing this?

2:19; 'methods'; methods' ability

2:20; 'unvisited'; ungauged?

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2:20; 'compares'; the proposed methods with

2:23; 'data when'; a relatively

2:24; 'copulas'

3:4-6; 'the dependence ... space'; this, I do not follow, it will turn out to be one value the way it's written. rather 'two variables in space and time, such as $u_1(s,t)$ and $u_2(s,t)$ at common locations s and instants t '

3:8; between 'Gaussian ... Frank' remove repeats of 'the'

3:11-13; instead of Z_1 and Z_2 rather put $Z_1(s,t)$ and $Z_2(s,t)$?

3:14; ' $Cu_2t(u_1)$ '; surely $Cu_2s,t(u_1)$ including s as well?

3:15; 'one ... time'; s and t

3:16; ' pu_1 '; the dependence on u_2 is lost in pu_1 and should be pu_1/u_2

3:17-18; ' s refers ... in time'; Aha!! at last!! put this sentence up front as well to inform the reader

3:18; 'stationarity'; during each t

3:20; 'change'; spatially

3:22; add 'for $l = 1, 2$ '

3:23; 'for z_i '; where $k = 4$ or 5 .

3:24; 'approximately' should be omitted as ranks are increasing integers

3:35; instead of 'cannot occur'; are prevented from occurring

3:26; 'unvisited'; replace by 'ungauged'

3:27; 'a polynomial is fitted'; you fit a 3rd order polynomial, to 4 or 5 points, which is notorious for 'flying away' at the ends - why not fit a spline?

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3:29; 'at weather ... step'; on a first read through I noted: how many weather stations? Aha - I see 5 in Figure 1 - that's very low - especially to fit a copula day-by-day. do you pool the estimates to refine the estimated copulas? Please explain the steps more clearly.

4:1; except for the

4:9; In Table 3 a different copula is fitted to each of 60 days of 5 observations, when there is relatively stationary behaviour of the observations in each month. Why not pool the monthly data and get a decent relationship? Why not go the whole hog and treat each of 12 months and get some macro- instead of just disjointed micro-structure?

4:12; 'to obtain ... compares'; If you are doing cross-validation, 5 sites is very few ..

4:30; I'm sorry to say that I tried to trawl through Section 2.3 several times but gave up - it's too 'busy', complicated and not well explained

6:13; 'land cover'; Oh? how's that measured? x , y & e are spatial coordinates giving elevation above sea level at a point in plan. R increases at x and y increase, even over a flat surface where e is constant, and R is then constant along a circular path in plan???

6:20; 'use nearest ... copulas'; turns into space divided by 5 Thiessen polygons??

7:4; 2.3.6 ; As I emphasise on page 11, because this QS is the best of all the methods, doing what you want to do, you should take the trouble to explain it more carefully, instead of using the many back references, which are annoying.

7:20; 'Here we ... search.' This needs more explanation

7:25; 'reminder'; remainder

9:5-6; 'Five ... long range .. area'; What is the logic here? you limit the observations to only 2 months!! you throw away the 'long range of air temperature measurements'!! On the flip side, if you are limiting yourself to 1 year, surely you can find other stations

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which increase the validation basis? And in the following sentence you inform the reader that you are only working with 2 months? This is very sparse...

9:15-16; 'Due ... data'; This is surely not a surprise, nor a disadvantage. you have two estimates of temperature: uniformly tiled ECMWF 'data' and point weather station data. If you believe the station values to be 'true' and useful for agriculture, then you transform the ECMWF values to station scale all over the tiles, which it seems you have not smoothed in Figs 6 & 7. Perhaps this paragraph should be relocated to the introduction?

9:29; 'forecast ... outliers'; how do you determine outliers? - just because they are low? - how about Station 1 June 20? - I've ringed it in the figure.

10:1-2; 'there ... outliers'; what do you mean? why the fuss?

10:5; 'The ... 3.4C'; why not use this information directly rather than model with copulas?

5:8; 'all moments'; the treatment of the standard deviations is unfair - better to use Coefficient of variation?

10:15-16; 'A third ... as well'; Poly(3) bad choice - better to use splines which behave better at the ends. however see my note below Fig 5.

10:20; 'March and June'; I cannot understand why you limit the analysis to these 2 months - what's the matter with the other 10? their behaviour might help the analysis

11:1; 'QS performs best'; why not say this up front in the introduction and abstract? it's far and away the best

11:6 and again in 11:16; 'QS performs best'; unfortunately QS is poorly explained in 2.3.6 with many back references

11:10-11; 'Since ... values'; why not pool the daily values in each month?

C5

11:10; 'uncertainties'; but these uncertainties are all pooled into SMAE, so why define R as in Eq (11)??

12:22-24; 'Furthermore ... observations'; poor choice - pool the days into months - you do not even look at serial ccs, which might have added value

13:11; Add 'One of' before 'The new methods ..' and change 'are' to 'is'

Table 3: ' ... at each day ...' I cannot understand why you do not pool the data for the months and analyse the other 10 months to get the full picture. I think the analysis is over-elaborate in some ways and woefully inadequate in others. Also, 16 out of 30 is only just 'most', by one! you should have given the modelling procedure something to chew on by pooling the days!

Table 4: define 'SMAE' and please describe the headings [MQM etc] in the table caption. The SMAE numbers in the table should be reported to 3 significant figures - 2 is too low for intercomparison. This is done in Table 5, which is fine.

Figure 3: note the upper 'outlier' I've flagged - why are the red points labelled as outliers? Because they are going negative? That's not a good reason to throw this meagre set of data away - it's informative. Negative ECMWF data can be transformed into the range of the gauge data. I think you should pool them. In addition, why not make all obs axes the same spread [14 - 33] to make visual comparison easier?

Figure 4: 'moments'; pooled moments from 5 sites? averaged over the 5 stations? you've destroyed the clear structure of Figure 3 by being over-complicated? Also, stdev is a poor comparison - rather report coefficient of variation - then the scales will be similar. By the way, the skewness of the data is close to its average of zero in March, but diverges in June. I don't think there are enough data to get a useful kurtosis, even though it averages around 2 ...

Figure 5; in the upper panel, why only 4 points from 5 gauges? in Fig 2 they are all there Also, because the relationships between Observed and Forecast are relatively

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stationary within the months, why not rank them monthly and fit a decent curve using least squares - I'm unhappy that you use polynomials - they go wild at the ends - rather use splines through the 150 (pooled from 30 days of 5 gauges) ranked points. Also, in the lower figure, if these are quantiles on the day, why aren't they vertically evenly spaced at $i/(k+1)$, $i = 1, \dots, k$??

Figures 6 & 7 are very informative. Why not fit some surfaces to the gauge observations, e.g. using simple kriging, for better comparison? In the captions, second line, insert 'for 3 selected days' between 'area' and 'in'. Comment - there is no contest between QS and the other methods - it's smoother and follows the ECMWF panels (you might have given the ECMWF their own shifted legend to make visual comparisons easier?)

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/hess-2017-93/hess-2017-93-RC3-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2017-93, 2017.