

## [Response to the referees' comments]

We are very grateful for the referee for the reviewing our manuscript again, and giving us further comments for improvement. Overall, we agree with the referee's suggestions, and have revised the manuscript based on them. Here, we provide responses to each comment by the reviewers. The modified parts are highlighted in yellow in the revised manuscript.

### Referee: 3

We would like to thank Referee 3 for the positive comments and all the additional editorial remarks. We have revised all of them as follows:

#### Editorial remarks

line 22 – do the Authors want to say 'physically consistent'
Response: Revised.
line 43 - 'in' each grid point
Response: Revised.
line 77 – 'given' better than 'provided'
Response: Revised.
lines 78-79 – I would remove 'Since' from the beginning of this sentence and replace the comma with 'and'. The reason I am proposing this is that there seems to be no straightforward logical connection between the size of the pixel and the fact that you only use those pixels which contain more than one rain gauge station. You could do it regardless of the resolution chosen, within limits, of course. I would not formulate the sentence in a way suggesting that the second part is a logical consequence of the first part.
Response: Thank you for pointing this out. As the referee commented, there is no logical connection between the pixel size and the fact that we only use the pixels with rain gauge included. Therefore, we decided to move the explanation on the spatial resolution to the beginning of the second sentence of Section 2.1.1 (line 73).
Figure 1 – the description of $y_t^o$ disappeared from the figure. It was present in the original manuscript, i.e. Observation (CPC rain gauge)
Response: Sorry for the mistake. We added the description "Observation (CPC rain gauge)" to Fig. 1 again.

line 105-106 – Is the sentence on superscripts necessary? I would think that the symbols have been implicitly defined in the previous sentence
Response: We agree with the referee's comment, and excluded this sentence.
line 121 – 'is shown' rather than 'are shown'
Response: Revised.
line 299 – I propose to remove 'the first guess considering'; I think the sentence would be clearer without this phrase
Response: We rephrased it to "is also adjusted considering".
line 305 – I suggest: 'at a finer scale'
Response: Revised.
line 384 – 'our results indicate' rather than 'it is indicated'
Response: Revised.
line 391 – maybe 'discrepancies' rather than 'bias'
Response: Revised.
line 516 – remove 'on the sides' for clarity
Response: Revised.