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Geoscientific Model Development Discussions

Interactive comment on "The Land surface Data Toolkit (LDTv7.2) – a data fusion environment for land data assimilation systems" *by* Kristi R. Arsenault et al.

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We would like to thank the reviewer for their thorough review of the paper, comments and helpful feedback.

Comment #1: Line 31: lots of acronyms here makes it quite hard to read. Could you maybe write out MDF its only used 6 times?

Response: Without the page specified, we are not sure which "Line 31" the reviewer may be referring to.

In response to the reviewer's request about the "MDF" acronym, we do introduce what

the "MDF" stands for on page 3, line 6, but we have included it again on line 25 of page 4 and in our Figure 1 caption.

Comment #2: Section 2 Background. A few additional examples of data processing environments designed to support large scale modelling would be a nice addition. Is it really the case that you would only classify the WRF as relevant to this broad definition? For me this section doesn't do enough to set the context within which LDT has been developed and is my only substantive criticism of the paper. Furthermore, you could also replace ArcGIS and Matlab with QGIS and R to have much the same functionality in an open source framework. Overall this paragraph is not very convincing relative to the rest of the paper.

Response: Thank you for the feedback on this particular section. In our review of available data processing software for land surface and hydrological models, not many models have a designated and comprehensive preprocessor that handles all inclusively many of the features that LDT does or have supporting documentation available. The WRF preprocessing toolset is one known example that has technical description documents, tutorials and available test cases. Also, we are aware of some LSM or hydrological model preprocessing software developed by different institutions, but in some instances, some of the documentation may not be shared publicly (e.g., with the JULES model) or several different steps, scripts and languages may be required to derive new inputs for a model (e.g., the Community Land Model).

We do agree that providing a few additional examples of data processing environments would be useful to further highlight the purpose for why LDT was developed. We have updated the first paragraph of Section 2, addressing the concerns noted by the reviewer, and included some additional examples of what is found with other preprocessing environments.

In response to the reviewer's point about QGIS and R being an open-source alternative to ArcGIS and Matlab, this is a valid point, so we have modified the text in this part of

Section 2 to better reflect these other options.

Comment #3: Is the text wonky on Figure 1? Maybe it's just my eyes, but it would look a little better if straightened up.

Response: Thank you for noticing this. We will make sure that the Figure 1 graphic is updated for the final paper submission.

Comment #4: P6, line 28: Am I correct in thinking that hydrological response unit approach to sub-grid parametrisation is not supported. If so could you briefly comment on the implications and future potential/challenges in this regard?

Response: We appreciate the reviewer's question on this topic. At this time, we do not support the use or models that use hydrological response units (HRUs) in any public versions of LDT. LDT does provide support for gridded drainage basin areas for the HyMAP-1 and 2 model versions. However, efforts are underway to merge WRF-Hydro with LDT and the Land Information Systems (LIS), where WRF-Hydro utilizes Hydrologic Unit Codes (HUC) basin and stream segments, so this could lead to future development and incorporation of models that support the HRU model unit.

The potential may exist for representing HRUs and using LDT to support that. Currently, ArcGIS is used to help derive some of the needed topographic parameters and basin delineation to generate the higher resolution routing grids (e.g., for WRF-Hydro). Thus, the challenge will be finding ways to replicate the ArcGIS capabilities within the LDT software environment to be able generate the relevant subbasin-related information. Also, Samaniego et al. (2017) point out some of efforts and difficulties associated with employing the HRU as the landunit representation involve issues, for example, with scaling of parameters to different domains or coarser resolutions not calibrated. So as the need arises, we would make the effort to implement the necessary support for HRU subgrid parameterization as best as possible, trying to address some of these challenges.

Comment #5: Section 4.4. The frequent use of "currently" here suggest changes are planned or in progress. Perhaps either mention imminent development plans or drop the "currently" bit.

Response: Thank you for this suggestion. We have replaced "currently" in a couple of locations with different wording to indicate whether a feature is in progress or fully mature at this time.

References

Samaniego, L., and co-authors: Toward seamless hydrologic predictions across spatial scales, Hydrol. Earth Syst. Sci., 21, 4323-4346, 2017. https://doi.org/10.5194/hess-21-4323-2017

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