Using Earth Observations to Support Regional and National Environmental Health Surveillance

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The 3rd HAQAST Meeting

November 28-29, 2017

Columbia University

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The Team and Stake Holders

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Team

- Yang Liu, Emory University (PI)
- Howard Chang, Emory University
- Matthew Strickland, University of Nevada, Reno
- Heather Holmes, University of Nevada, Reno

Stakeholders

- CDC's Environmental Public Health Tracking Network
- Colorado Department of Public Health and Environment (CDPHE)

Study Objectives

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- Conduct a multi-year time-series epidemiological study to evaluate the health impact of air pollution levels elevated by wildfires in Colorado.
- Conduct a national scale epidemiological study to link age-specific county-level daily counts of ED visits with satellite-driven air pollution exposure estimates to demonstrate an application of Tracking's surveillance data.

Daily $PM_{2.5}$ Modeling During Fire Season in Colorado

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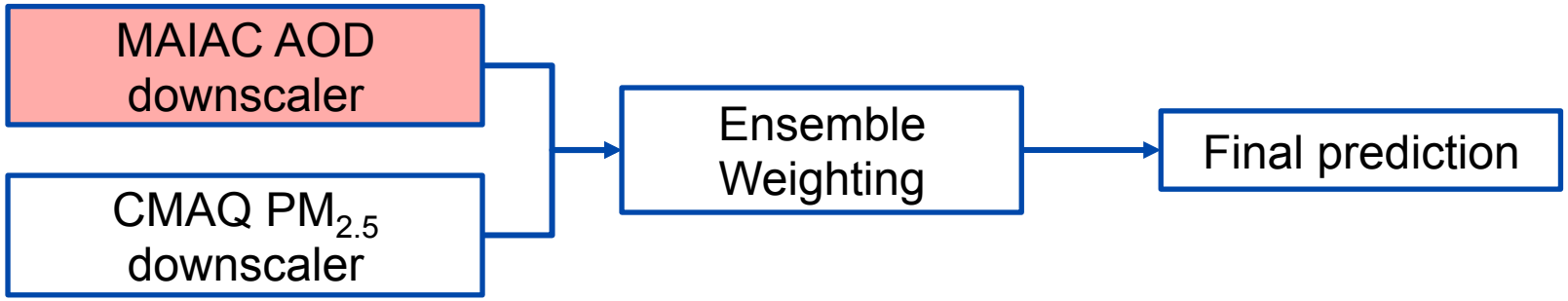
Goal: Develop a satellite-based high-resolution $PM_{2.5}$ exposure model in Colorado to support epidemiologic research

Approach



Downscaler Model $$Y_{st} = \alpha_{st} + \beta_{st} X_{st} + \gamma Z_{st} + \varepsilon_{st}$$

Ensemble Weighting function $$PM_{2.5,st} = (1 - w_s) Y_{st}^{AOD} + w_s Y_{st}^{CMAQ}$$

Ten-fold Cross Validation Results

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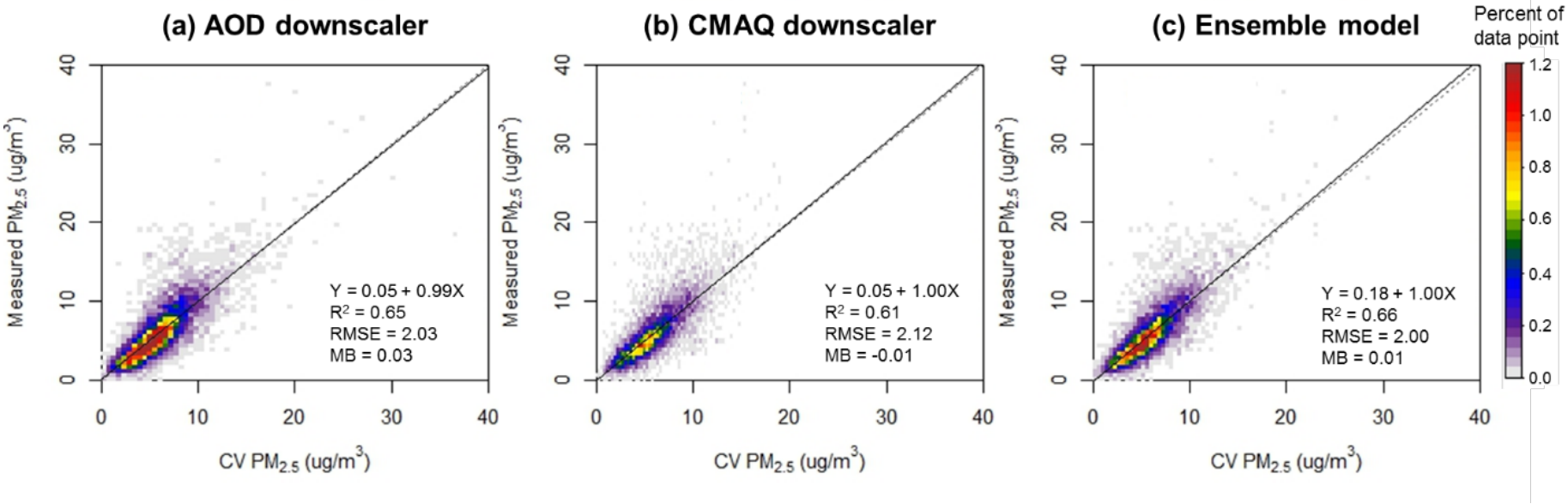

- The CV R^2 of the ensemble model was 0.66, better than the AOD downscaler or CMAQ downscaler alone
- The performance of the Bayesian ensemble model is better than the previously used multi-stage model when using same parameters (R^2 = 0.44)

Predicted Fire Season $PM_{2.5}$ Maps

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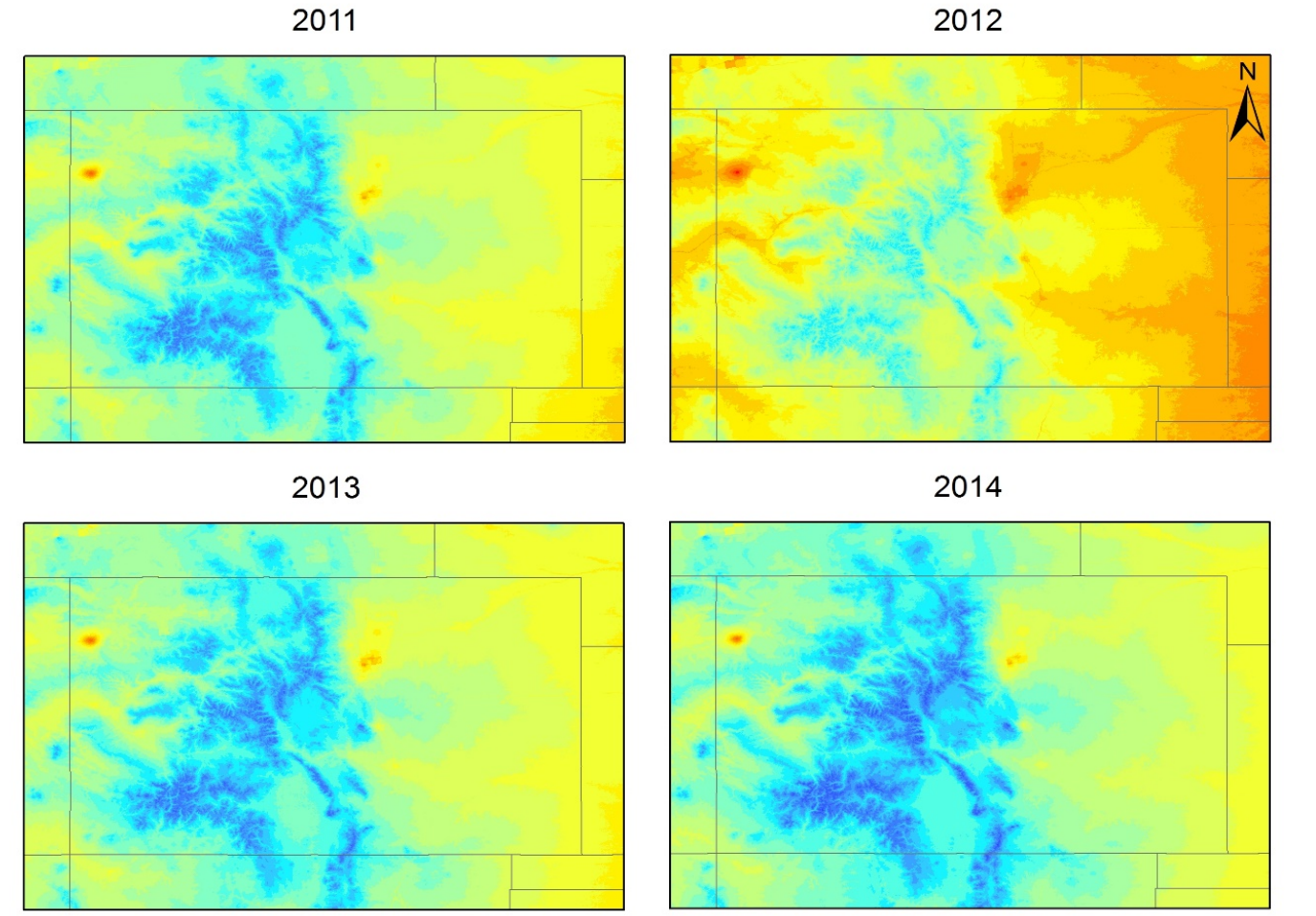

The year of 2012 had enhanced $PM_{2.5}$ compared to other years because Colorado experienced an unusually strong fire season in 2012

Predicted Monthly Mean $PM_{2.5}$ Over Fire Events

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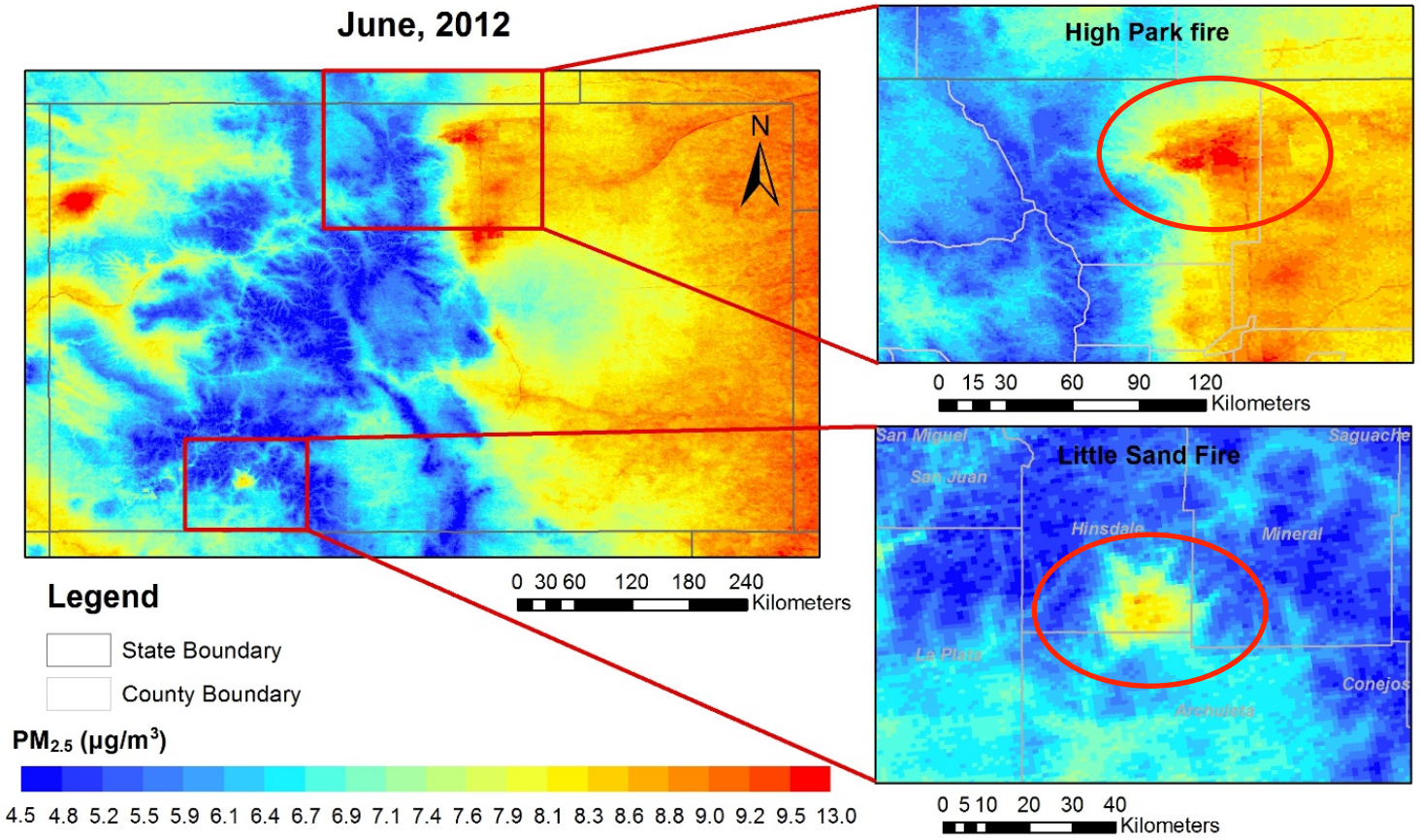

Our model is able to capture the local scale variability in $PM_{2.5}$ concentrations due to wildfires

Current Status

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- PM exposure estimates have been aggregated to 4 km health data grid
- ED visits data from Colorado has been preprocessed and is ready for model incorporation
- Data management and epidemiologic model investigations are currently underway