Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2015-203-AC2, 2016

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "Improved Forecasting of Thermospheric Densities using Multi-Model Ensembles" *by* S. Elvidge et al.

S. Elvidge et al.

s.elvidge@bham.ac.uk

Received and published: 17 May 2016

Many thanks for the review of our paper. We have replied to your specific comments below:

"Line 164: The CHAMP data was probably taken more often that 45 seconds, but then was averaged to 3 degrees in latitude, which is about 45 seconds."

Thank you for this. It would seem the accelerometer data was collected at rate of 1 Hz, and then averaged as you suggested. I have updated the text to reflect this.

"Lines 165-175: There is a change in tense in this paragraph compared to the rest of the paper that should be corrected. "

Corrected.

Printer-friendly version

Discussion paper

"Line 178: Trilinear interpolation was mentioned. Does this mean the model files were output at the exact correct time? How often were the model output files written?"

It was an oversight to not include this information. The model output files were written every 30 minutes and the closest CHAMP time was taken. Since there is CHAMP data every 45 seconds, the closest matching time is always within one internal model timestep. As such it was decided that this would have little impact on the results. However this information should be included in the text which I have now updated.

"Line 252: The "I" is missing in "It" "

Corrected.

"Line 258: Comma after "conditions" "

Added.

"Line 261: Comma after "possible" "

Added.

"Line 262-263: Should use "e.g.," instead of "i.e." "

Corrected.

"Line 267: Comma after "models" "

Added.

"Line 270: Need should be "needed". Comma after "grids" "

Corrected.

"Line 274: Comma after "run", "grid" should be "state-vector", and then "conditions" should be "condition" "

Corrected

"Line 275: "this" should be "the six-hour period" "

Corrected.

"Line 276: Comma after "period" "

Added

"Line 278: The argument here that this is a "true forecast" is not really true at all, since it would imply that you are running all three models with real inputs/drivers. What really should be done is that all three models should be run in a "predictive" mode for 6 hours, then the MME should occur and all three should be re-initialized. Then the sequence should start again. But, as it is now, the MME is like a "truth" simulation and you are always bringing the TIEGCM back up to the truth. This is not like how it would be done in real predictive mode. "

I believe in this case that what we are describing is a true forecast. TIE-GCM, initialised with the equally weighted MME, is run forward for 6 hours with no external driver information (since this wouldn't be available in reality). This is how the system could be run operationally. The MME is created using historic model information (up to 'now' in a real system) and then propagated forward. The MME forecast is then compared to the observations over that time period for us to judge how successful the approach was. The mean square error weighted MME however isn't entirely a true forecast, since the weighting is created using data from the entire time period. This information wouldn't be available in a real predictive mode. We have noted this in the text.

"Line 284: "conditions" to "condition" "

Corrected.

"Line 285: "combine" to "converge" "

Corrected.

"Line 288: Change the rest of the sentence starting with "the two models..." to "the

two models, started with different initial conditions, are decreasing towards zero, as expected, but it takes approximately 70 hours to read these levels." Really, a much better way to do this would be to fit an exponential decay to this curve and report the e-folding time. It should never really reach zero. "

I've updated the text as you suggested and also included the e-folding time.

"Line 305 and around there: It seems like the original MME - combining the 3 models - does better than the TIEGCM initialized with the MME. Why not run all 3 models and use an MME for the forecast also?"

An MME could be used for the forecast by running each of the models forward and then combining the outputs (the models would have to use estimated driving parameters). However such an approach is expected to have worse performance long-term since if you have a poor specification of the densities in the first place propagating them forwards with the models would result in poor forecasts. The point of the MME should be to reduce the uncertainties in the initial conditions for better forecasts. An approach which could yield an improvement would be to use the MME as the initial conditions to multiple models, run each forward for the forecast window, and then create a further MME by combining the outputs. The final MME would then be the best estimate for the forecast. However this can not yet be achieved since we have not got GITM running using the MME as the initial conditions. This is something we are working on.

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2015-203, 2016.

Printer-friendly version

Discussion paper