

Reply to comments by Anonymous Referee #1.

Our response to the comments by Referee #1 is provided in bold font.

1. General Comments

The article evaluates how a pan-European quantitative precipitation estimation (QPE) based on OPERA radar rain rate adjusted with personal weather station (PWS) rain gauge observations compares with (1) a QPE based on OPERA radar rain rate adjusted with ECA&D rain gauge observations called EURADCLIM, (2) a QPE based on OPERA radar rain rate unadjusted with observations, when evaluated against ECA&D rain gauge observations.

The article is well-written and of good quality, I recommend this manuscript to be published after technical corrections and, if the authors find them useful, taking into account my two specific comments.

We thank the reviewer for recognizing the value of our work and for the constructive feedback. The suggestions to modify the paper in accordance with the HESS submission guidelines were appreciated.

2. Specific Comments

- L150 and L300: "the NMHSs that generally operate their rain gauges in open rural areas (following World Meteorological Organization regulations)." and "Hence, to comply with World Meteorological Organization regulations, NMHSs typically measure in areas with few or lower obstacles. Hence, the (automatic) weather stations are typically located outside city centres, often in more rural areas.". These two sentences suggest that the WMO's installation rules force NMHSs to install their stations outside urban centres. I'd like to qualify this statement: first, even if it is more complicated than in the countryside, it is possible to find open areas (for example in parks, sports complexes, etc.) in the urban centres of many towns and cities. Secondly, the installation of NMHS stations is historically linked, in the 20th century, to the needs of the aeronautical industry, and so near the big cities, the stations are often installed on airports. Finally, the densification of many European networks was often carried out to ensure regular coverage of countries, and the city centres represent negligible fractions of the area of many countries.

We modified these statements and replaced 1) "Note that the PWS network tends to be of high density in the areas where the population density is high, which contrasts with the networks operated by the NMHSs that generally operate their rain gauges in open rural areas (following World Meteorological Organization regulations)." by (L. 149-151) "Note that the PWS network tends to be of high density in the areas where the population density is high, whereas it is more

difficult to find locations for NMHS gauges in urban areas complying with World Meteorological Organization regulations.”; 2) “Hence, to comply with World Meteorological Organization regulations, NMHSs typically measure in areas with few or lower obstacles. Hence, the (automatic) weather stations are typically located outside city centres, often in more rural areas.” by (L. 315-320) “Hence, to comply with World Meteorological Organization regulations, NMHSs typically measure in areas with few or lower obstacles. Therefore, the (automatic) weather stations are typically located outside city centres, often in more rural areas, although open areas can also be found in cities. Note that originally NMHS weather stations were often installed at airports, close to large cities, and are present to date. Although urban rainfall monitoring is relevant, cities generally represent only a small fraction of the land surface of a country. Meteorological networks have been designed to ensure regular coverage of countries.”

- L265: "Rain gauges are generally expected to have either a heating device (in case of automatic gauges) or instructions to melt precipitation (in case of manual gauges)." Also, NMHS rain gauges often have a larger reception cone volume than Netatmo rain gauges, enabling them to collect more solid precipitation, which gradually melt after falling, even if they are not heated.

We added to the text (L. 278-280): “Moreover, rain gauges operated by NMHSs often have a larger reception cone volume than PWS rain gauges, enabling them to collect more solid precipitation, which can gradually melt, even if the gauges are not heated.”

3. Technical Corrections

- L5 and following: "1-year" should be "1 year". Consider following the HESS submission guidelines (<https://www.hydrology-and-earth-system-sciences.net/submission.html>) for hyphens.

We removed all these kind of occurrences of hyphens, e.g., for “1-year”, “1-h”, “24-h”, et cetera, also in the figures.

- L68 and following: "September 1, 2019" should be "1 September 2019". Consider following the HESS guidelines for date and time.

We changed this accordingly for all occurrences of dates.

- L117: "and coauthors" -> "et al."?

We now list all 39 coauthors in the reference list.

- L146 and following: "Figure 1c–d" -> "Fig. 1c–d". According to the HESS guidelines: "The abbreviation "Fig." should be used when it appears in running text and should be followed by a number unless it comes at the beginning of a sentence."

We modified this accordingly.

- L274 and following: I find the word "extreme" a bit too much for the examples given. "Heavy rainfall" is sufficient. The threshold of 150 mm in 1 day is the usual threshold in the Mediterranean basin for what is known in the literature as a heavy precipitation event (HPE).

We replaced “extreme” by “heavy rainfall” or “heavy precipitation”.

- L277 and following: (panel c) -> (Fig. 8c)?

We replaced all occurrences of “panel” by “Fig. 8” or “Fig. 9”.

- L484 and L526: consider providing Digital Object Identifier (DOI) for these two articles that have one.

We added a DOI for these two articles.

- L535: "https://doi.org/https://doi.org/" should be "https://doi.org/".

We corrected this.

- L543: "https://www.netatmo.com/en-gb/weather/weatherstation/specifications" should be updated to "https://www.netatmo.com/en-eu/smart-weather-station#specifications".

Because we specifically refer to the specifications of the rain gauge module, we now refer to “https://www.netatmo.com/en-eu/smart-rain-gauge”.

- L569: "https://knmi-ecad-assets-prd.s3.amazonaws.com/documents/atbd.pdf" is not working.

The correct URL was in the bibliography file, but when clicking on the link in the PDF document it did not work indeed. We solved this by putting the URL on the next line.