

## Reply to reviewer Paul Dirmeyer

- *Objectives section: An obvious "omission" is anything to do directly with vegetation or the carbon cycle, which will probably stir up questions in the minds of readers. The authors should declare the territory of this MIP up front, presaging Fig 3, that the focus is on the "GEWEXy" bits, especially the water cycle. State explicitly that there are other MIPs (e.g., LUMIP) that are concerned with the vegetation aspect of the land surface (can say "...as described later..." as this does get addressed eventually with Figs 2 and 3 on p.6).*

Good point, also commented on by other reviewers. In the "objectives" section we added a paragraph explaining the link to LUMIP: "While vegetation, carbon cycle, soil moisture, snow, surface energy balance and land-atmosphere interaction are all intimately coupled in the real world, LS3MIP focuses - necessarily - on the physical subdomain in this complex system. Interactions with vegetation and carbon cycle are included in the analyses wherever this is possible without losing this essential focus. In the complementary experiments Land Use MIP (LUMIP; see Lawrence et al. submitted) and C4MIP (Jones et al, 2016) vegetation, the terrestrial carbon cycle and land management are the central topics of analysis. LS3MIP and LUMIP share some model experiments and analyses (see below) to allow addressing the complex interactions at the land surface and yet remain able to focus on well-posed hypotheses and research approaches."

- *Highly relevant work on snow-climate coupling should be cited (Xu and Dirmeyer 2011) especially regarding the albedo versus delayed hydrologic effects (Xu and Dirmeyer 2013), the latter also at line 191.*

Sorry we missed these references. We've added a sentence in the introduction section "Temporal dynamics of the snow-atmosphere coupling during various phases of snow depletion (Xu and Dirmeyer 2011, 2012) are crucial for a proper representation of the timing and atmospheric response to snow melt." and added a reference near line 191

- *Para lines 176-192: This is rather redundant with the first paragraph of the introduction. Probably needs to be in only one place. Same para: Is WCRP the only "customer" for this project? Seems that the potential audience is much broader - should be stated here. Along with the next paragraph, gives short shrift to the broader impacts of L3MIP.*

Apart from removing some redundant references to WCRP, we've added a sentence describing the potential revenues of LS3MIP: "LS3MIP is geared to extend and consolidate available data, models and theories to support human awareness and resilience to highly variable environmental conditions in a large ensemble of sectoral domains, including

disaster risk reduction, food security, public safety, nature conservation and societal wellbeing.”

- *L297: Which NCEP reanalysis? There are 3 separate unique NCEP reanalyses.*

This can be found in the documentation of the CRU-NCEP data set and is of minor relevance for this paper

- *Para lines 427-439: Really need to avoid prescribing surface soil layer moisture as well, because it can cause highly unrealistic Bowen ratios where net radiation is high, (cf. GLACE2 experiment "S"; Koster et al. 2006)*

Yes, we are aware of this, and have added a reference to this notion. As we made clear in the manuscript, a standardization of this approach is difficult, and should be carefully tested by the modelling groups.

- *L510-12: What is the protocol for ensemble construction? Are there suggestions of a prioritized list of preferred approaches like there were for GLACE-1 and -2?*

Good point. We've added the phrase "The procedure to initialize the land surface states in the ensemble members is left to the participant, but should allow to generate sufficient spread that can be considered representative for the climate system under study. Koster et al. (2006) proposed a preference hierarchy of methods depending on the availability of initialization fields, and LS3MIP will follow this proposal."

- *Tier 2 experiments in LFMIP: The mean AOGCM climatology of SST will certainly differ from that of an AMIP run based on observed SST, introducing two differences between the experiments, not one. What are the implications?*

The implications will be substantial, but also a systematic biases in SSTs is an inherent part of the analysis of the role of SSTs on land-atmosphere coupling.

- *L699-702: It seems agricultural areas in general should be a focus.*

Indeed, added as such

- Other minor corrections and suggestions for citations: changed as suggested