Bold text indicates the original reviewer comment, and plain text indicates the response.

Response to RC2

General comments:

Thanks for the opportunity to review this MS. The MS describes the development of an empirical model of post fire debris flow volume that draws on a greater quantity of observation data and aims to create a more general model for the Western US than the current models developed from datasets collected in different regions. The paper is well suited to the audience of NHESS. The overall objective is sound (a more generic model), The methods are well suited to the aim and are executed in an extremely structured and well defended and explained way. I particularly liked the extensive detail justifying the logic of the decisions regarding the acceptance/exclusion of the many possible models. The performance comparisons with existing models were really well justified in terms of the metrics used but also the graphics and tables. The authors conclusions and interpretation of the results were clear and concise. Overall this is a very high quality MS. I only have two minor suggestions.

Specific comments:

1. **One relates to the figures of distributions of the residuals; would it be possible to include a second x axis with the untransformed values for this distribution, as it is difficult to interpret in the context of units that are intuitive.**

   Thank you for this comment. Because all four volume models were developed in natural logarithmic space, the residuals represent differences in log space. Transforming the residuals into dimensional space would change their distribution. As a result, a second x-axis with untransformed (dimensional) values would not accurately reflect true values of the residuals if they were transformed into dimensional space.

   However, we appreciate that the current x-axis values in these figures are not the most intuitive. To improve the interpretability of these figures, we have instead added a second x-axis that shows the ratio of the predicted volume to the observed volume. We calculated this ratio by exponentiating the natural logarithmic residuals. For example, if the residual for a given volume is 0, indicating no difference between predicted and observed volume, then the ratio of predicted to observed volume would be 1, because $e^0 = 1$.

   We added a second x-axis that shows the ratio of predicted to observed volume to Figures 3 and 5 in the main text and Figures S3, S4, and S5 in the supplement.

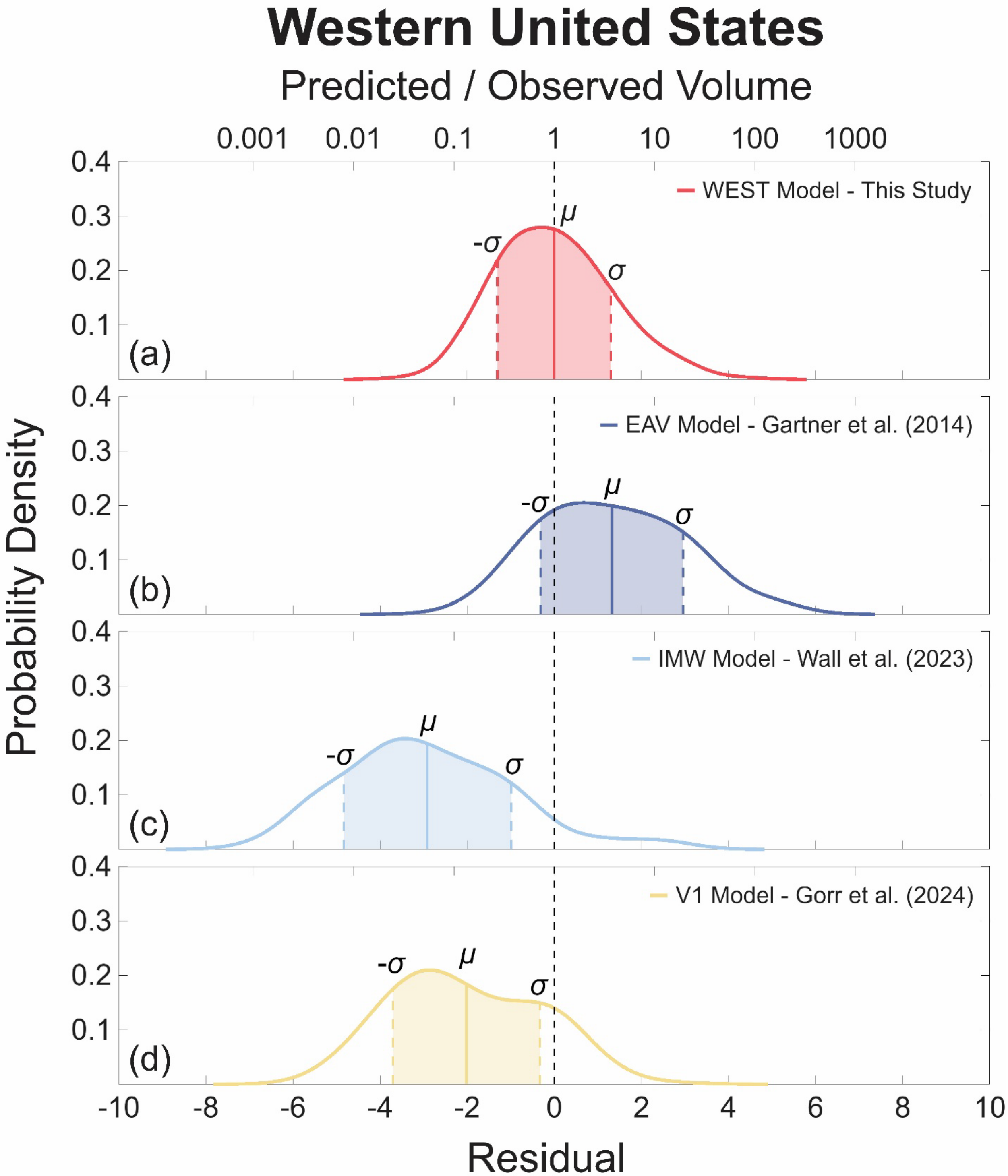

Figure 3: Probability density functions for the residuals of the (a) western United States (WEST), (b) Emergency Assessment volume (EAV), (c) Intermountain West (IMW), and (d) V1 models when applied to the entire western United States dataset.

2. **The second point is, I know the scope of the model development is restricted to the western US, but it would be good to see the results interpreted a little in the context of the rest of the world. How does this model/modelling approach/variables compare to what others have published on this topic? What might the implications be for this new analysis for other researchers with similar objectives in other regions/continents re estimating post fire debris flow volumes? This could make the US work more relevant to a wider audience than western US practitioners and researchers.**

   We are not aware of any postfire debris-flow volume models that have been developed for use outside of the western United States. However, findings from previous studies of postfire debris flows in Australia indicate that the primary controls on postfire debris-flow volume are broadly similar across geographic regions. We agree that discussing the implications for international researchers is critical, so we have added the following paragraph to Section 5.2 in the Discussion:

   "Similarly, more data are needed to evaluate the performance of the WEST model when applied outside of the western United States. Although postfire debris flows are common hazards in fire-prone regions around the world, including Australia (e.g., Nyman et al., 2011), Canada (Hancock and Wlodarczyk, 2025), Italy (e.g., Esposito et al., 2023), and Spain (García-Ruiz et al., 2013), debris-flow volumes and associated rainfall data remain scarce outside of the western United States. This lack of data has limited the development of postfire debris-flow volume models for these regions and has prevented the evaluation of most volume models developed for use in the western United States, including the WEST model, when applied elsewhere. However, previous studies suggest that the primary controls on postfire debris-flow volume may be consistent across geographic regions. For example, Nyman et al. (2015) found that watershed area was the most important control on the volume of 10 postfire debris flows that initiated in southeast Australia and that volumes could be accurately predicted using an empirical volume model developed for use in the western United States (Gartner et al., 2008). Similar to the WEST model, this model predicts postfire debris-flow volume as a function of rainfall characteristics, watershed area and slope, and burn severity (Gartner et al., 2008). These similarities indicate that the primary controls on postfire debris-flow volume are generally transferrable across geographic settings, although additional volume data from fire-prone regions around the world are needed to evaluate the performance of the WEST model beyond the western United States."