

## Replies to RC1

Please find below:

- In black, original comments by RC1
  - In green, replies by the authors
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**Manuscript:** WFDE5: bias adjusted ERA5 reanalysis data for impact studies

The authors developed a new meteorological forcing dataset that can be used to force impact models, as reference dataset for bias correction or for climate model evaluation studies. The new WFDE5 dataset is based on bias-adjusted ERA5 reanalysis data and is a successor of the widely used WATCH forcing datasets based on ERA40 (WFD) and ERA-Interim (WFDEI). Consequently, the application potential of the WFDE5 is high and will be likely receive a similar interest by the scientific community as its two predecessors. Therefore, the dataset and the associated manuscript are well suited for a publication in ESSD.

The paper is well written and provides the necessary information about the data and includes a suitable comparison to selected Fluxnet data and to ERA5 and WFDEI data. I have only one major remark.

Currently there are only two sentences in the end of the conclusions that note the availability of 0.25° gridded precipitation datasets and the potential of utilizing the higher resolution of ERA5 instead of the present aggregation to 0.5°. This was actually my first thought about WFDE5, i.e. why it is still using 0.5° and not 0.25°? Therefore I think that the choice of losing resolution and, hence, not using 0.25° should be discussed more thoroughly with pros and cons for both resolutions. Precipitation is the most important variable and a bias adjustment with 0.25° gridded observations can already be conducted. Only using a bias adjustment of other variables with coarser resolution data (such as 0.5° CRU data) may lead to a loss of some high resolution information.

Thanks for this observation. An additional paragraph has been added to the manuscript containing a more detailed discussion on the choice of generating WFDE5 with a 0.5° x 0.5° resolution.

### 2.3 Higher resolution WFDE5 data.

The WFDE5 has been provided at 0.5° x 0.5° resolution rather than at 0.25° x 0.25° in the original ERA5 data. There are several reasons for this. The project to generate WFDE5 was designed also to deliver open source software so that users could re-generate the data at the original or, eventually, higher resolution. Three main considerations influenced the initial generation of the WFDE5 dataset:

- a) The need to generate data in time for ISIMIP3 and their reporting to the AR6 of IPCC in 2020;
- b) The need to convert the existing WFDEI Fortran programs into CDS Toolbox workflows and easily test the output;
- c) The requirement for appropriate, and freely-available, global land gridded observations for bias correction.

The first consideration meant that any procedures adopted had to be practical and fast. The simplest way to test whether the CDS Toolbox workflows programs were working was to apply them to ERA-Interim data and check that they correctly reproduced the WFDEI data. This implied generating output at the same resolution as the WFDEI and CRU. Additionally, ISIMIP3 only required data at 0.5 x 0.5o since their models were set up at that resolution.

The WFDE5 CDS workflows will eventually allow users to generate higher resolution data on their own. At the moment, this can only be done using interpolated CRU TS4.03 and GPCCv2018 datasets, copies of which are hosted on a dedicated CDS machine and made accessible through the CDS Toolbox. Another option would be to use higher-resolution observational datasets, such as quarter-degree GPCC or MSWEP (Beck et al., 2017; 2019b) for total precipitation. This option will be viable once additional datasets can be hosted on the C3S Climate Data Store.

New reference:

Beck, H.E., Vergoploan, N., Pan, M., Levizzani, V., van Dijk, A.I.J.M., Weedon, G.P., Brocca, L., Pappenberger, F., Huffman, G.J. and Wood, E.J.: Global-scale evaluation of 22 precipitation datasets using gauge observations and hydrological modelling, *Hydrology and Earth System Sciences*, 21, 6201-6217, <https://10.5194/hess-21-6201-2017>, 2017.

In summary, I suggest accepting the paper for publication after minor revisions are conducted.

### **Minor remarks**

In the following suggestions for editorial corrections are marked in *italic*.

Line 7

... *result* ...

Thanks. Done as suggested.

Line 50

ERA5 *utilizes* a vast ...

Thanks. Done as suggested.

Line 55

Abbreviation CMIP5 needs to be explained.

Thanks. Done as suggested.

Line 132

... only *for grid-points* ...

Thanks. Done as suggested.

Line 181

Section 3 is largely redundant with section 7. Please remove one of these two sections.

Thanks for your suggestion. Sec. 7 has been removed and merged into Sec. 3, renamed "Code and data availability".

Line 206

... of *data have* been ...

Thanks. Done as suggested.

Line 211

... any time *step* ...

Thanks. Done as suggested.

Line 277

... *performances* ...

Thanks. Done as suggested.

Line 307-316

It should be made clear, that W5E5 is not part of the present publication and the associated information is only provided to highlight the differences between WFDE5 and W5E5. I assume that the details of W5E5 are already published elsewhere (e.g. Lange 2019c), so the authors may even shorten this subsection.

Thanks for your suggestion. Lines 311-316 have been replaced by the following sentence: "More information about the W5E5 dataset is provided by Lange et al. (2019c)."

Line 321

... shortwave *radiation* ...

Thanks. Done as suggested.

Line 322

Sentence is unclear and needs rewriting.

Thanks for your suggestion. The sentence has been rephrased as follows, now connecting directly to the previous sentence: "WFDE5 benefits from the improvements of ERA5 compared to ERA-Interim as well as from the additional corrections of precipitation and shortwave radiation described above."