

***Interactive comment on* “BESS-STAIR: a
framework to estimate daily, 30-meter, and
allweather crop evapotranspiration using
multi-source satellite data for the U.S. Corn Belt”
by C. Jiang et al.**

Anonymous Referee #2

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General: This is an interesting and impactful study. However, I think that the authors have not currently highlighted its strengths as well as they could. The way I see it, this study provides a novel ET algorithm because of (1) the explicit treatment and modeling of stomatal conductance and canopy conductance; (2) the detailed representation of leaf architecture and inclination distribution; and (3) the ingenuity in gap filling cloudy days in the Midwest. I think it is disingenuous of the authors to call this a coupled water-carbon-energy model. To me, this implies that there will be some sort of simulation of photosynthesis, NEP, NPP, and/or yields. I see that stomatal conductance

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was calculated using the Farquhar and Ball-Berry models. In order to make these calculations, there needed to be an estimate of net photosynthesis. Why are these estimates and maps not included as results in the study? If there is some limitation to simulating the carbon cycle, the authors should explain what that is or actually simulate some carbon components. I'm guessing there is some limitation here and I think that rather than calling BESS-STAIR a water-carbon-energy model, that the authors should focus on the excellent strides that they have made by explicitly simulating the dynamic stomatal response, leaf inclination, and gap filling using surface albedo. Specific comments: Line 21: "water-carbon-energy" coupled is a little disingenuous. To me this implies there will be a carbon budget or some carbon-related outputs from the model (e.g. Anet, NEP, NPP, yield). Line 22: 'satellite' spelled incorrectly. Line 37: Add "evaporation" to leaf transpiration. Line 37: "ET at cropland is usually considered as crop water needs" is confusing. Please rephrase. Line 43: USDA, 1997 is an outdated reference. Please update, perhaps with some Midwest US specific references about precision irrigation. Line 44: You bring up the urgency of this need here. I ask you to follow up on this both in your computation and the discussion of the scalability of this model and also how it compares or outcompetes other similar models (e.g. STAR-FM). Line 48: "competitions" is an odd work to use here. Please rephrase. Line 113: Figure 1 is where I get confused about your use of coupled water-carbon-energy cycling to describe this model. If you have VCmax 25 and Ball-Berry parameters, what are you missing for Amax, and other carbon outputs? Line 155: How is STAIR different from STAR-FM? (Semmens et al., 2015) Lines 197-199: This is the first time that corn and soy are mentioned as the specific crops studied. It would be better if these were specified earlier in the manuscript. Lines 235-235: Including the leaf inclination distribution is novel and interesting. It would be great to highlight this aspect of your work more in the abstract and also place it into context in the intro (I do not believe other satellite-based ET models characterize the canopy to this detail). Line 255: Is soil albedo also estimated prior to canopy closure? Line 322: I agree with Reviewer 1. Please make the necessary conversions and stick with ET. Introducing LH at this point in the paper

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is a distraction. Line 394: Please expand on the “high computational efficiency” of this model. Line 407: You mention PET here, but there are no PET maps. It would be interesting to compare PET to ET in a drought year (e.g. 2012). Line 443: You criticize other models for only focusing on the water cycle, but as it stands, this paper also only shares results related to the water cycle. I think you either should share some carbon cycle results or remove this type of language. Lines 478-479: Traditionally, we do not introduce new figures in the discussion section. It would be better to move Figure 12 to the results section. Line 505: Can you investigate drought and soil moisture using the 2012 drought year in your dataset? Line 531-534: Back to your urgency point in the introduction—how far are we from real-time ET estimates at 30-m being freely available for irrigation management?

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