

Interactive comment on “Improving the precipitation accumulation analysis using radar-, gauge- and lightning measurements” by E. Gregow et al.

Anonymous Referee #3

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This paper addresses the question of how the use of lightning data can help improve rainfall accumulation estimation. The topic is relevant and paper on this issue are welcomed. However the manuscript exhibit severe flaws, and cannot be published in its current form. The modification needed require in-depth modification.

General comments: - Overall the paper is quite difficult to read, many processing techniques are tested on various data sets, presented not at the same time. May be a scheme summarizing the techniques would help. I think the paper should also be organized better. A solution could be to present “data”, then methods with a subsection on the various products from the radar, gauge and lightning, and a subsection on how the comparison is performed. - There seems to be a contradiction between the ab-

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stract and the content. abstract l.8-9 : “the performed... usefulness of...” and l.201 “The overall result... neutral to positive impact...” and same comment on the dependent sub-set (l.211-212) - The conclusion seems to be that basically when radar data is available lightning data is rather useless. This is already a result that should be stressed (it is already mentioned). That said I have the feeling that the paper could be more interesting by shifting its scope to how to estimate rainfall (locally) from lightning data when no radar data is available (this would correspond to developing more in depth what is done with figure 7). After this analysis, you could practically test the interest by artificially removing some radar data.

Detailed comments:

- The title “radar -,gauge-” formula is not very clear.

1) Introduction - It should be extended to include a state of art section on the actual topic of the paper, i.e. lightning measurement assimilation for rainfall or more generally in meteorology. (ex among many others: Papadopoulos et al. 2005; Morales et al 2003)

2) Observations and instrumentation - p2 l49 : “LAPS” is used but was not defined before in the manuscript - p3 l76: “as as proxy”, one “as” should be removed - section 2.2 : how mosaicking is done ? Some more detail on the radar processing should be provided. how dual polarisation is used ? The differences in terms of sampling area between rain gauges and radar are almost not mentioned (l.81). This discussion should at least be expanded because it can have an influence on the standard scores used after. See for example reference such as Jaffrain and Berne 2012; Gires et al. 2014; on this issue

3) Methods - l94 : randB method mentioned but not defined after - section 3.1 : more details on LAPS are needed. Sentences such as “LAPS uses statistical methods to perform high-resolution analysis” are too general for a scientific paper. It is not clear what is the purpose of LAPS and what data is used out of it, and how it is related to the

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radar mosaic product of FMI. - Section 3.2: Some indication on the number of lightning strokes used to calibrate the relation should be given. Figure 3.b : the vertical scale should be changed to improve the visibility of the relation. Could you confirm that the temporal resolution is indeed of 5 min - Eq 3 : so the dual pol capacities are not used ? - l.151-152 : when merging radar and lightning data, why choosing the maximum ? When radar data is available, is not radar more reliable than one choice among the 6 different profiles for lightning ? Please justify this choice. - Section 3.4 : why only one sub section ? You have to say at least few words on Rand B method and Barnes analysis. It is very difficult to understand this section with so little explanations.

4) Results and verification - p. 7 is methodology and should be moved in the corresponding section. Please confirm that in eq. 4-7, values are taken at the hourly resolution ? It might be interesting to test other time steps. - l.187-188 : "the avg Rad-lig reflectivity profile. Please clarify ? - Figure 4 : please clarify what is plotted and how it was obtained. It is also almost not commented in the text. - Figure 5 : again mention time steps used (1h ?). l.220-224 : the figure should be more commented. - l.228-230 : the quantiles mentioned are not clear. - Figure 7 and comments : the change in quantile seems to improve rainfall estimates. Why was not it used in the first place ? - Figure 8 : please comment more the figure...

References: - Extending the Capabilities of High-Frequency Rainfall Estimation from Geostationary-Based Satellite Infrared via a Network of Long-Range Lightning Observations Carlos A. Morales and Emmanouil N. Anagnostou *Journal of Hydrometeorology* 2003 4:2, 141-159 - Improving Convective Precipitation Forecasting through Assimilation of Regional Lightning Measurements in a Mesoscale Model Anastasios Papadopoulos, Themis G. Chronis, and Emmanouil N. Anagnostou *Monthly Weather Review* 2005 133:7, 1961-1977 - Gires, A. et al., 2014. Influence of small scale rainfall variability on standard comparison tools between radar and rain gauge data. *Atmospheric Research*, 138(0): 125-138. - Jaffrain, J. and Berne, A., 2012. Influence of the Subgrid Variability of the Raindrop Size Distribution on Radar Rainfall Estimators.

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