

This manuscript convincingly demonstrates the benefits of lightning data assimilation in the WRF model when run regionally over CONUS and when run over the Northern Hemisphere at coarser resolution. The benefits over CONUS were the greatest when high detection efficiency National Lightning Detection Network data are used, but model performance improvement was noted even when the lower detection efficiency World Wide Lightning Location Network (WWLLN) data are used. The authors considered the effects of two of the Kain-Fritsch convective scheme parameters (trigger function and convective time step) in association with the lightning assimilation. These parameters have major effects on precipitation in the base case without lightning assimilation, but the effects of variation of these parameters is diminished when the assimilation is used. The paper presents comprehensive statistics on the performance of the simulations with the two lightning data sets and with the variation of convective parameters. The results suggest possible future improvement of the lightning assimilation scheme to take into account horizontal grid resolution by using the observed flash densities to determine when to trigger convection. The paper certainly fits in the scope of GMD, and I recommend publication after some minor revisions outlined below.

**We thank the reviewer for this overall positive and supportive assessment.**

line 32-33: monthly mean daily precipitation

**Thanks, the correction has now been made.**

line 64: add some more references: Allen et al. (2012); Kang et al. (2019a,b)

**Thank you for the suggestion. The references are now added.**

line 90: Even though there are some....

**Thanks, the change is now made.**

lines 93-94: ...there is no literature evaluating how these parameters...

**Thanks, the change is now made.**

line 104: efficiency is much lower than the >95% of NLDN for cloud-to-ground (CG) flashes

**Thank you so much for catching this point. We have now revised the manuscript accordingly.**

line 109: ...with NLDN lightning flashes over CONUS

**Thanks, the change is made.**

line 212: and snow.

**If the “are employed” after “and snow” is removed, the sentence is not complete. So, we keep the sentence as it was written.**

line 218: move URL to after the word "dataset" in the previous line

**Thanks, the URL is now moved to after the word “dataset”.**

line 298: ...present the more dramatic fluctuations...

**Thanks, the change is made.**

line 376: ...errors were noticable (Figure 6).

**Thanks for the suggestion. We have now added “Figure 6”.**

line 436: ...among the BASE cases were noted in all the....

**Thanks. We have now revised the sentence as suggested.**

line 462: In the analysis in Figure 3b....

**Thanks. We now changed the word “with” to “in”.**

line 503: ...12-km LTA cases (both K2C10W and K2C10N)

**Thanks, we have added the case names for clarity.**

line 507: ...in that the precipitation from Trig2 was....

**Thanks, the change has been made.**

line 574: ...directions are to use criteria values of lightning flash density dependent on grid resolution to trigger deep convection...

**Thank you so much for the suggestion. We have now revised the sentence as suggested.**

line 586: "updates" Please remind the reader here what the updates were

**Thanks for the suggestion. We have now revised the sentence as: "Separately, the original LTA technique as described in Heath et al. (2016) showed influence from the cumulus parameters on the LTA cases (Figure S8), but after implementing the updated cloud top height (one model level above -20° C) and the additional pre-conditioning shallow convection (see in Section 2), the fluctuations among the LTA cases were significantly reduced."**

line 603: ...the convective processes (e.g., convective transport of air pollutants matching the times and locations of lightning NO<sub>x</sub> production) to have....

**Thank you. The clarification has now been added.**

line 610: I'm not sure what is meant by "scope" here. Please add "strokes per flash" to this list of new data from GLM.

**Thanks for the comment. We have now replaced the vague word "scope" with "strokes per flash" in the revised sentence.**

lines 640-647: should these items be moved to the "Code and Data Availability" section?

**We agree. We have now moved these descriptions to the "Code and Data Availability" section.**