

Interactive comment on “Climate data induced uncertainties in simulated carbon fluxes under corn and soybean systems” by Varaprasad Bandaru

Anonymous Referee #2

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General comments

This paper addresses the impact of uncertainties in gridded climate datasets on model estimates of crop carbon sink. The authors use weather and net ecosystem exchange (NEE) data from 4 AmeriFlux sites as reference. They test the impact of 4 gridded climate dataset on simulated NEE using the EPIC model.

I find this issue of uncertainty due to climate forcing data important and often overlooked in the carbon cycle community. It is hence important to study. The author chose to tackle the issue at local scale with 4 corn and soybean FluxNet sites, which allows him to have an observed reference. To my knowledge, this has not been done yet and

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is an interesting approach.

However, I am not convinced by the method chosen and especially by the analysis of the results. The author presents the results of his study as if the model was a black box.

-To test the relative importance of the different forcing climate variables, the author chose to successively replace one variable from the observed forcing dataset by the corresponding gridded variable. Although this method is often used it doesn't respect the physical consistency of the climate forcing (eg: the forcing could impose high short-wave with high precipitation, or low relative humidity with precipitation etc) and depending on the model, this can lead to unrealistic results, especially if the model resolves a surface energy and water balance. This caveat should be at least discussed in the discussion. -The author uses relative humidity instead of specific humidity. The problem is that relative humidity mixes information on air water content and temperature. -The author bases its analysis on a comparison between forcing variables from the gridded datasets and the observed ones with mean bias and mean absolute percentage error (MAPE) as metric. He then looks at the impact of these errors on simulated NEE and uses MAPE as metric. The stated goal is to look at the effect of climate data uncertainties on the net carbon balance of crops. To do that the author has to look at bias of NEE, not MAPE. What matters first is the annual amount of carbon absorbed or released. Second, once the author shows the error, he should explain it. This is a modelling study and the author has all the tools to explain what is happening: when NEE is increasing, is it because of an increase in NPP or a decrease in heterotrophic respiration? The author just mentions the possibility although he just has to look at the model results to see what is happening.

Figures: all the figures should be in color, and the axes titles should be bigger

Detailed comments:

L 182-187: this description is not satisfying. I could not understand what NLDAS is

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by just reading it. The description from the NLDAS website is not longer and far more informative. “through downscaling” of what ?

L 205: “constitute an independent”

L 229: should be 2.4 instead of 2.3. Similar for all the subsections

L256-263: These steps were not done for calibration also ? if yes, the author should put this before the calibration part. If not he should explain better how they performed calibration without spin-up or soil data.

L 267: - the author should add a Table with the simulations – Unless I missed it, the author doesn't explain what shortwave data he uses with PRISM – The author should explain how he imposes irrigation

L 281-287 : looking at a relative error of temperature in degree Celsius doesn't make any sense because the error is large for small values of T. And small values of T in C don't represent a small store of anything, it is just an arbitrary scale. The results of MAPE would be completely different in °K. Ex: in °C : $W_g = 2, W_o = 1$: $MAPE = (2-1)/1 \% = 100\%$ In °K : $W_g = 275, W_o = 274$: $MAPE = 1/274 \% = 0.36 \%$

It does make sense for variables where the zero is not an arbitrary point like shortwave radiation or precipitation: 0 W means no radiation, and 0 mm means no water. On the contrary 0°C does not mean no energy (0 K does).

L 299-306: we would want to know the mean bias over the whole growing season

L 312: in this section the author has to explain which simulations he is looking at. If I am not mistaken, in Figure 4 and 5 the author looks at the 4 simulations with the 4 untouched gridded datasets and in Figure 6 he uses the additional simulations where 1 variable is changed at the time. This should be clearly stated in the text and in the figure captions. The author could refer to the Table summarizing the simulations I suggested.

L319: I would talk about seasonal cycle instead of “better alignment”

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L327: this is where the author should look at his model results. He can look at NPP and heterotrophic respiration (or GPP and total respiration) to understand what is happening. A simple description is not enough, this is not data.

L 348 : there seems to be a problem with this sentence

L 354: I believe it should be section 3.1

L 376-378: NLDAS and NARR assimilate weather data, so this argument is not sufficient

L 392-394: this argument is not correct for temperature. It depends on the unit chosen (°C instead of °K). L395-405: the study covers DoY 90-300, spring to fall. Winter months are not studied, so this all paragraph doesn't make any sense.

L406 Trend is used here (like in the rest of the manuscript) in the common language sense, which is a bit disturbing. The author didn't compute a trend. Rework.

L412-415: circular argument – the author should use “assimilation” instead of “sequestration” to avoid this

L 423-425: problem with the sentence

L 433: “climate variables won't translate linearly to the. . .” why would the author believe that ? I would add “As expected . . .”

L437: “However, the biases . . .” I don't believe the author showed this result.

L457-459: what is the link between “daily biomass” (what is this? a stock or a flux?) and NEE ? If you use this argument you have to show these results from the model.

L470-472: “shortwave radiation determines total potential biomass”: this is extremely strange. SW radiation is the primary driver of photosynthesis. EPIC doesn't calculate photosynthesis?