

Responses to the Comments and Suggestions

Editor

Based on the reviewer comment received, I think that the manuscript could become suitable for publication after incorporating the proposed changes.

Re: We appreciate the Editor's positive evaluation of our manuscript and the opportunity to revise it. We have carefully considered the comments from Reviewer 1 and revised the manuscript accordingly. A point-by-point response to the reviewer's comments is provided below.

Reviewer #1

I focused my re-review on the sections of the manuscript which were revised. I am now satisfied with the response to comments from the last round of revisions. Particularly, addition of the disclaimer that the BrTHF product may be less reliable in locations away from where the neural network was trained, and the discussion on applications where this product will be useful. I do not have further major comments.

Re: We sincerely thank Reviewer 1 for the constructive feedback. We are glad that the additional disclaimer regarding the reduced reliability of the BrTHF product outside the training domain and the expanded discussion of its applications have addressed the concerns raised in the previous round of review.

Minor suggestions (line numbers in tracked changes version):

L29 - The improvement is mostly in the representation of the Bowen ratio (as said at L34). This sentence may imply otherwise, so I suggest revising it.

Re: Thank you for your comment. We agree that the primary strength of the BrTHF model lies in its improved representation of the Bowen ratio (β). Accordingly, we have revised the sentence in the Abstract to avoid overstating the individual flux component improvements.

28 “The spatial ten-fold cross-validation results showed that the BrTHF model achieved
29 root mean square errors of 6.05 W/m², 23.67 W/m² and 0.22 and correlation coefficients
30 of 0.93, 0.91 and 0.25 for the SHF, LHF and β , respectively. Compared with the physics-
31 agnostic NN model and seven widely used air-sea turbulent heat flux products
32 (including JOFURO3, IFREMER, SeaFlux, ERA5, MERRA2, OAFflux, and OHF), the
33 BrTHF model shows better agreement with observations, primarily attributable to its
34 improved representation of β .”

35

36 L437 – “transferability” – Do you mean generalizability?

37 Re: Thank you for your comment. We agree that “generalizability” is a more precise
38 term in this context. We have revised “transferability” to “generalizability” accordingly.

39

40 L630-633 – This section is fine, but it might be better with a few additional
41 references (i.e., to show more examples of studies that BrTHF would be useful for)

42 Re: Thank you for your comment. We agree that including additional examples from
43 existing studies can better illustrate the potential applications of the BrTHF product.
44 Accordingly, we have added several relevant references in the first paragraph of Section
45 3.5.1, covering studies on surface energy partitioning (Jo et al., 2004; Yang and
46 Roderick, 2019), climate variability (Weisberg and Wang, 1997), and hydrological
47 cycle regulation (Cai and Lu, 2009).

48 “The primary advantage of the BrTHF model lies in its accurate estimation of β ,
49 which shows the most pronounced improvement among all flux components. As a key
50 indicator of surface energy partitioning, β is widely used within the surface energy
51 balance framework to ensure physically consistent and reliable estimates of SHF and
52 LHF (Jo et al., 2004; Yang and Roderick, 2019; Yang et al., 2025). In addition, β serves
53 as an effective diagnostic variable in the studies of large-scale climate variability (e.g.,
54 El Niño) (Jo, 2002; Weisberg and Wang, 1997), and in investigations of how surface
55 energy constraints regulate the hydrological cycle (e.g., precipitation) (Cai and Lu,
56 2009; Wang et al., 2021). With its enhanced representation of β , the BrTHF product is
57 expected to provide more reliable support for such applications.”

58

59 L647 - “somewhat marginally lower” - “somewhat” and “marginally” mean
60 two different things to me. I suggest to reword.

61 Re: Thank you for your comment. We agree that the use of both “somewhat” and
62 “marginally” may be confusing. We have revised the expression to “marginally lower”.

63

64 L716 - Remove “primarily” and just say “optimized”

65 Re: Thank you for your comment. Done as you suggested.

66

67 L719 - “Certain uncertainties” - It may be helpful to be a bit more explicit- e.g.,
68 say that the conditions are outside the range of values used to train the neural network

69 Re: Thank you for your comment. We have revised the sentence in the second paragraph
70 of Section 3.5.2 to clarify that the increased uncertainty arises when model inputs fall
71 outside the range of values represented in the training data.

72 “In remote regions far from the observation-rich regions, such as the high-latitude
73 Southern Ocean, the model inputs may fall outside the range of values represented in
74 the training data, leading to increased uncertainty.”

75

76 L761 - What does “method-consistent” mean? If you are forcing COARE with
77 the same conditions/variables, that sounds like a different method from BrTHF.

78 Re: Thank you for your comment. We have removed the term “method-consistent” for
79 clarification.

80

81 L781 - “limitations” is misspelled

82 Re: Thank you for your comment. We have corrected it accordingly.

83

84 **Reference:**

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