

# Impact of ambient particulate elements in Los Angeles and their sources

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# Ambient particulate elements in Los Angeles and their sources

**Motivation:** One of the first attempts at looking at **high-time resolution PM<sub>2.5</sub>** monitoring of **metals and elements** in **Los Angeles**



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## **Existing approaches:**

- either **offline** using  **$PM_{2.5}$  filters** – labor intensive & loss of information
- or **continuous** high-time resolution monitoring of  **$PM_{10}$**
- or intensive campaigns **next to metal facilities**

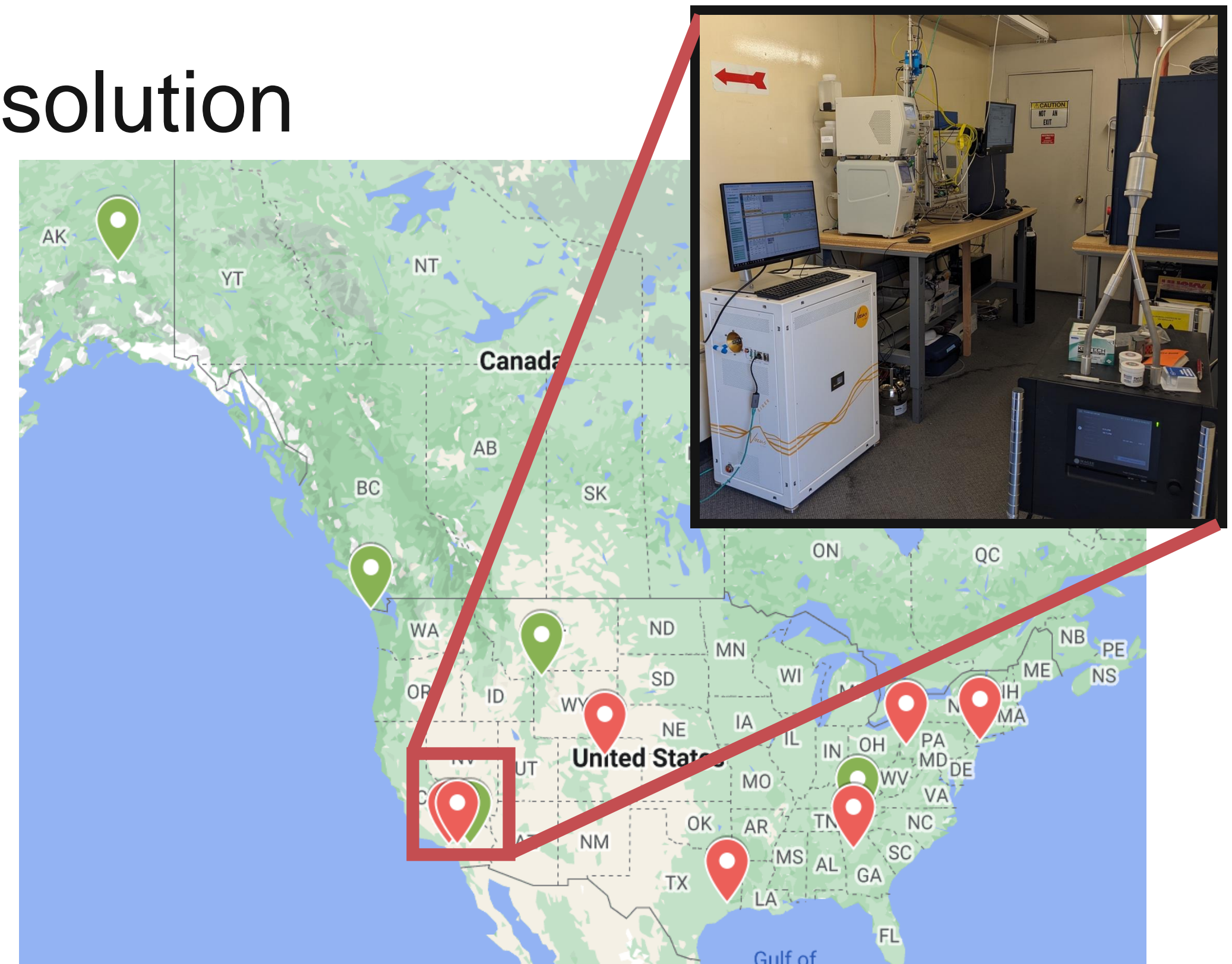
# Ambient particulate elements in Los Angeles and their sources

**Motivation:** One of the first attempts at looking at **high-time resolution  $\text{PM}_{2.5}$**  monitoring of **metals and elements** in **Los Angeles**

**Existing approaches:** lack in time-resolution

**Our approach:** leverages **ASCENT**

- Pico Rivera site: operational since July 2023



# Ambient particulate elements in Los Angeles and their sources

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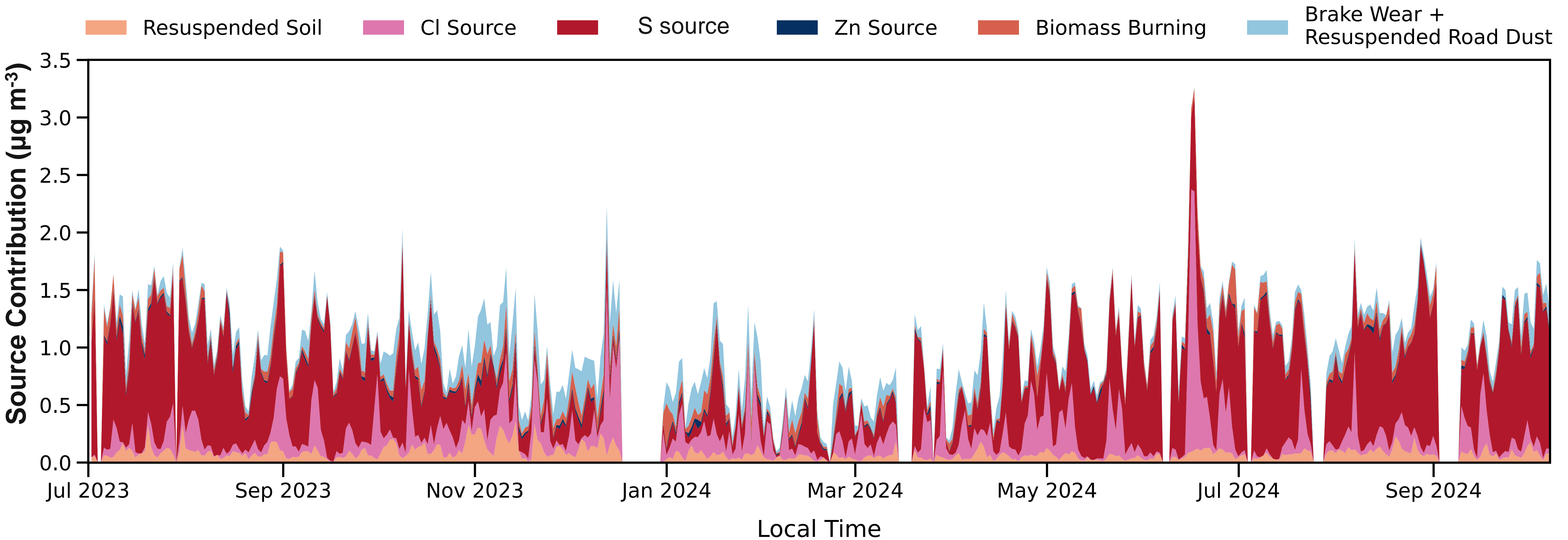
## **Contributions:**

- Look at **PM<sub>2.5</sub> elements & metals** from the Xact 625i
- Identify **sources** for two ASCENT sites & compare results
- Decipher which sources are **local vs regional**



# Overall time series

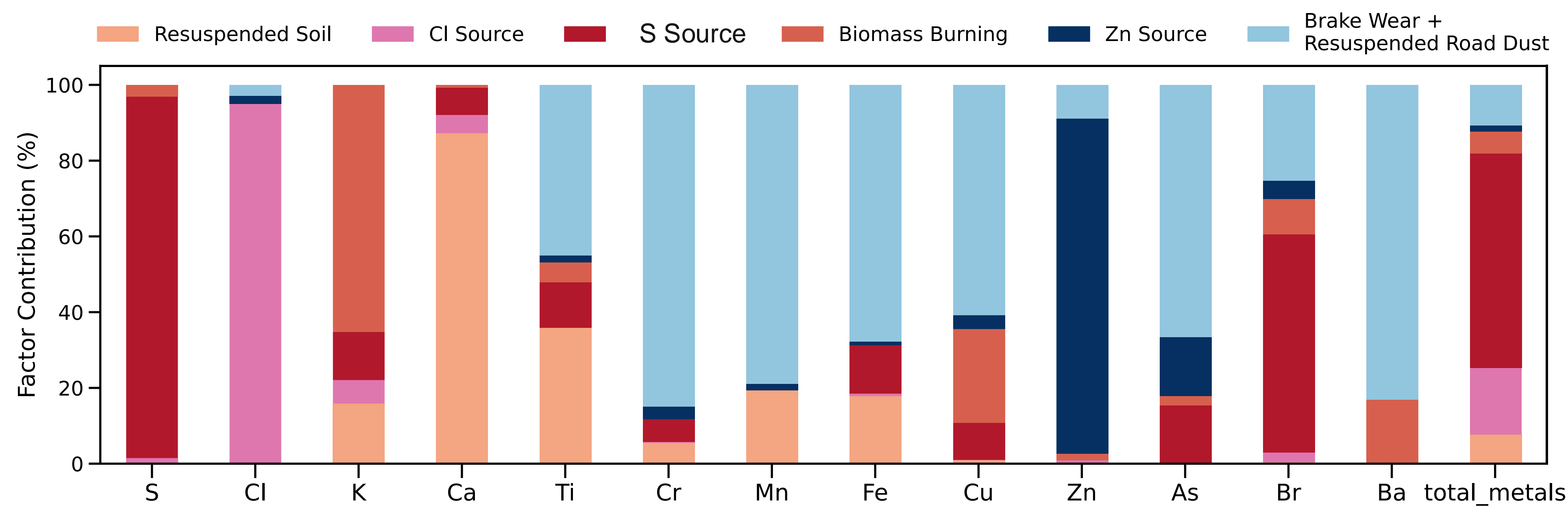
Pico Rivera, July 2023 – September 2024



# Source Identification

Using EPA PMF v5.0

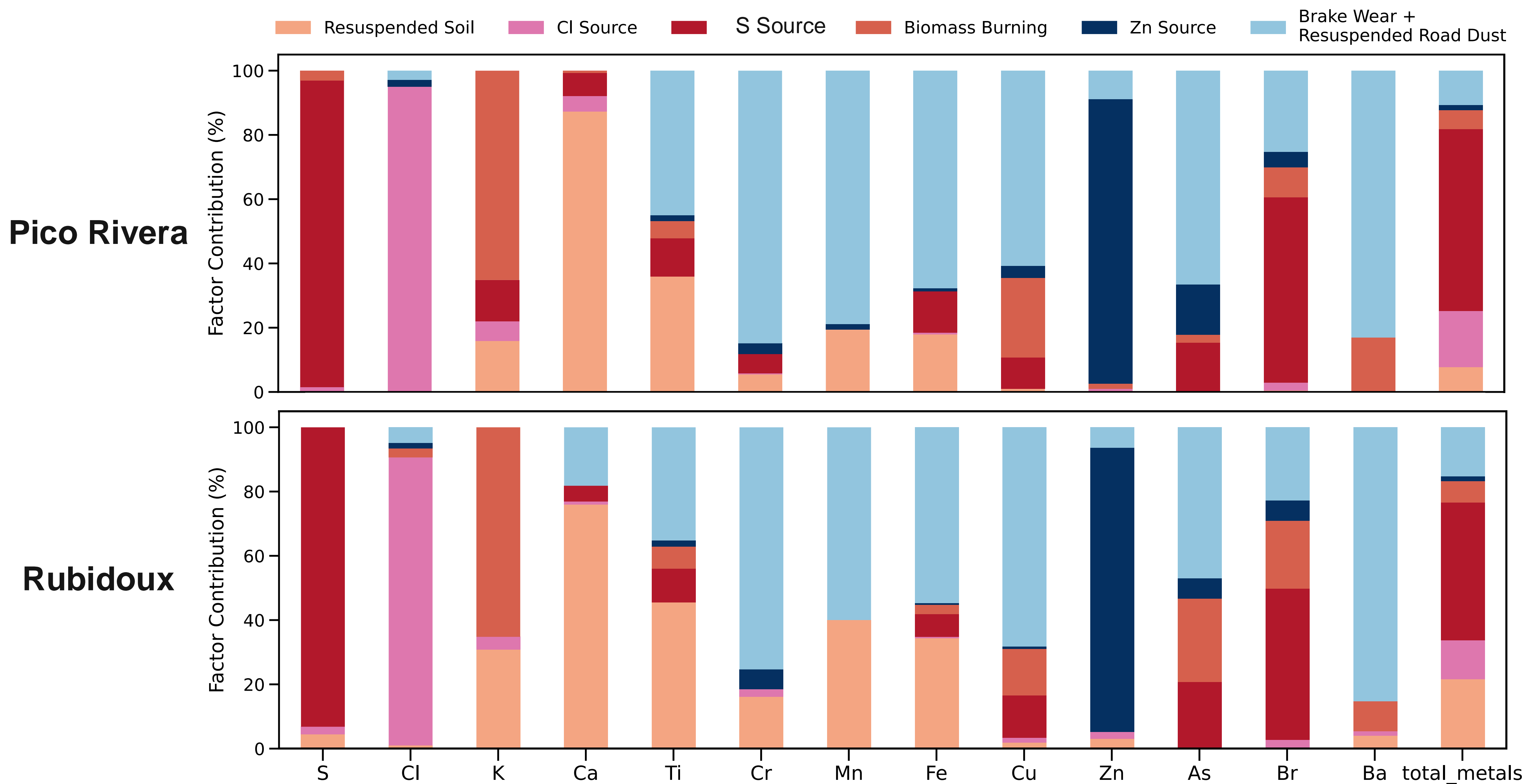
Pico Rivera



**We identify 6 sources consistent among both datasets (6 month and 12 month)**

# Comparison of two urban sites

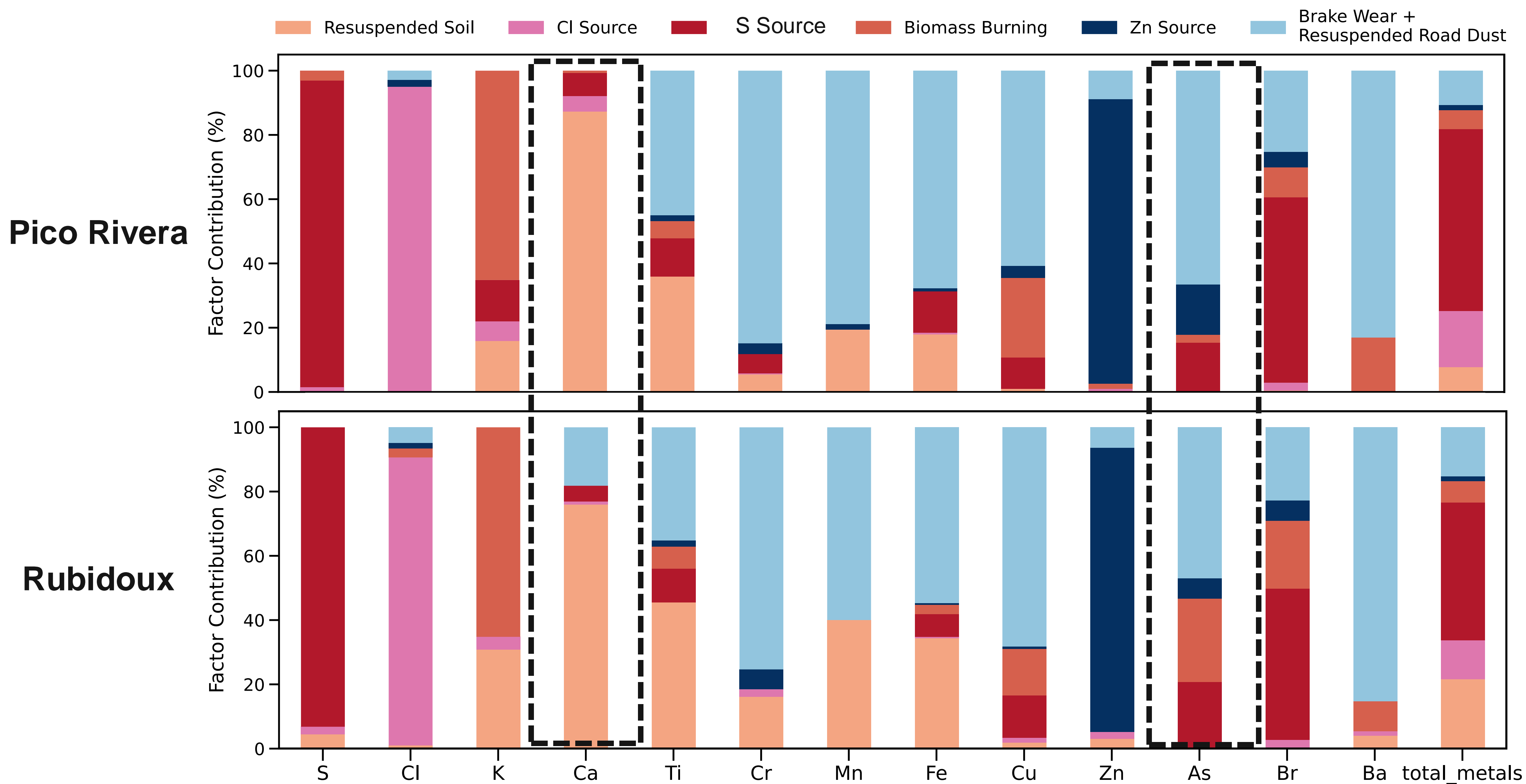
Pico Rivera (top) and Rubidoux (bottom): **very similar profiles**





# Comparison of two urban sites

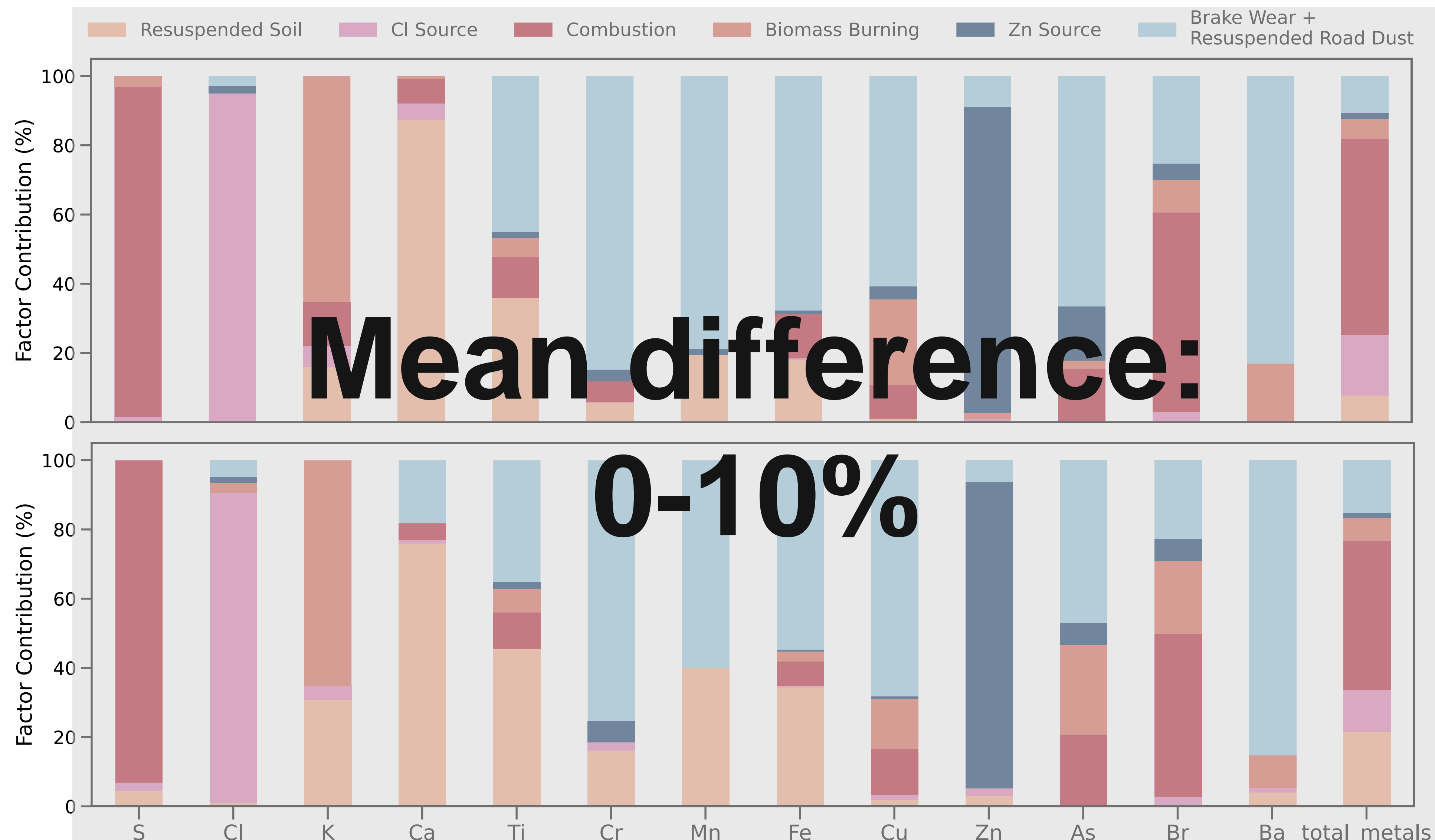
Pico Rivera (top) and Rubidoux (bottom): **very similar profiles**



# Comparison of two urban sites

Pico Rivera (top) and Rubidoux (bottom): **similar profiles**

Pico Rivera

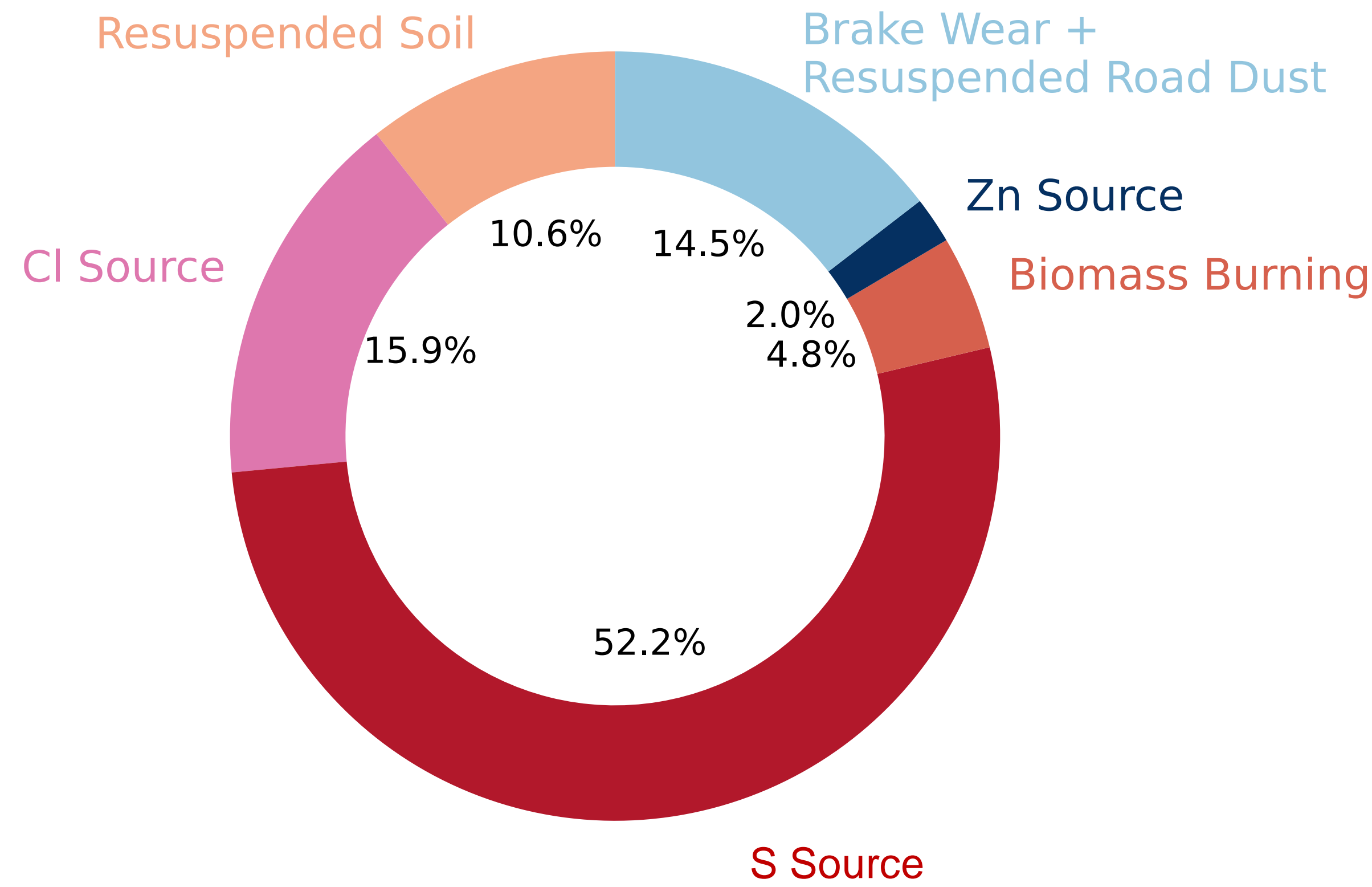


Rubidoux

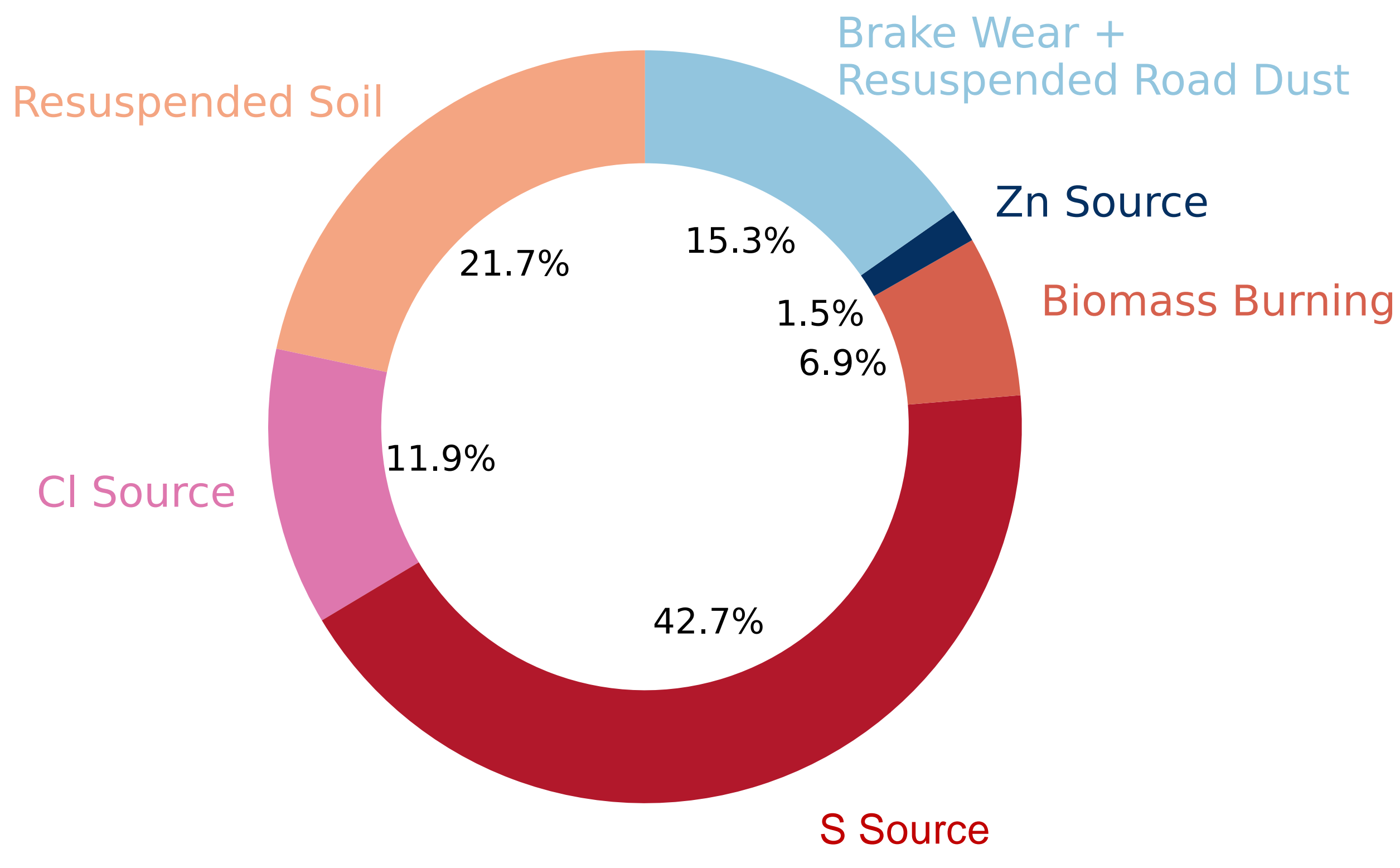
# Comparison of two urban sites

Pico Rivera and Rubidoux: **similar sources**

**Pico Rivera**



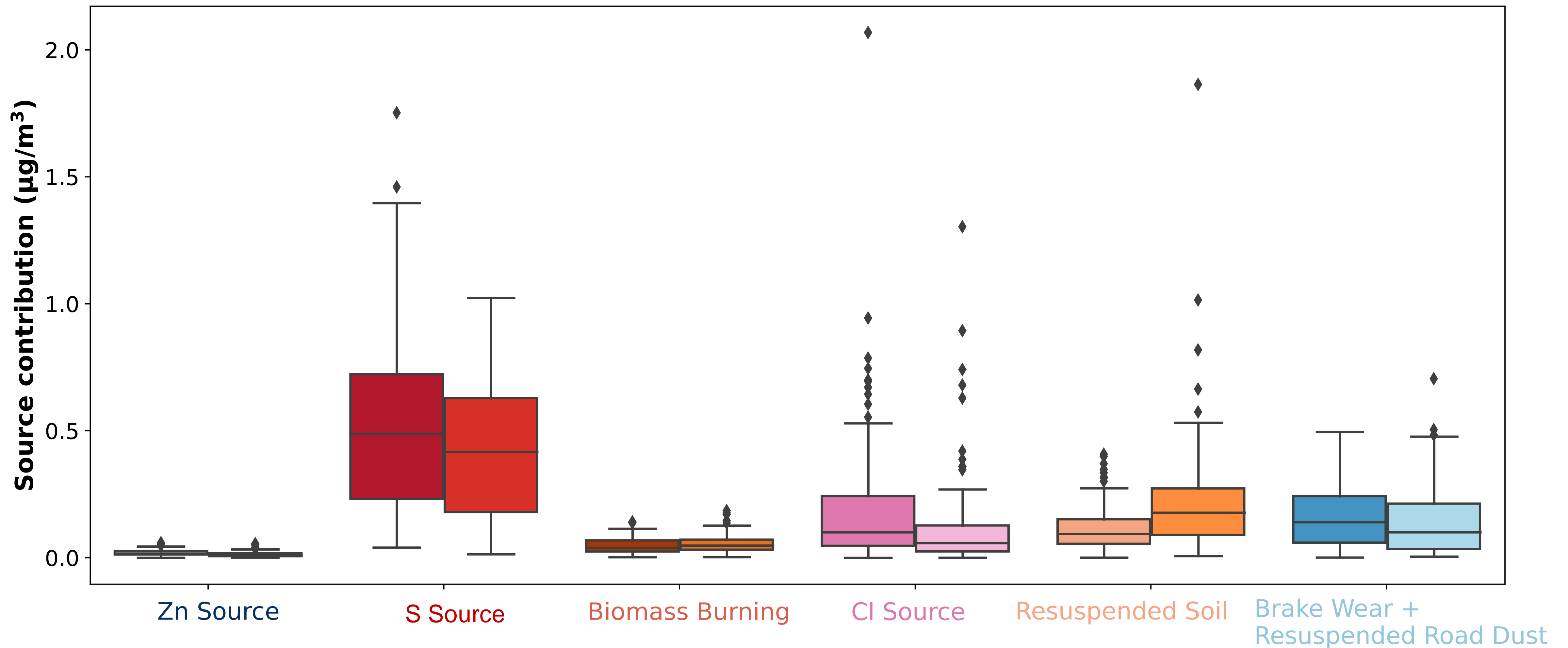
**Rubidoux**



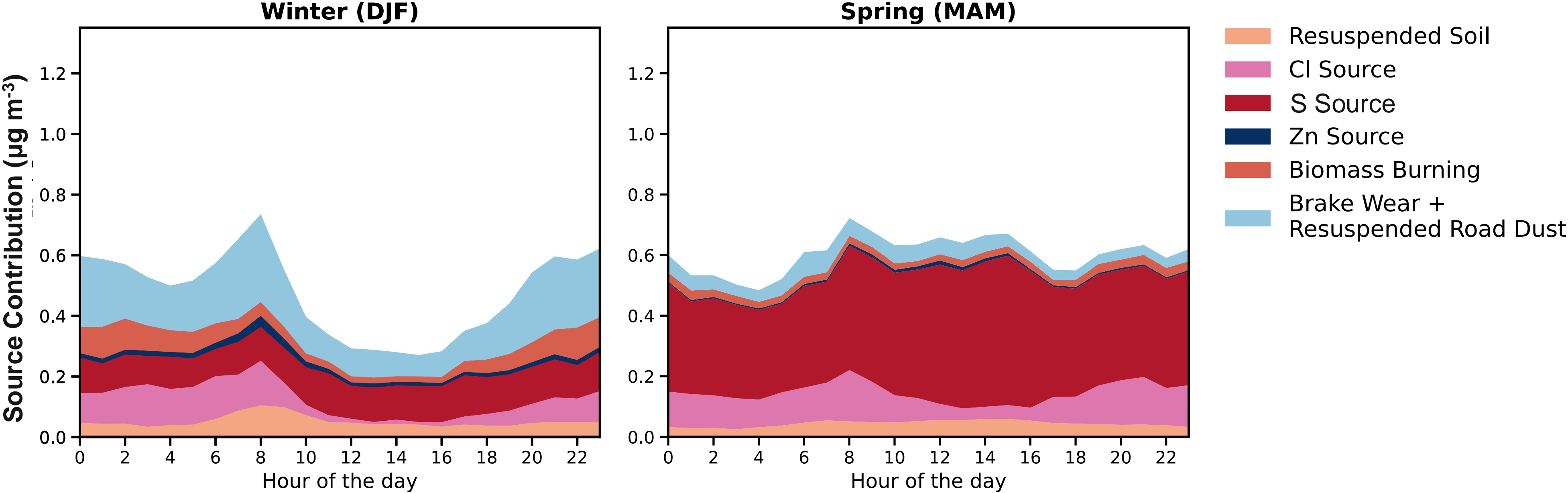


# Comparison of two urban sites

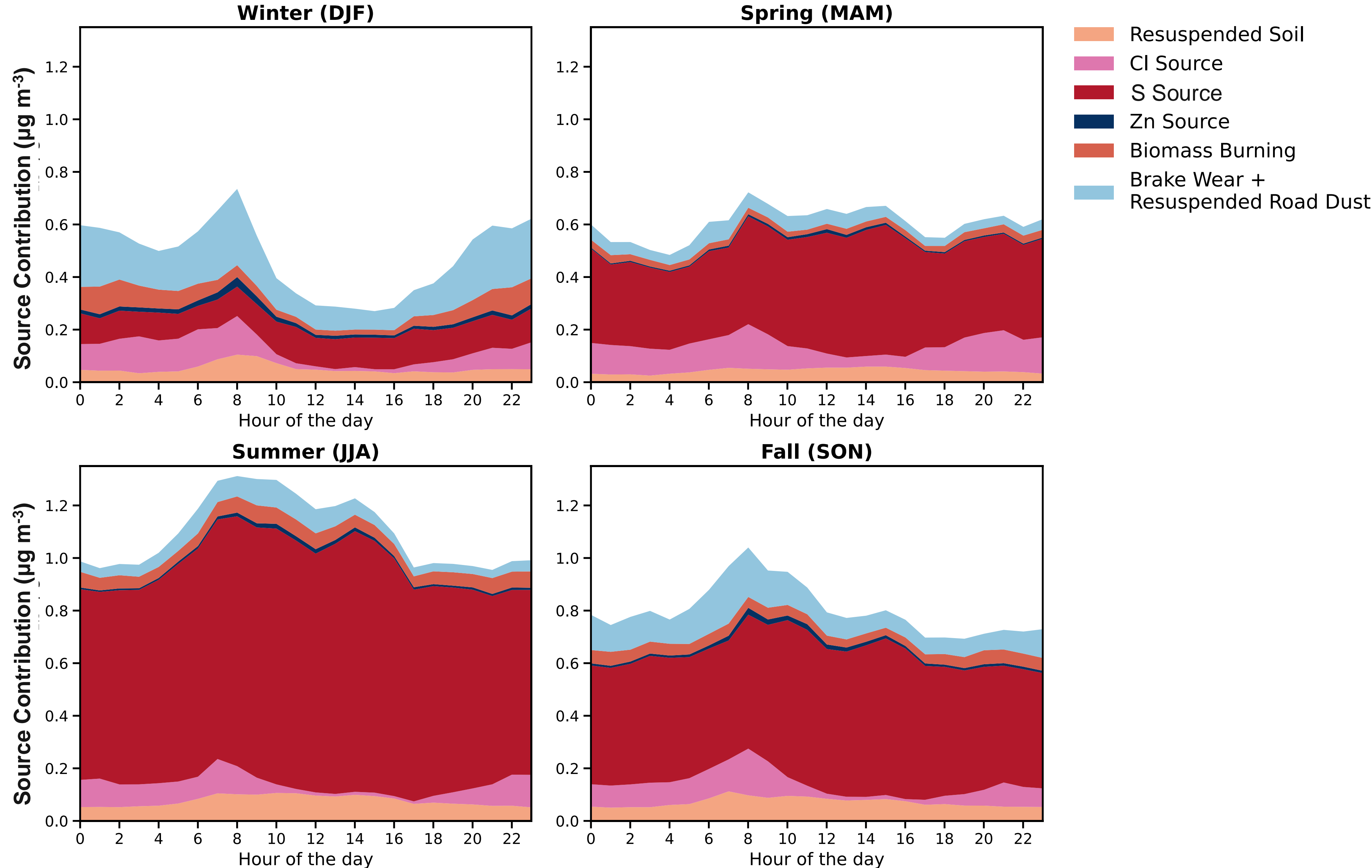
Pico Rivera (left) and Rubidoux (right): **similar sources**



# Seasonal variation



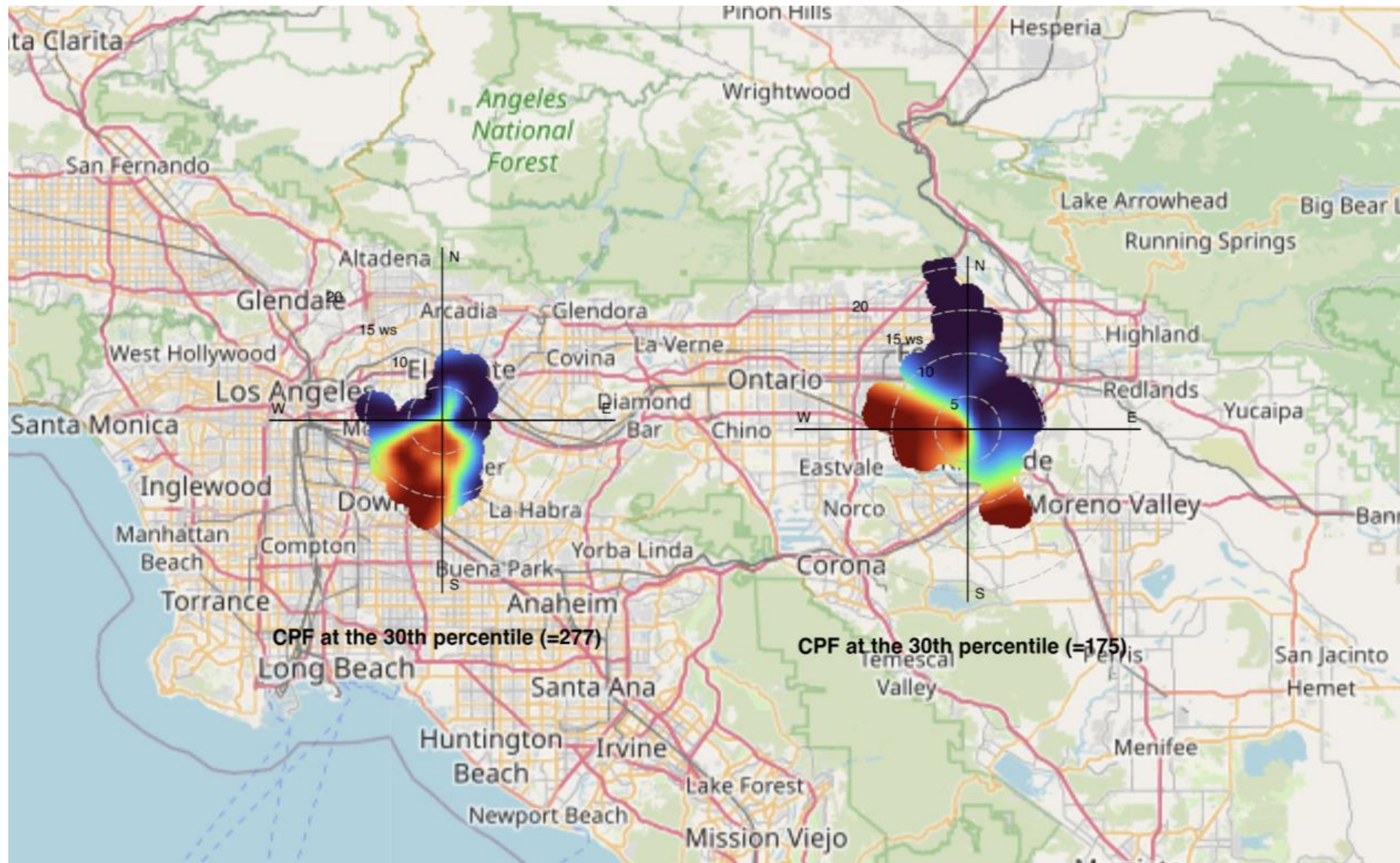
# Seasonal variation





# S Source

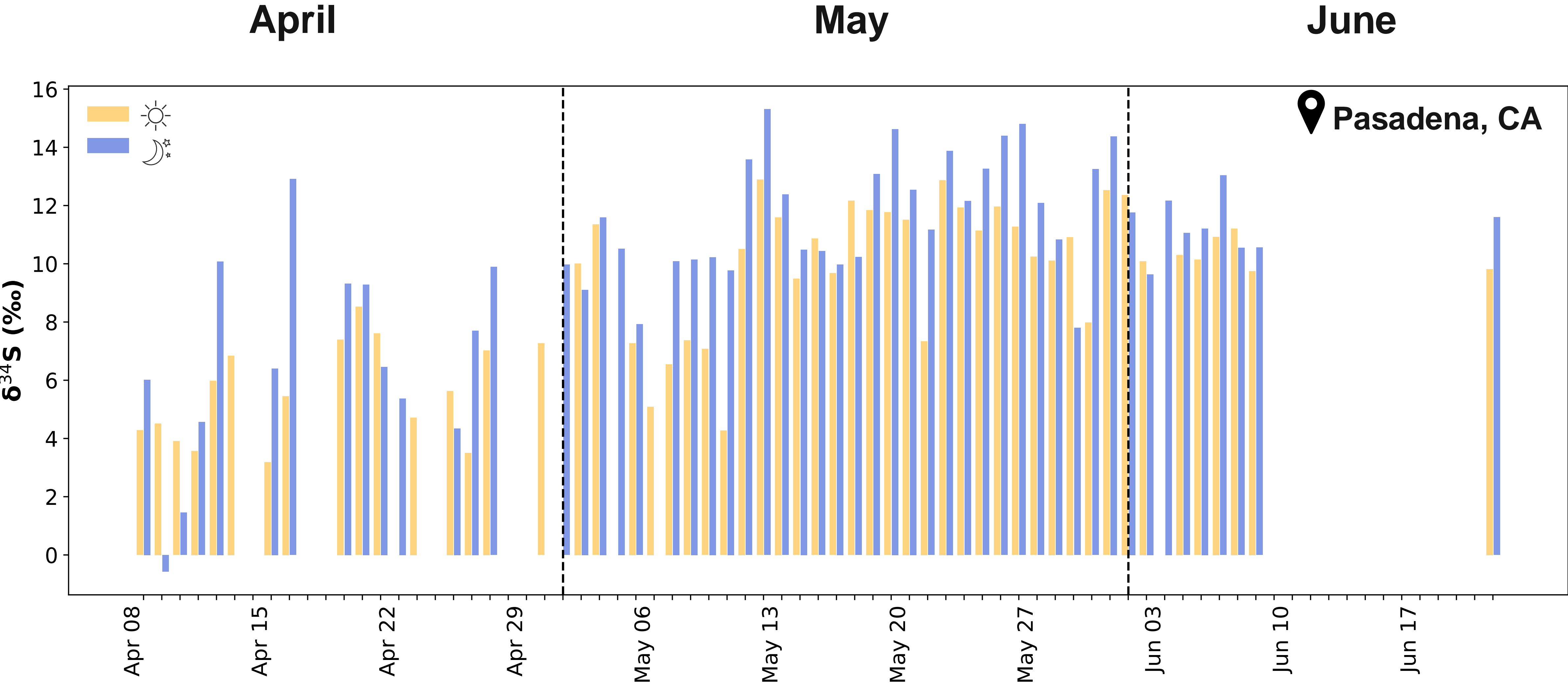
Main contributing element: S





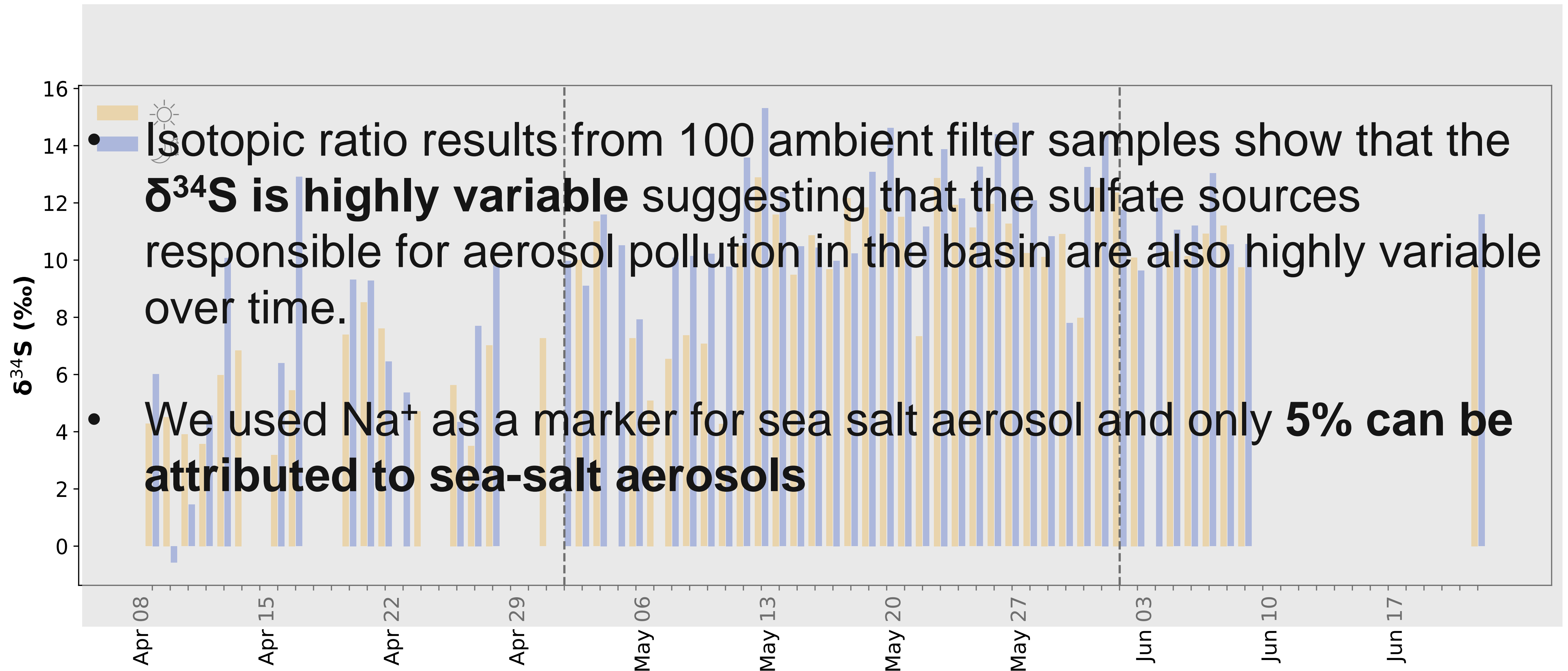
# S Source: combustion?

$\delta^{34}\text{S}$  is highly variable



# S Source: combustion?

$\delta^{34}\text{S}$  is highly variable – only 5% is attributed to sea salt





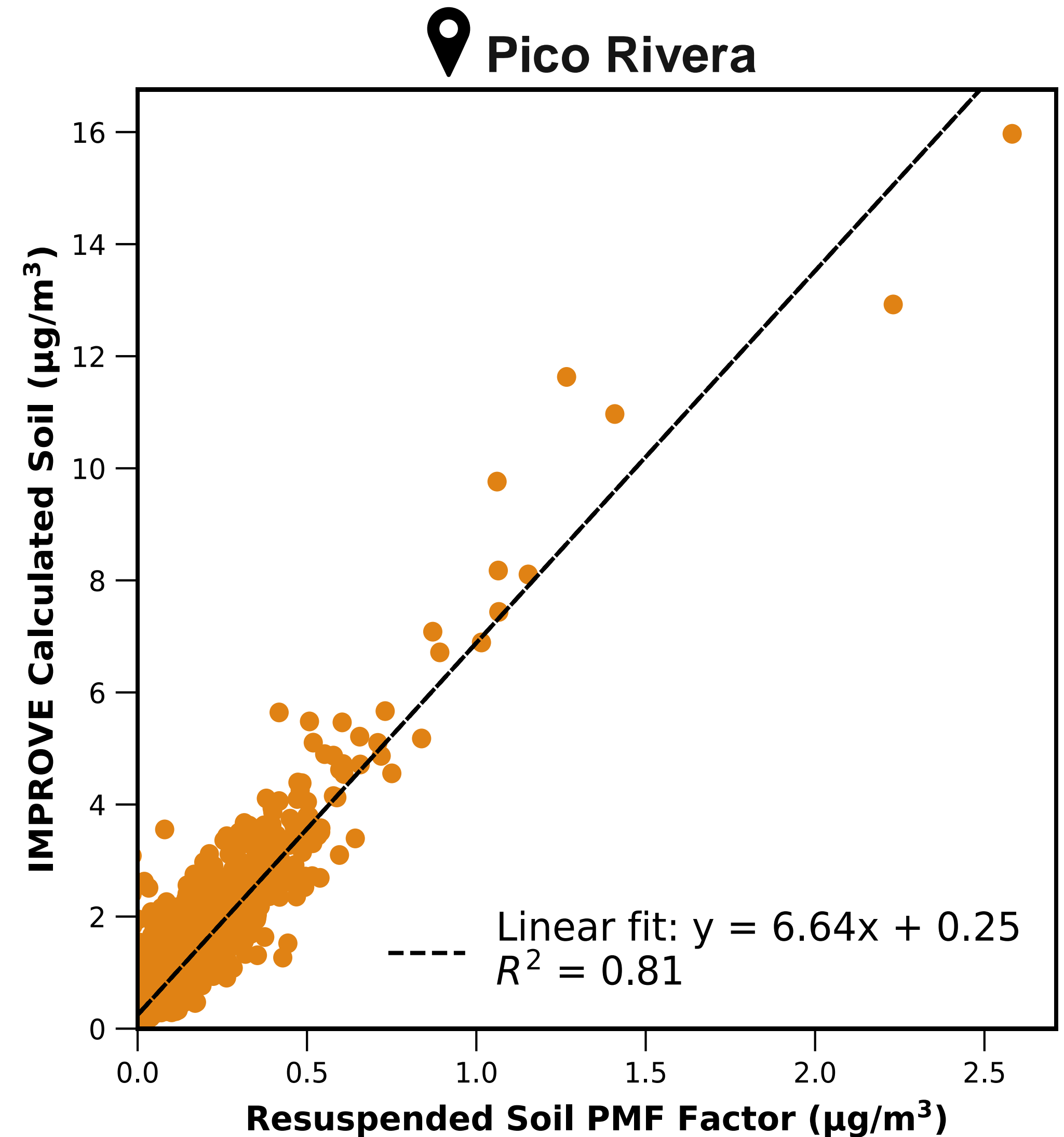
# Resuspended Soil

**IMPROVE** Calculated **Soil** vs PMF factor

Main contributing trace elements:  
**Ca, Ti, Mn, Fe**

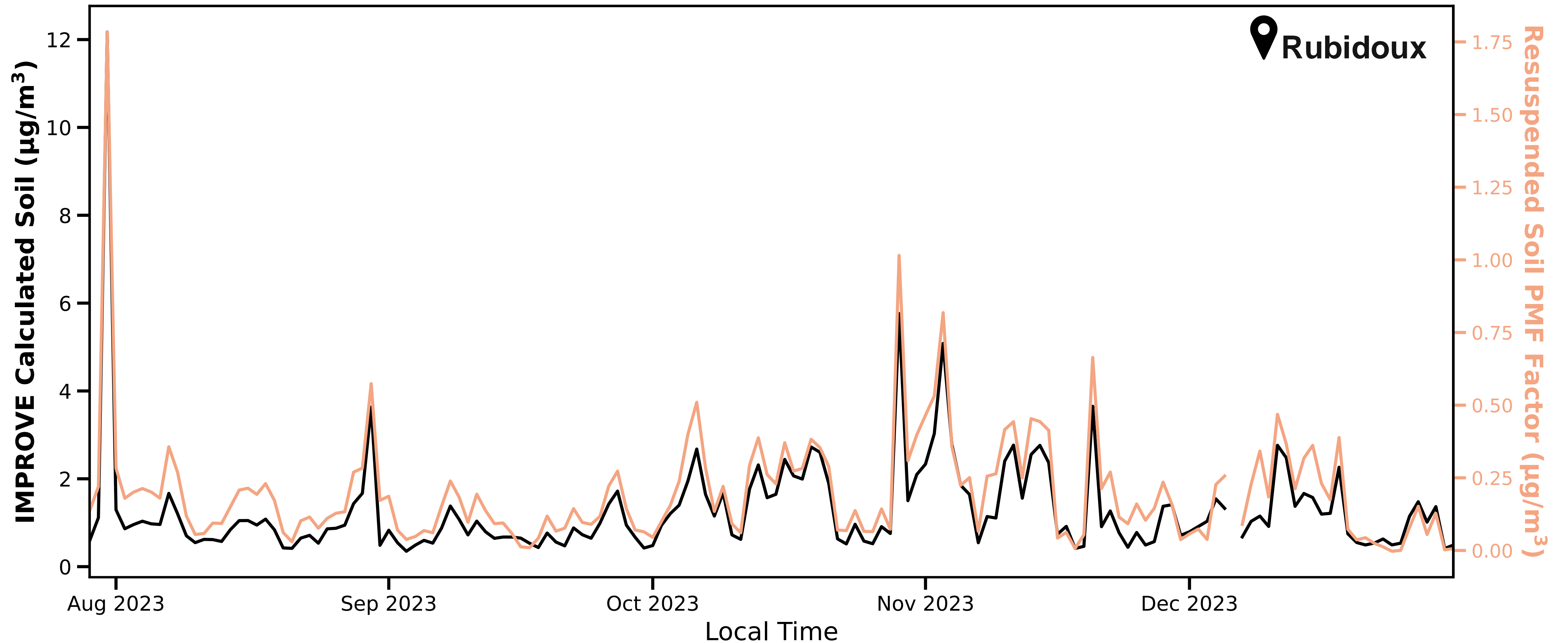
**IMPROVE** Soil equation:

$$\text{SOIL} = 2.20 \cdot \text{Al} + 2.49 \cdot \text{Si} + 1.63 \cdot \text{Ca} + 2.42 \cdot \text{Fe} + 1.94 \cdot \text{Ti}$$



# Resuspended Soil

IMPROVE Calculated **Soil** vs PMF factor

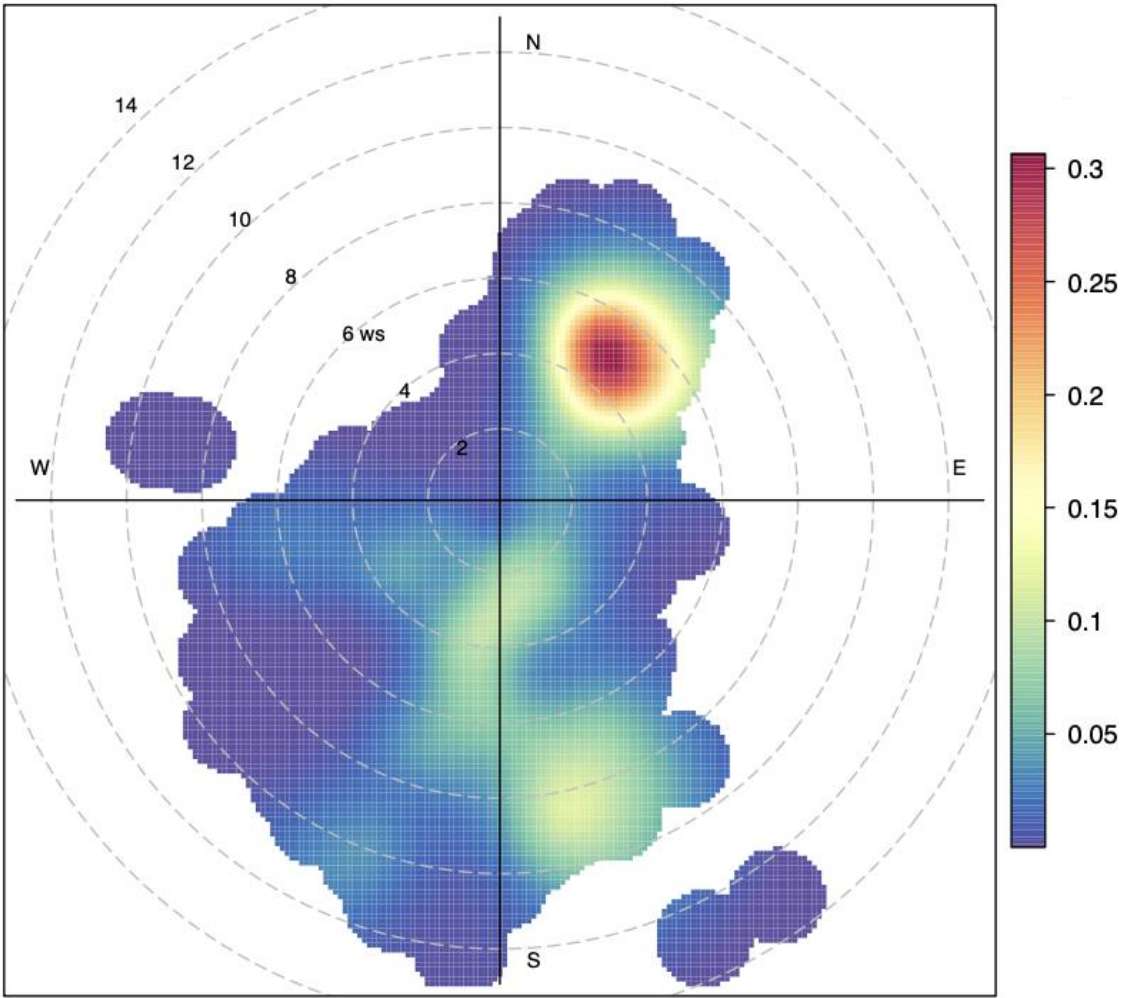
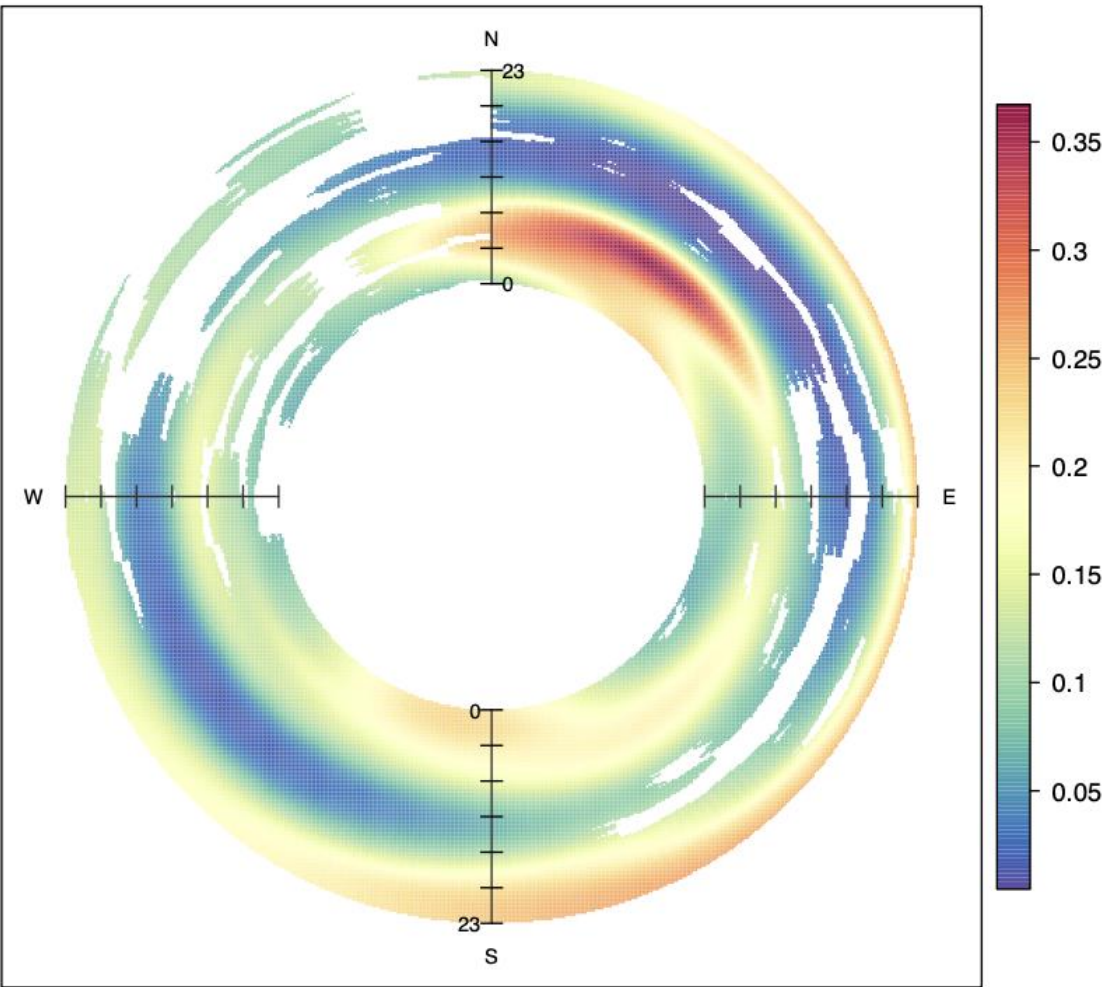
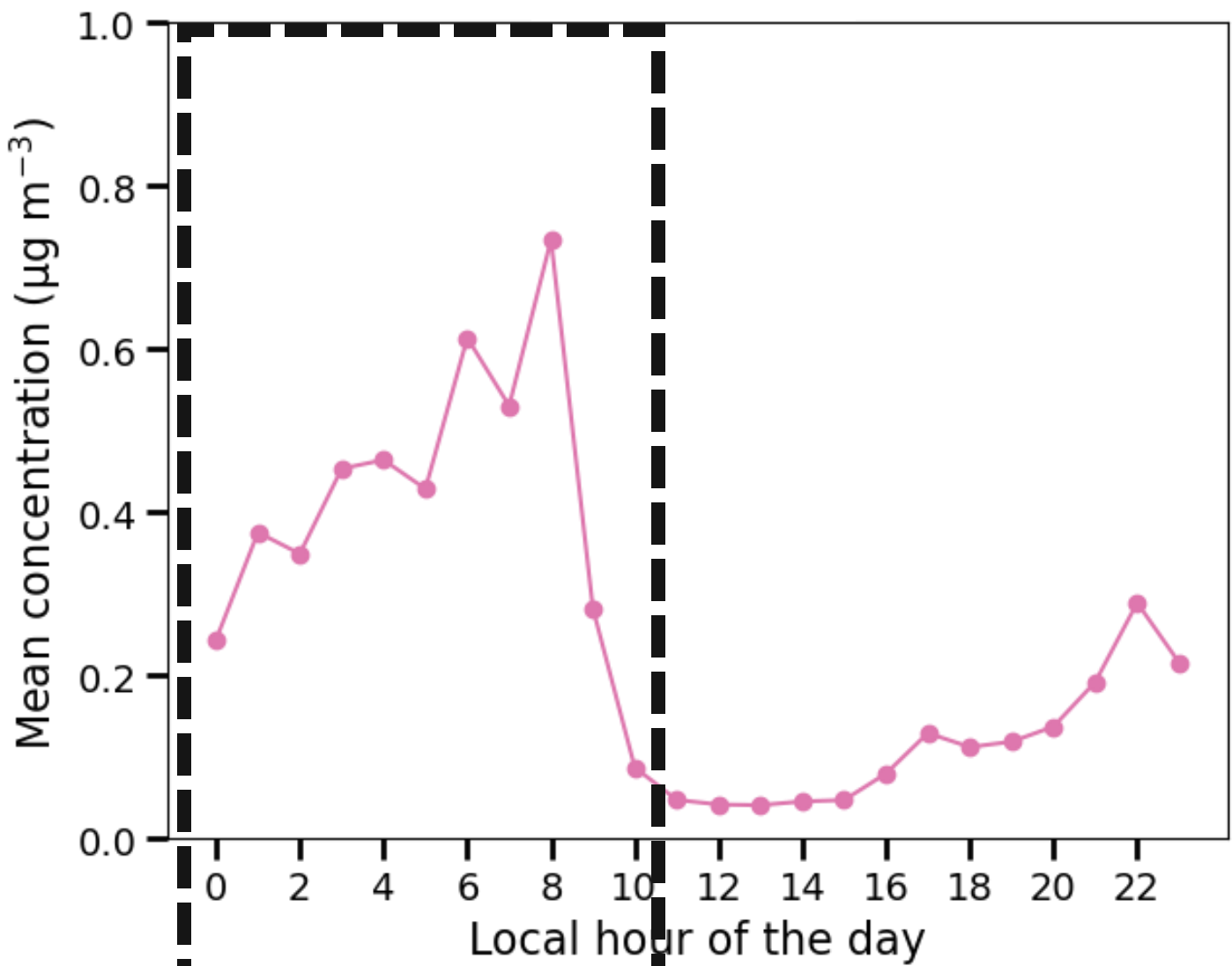




# Cl source

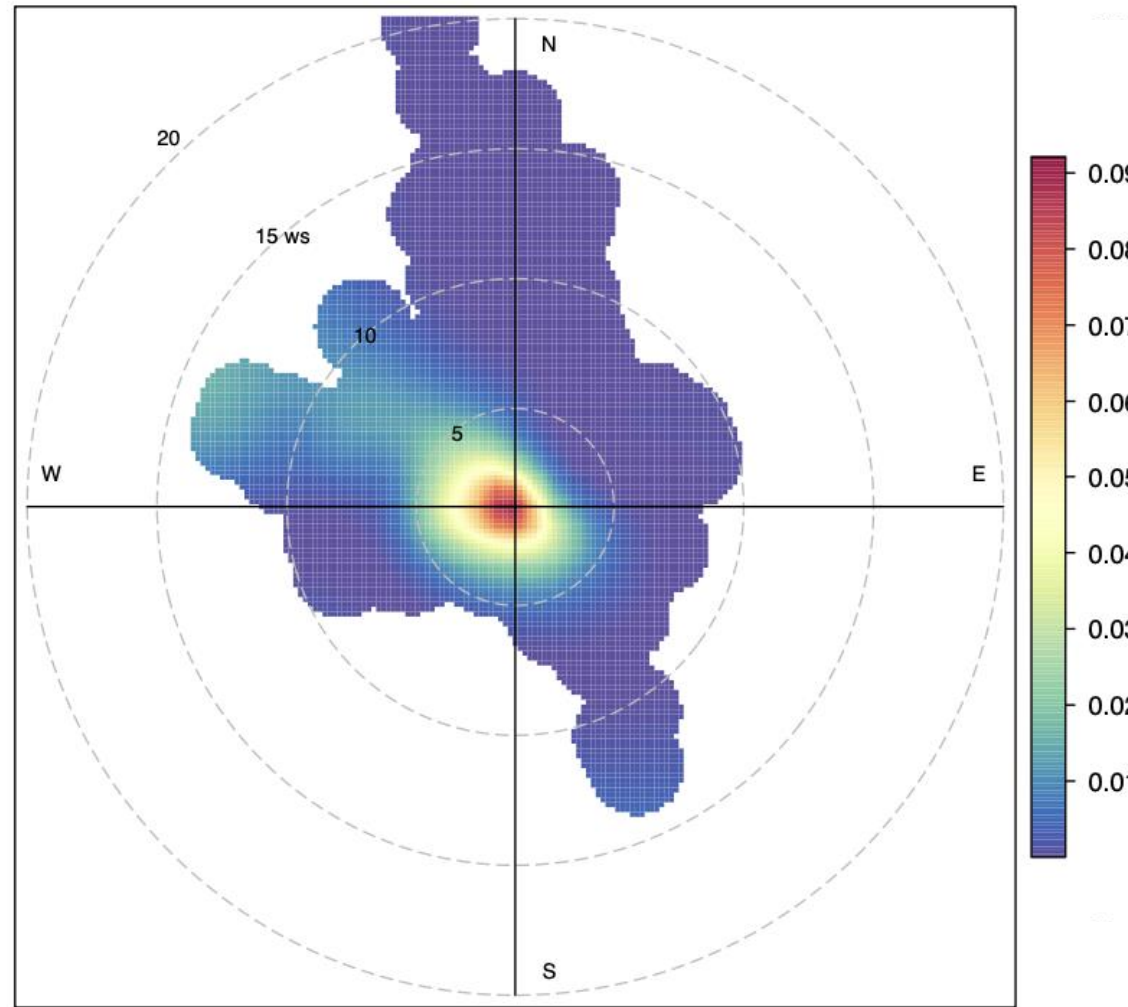
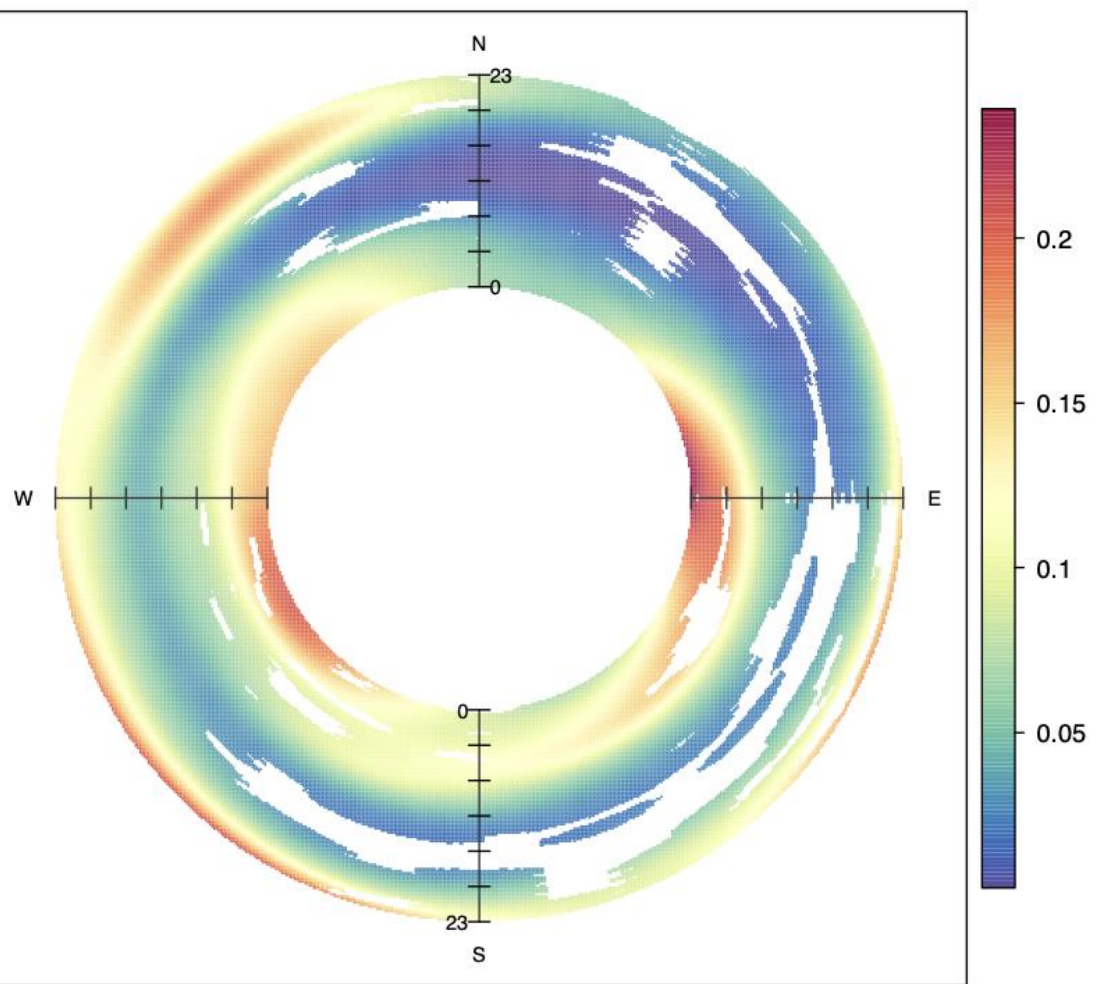
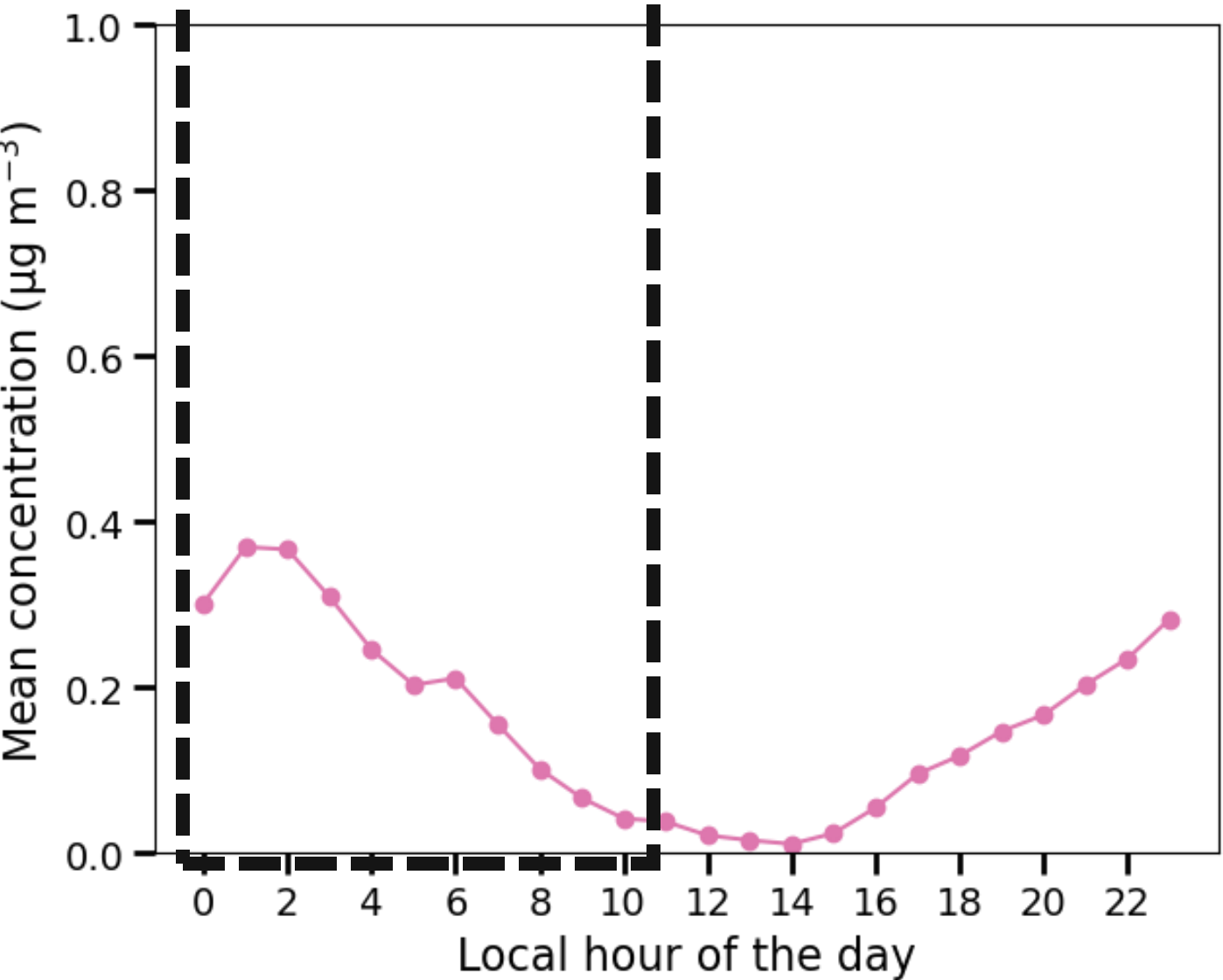
## Diurnal and wind analysis

Pico Rivera



CPF at the 90th percentile (=0.46)

Rubidoux



CPF at the 90th percentile (=0.23)



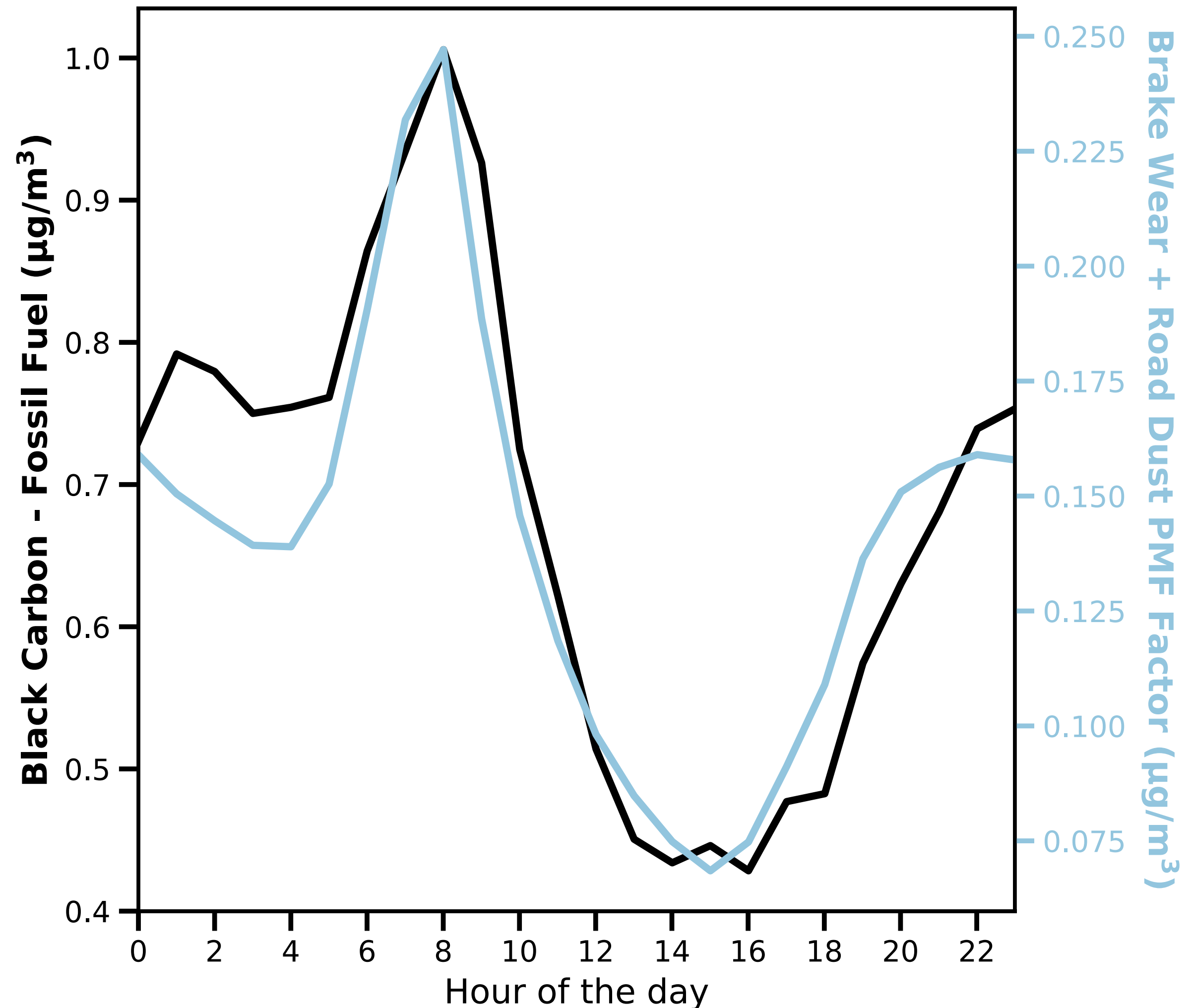
# Brake Wear + Resuspended Road Dust

Aethalometer **Black Carbon** (fossil fuel fraction) vs PMF factor

Main contributing trace elements:  
**Ba, Fe, Cu and Cr**

**Aethalometer model:**

$$BC = BC_{ff} + BC_{bb}$$



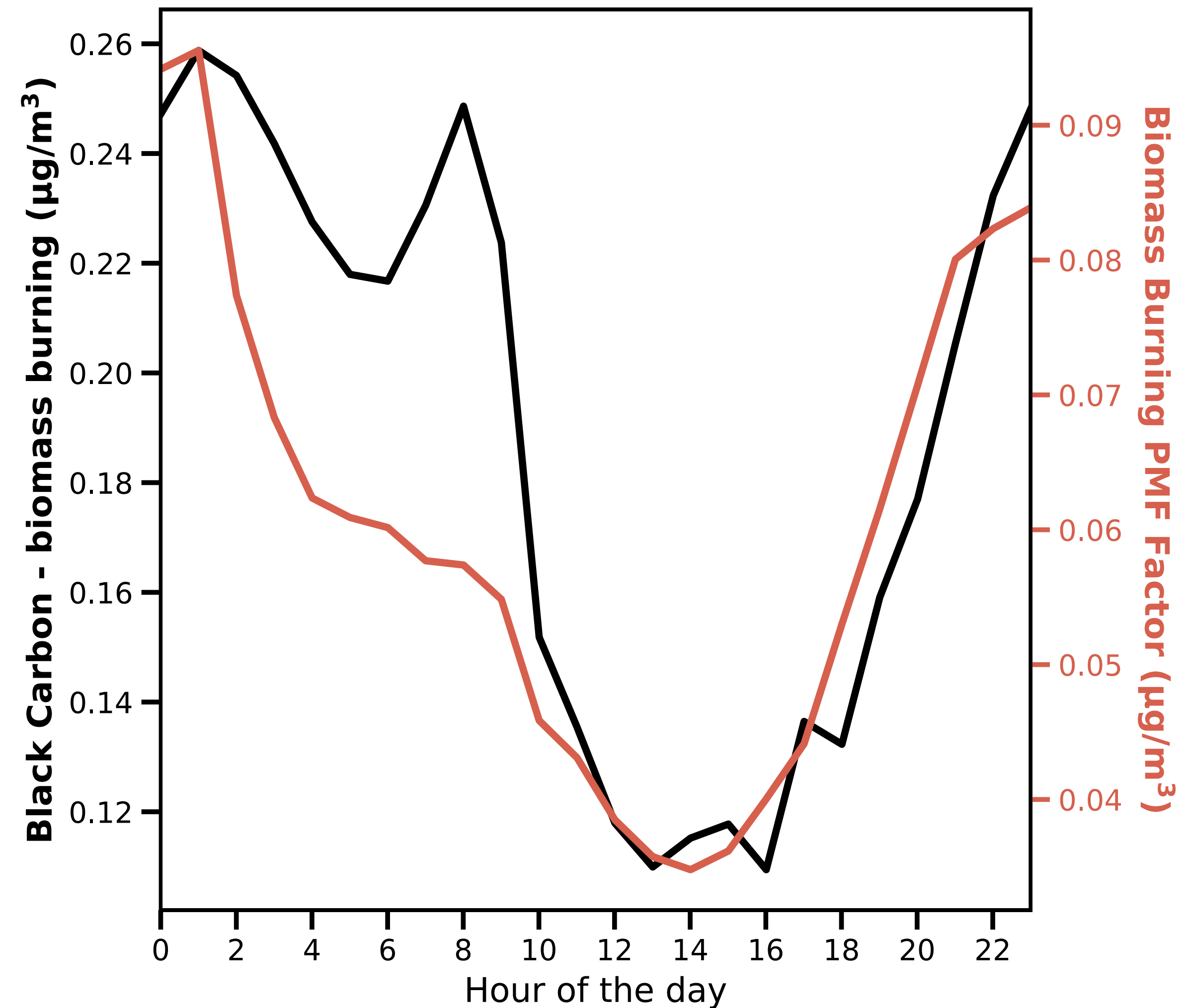
# Biomass Burning

Aethalometer **Black Carbon** (biomass burning fraction) vs PMF factor

Main contributing trace elements:  
**K, Ba, Cu**

**Aethalometer model:**

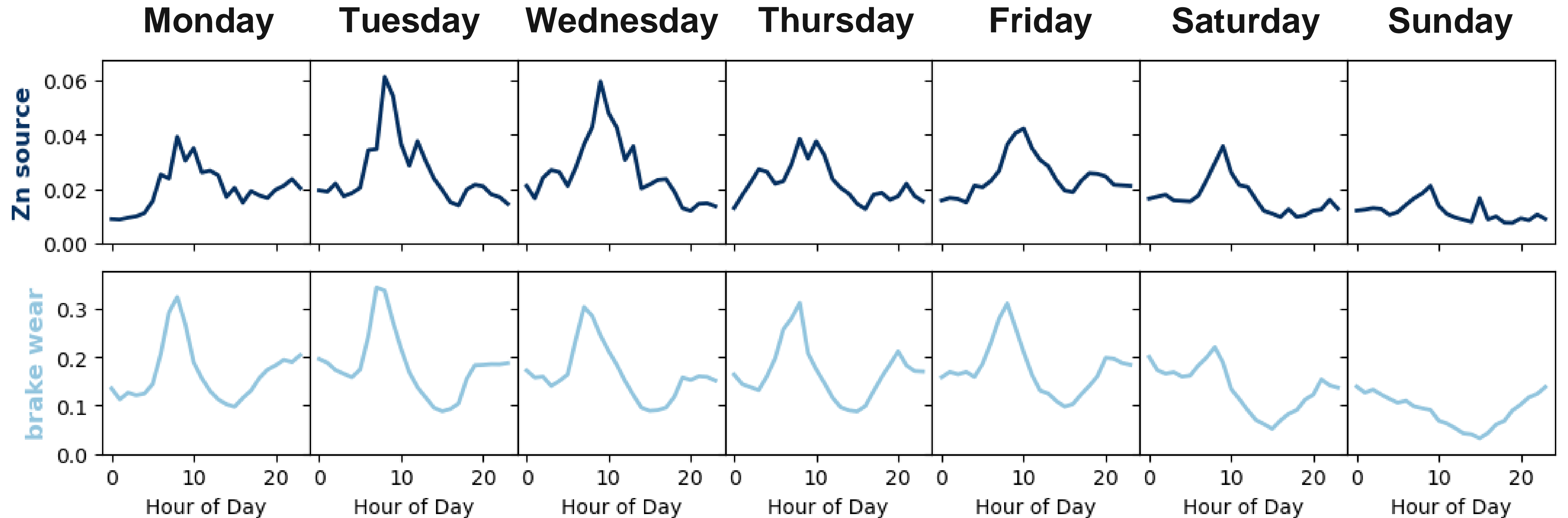
$$BC = BC_{ff} + BC_{bb}$$





# Zn Source

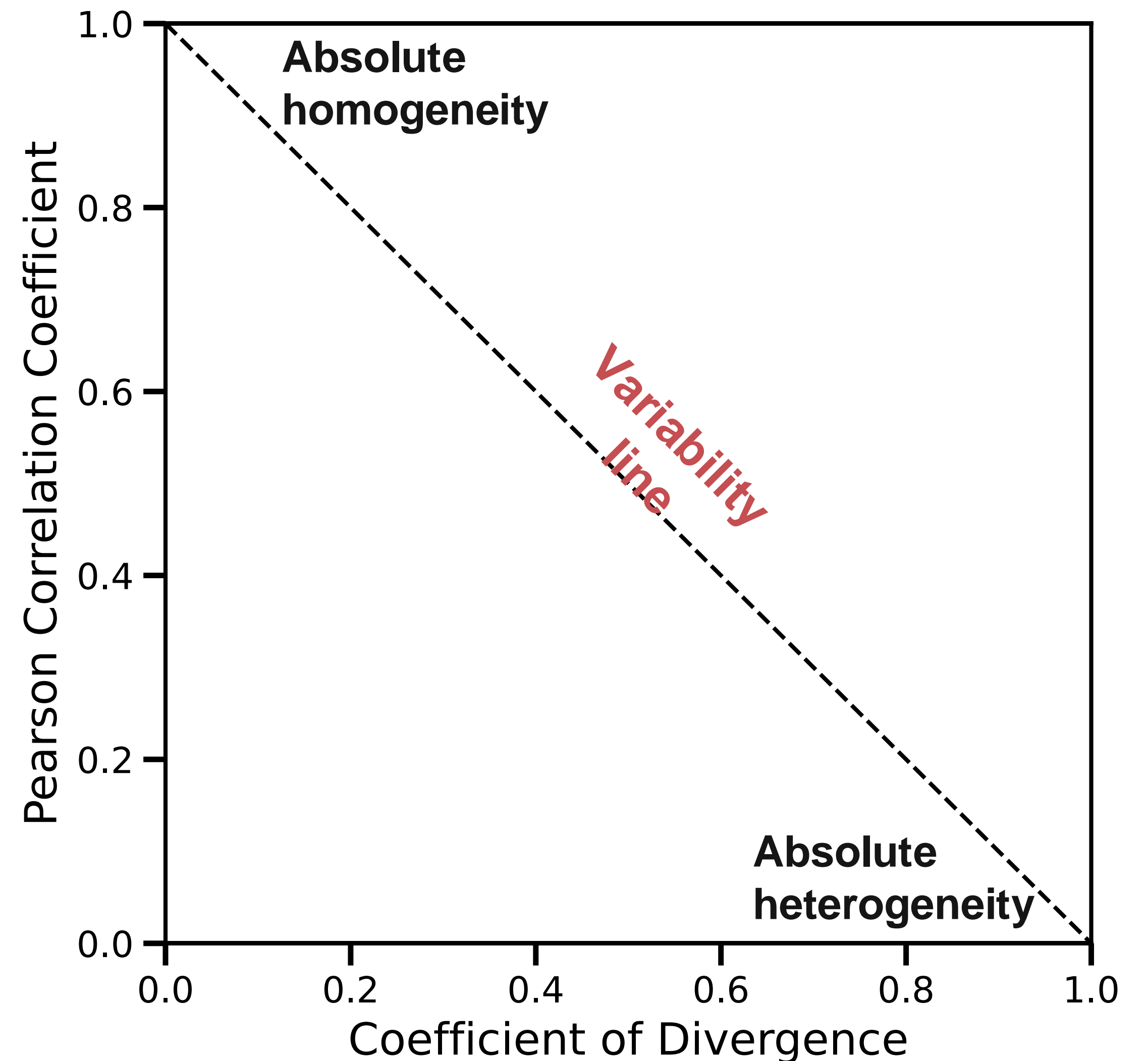
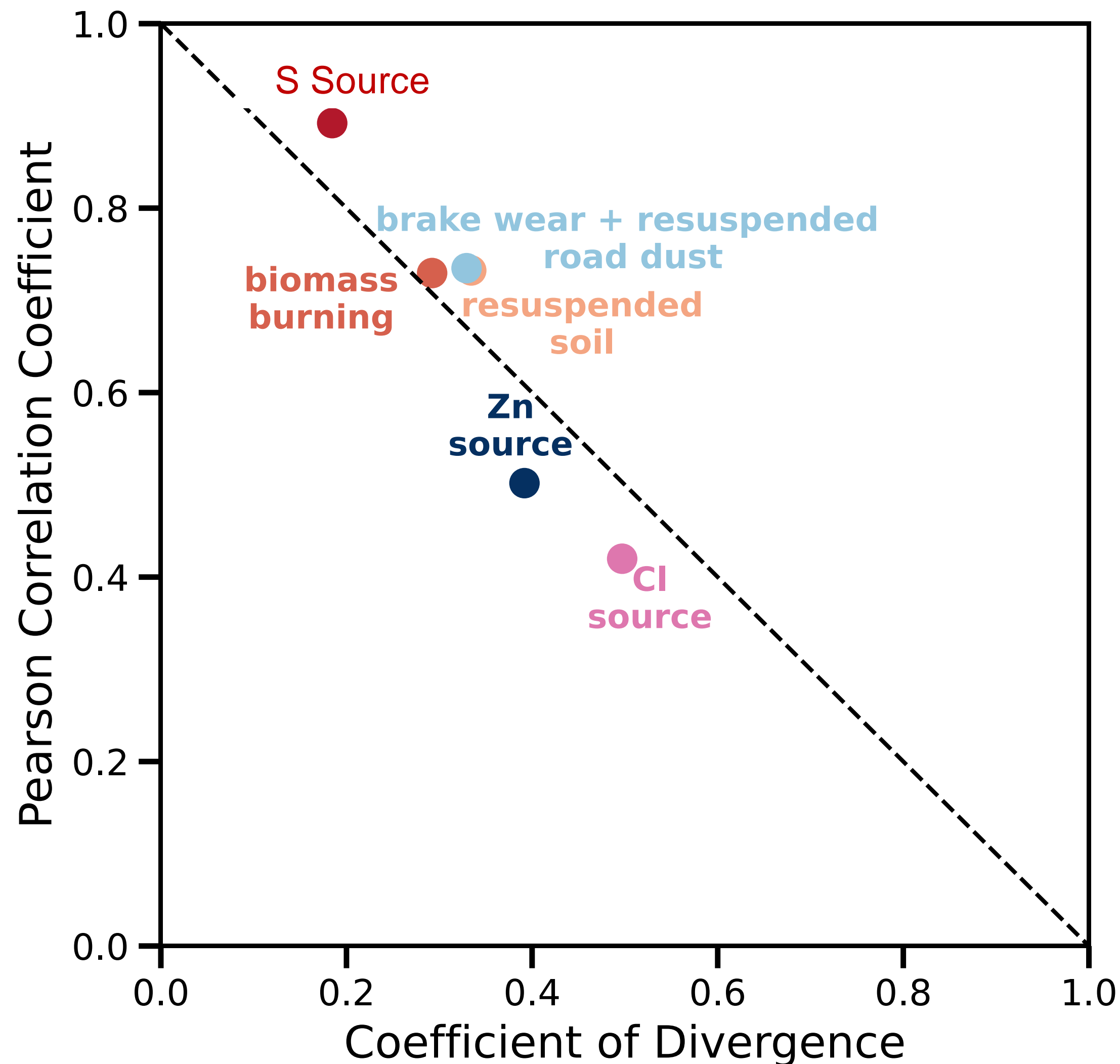
Weekday vs weekend



# Regional vs local effects

Comparing contributing sources in Pico Rivera and Rubidoux

$$\text{COD}_{jk} = \sqrt{\frac{1}{n} \sum_{i=1}^n \left( \frac{x_{ij} - x_{ik}}{x_{ij} + x_{ik}} \right)^2}$$



# Takeaways

- Measured and explored **yearlong  $\text{PM}_{2.5}$  elements & metals in Los Angeles**
- **Identified 6 sources:** S source, biomass burning, resuspended soil, Cl source, Zn source, brake wear and resuspended road dust
- **Compared** results from two urban sites (**Pico Rivera and Rubidoux**) and found almost identical source profiles
- While elements and metals have been generally considered as highly localized, with  **$\text{PM}_{2.5}$  elements** that are more **homogeneously mixed we can identify regional sources as well.**