

Interactive comment on “Rainfall retrieval with commercial microwave links in São Paulo, Brazil” by Manuel F. Rios Gaona et al.

Anonymous Referee #1

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Summary:

The paper presents an interesting topic. The authors analyze CML data in sub-tropic climate, namely Sao Paulo (Brazil), to derive rainfall information and validate it via a fairly dense network of rain gauges. This seems to be the first time a CML data set from this part of the world is analyzed in this sense, making the manuscript a potentially valuable scientific contribution in AMT. However, in my opinion the analysis is far from complete and misses out a lot of potential. As the authors state, and I acknowledge their honesty, they neglected the majority of the available CML data sets in their analysis, because, either their existing processing code cannot cope with it, or because comparison with nearby rain gauges was not possible or showed low correlation. This is a major shortcoming (see the list of my main concerns below). In general the paper

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is well structured and the writing is okay. Given the number of major concerns that I have and owing to the fact that this manuscript is already in open discussion, I recommend a major revision. Completely redoing the analysis with a new direction (focusing more on the CML data quality issue) and resubmitting would maybe be easier if the manuscript would not be openly available already.

Main concerns:

- It has already been shown in numerous publications, among them many from the authors of this manuscript, that CML data can be used to derive reliable rainfall information. Hence, the result, that the authors can derive meaningful rainfall information from CML data is not very exciting news. The fact that the rainfall climate is different for the data set presented here, is relevant, however, the impact on the resulting rain rate seems to be negligible in comparison to the other uncertainties (e.g. the considerable differences of the relative bias for the 5 CML-gauge pairs, or the known uncertainties due to wet antenna, quantization, etc.).
- Only being able to derive meaningful results for 5 out of 250 CMLs indicates that either the methods used by the authors are lacking or the technique of using CML data for rainfall estimation in general is less promising than expected.
- The fact that the majority of the CML data, the Ericsson data which only provides the minimum signal levels, cannot be used with the existing codebase of the authors (RAINLINK) should not be an excuse for not analysing it. Rather this calls for adjusting or extending the existing code.
- The final analysis is based only on short or very short CMLs, but the authors do not state if they applied a wet antenna correction method, even though they note themselves that the effect of wet antenna can strongly impact shorter CMLs. This makes all the reasoning about biases arbitrary.

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- The authors state that gauge records can also be unreliable, nevertheless they use low correlation with gauge records as indicator to neglect CML data.

Recommendations:

- I recommend an extensive major revision, i.e. a real extension of the current analysis (see my points below)
- Given the seemingly very heterogeneous quality of the raw data set (which is fine for an opportunistic sensing technique like the one used here), the scientific focus should in my opinion be to describe how to cope with this data quality issue.
- The constraint to neglect CMLs which are further than 1 km away from a rain gauge should be weakened. One can argue about what a “reasonable” threshold distance for comparing two rainfall measurements is. But, 1 km is really very strict, in particular, since the CMLs integrate over hundreds of meters or several kilometers anyway. The increased distance between CML and gauge will add additional uncertainty for sure, but when I look at the presented results and the relative biases from Table 1, having more data for the analysis seems to be more important than absolute accuracy of rain rates and/or rainfall sums.
- The Ericsson data should be included, i.e. RAINLINK should be extended to be able to process this data, or other code should be written or reused.

Other major comments and questions:

Page 4, line 22: What were the actual lengths and frequencies of the “long” CMLs? If the transmit power is high enough or large antennas are used, “uncommon” combination are possible. From Fig 1. some of the very long CMLs look strange indeed, though.

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Page 6, line 13: A 50 km radius to look for CMLs with jointly decreasing power levels seems a bit large, in particular since, as the authors write in section 2.1 and 3.1, there is a lot of convective spatially very variable rainfall in the study region. Hence, is this radius of 50km too big? And how sensitive are the RAINLINK processing results on this threshold?

Page 8, line 7: Limiting the analysis to CML-gauge pairs were both show a rainfall depth above 0 mm, neglects the validation of the challenging step of detecting rain events in the CML time series, which, to my understanding, is the first step in RAINLINK. Wrong detections, i.e. missed rain events or artificially generated rain, may considerably add bias to the accumulations. Hence, this effect should be included in the validation or added in a separate validation.

Page 8, line 31ff: Given that this is the result for 1 out of 250 CMLs, I would recommend not to draw that optimistic conclusions based on the current state of the analysis.

Fig 1: As it is mentioned in the text, the very long CMLs indeed look strange since they do not even end on one of the summit of the mountains in the north and north-east. Wouldn't it be possible to check via GoogleMaps satellite images if there is a relay or cell phone tower there? It would be nice to have a more solid basis for neglecting these CMLs. At least give more details in the text. Maybe it would also be good to show two or three maps, one with all CMLs, one with “reasonable” CMLs and in addition only the CMLs used for analysis (which hopefully will be much more in the next revision of the manuscript. . .).

Technical and minor comments (this is a uncomplete list, since I assume that the manuscript will considerably change with the next iteration):

Fig 2: I only see 4 crosses not 5 as indicated in the caption. Also the red circles and red crosses seem not to add up to 11. Maybe overplotting is an issue here. If yes, this should be mentioned. Furthermore, no CMLs longer than 8 km are shown, even though the caption states that all HU CMLs are plotted, for which, according to Fig 1.,

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some are definitely longer than 8 km.

Fig 5: The two yellowish colors are hard to distinguish. Anyway, if colors are different, markers could maybe be the same to make the graph easier to read. Or even better, have separate scatter plots for the CMLs, or at least for selected ones, if the number of CMLs increases with an extended analysis.

Table 1 and Table 2: The relative biases are exactly the same in both tables. As far as I understood, Table 2 is based only on a subset of the rain events from Table 1. Hence, I assume there is something wrong with either Table 1 or Table 2.

Table 1 and Table 2: Is CML 12 and 13 along the same path, but just the two directions?

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