

Implementation of a dry surface layer soil resistance in two contrasting semi-arid sites with SURFEX-ISBA V9.0

Belén Martí, Jannis Groh, Guylaine Canut, and Aaron Boone.

Comments to the author.

This paper explores how adding a dry surface layer (DSL) soil resistance parametrization to the ISBA land surface model (LSM) within the SURFEX V9.0 within the MEB scheme improves the simulation of evapotranspiration (ET) in semi-arid environments. The study focuses on two contrasting field sites from the LIAISE campaign in Spain. The study addresses a longstanding error found in several land surface models, namely an overestimation of evapotranspiration in semi-arid environments, and is an important advance in SURFEX-ISBA parametrization development. A comprehensive evaluation of the DSL scheme is presented with encouraging and interesting results demonstrated. The commentary is well written, succinct (although it is a lengthy manuscript) and meets the objectives laid out in the study.

I recommend this article for publication after addressing a few minor points which are detailed below.

Minor Revisions

1. The author has a significant number of parameters which are defined in Section 2. The author could consider a table of parameter lists (including symbol, units, parameter name, and equation number) either in Section 2 or as an Appendix. I feel this would be a useful reference/look-up to help with interpretability of this section.
2. Line 257-259 The SEB stations and associated data are contributions from a number of research groups. The one reference here (Price 2023) is not sufficient. Please add more references for the datasets.
3. Line 286-287 'energy budget of a short dry-down period near the end of the LOP shows a lower R_n compared to La Cendrosa' Would shortwave differences between July & September not also be a factor in the differences in R_n between the sites?
4. Line 286 'Short dry-down' Could you add a line about the rainfall event timing that causes this dry-down. When I get to Fig 6, it looks like there is 1 mm rainfall on 02/09, is this sufficient to be termed a dry-down?
5. Section 4.2 What are the lengths of the two simulations (i.e. start/end date) or are they the same as the plots? For clarity, please add a sentence to explain.
6. Figures. There is inconsistency between the date formatting on plots e.g. Fig2/ Fig 6 have 07/05 and 05/07. Please could all plots have same start/end wherever possible, this makes it easier to line up harvest dates/irrigation dates and see the impact of these events on various parameters. Please could the lines for harvest/irrigation be added to all relevant plots e.g., Fig 9 and Fig 11.
7. Table 5/6. I think a lot of the statistics displayed in the tables could be included within captions in subplots on Fig4/5. This would make it easier to move between the text and figures and not also have to refer to the tables. The tables could again be moved into an Appendix.
8. Table5/6 It is not clear which parameter the 'Corr' relates to - it could be H/LE/G from the way the table is laid out. I have assumed it is H and LE, but it is not clear.
9. Line 451 'low/high vegetation' I think this is the first time you use this – could you add a line to explain what is meant by this.
10. Line 463 'Cendrosa (56Wm⁻²) and Els Plans (50Wm⁻²)' I struggled to see where these numbers came from in Table 5/6. Could you please check.

11. Line 474 'except for an improvement from 0.81 to 0.88 in the overall correlation' I could be wrong, but are these not the correlations for La Cendrosa, whilst the Els Plans correlations are 0.87-0.89?
12. Line 476 The value of 57 Wm⁻² isn't in Table 6 for the G parameter. Please check and consistency within text.
13. Line 486 Please add the date of the two irrigation events in brackets.
14. Line 485-490 Please could you add a short explanation as to why the LE differences are so different after the two irrigation events. This is presumably due to the high/low vegetation differences, but it would be good to make this clear to readers.
15. Fig 6 The very low precipitation is quite difficult to see, particular in (b). Can the second plot axis be changed to make the precip clearer.
16. Fig 6 Please add the precipitation into the legend (red) obs precip (black) obs LE.
17. Fig 7 Please consider having the same scale for R_{soil} for (a) and (b) as this will highlight the different magnitudes of the resistance between the two sights.
18. Fig 9 Either in the manuscript text or in the Figure caption, please could you provide a line or two what the standard deviation is from the simulation? Is this the standard deviation of the three simulations? Or is this one simulation (if so, which)?
19. Fig 9 Please could you include additional date ticks on panel (a).

Technical and typographical corrections

Line 54-56 Unclear sentence, please consider revising.

Line 83 Please define SEB

Line 121 'where f indicates the proportionality of internal CO₂ and inside the leaf boundary layer' remove and?

Line 216 Reference formatting incorrect.

Line 256 Change 'part' to 'region'

Fig 2/ Fig 3 – Spacing needed between theRes.

Line 369 Typo

Line 443 Typo? – residual

Line 478 Typo? Solids > Soils?

Line 477–480 Check sentence structure

Line 489 Please change 'other irrigation event' to 'second irrigation event', and please include the date of the event in brackets

Line 541-542 Date formatting: 29 July