Review of "A New Method for Calculating Highway Blocking due to High Impact Weather Conditions", by Liu et al. 2024 NHESSD

General comment

In this study, the authors propose a new, data-driven approach to evaluating the impact of severe weather conditions on highway infrastructures across China. They suggest employing k-means and CRITIC methodologies to assess the significance of various natural phenomena and to classify the impact of highway interruptions using a set of significant variables (both technical and economic) provided by the authorities. The scope of the study is relevant and aligns with the journal's topics. However, there are critical aspects that prevent the publication of this version. Most notably, the methodological presentation requires significant improvement, necessitating more detailed explanations and changes to the current structure. Additionally, the presentation of results needs enhancement. Furthermore, the discussion and the adopted terminology require critical review. Finally, the English language usage needs improvement (a few examples are listed below, but an overall revision is recommended).

Specific comments

- Weather event definition: the term "High-impact weather condition" lacks a specific and clear definition. It is not explicitly defined within the text, and its usage could be questionable. A natural event (i.e., rainfall, ice, etc.) might be severe or not, and might cause, or not, impacts on the highway and on other infrastructures depending on their characteristics. Therefore, I suggest referring simply to weather-related conditions. Furthermore, the adoption of this term implies that you consider exclusively such events, potentially overlooking medium-impact or low-impact weather conditions (which are not defined in the text). Perhaps, on page 2, line 50, you refer to "adverse" weather, which could serve as a suitable alternative.

- Data characterization:

  - Section 2.2.1: how are highway blockage events defined? What are the requirements in terms of their extent (length) or duration in order to be classified as such? Which is temporal and spatial aggregation of such events? Are those associated to a give region, district, or specific highway? Additional details should also be provided on the validity check you performed. The reference to "manual statistics" is not clear.
  - Section 2.2.2: how did you use the meteorological data to classifiy and attribute weather events to highway blocking scenarios? Which are the spatial and temporal aggregation you adopted for such data? How did you consider cases with multiple weather events attributions?
  - Section 2.2.3: More details need to be provided to describe the data characterizing the economic aspects of the highways. What temporal and spatial resolution do the data refer to? (e.g., annual flow, daily flow?) The sentence at L103 is not clear; what is its purpose and how are these classifications used?

- Abstract: there are several repetitions that could be removed, making the text more effective and clearer. Also, you should try to be quantitative while presenting the outcomes.

- Methodology:

- Section 2.3.1: although not new, the K-means methodology needs to be better explained. The analytical formalism is unclear. For instance, what are xi1 and xi2 of P4? I suggest rephrasing and expanding the overall section.
- Section 2.3.2: similarly, mathematical formalism should be checked (see perhaps eq. 3 where the same counter (i) is used for two summations having two reference set).
- Section 2.3.3: please define “express capacity”. I believe a table summarizing the overall set of variables you adopted would benefit the methodology presentation. Which is the specific unit area that you adopted to calculate the highway density? L154-155: this sentence is definitely not clear: which are the items you are referring to? If there is strong correlation among some data, you should not consider all of them. Have you tried to perform a principal component analysis to evaluate such aspects?
  Also, lines 155-157 should go to previous section (2.3.1).

- Results

- The inner pie graph of figure 2 is not described within the text. Differences among the two plots are not clear, I suggest just keeping the external plot. Also, icing is not shown in the figure.
- Figure 3 is too small. I would consider to separate the two panels. Region names should be added to the map. Plots, as well as legends, should be more quantitative. Which are the values associated to the bars in pale 3b? Also, I suggest removing the lateral minor-boxes showing the islands, since it looks like there are nor results for those regions.
- L188-191 need to be rephrased.
- what do you mean for “basic resources of the road”? P10L233.
- Presentation of the severity classes should be moved to the methodological section. Specifically, text from the beginning of section 3.3 to line 247 is more appropriate in section 2. Then, in section 3 you present the results. Concerning such results, I suppose that the outcomes in Table 3 would be more readable if shown through graphs.
- Figure 7 is qualitative. I do not see much values on such plots unless, at least, upper and lower bounds are shown.
- Table 6: labels adopted for the items are different from those used within the text. Please revise and be uniform.

- Discussion

- The overall discussion is lacking, with insufficient critical analysis of the strengths and limitations of the methodology.
- The weights shown in eq. 8 are quite uniform among the considered items. What is the sensitivity of the outcomes to variations in such weights? Any comments on their values? It would have been beneficial to consider additional data or to remove some of those already considered.
- I disagree with the use of losses or damages, as adopted in the discussion and in Figure 8. From what I have understood, this analysis is an exposure evaluation rather than a damage assessment. The classifications shown in Figure 7 (which can be further explained with the details of Figure 8) provide a picture of the overall highway loads over the area, which do not necessarily correspond to real damage. This is a key aspect that deserves consideration and affects the overall scope and ambition of the manuscript. Furthermore, Conclusions should be revised accordingly to such definition.

Minor comments:

- P2, L(line)40-45: please check the sentence structures here and rephrase.
- P2, L54: HIW acronym is not defined.
- P4, L8: please check the sentence starting with “For the classification…”. It looks uncomplete.