

Interactive comment on “A European lightning density analysis using 5 yr of ATDnet data” by G. Anderson and D. Klugmann

Anonymous Referee #2

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The authors present “flash densities” over Europe determined with data from the ATDnet lightning location system. It is an interesting paper with new results but in my opinion some terminology should be changed and some general things should be clarified.

Normally the term “flash density” refers to densities of cloud-to-ground (CG) flashes. The reason is that a flash is defined as combination of one or more leader return stroke sequences and in intra-cloud (IC) discharges those not necessarily exist. Therefore the term IC discharge and not the term IC flash should be used. With this terminology the IC detection of ATDnet is a kind of error for the results. Further the authors stated in line 105 “As such the flash density plots produced here will be similar to the CG flash distribution of Europe, but not the same”. [Gaffard et al., 2008] found 45% time corre-

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lated “fixes” with other LLS. One could think that the uncorrelated messages are mainly IC discharges. Having all this in mind an estimation of how many ICs are included in the CG flash densities is necessary. The other possibility, which I would prefer for this paper because I think it is hard to determine the IC contamination, is not to use the term flash density but to use “lightning density”. In this case the term is more general and all the terminology in the paper should be adapted. To summarize this paragraph – there is a terminology problem in the paper.

There is no comment about the accuracy of the flash density (or lightning density) in the paper. The accuracy depends on the number of flashes/discharges in a grid cell - see [Diendorfer, 2008]. For grid cells in the north (smaller compared to lower latitude and less lightning activity) the accuracy must be much lower. At least the issue with the grid cell size could be avoided if the grid is made in the projection – see also comment below (detailed remarks).

To understand the effect of DE of the ATDnet a multiplicity distribution could be presented. What is the average multiplicity after grouping strokes to flashes? This could be compared to published multiplicity distributions (pos. and neg. flashes have to be combined because they are normally presented separately). Even a mean multiplicity plot for Europe can help to find some performance issues. The authors speak about this starting from line 410 on but draw the wrong conclusion – this analysis should be made not to show a regional dependence of multiplicity but to show how much the performance of the network varies – depending on how much the variation is.

Detailed remarks: - Line 45: LF networks easily detect over the North Sea or the Mediterranean – for VHF networks you are correct! Same in line 48! - Line 145: I do not understand the term flash density ‘rate’. Maybe the authors should explain it. - To avoid differences in the grid size it is better to define the grid cell already in a projection and extract data for each grid cell already in the projection. - Line 168-173: You should make sure you compare those flash densities for the same grid size – otherwise the comparison doesn’t make sense. I know of regions in Europe with flash densities up

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to 20 flashes year⁻¹ km⁻² but the grid size for determination of those densities was 1x1km. - Line 181-184: I do not understand the region enclosed by 4 points. . . - what do you mean with this because those 4 points basically covers half Europe. - Line 226-227: Hard to see in the figure. - Line 418: It is dangerous to advertise the results for risk assessment because the data is averaged over large areas (e.g. 20x14km at 50° latitude) where much flash higher densities could occur. Therefore averaging over such a large region could underestimate the risk for some smaller regions. For risk assessment flash densities with better spatial resolution should be used.

Minor problems: - All figures with flash densities are definitely too small. It is not possible to see something on a printout – in the PDF version you have to zoom. Basically all figures should be enlarged.

References: Diendorfer, G. (2008), Some Comments on the Achievable Accuracy of Local Ground Flash Density Values, in *Lightning Protection (ICLP)*, 2008 International Conference on, pp. 1–6, Uppsala, Sweden. Gaffard, C., J. Nash, N. Atkinson, A. Bennett, G. Callaghan, E. Hibbett, P. Taylor, M. Turp, and W. Schulz (2008), Observing Lightning Around the Globe from the Surface, in *International Lightning Detection Conference (ILDC)* International Lightning Meteorology Conference (ILMC).

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