Summary:

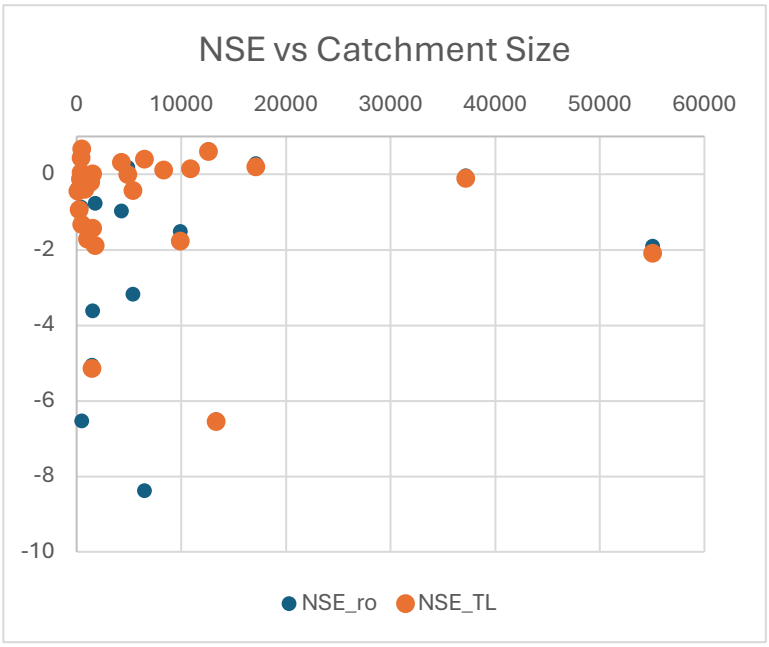
This manuscript presents a novel framework to incorporate transmission losses into existing rainfall runoff models. The authors present a workflow that uses publicly available datasets to calculate hydrometrologic fluxes and watershed structure to quantify the amount of transmission losses. The results presented found that incorporating transmission losses into models have a mixed rate of success (9 out of 28 catchments saw improvement) but showed marked success in those catchments.

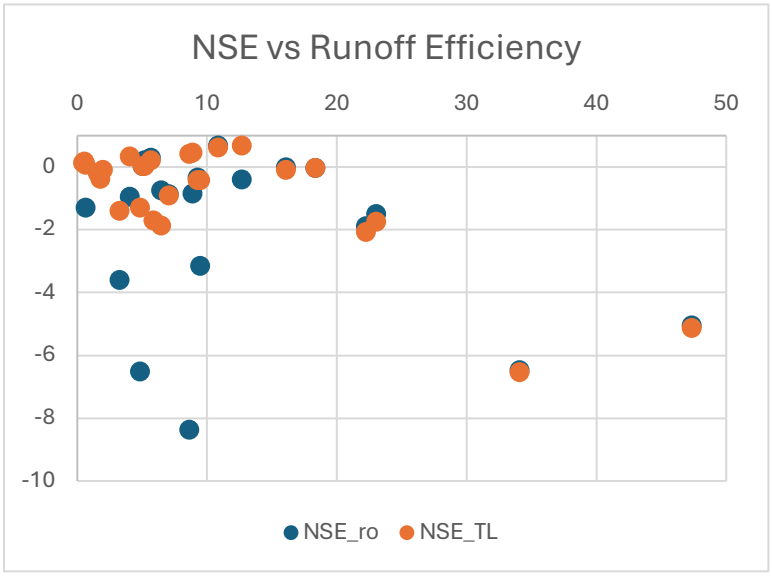
Overarching thoughts:

First, I want to thank the authors for presenting a framework that highlights the recent advancements and interest in non-perennial systems. Work such as this is important to our fundamental understanding of these systems. Below I summarize some suggestions that could help strengthen the manuscript.

1. Comment: This manuscript is unique in that it uses publicly available and accessible data as inputs into the workflow as well as providing processing code (the DOI provided did not work unfortunately). However, this seems contrary to the processing tools used of ArcGIS and Matlab both of which require expensive licenses to run analysis, and the workflow presented here. While I don't want to disparage the authors on this choice, highlighting freely available datasets in line 529 with the paid nature of the software seems counterintuitive.
   Suggested action: I would consider not highlighting the point that the data is freely available.
2. Comment: On the topic of data used, I am curious to why the authors did not use CAMELS/CARVAN datasets that leverage all the needed precipitation, watershed attributes, and land use data needed for the analysis in one common location? I worry that presenting a workflow that leverages many datasets that a user must collect and provide rationale for using, outside the standard for the hydrologic modeling community, might present problems for users as well as produce duplicate tools.
   Suggested action: Either a comparative analysis of how the products used here compare to other data sources (i.e. CAMELS) or a rationale why these products were used over other more accessible products.
3. Comment: A theme that perplexes me throughout the manuscript is what is it within the catchments that make the model perform "better" or "worse". Are there spatial patterns? Is it related to a baseflow, groundwater influence, etc.? The relationships of "why" this model performs better don't seem to be well established instead this model behavior as presented now seems to be an emergent behavior. For example,

the authors state on lines 479-480 "…HRRTLE exhibits improved performance with smaller catchment sizes.." and in subsequent paragraphs highlight runoff ratios as potentially important. However, in simply plotting NSE vs these characteristics there seems to be little correlation between goodness-of-fit and these watershed characteristics (see below).





Suggested action: A more rigorous exploratory analysis of model results that include statistical tests (t-test, correlation plots, PCA, etc.) or any additional quantitative analysis that relates model performance to hydrologic and watershed function.

4. Comment: The title of the manuscript uses the word "ephemeral" but the basis of the manuscript is largely focused on arid regions which is not exclusively 1:1 with

ephemeral networks. For example, Brinkerhoff et al. (2024) showed that between 40% and 60% of the river and stream network in the contiguous US is ephemeral with significant portion of ephemeral networks located in humid regions. Additionally, the large-size of some of the watersheds in this study may incorporate majority ephemeral systems, but higher-order streams are analyzed for losses.
Suggested action: I would drop ephemeral from the manuscript where appropriate and replace with arid/semi-arid.

5. Comment: It would be great to know the magnitude of transmission losses predicted in HRRTLE to understand how much streamflow is being lost in these systems, and therefore cannot be captured with water harvesting practices. This could add significant impact to the manuscript.
   Suggested action: Calculate transmission loss to streamflow ratio or volume of streamflow lost for catchments.
6. There have been other studies that have looked at spatial/watershed connectivity on a higher resolution or related to climate, physiography, etc. It would be good to highlight them or at least cite them as they would help bolster the introduction and discussion.
   - Husic et al., 2022: https://doi.org/10.1029/2022GL099898
   - Chen et al., 2019: https://www.nature.com/articles/s41586-019-1558-8

   Suggested action: Authors choice.

Specific feedback:

Line 334: This is confusing to me. The catchments have streamgages that are used to calculate the runoff ratio? Please clarify.

After figure 3: Larger map (like figure 2) where watershed points are colored by goodness-of-fit metric of choice. This would help a reader discern spatial patterns (if any).

Lines 478-479: Superior compared to what? There were no other instances of models compared, correct? Just incorporation of TL and non-TL simulations?

Line 491: What was the degree of development in the catchments? Comparing how much "disturbance" is in a catchment could lend insight into the varying degrees of runoff efficiency and therefore how important transmission losses may be in a catchment.

Lines 535-545: This paragraph seems disorganized and a bit tough to read. This seems like it would be better as a table or reduced to a single line that states "Studies that utilize varying types of hydrologic models (rainfall-runoff, hydrodynamic, process-based, etc) do not explicitly represent transmission losses (citations)." Then transition to why this is

important tied to the results of this study. Right now, this reads as a “bashing” of other studies.