Supplementary Materials

Machine Learning-Based Integration of High-Resolution Wildfire Smoke Simulations and Observations for Regional Health Impact Assessment

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Equations:

The equations of statistical metrics used for the modeling performance evaluation and comparison in the main text are listed below:

Mean absolute error (MAE):

$$MAE = \frac{\sum_i^n abs(\widehat{y_i} - y_i)}{n}, \quad \text{(S1)}$$

Fractional bias (FB):

$$FB = \frac{\sum_i^n (\widehat{y_i} - y_i)}{\sum_i^n y_i} \times 100\%, \quad \text{(S2)}$$

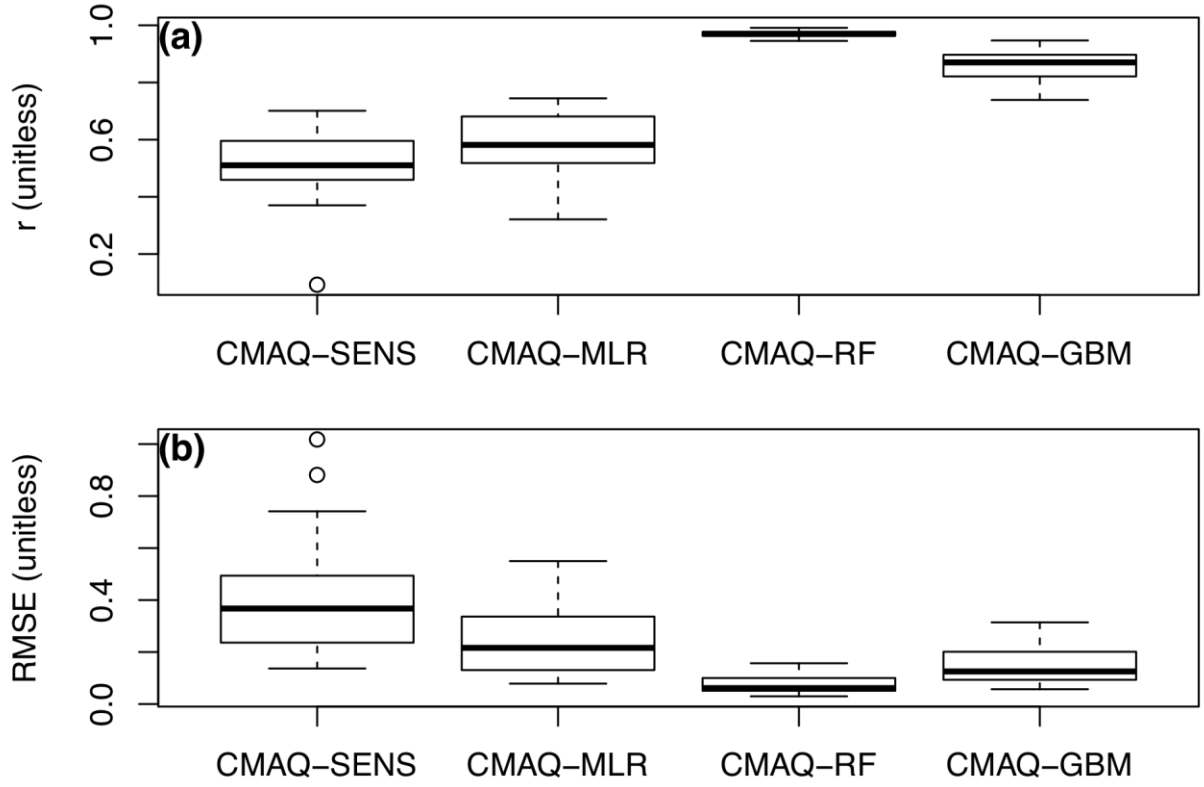
R-squared (R^2):

$$R^2 = \frac{\sum_i^n (\widehat{y_i} - \bar{y})^2}{\sum_i^n (y_i - \bar{y})^2} = 1 - \frac{\sum_i^n (y_i - \widehat{y_i})^2}{\sum_i^n (y_i - \bar{y})^2}, \quad \text{(S3)}$$

Root mean squared error (RMSE):

$$RMSE = \sqrt{\frac{\sum_i^n (\widehat{y_i} - y_i)^2}{n}}, \quad \text{(S4)}$$

In Equations S1-S4, y_i is the i^{th} observed value, $\widehat{y_i}$ is the i^{th} predicted value, $\bar{y}$ is the mean value of all observations, and n is the sample size of observations.



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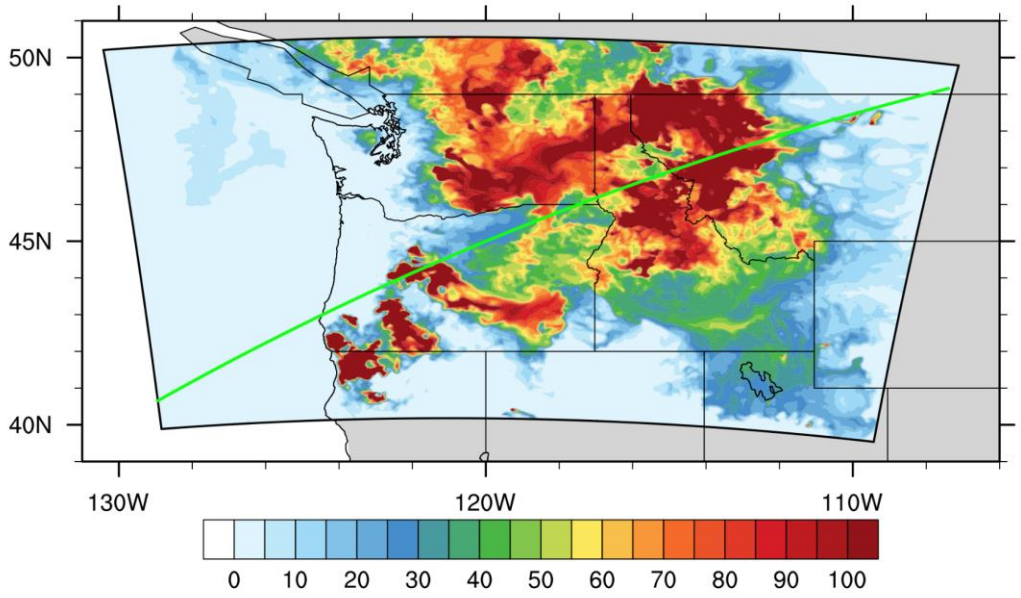

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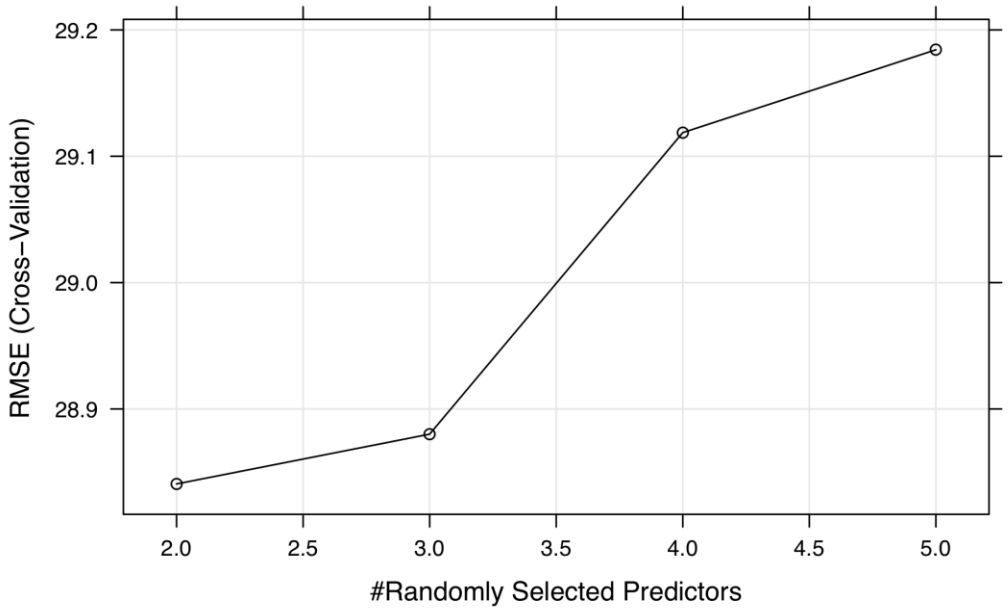


Figure S3. The modeling performance comparison in terms of RMSE with different *mtry* parameter settings in the RF method. Here *mtry* is the number of variables randomly sampled as candidates at each split.

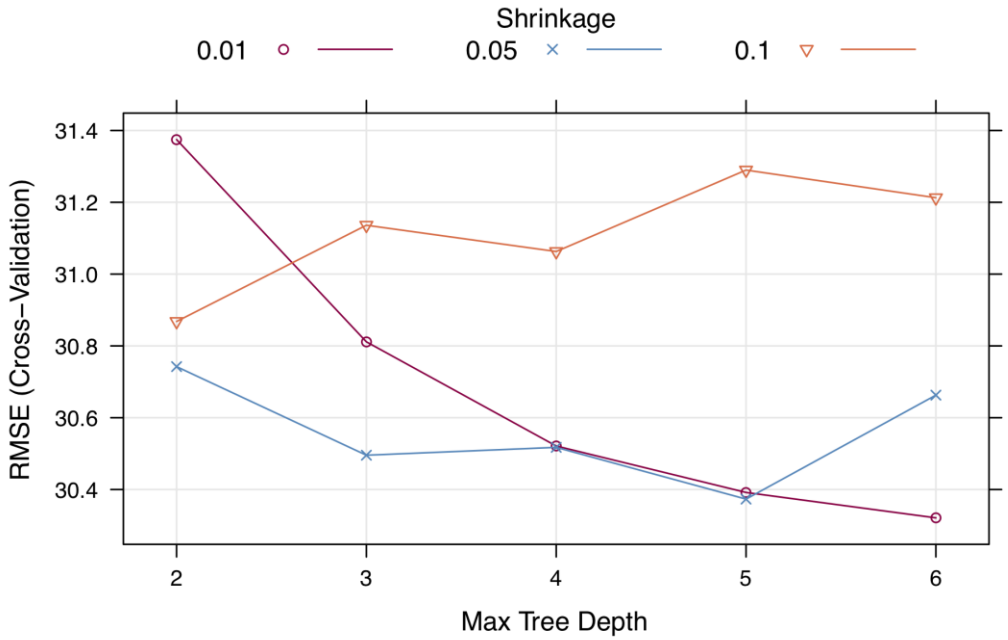
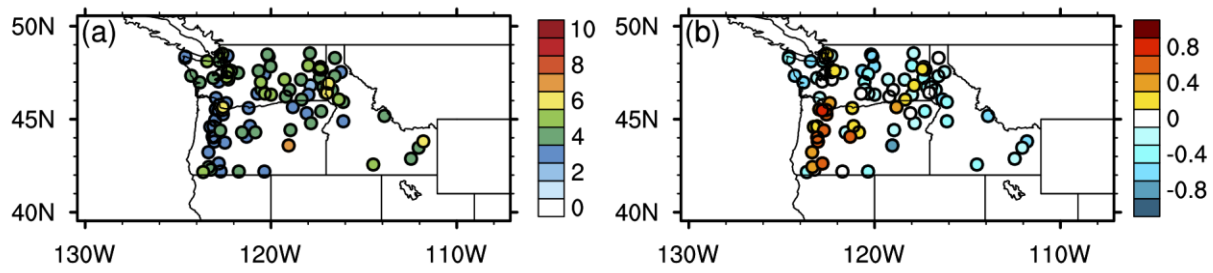


Figure S4. The modeling performance comparison in terms of RMSE with different *shrinkage* and *interaction.depth* parameter settings in the GBM method. Here *shrinkage* is the learning rate applied to each tree in the expansion, and *interaction.depth* is the maximum depth of each tree allowing variable interactions.



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