

## ***Interactive comment on “WFDE5: bias adjusted ERA5 reanalysis data for impact studies” by Marco Cucchi et al.***

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Comments on “WFDE5: bias adjusted ERA5 reanalysis data for impact studies” by Cucchi et al.

This paper introduced the most advanced WFDE5 database for climatic usage. The performance of WFDE5 and its related WFDE5\_CRU/GPCC are evaluated with site observations and spatial patterns. The results by driving a hydrological model also show improvements compared to its raw ERA5 data. In general, this paper is important for the community and should be published quickly. It is now well written and well structured. A few comments can be considered before the final acceptance.

Major comments:

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As one of the previous referees mentioned, the ERA5 is already in 0.25o. But the authors aggregate them to 0.5 o for comparison with current 0.5o WFDEI. Some discussions should be added for this change.

Compared to ERA-I/WFDEI, ERA5/WFDE5 has superiority in small-scale weather patterns (hourly compared to 3-hourly, 0.25o/0.5 o). However, this is not shown in the results. I think, one typical event over grids or regions with storm will be helpful to show this advantage. Is it has been included in Hersbach et al. (2020, under review)?

Although the hydrological model is not the core of this paper, some of the explanations are not convincing (please see the minor comments).

Minor comments:

Line 62, 21th should be 21st

Line 88-91 & line 97-99 repeated sentences about the bias correction.

Line 97-99 how the monthly values are applied to bias correction for hourly data. What are the differences in the methods for old 3-hourly and for the hourly data here?

Figure 2. typo. a) FN205 missing ‘1’ in FN2015 Figure 2. In table 2, rainf\_CRU and rainfall\_CRU+GPCC are introduced. So here Precipitation\_GPCC is with CRU or not?

Table A17. Some shades in cells are useful if we compare the relative results between WFDEI and WFDE5. The cell can be with light gray if it shows a better performance. Also applicable to other Tables.

Figure 3 make a map of difference will be more straightforward for discussion. In general, the description of the spatial pattern of WFDE5 is not as solid as the discussions on point observations and later global assessment of water balance.

Line 241. No evidence shows that WFDE5 performs better without comparison to observations, even though we see the high-resolution features in WFDE5. A comparison on dense gauge observations over the US could be helpful if the author would like to do

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so. (or including the topography will be helpful for the discussion on the topographic effect on temperature.) How about precipitation, its spatial characteristics could be more obvious with topographic effects.

Table 6, caption should mention that the results are for global scale.

Line 261. Not significantly higher, <5% for AET; but ~13% for discharge.

Line 263 (previous estimates, better to use some values rather than only mentioning Table 2). Why for this comparison, in Muller Schmied et al., 2014, the STANDARD is results for WFD+WFDEI (111070), and CLIMATE scenario is WFDEI\_CRU/GPCC (112969). When you do same routines to ERA5 (bias correction with CRU/GPCC), you must have this result.

Similar in Line 265 for AET and Q, some numbers are helpful for the conclusion.

Line 267-269, please specify that 1825 and 768 is for river discharge. Line 269, Differences between ERA5 and ERA-I could also lead to the difference in estimated discharge. But a more straightforward comparison is that WFDEI-CRU is 573 larger than WFDE5-CRU which can be explained by the CRU versions.

Line 270-272. Not agree. How did you explain AET in WFDE5-GPCC is less than that in WFDEI-GPCC. Abstraction goes to the river discharge rather to the AET, so I would attribute the difference to the water use schemes in hydrological model which are associated with the variabilities of forcing in ERA5 and ERA-I. If the model estimates the PET, you can list it in the Table as well.

Line 270, any reference for the net radiation difference in WFDE5 than in WFDEI (or ERA5 to ERA-I)? Regarding the comparison between WFDE5 and ERA5, a global map of the differences between the precipitation and SWdown (which has been modified according to Table 2) is recommended.

Figure 5. substantial changes from ERA5 to WFDE5 in Yangtze, what has resulted in the changes?

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