Supplemental Information

Black carbon and particulate matter mass concentrations in the Metropolitan District of Caracas, Venezuela. An assessment of temporal variation and contributing sources

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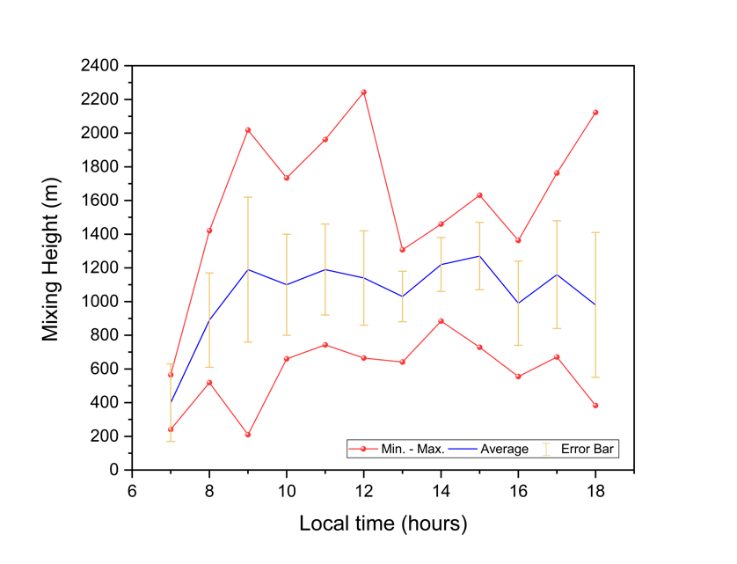
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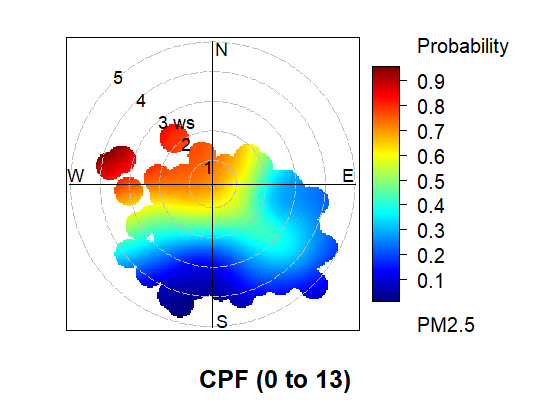
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**Figure S1.** 

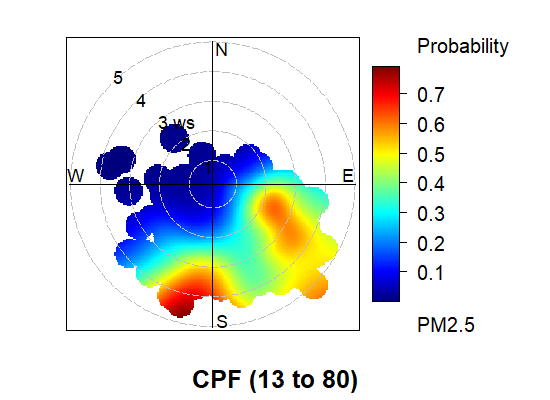
Diurnal cycle for the mixing layer height in the urban site from January to May 1999 (Adapted from Sena, 2003).

**Figure S2.**



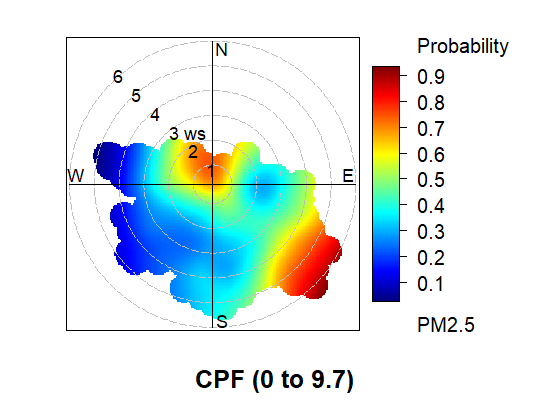
**(a)**

**PM2.5 – Wet season (0 – 50 %)**



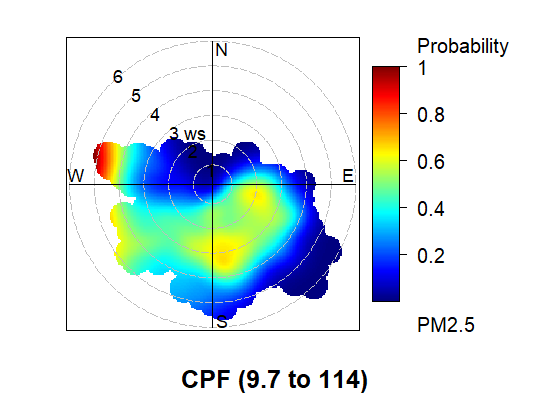
**PM2.5 – Wet season (50 – 100 %)**

**(b)**



**PM2.5 – Dry season (0 – 50 %)**

**(c)**



**PM2.5 – Dry season (50 – 100 %)**

**(d)**

CBPF

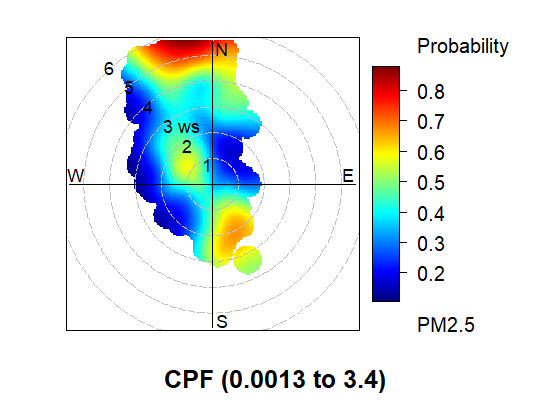
CBPF

CBPF

CBPF

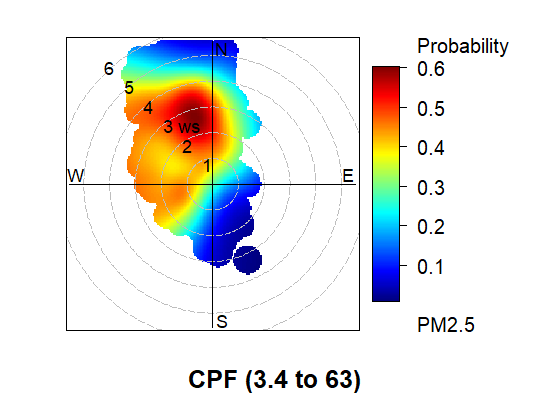
Polar plots of the conditional bivariate probability function (CBPF) for percentile range 0 to 50, and 50 to 100, of the concentration of PM2.5 in the urban site, from hourly medians during the wet and dry seasons. The color scale represents the probability of finding a higher PM2.5, while the circles reflect the wind speed in each wind direction vector.

**Figure S3**



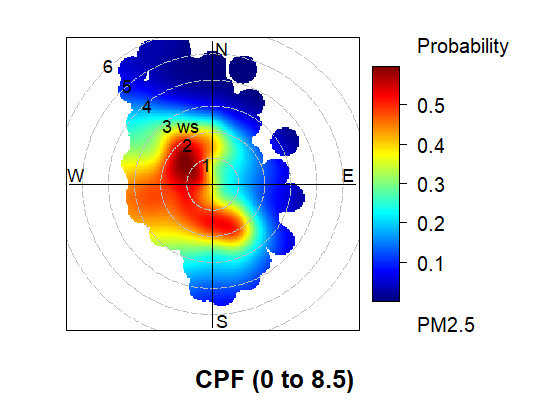
**(a)**

**PM2.5 – Wet season (0 – 50 %)**



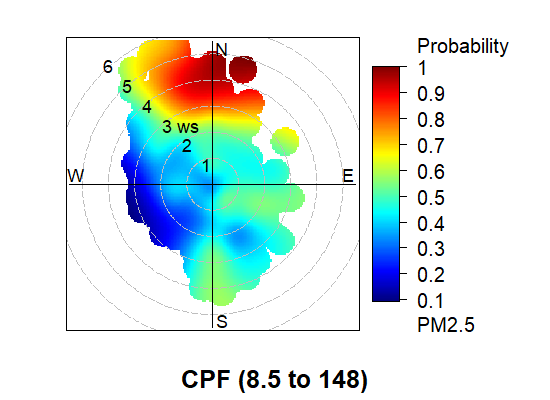
**(b)**

**PM2.5 – Wet season (50 – 100 %)**



**(c)**

**PM2.5 – Dry season (0 – 50 %)**



**(d)**

**PM2.5 – Dry season (50 – 100 %)**

CBPF

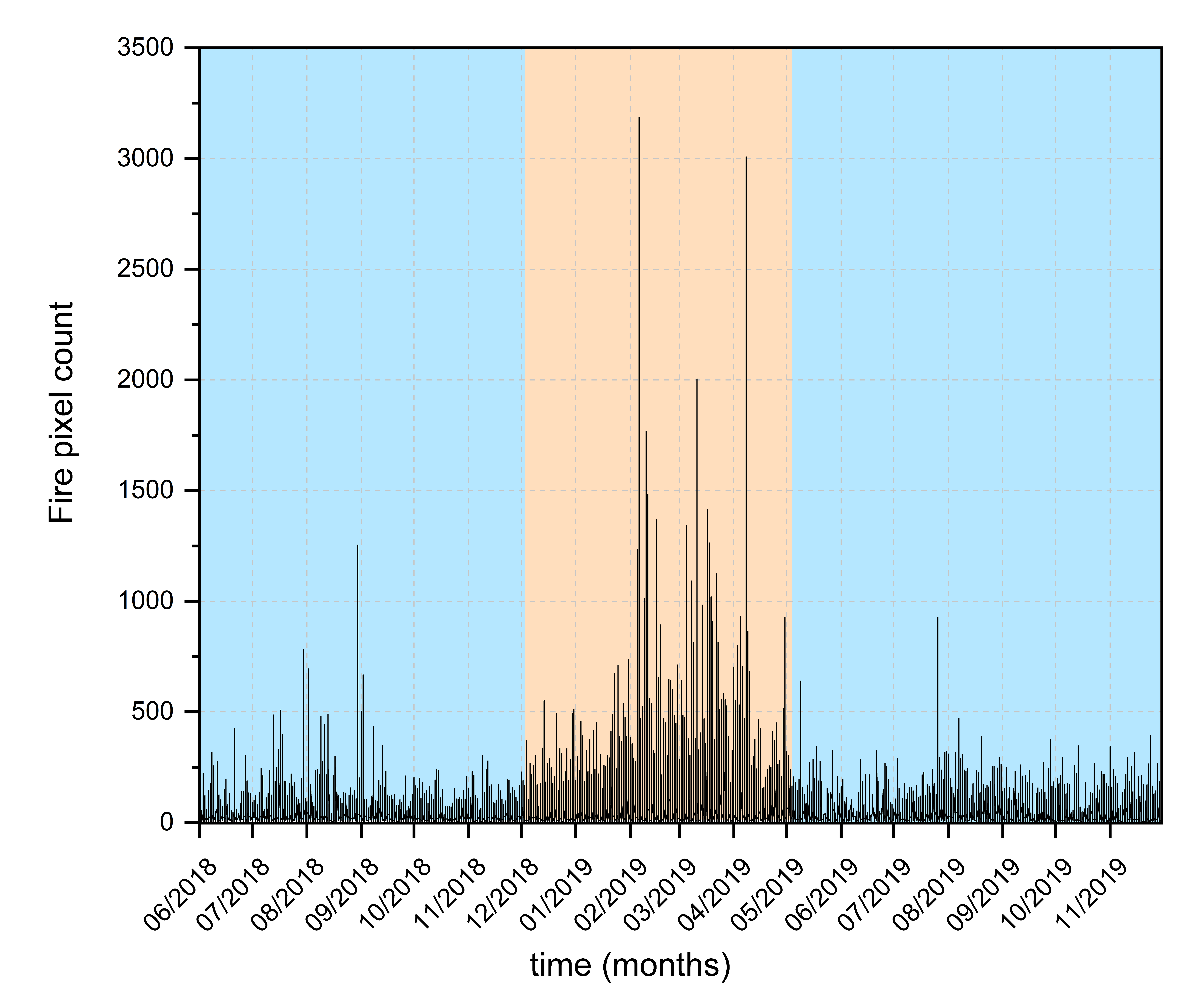
CBPF

CBPF

CBPF

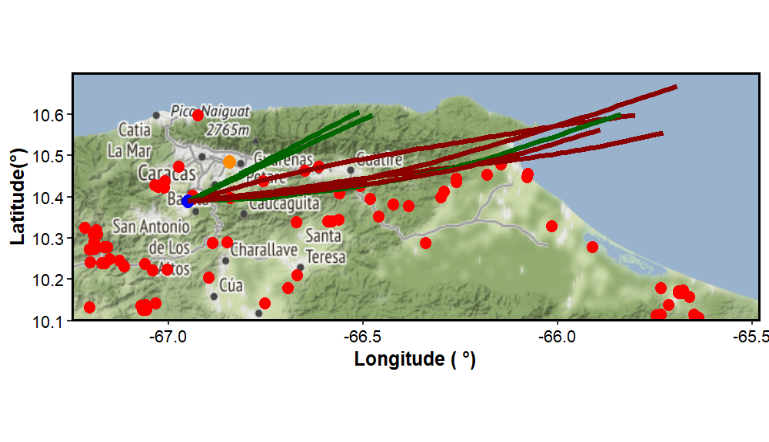
Polar plots of the conditional bivariate probability function (CBPF) for percentile range 0 to 50, 50 to 100, of the concentration of PM2.5 in the forest site, during the wet and dry seasons, from medium hours. The color scale represents the probability of finding a higher PM2.5, while the circles reflect the wind speed in each wind direction vector.

**Figure S4**

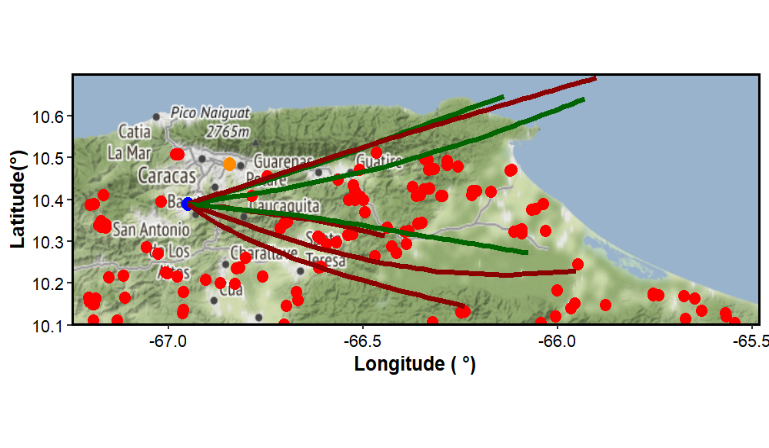
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Summary plot of seasonal distribution of fire pixel counts for the north area of Venezuela for all the period of measurements. The blue area represents the wet season, while the red area represents the dry season. (FIRMS MCD14ML fire database)

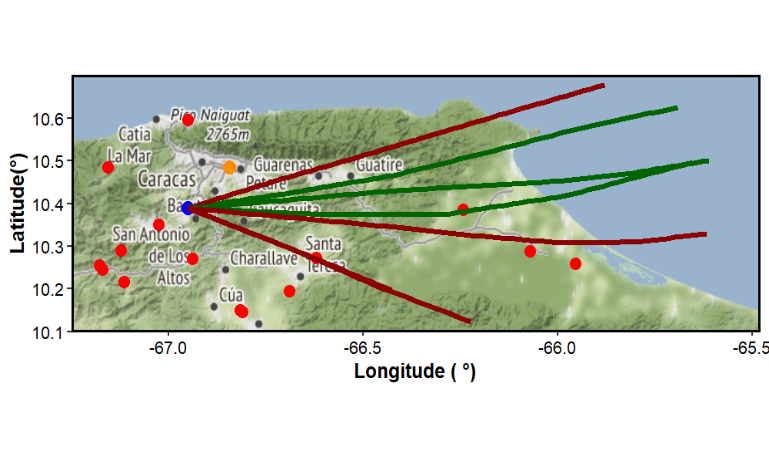
**Figure S5**



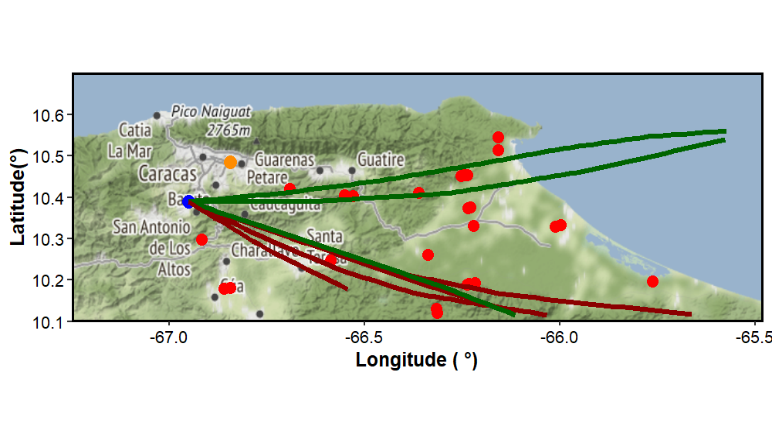
(d)



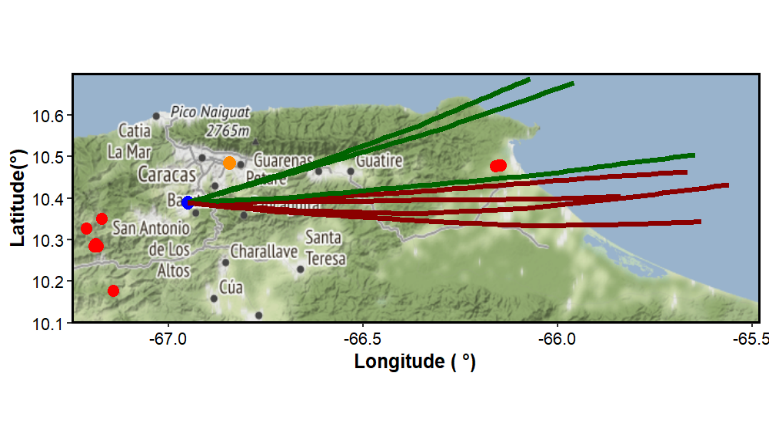
(e)



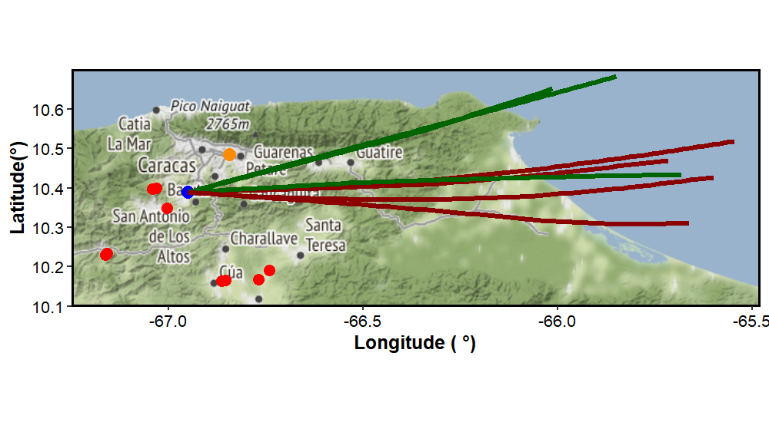
(b)



(f)



(c)



(a)

Active fire locations (red dots) during one-day backward trajectories arriving every 6 h at the forest site at 500 m (dark green) and 1000 m (dark red) for (a) January 05th, 2019, (b) February 14th, 2019, (c) March 15th, 2019, (d) March 25th, 2019, (e) April 11th, 2019, (f) April 28th, 2019. The blue dot is the forest site, and the yellow dot is the urban site.

**Table S1.**

Summary of the measurement interval and the number of hours used to generate polar plots for the Conditional Bivariate Probability Function for the urban and forest sites, per site and season.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Site | Season | Pollutant | Start-time | End-time | Number of hours to polar plots |
| Forest site | wet season | PM2.5 | June 1, 2018 | November 30, 2018 | 2614 |
| Urban site | wet season | PM2.5 | June 1, 2018 | May 31, 2019 | 958 |
| Urban site | wet season | eBC | June 1, 2018 | May 21, 2019 | 4331 |
| Forest site | dry season | PM2.5 | December 1, 2018 | April 30, 2019 | 3644 |
| Urban site | dry season | PM2.5 | December 1, 2018 | April 30, 2019 | 4067 |
| Urban site | dry season | eBC | December 1, 2018 | April 30, 2019 | 3858 |

**Table S2.**

Summary of the median, mean, standard deviation, percentiles 25 and 75, and maximum and minimum for meteorological parameters, from the hourly data, for the urban and forest sites.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Min. | 25 % | Median | Mean | Std. Dev.\* | 75 % | Max. |
| *Urban site* | | | | | | | |
| Temperature (°C) | 12.63 | 17.94 | 19.7 | 20.2 | 3.17 | 22.69 | 30.1 |
| Relative humidity (%) | 38 | 73.2 | 78.75 | 77.36 | 10.22 | 85.57 | 95 |
| Rain (mm.) | 0.2 | 0.6 | 1.8 | 5.55 | 9.17 | 6.80 | 60 |
| Wind velocity (m s-1) | 0.19 | 1.28 | 2.02 | 2.15 | 1.04 | 2.98 | 6.97 |
| Wind direction (°) | 1.9 | 115.7 | 128 | 140.2 | 45.42 | 150.2 | 358.7 |
| *Forest site* | | | | | | | |
| Temperature (°C) | 9.9 | 15.17 | 16.59 | 16.84 | 2.45 | 18.4 | 27 |
| Relative humidity (%) | 35.1 | 75.3 | 83.5 | 82.1 | 11.5 | 91.2 | 99 |
| Rain (mm.) | 0.2 | 0.6 | 1.8 | 6.15 | 10 | 6.2 | 84.6 |
| Wind velocity (m s-1) | - | 0.96 | 1.47 | 1.68 | 0.98 | 2.2 | 5.97 |
| Wind direction (°) | - | 251.4 | 317.2 | 277.1 | 87.46 | 335.4 | 360 |

*\*Standard deviation*

**Table S3.**

Summary of the median, average, standard deviation, and percentiles 25 and 75, for PM2.5 and eBC for weekdays and weekends, during the entire period of measurements, from daily values, for the urban and forest site (µg m-3).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **25%** | **Median** | **Average** | **Standard deviation** | **75%** |
|  |  | *(µg m-3)* | | | | |
| ***Urban site*** | | | | | | |
| **PM2.5** | **Weekdays** | 7.07 | 11.80 | 14.83 | 10.29 | 17.62 |
| **Weekend** | 6.90 | 10.25 | 13.32 | 8.45 | 17.91 |
| **eBC** | **Weekdays** | 1.18 | 1.63 | 1.84 | 0.98 | 2.18 |
| **Weekend** | 0.92 | 1.28 | 1.44 | 0.91 | 1.60 |
| ***Forest site*** | | | | | | |
| **PM2.5** | **Weekdays** | 3.40 | 6.38 | 10.35 | 10.62 | 13.30 |
| **Weekend** | 4.07 | 7.05 | 9.78 | 8.05 | 12.57 |