

## **Review: Structural uncertainty in the direct human forcing of future global burned area (egosphere-2025-3728)**

In this manuscript, the authors perform a sort of miniature model intercomparison project, forcing the WHAM-INFERNO and Haas fire models with a standard set of inputs to explore how they respond to changing climatic and socioeconomic drivers. These two models fall on opposite ends of the “representation of human effects on fire” axis, the goal was to explore how those differences in model structure (among others) manifest in terms of burned area through 2100 under two different future scenarios.

Overall, this is a neat little paper. There’s not a lot here, exactly, but I think it does contribute something important to the literature: Comparing models developed recently with the aim of addressing separate known issues in global fire modeling.

The manuscript is well-organized and the writing quality is good. However, there are a number of points where the authors make interpretive leaps that seem unsupported by the presented analyses, as well as under-explained analyses. I would like to see these addressed and have given more detail below.

### **Substantive comments**

- L136-140: If the coupling is “offline,” does that mean the fuel burning from WHAM fires doesn’t impact INFERNO flammability? Wouldn’t that cause the total WHAM-INFERNO burned area to be artificially high?
- L164-166, Table 2: Why bias-correct climate forcings from ISIMIP3b, which are already bias-corrected?
- L220: “with model projections of DHF”? Shouldn’t it be “model outputs” or even better “inter-model differences in outputs”? What is a model projection of DHF if DHFs are inputs? ... Based on text later in the paper, I think it would be clearer throughout to refer to this as “socioeconomic effects” or similar. “Direct human forcing” in most of the literature refers to things like land use etc. that are model inputs.
- L232-233: Why wasn’t a direct evaluation of IAV possible? The possibility of improved IAV performance is important enough that I feel like an extra model run covering the years in question would be justified.
- Fig. 2 (L270):
  - Is it right that the middle of the Amazon is projected to be burned with “vegetation” managed fire about every 10 years under both SSPs? That feels

high! Which exactly of the “vegetation” management types is the cause of that? How does it compare to the present day?

- A supplemental map with land cover fractions would help the reader interpret these results.
- The color bar would really benefit from a limited number of bins; it’s basically impossible to distinguish any color from about 0.1 to 0.2.
- L310-313: There doesn’t appear to be evidence for this interpretation of climate vs. socioeconomic drivers in Fig. 6.
- Fig. 7 (L325): This is another situation where a limited number of color bins would be helpful.
- L316, “where the climate signal is least disrupted by DHF in the present”: Where is the evidence for this statement?
- L334-340: Figs. S1 and S2, the only ones referenced in this paragraph, don’t seem to include these analyses—they’re just maps. Scatter plots or something would be helpful.
- L347-348: Again, I don’t get the evidence here, although the statement is vague. Maybe just leave it out of the Results if it’s actually explained in the Discussion.
- L355-356: What is this analysis? Was it mentioned in the Methods? What exactly is being compared here, gridcells in 2100?
- L358-359: Fig. S3 does not appear to show anything about intra-model correlations across scenarios.
- L362-364: “there is greater agreement in determining how DHF will respond to socio-economic development (which dominates SSP1) than to a changing climate (which dominates SSP3).” This “dominates” language is strange. Socio-economic development and climate change are very different things, so it feels a bit comparing apples and oranges. Thinking strictly about influence on burned area and comparing Fig. 9 with Fig. 6 (a comparison this sentence should reference), it’s not accurate to say that socio-economic development “dominates” SSP1 for Haas, although it does for WHAM.
- L 379-381: Where are these correlations coming from? Gridcell-by-gridcell where DHF has a positive effect?

### **Minor comments/corrections**

- Throughout: Figures are too-resolution and some (e.g., Fig. 4) show JPEG artifacts. Per the GMD manuscript composition guidelines, JPEG should only be used for photographs. Maps etc. should be PNG format instead.
- L20: “of” should be “on”

- L67 and throughout: “ensemble” doesn’t seem like the right word for the coupled WHAM-INFERNO **system**. “Ensemble”, at least in my experience, is about groups of model runs from either a single model (e.g., an Earth System Model might run 5 simulations with slightly varied initial conditions to sample over uncertainty) or different models (e.g., the FireMIP phase 1 “ensemble” of models).
- L73-75: This seems like a result in the middle of the Introduction
- L122: “indigeous” typo
- L209:
  - “minima” (plural) should be “minimum” (singular).
  - -425 does not look right for unmanaged fire
- L421: Refer to Fig. 1.
- L436: Refer to Fig. 1.
- L553-555: Spaces missing between various pairs of words.
- Fig. S2: Mention that these are GFED regions.
- Fig. S3: What is “anom.”? Is that supposed to be “change over 2020-2100”?