

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC1
<https://doi.org/10.5194/nhess-2021-245-AC1>, 2021
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Reply on RC1

Tadas Nikonovas et al.

Author comment on "ProbFire: a probabilistic fire early warning system for Indonesia" by
Tadas Nikonovas et al., Nat. Hazards Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/nhess-2021-245-AC1>, 2021

The authors would like to thank the reviewer #1 for their positive view of the manuscript and also for constructive feedback and suggestions for improvement. Please find below a point by point response to the comments received.

Reviewer comments received are italicised while our responses are in normal font. Line numbers in our responses refer to those in the revised manuscript.

Line 179: "total monthly prediction for the five preceding months", is it necessary to use the value of the previous five months? Is the three preceding months enough considered the long-term impact of precipitation (similar to DC in FWI)? The results also show that the longer prediction time, the lower reliability.

During the model development and testing phase we have experimented with various time windows for different climate variables. The testing results showed that it is beneficial to include precipitation for five preceding months rather than three (which as R1 indicates here is approximately the length of precipitation "memory" of drought code). The benefit of extending precipitation record beyond three months was mainly manifested through small but tangible increase in prediction confidence for active fire count > 10 cases (improving prediction sharpness). This result was also one of the reasons why we decided against using the fire weather indices as predictors in this study in the first place (another reason being lower computational complexity). We have amended the sentence (lines 185-187) clarifying this:

"Precipitation for the five months preceding the month of interest was included to characterise long term build-up of drought conditions, and the number of months was determined empirically during the model optimization stage."

Line 286: Fig S3, it is recommended to adjust its order according to the cited order in text.

Thank you for the suggestion, subplots reordered to follow the order of discussion in the Methods section.

Line 299: "fire occurrence probabilities for 2006 were predicted and evaluated", was 2006 selected randomly?

Here we simply used 2006 as an example to illustrate leave-one-year out dataset split strategy. The same procedure was applied to all years in the study period. We have rephrased the sentence to remove reference to a specific year: "For example, fire occurrence probabilities for year x were predicted and evaluated using data from all years except year x for model training.

Line 300 "This resulted in 17 different realizations of the model all having different weights and biases" it'd better show the weights of the indexes in text.

While we used a comparably simple multilayer perceptron model architecture with small number of features, the trained model nonetheless consists of 540 weights (connections between 18 x 15 x 2 neurons in the model) and 15 bias values (for each neuron in the hidden layer). As a result it is impractical to include these values in text. However, we do share the pre-trained model instances with weights and biases in the supplementary dataset (<https://zenodo.org/record/5206278>). The link to the dataset was added to the sentence lines (310-311), also clarifying why there are 17 model instances: "This resulted in 17 different realizations of the model (one for each year in the record) all having different weights and biases, due to different subsets of the dataset being used for training. Pretrained models with weights and biases are available at <https://zenodo.org/record/5206278>."

Line 359: formula (6) is not displayed correctly, " $\hat{\sigma}^2$ "?

Thank you for pointing this, the formula has been corrected.

Line 375-390: "if the event is a 'peatland fire', and the action is 'fire preventive measures', then loss would equal the total economic loss", it's better to explain the main preventive measures could be used in the region? How to determine the cost/loss ratio in the model? Did you get the ratios from fire statistics data? Do you calculate by subregion and land cover type?

The authors agree with the reviewer that including examples of fire preventative measures would be beneficial in illustrating the cost/loss model. The example of preventative measures is now added to the relevant paragraph (lines 389-393):

"In Indonesia, a range of different fire preventative actions could be utilized depending on lead time of forecasts. Early warning (lead times of several month) would allow the forecasters and the authorities to inform the communities in fire-prone areas, legislate to prevent agricultural fire use for the season and increase preparedness and train fire service personal, while forecasts issued at less than one month lead times could be utilised to deploy fire fighting and monitoring resources to the high-risk areas."

We would like to note here that one of the main properties of the model that makes it attractive as a forecast evaluation tool is the fact that the issuers of the forecast (the authors in this case) do not need to determine specific cost/loss ratios. This task would be difficult if not impossible without having access to information that only local fire management authorities have. The model simply shows potential economic value (y axis in Figs. 8 and 9) of the forecasts for a range of cost/loss ratios (x axis in Figs. 8 and 9). The task of determining the ratio is left to potential users of the forecasts; in this case policy makers and fire managers at national and local levels in Indonesia.

Line 442: "Figure 5: Same as Fig. 3" should be as fig 4.

Thank you for spotting this error. Corrected.

Line 449: "for West Kalimantan (Fig. 5d)", should be Fig 5f. However, the Fig 5e shows more obvious differences, which need to be explained.

Thank you for noting this mistake. Indeed, the reliability of predictions was low both for central Sumatra and west Kalimantan, and the figure reference was fixed accordingly. We have perhaps not made it clear enough that the interpretation on Line 449 applies only to ERA5-based predictions (red lines in Fig. 5). The sentence was rephrased. We believe that the reviewer refers to the more obvious differences in SEAS5-based predictions, which indeed were larger and more important. The interpretations of those differences is presented in the following sentences (lines 455-465)

Line 510: Fig. S1, I suggest to put this figure in text. It is the only figure to show the predicted results in spatial.

We agree with the suggestion. The figure was moved to the main text as figure 6.

Line 534: "Figure 9: Same as Fig. 8. but for prediction of active fires > 10 cases", I think the figures 8 and 9 can put together and just add the corresponding legend in upper.

We do agree that figures 8 and 9 ideally would be presented as one figure. However, we chose to separate them only because of size. While this should not matter for digital publication, but we are not convinced that they would be legible if put on one A4 page. We propose to move figure 8 to supplementary figures and only keep figure 9 in the main text.

In conclusion: it's better to explain the specific application of the model. For example, if active fire > 10 is predicted in the next month or the next three months in a region, what specific measures can be taken in a region?

This broader comment relates to the comment regarding lines 375-390. As discussed in our response to comment concerning lines 375-390 above, several examples of fire preventative actions which could be exercised in the region given forecasts issued at different lead times is now added to the relevant paragraph (lines 389-393)

Some words need to be checked and modified in format, such as "km2" on line 120, "t2m" on line 193, should be "km²" and "t_{2m}".

Thank you for pointing this, corrected to our best effort.