Geoscientific
Model Development
Discussions

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# *Interactive comment on* "Root mean square error (RMSE) or mean absolute error (MAE)?" *by* T. Chai and R. R. Draxler

**R. Sander (Editor)**

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It has not been easy for me as the editor of this manuscript to make a decision. I carefully evaluated the reviews. In the end, I decided to continue the review process even though 2 of the 3 reviews recommend rejection. In this editorial comment, I would like to explain the reasons for my decision.

### Anonymous Referee #1

- The reviewer states that "the MAE, in contrast to the RMSE, is a straightforward measure of average error magnitude." This is a circular argument. Of course, the

MAE is a straightforward measure of average error, simply because it is defined as the average error.

- The reviewer mentions the triangle inequality issue: "It is unfortunate that the authors of this paper misinterpret Willmott et al.'s correct point about combinations of elements within the squared-errors vector not satisfying the triangular inequality." I checked Willmott et al. (2009) and found the following statement regarding the triangular inequality: "It is clear that $4 \leq 2 + 3$; whereas, $4^2 \nleq 2^2 + 3^2$." I do not see why this should prove that the RMSE does not satisfy the triangular inequality. To me, the comparison simply means that the MAE puts more weight onto two small errors $(2 + 3 > 4)$, whereas the RMSE puts more weight onto a single large error $(4^2 > 2^2 + 3^2)$.

### Anonymous Referee #2

The main argument of Referee #2 is that the topic of the paper is textbook knowledge. I fully agree and think that it normally would not be worth publication in GMD. However, there are already two peer-reviewed publications by Willmott et al. (2005, 2009) which question this textbook knowledge. Therefore, I think it is necessary to continue the discussion. Probably the best place for the current manuscript would have been a direct comment on these articles in the journal Atmospheric Environment. However, as Referee #1 pointed out, Atmospheric Environment did not publish the comment. Since I think that the criticism by Chai & Draxler is justified, it should not be rejected, even though their main statement is only that "the textbook knowledge is correct".

**Suggestions for the authors**

Even though I think that the manuscript could eventually be published in GMD, I think that a few modifications are necessary:

- In the introduction, the authors say that "the MAE tends to be much smaller than the RMSE". This should be replaced by a more exact statement. It could be said that the RMSE is by definition *never* smaller than the MAE. The difference between RMSE and MAE depends on the variance.

- Also in the introduction, the authors say that "the RMSE penalizes large errors". Although this is often true, it should be noted that the RMSE penalizes variance but not necessarily large errors. For example, consider a set of 10 errors which are all 1. Then MAE and RMSE are identical: MAE = RMSE = 1. If the model improves and two of the errors are reduced to zero (1,1,1,1,0,0,1,1,1,1) then RMSE $\approx 0.9 >$ MAE = 0.8.

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