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**Geoscientific
Model Development
Discussions**

Interactive comment on "Bayesian calibration of the Thermosphere-Ionosphere Electrodynamics General Circulation Model (TIE-GCM)" *by* S. Guillas et al.

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We thank the reviewers for their comments that improved the presentation of the paper.

Anonymous Referee #1:

Specifically:

1. The measurements and simulations in figure 2 are unitless, as they are transformations of the original measurements and simulations y in [nT] (nano Tesla), via the function $y \rightarrow sgn(y)\log(1+|y|)$.

2. Some parameters in Figure 3 are cut off at certain values because the Metropolis-

Hastings algorithm rejects jumps beyond these values. It seems that these values correspond to the limits of the intervals we used in the design and there is too little information there. It would be interesting to calibrate TIE-GCM with a new design that would extend the values of the parameters beyond their current range, at least for some parameters.

Anonymous Referee #2:

The referee is right, we should aim to obtain single estimates of parameters like AMP, PHZ, EDN, based on the combined data sets. However, including multiple sites requires us to parametrise the discrepancy function by location, to account for spatially systematic model biases; in this way we borrow strength across multiple locations, but we do not over-count proximate locations, because we appreciate that they share error. We could combine the two likelihood functions with the original prior to get a better posterior, but only if we were confident that the two sites were sufficiently far apart that there was no systematic model bias. We cannot simply combine the two posterior distributions because that would double-count the prior.

Local time was used indeed. However, since the study is done for each location separately, it does not matter as we focus on covariances. If we were to model jointly the locations, we should indeed take care of this. The referee is right in the denomination of time as an input parameter, it a controllable parameters, which is included in the design but on which we do not do inference. The text was corrected accordingly.

As for the size of the covariance structure, page 492, line 11, the referee is right, and we are grateful to him/her for pointing out this mistake. There was a confusion in the text between a total number of runs of $n = 30$ and the size of the design of size $12n = 360$. The text is corrected accordingly.

To be precise, Referee #2 is correct in noting that "electron density" EDN is electron number density, not mass density.