Supplemental

Respiratory Data

The respiratory ED visit data includes asthma (ICD-9 493), acute bronchitis and bronchiolitis (ICD-9 466), chronic obstructive pulmonary disease (ICD-9 491, 492 and 496), pneumonia (ICD-9 480-87), and upper respiratory infections: (ICD-9 460–65). The data were obtained from California's Office of Statewide Health Planning and Development (OSHPD). From the OSHPD dataset, patient's date of visit, principal diagnosis, residential ZIP code, age, race, and sex were used for the analysis. Multiple visits by the same person cannot be identified.

Case-Crossover analysis for the epidemiological component

The case-crossover study design is an alternative method to conventional time series regression for analyzing associations between short-term air pollution exposure and the risk of an acute adverse health event (Alhanti et al. 2016; Lin et al. 2003; Maclure and Mittleman 2000; Gharibi et al. 2018; Gharibi et al. 2019; Gharibi et al. 2019; Entwistle et al. 2019). The case-crossover design is a match study for which each subject serves as its own control allowing the model to adjust for time varying confounders, including unknown confounders. By applying this design, the exposures during the hazard period (i.e. the day of ED admission) can be compared to their exposures on up to 3 or 4 referent days occurring on the same day of the week during the same month. Each individual serves as his/her own control, thus resulting in less confounding by factors that do not vary within a month.

To estimate the association between $PM_{2.5}$ and the odds of having ED visits due to all or each mentioned respiratory diseases in the California study area, conditional logistic regression models were applied. This analysis adjusts for meteorological factors (i. e. temperature (T) and relative humidity (RH)) via restricted cubic spline (RCS) with 3 degrees of freedom (3 d.f). The time-stratified case-crossover analysis using conditional logistic regression can be written as follows:

$$l_c(\beta) = \sum_{k=1}^{n} Y_k \times \{ \beta.\Big((PM_{2.5_{(k)1}}), \big(spline\ (T_{(k)1})\big), \big(spline\ (RH_{(k)1})\big)\Big) - \log\left[\sum_{j=2}^{5} exp\ \Big(\beta.\Big((PM_{2.5_{(k)j}}), \big(spline\ (T_{(k)j})\big), \big(spline\ (RH_{(k)j})\big)\Big)\Big)\right]\}$$

Where, Y_k is the daily count of asthma events on the k-th day; $\left(PM_{2.5_{(k)1}}\right), \left(spline(T_{(k)1})\right)$ and $\left(spline(RH_{(k)1})\right)$ are the covariates for the case (i. e. control day or the day that an individual visited the ED); $(PM_{2.5_{(k)j}}), \left(spline(T_{(k)j})\right)$ and $(spline(RH_{(k)j}))$ are the covariates for the three or four matched controls; and $\beta = \beta_1$ refers to the coefficient for $PM_{2.5}$.

The coefficient β corresponding to spline temperature and relative humidity is a vector of the spline variables. Note that RCS with k-knots (i. e. 3 knots in this study) provides $k - 1$ variables (i. e. the linear variable itself and $k - 2$ cubic variables).

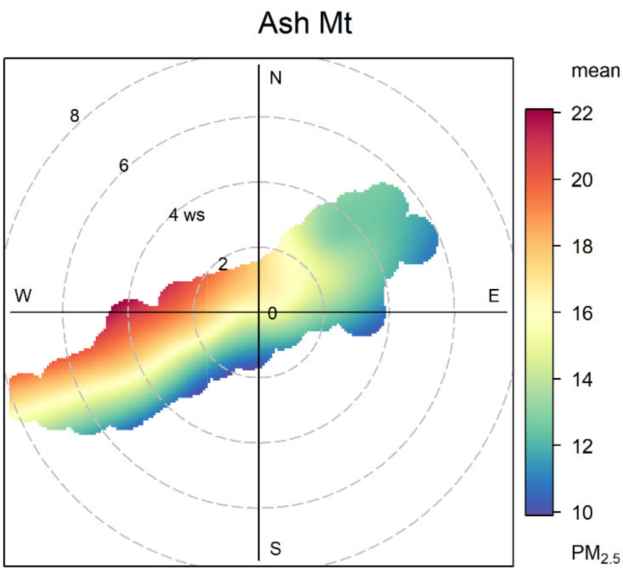
The reported odds ratios (OR) and 95% confidence intervals (CI) in this study are based on a 10 $\mu g/m^3$ increase in the concentration of $PM_{2.5}$. Potential effect modifications were evaluated by stratifying models for race and ethnicity (Non-Hispanic White, Non-Hispanic Black, and Hispanic), and age (2-5, 6-18, 19-40, 41-64, and >=65). All analyses were performed using STATA V. 14 (College Station, TX).

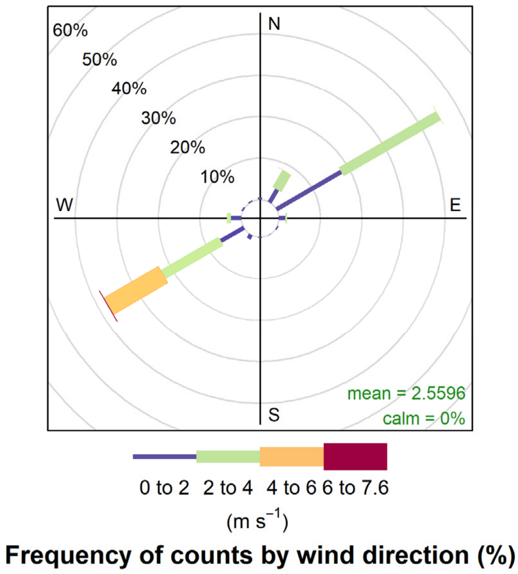
Remote Sensing/Satellite smoke

Figure S1. NASA Worldview imagery for the Rough Fire smoke 8/17/2015.

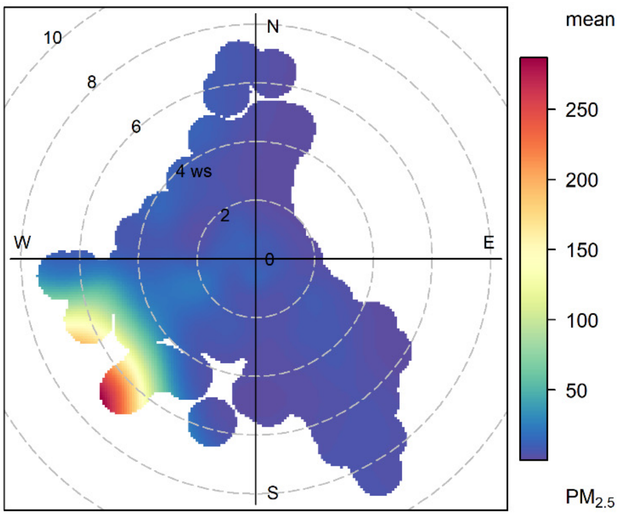
Figure S2. NASA Worldview imagery for the Rough Fire smoke 9/8/2015.

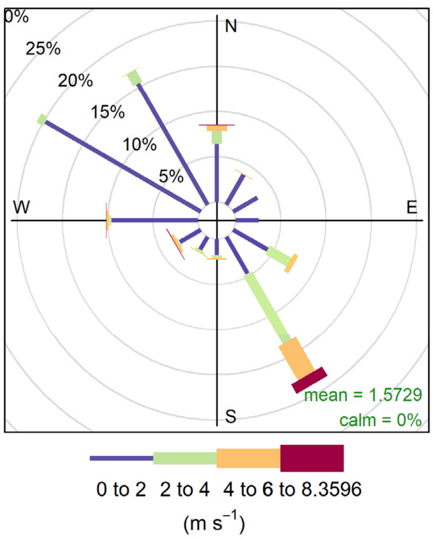
Wind Roses


Ash Mt
N
S
W
E
8
6
4 ws
2
0
mean
22
20
18
16
14
12
10
PM2.5


60%
50%
40%
30%
20%
10%
N
S
W
E
mean = 2.5596
calm = 0%
0 to 2
2 to 4
4 to 6
6 to 7.6
(m s-1)
Frequency of counts by wind direction (%)

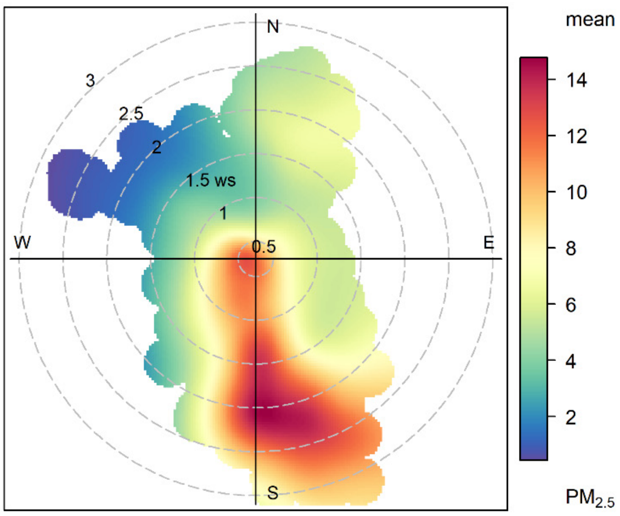
Bishop

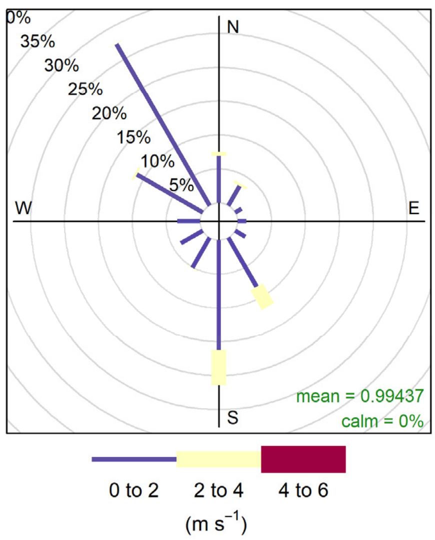




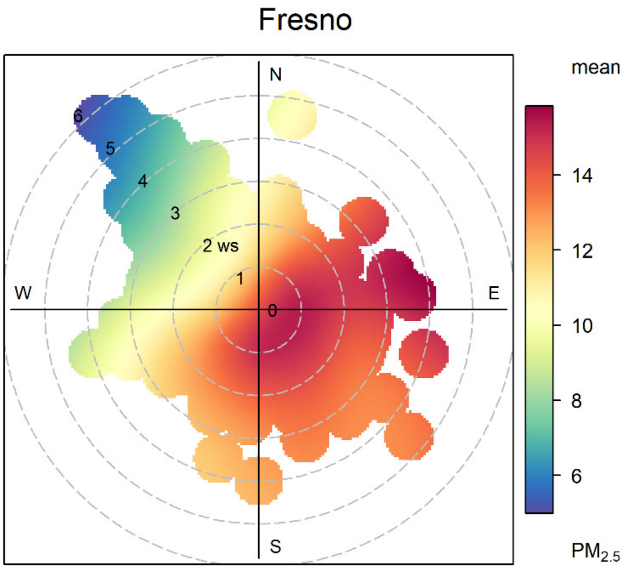
Frequency of counts by wind direction (%)

Devils Postpile

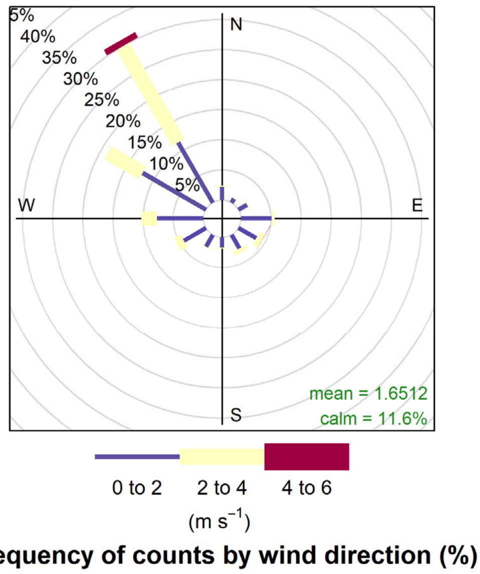




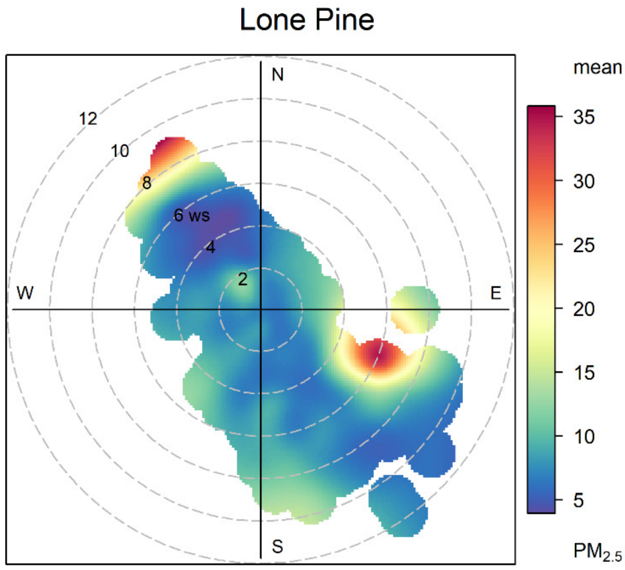
Frequency of counts by wind direction (%)

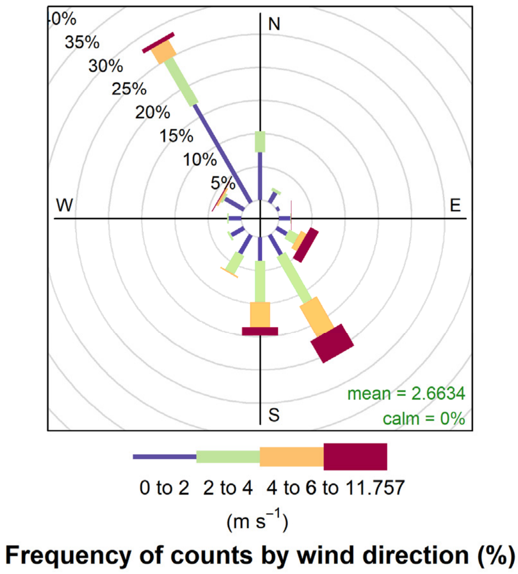


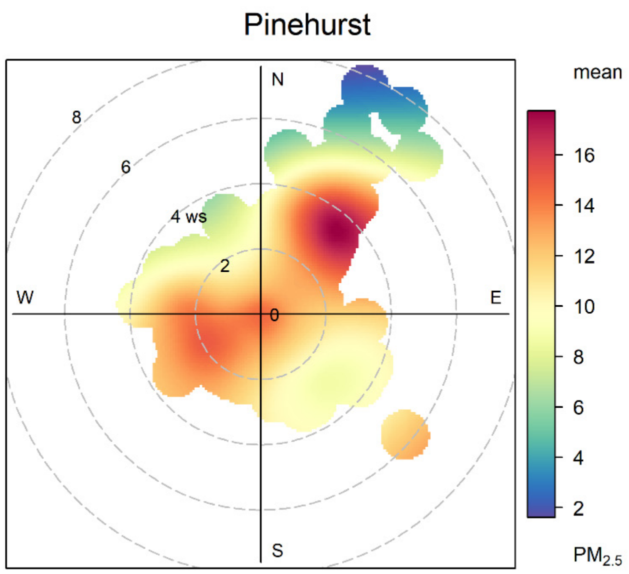
Fresno
N
S
E
W
mean
14
12
10
8
6
PM2.5
6
5
4
3
2 ws
1
0

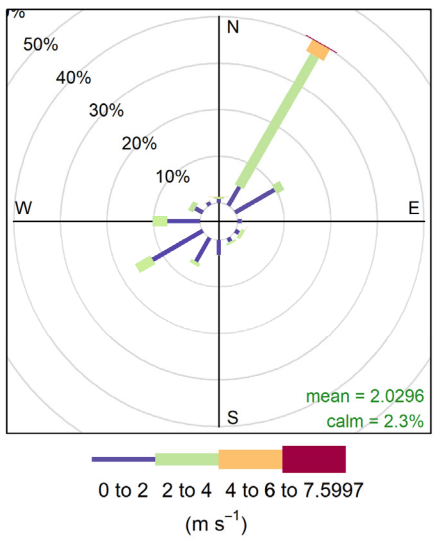


5%
40%
35%
30%
25%
20%
15%
10%
5%
N
S
E
W
mean = 1.6512
calm = 11.6%
0 to 2
2 to 4
4 to 6
(m s-1)
Frequency of counts by wind direction (%)

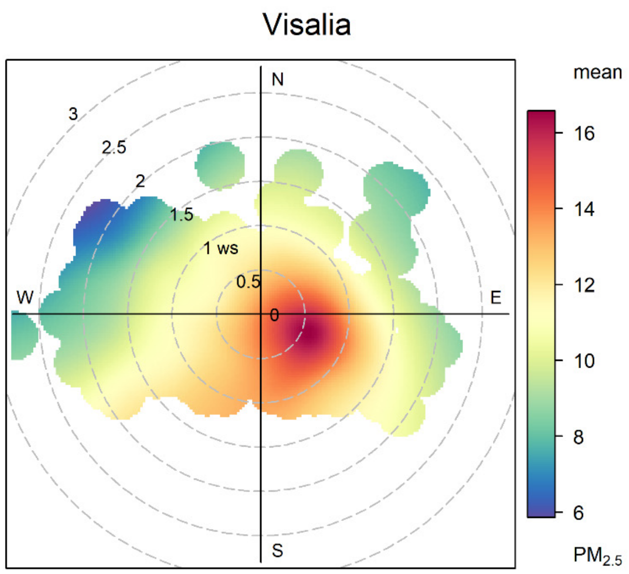

Lone Pine
N
S
E
W
12
10
8
6 ws
4
2
mean
35
30
25
20
15
10
5
PM2.5

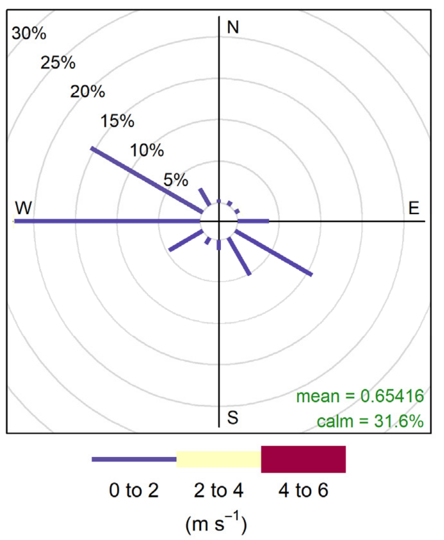

N
S
E
W
35%
30%
25%
20%
15%
10%
5%
mean = 2.6634
calm = 0%
0 to 2
2 to 4
4 to 6
6 to 11.757
(m s-1)
Frequency of counts by wind direction (%)





Frequency of counts by wind direction (%)





Frequency of counts by wind direction (%)