Temporal Patterns in NO_x Emissions from Diesel Engines

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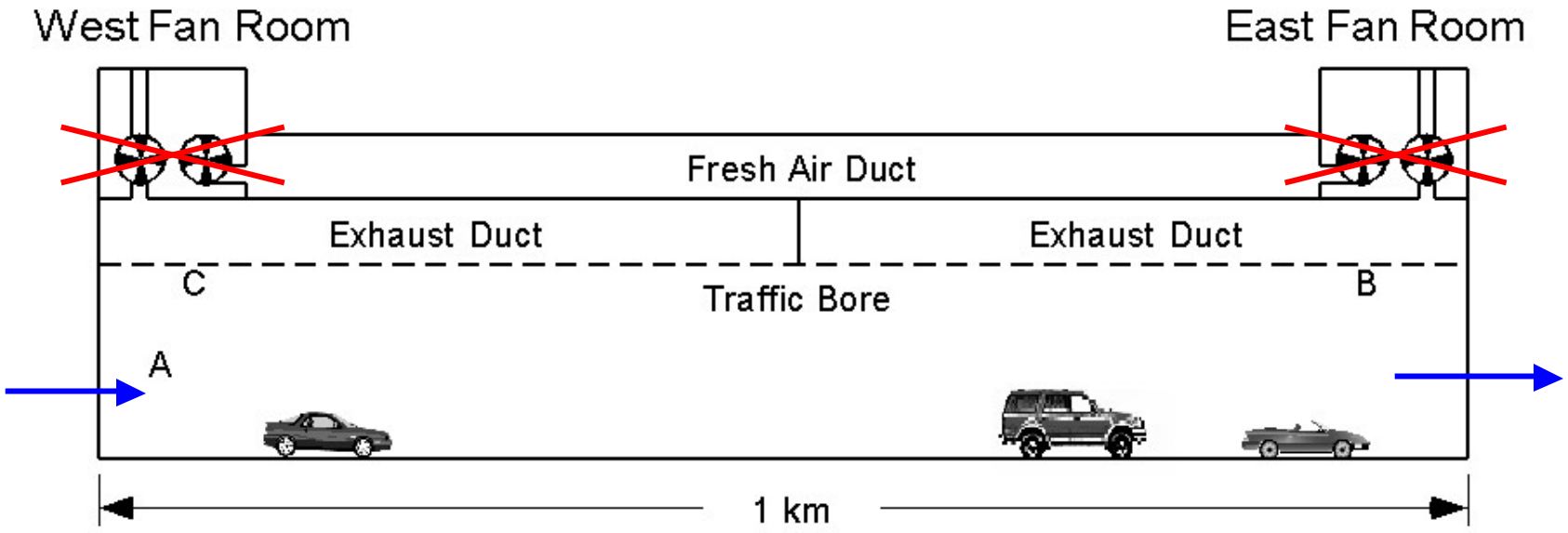
Outline

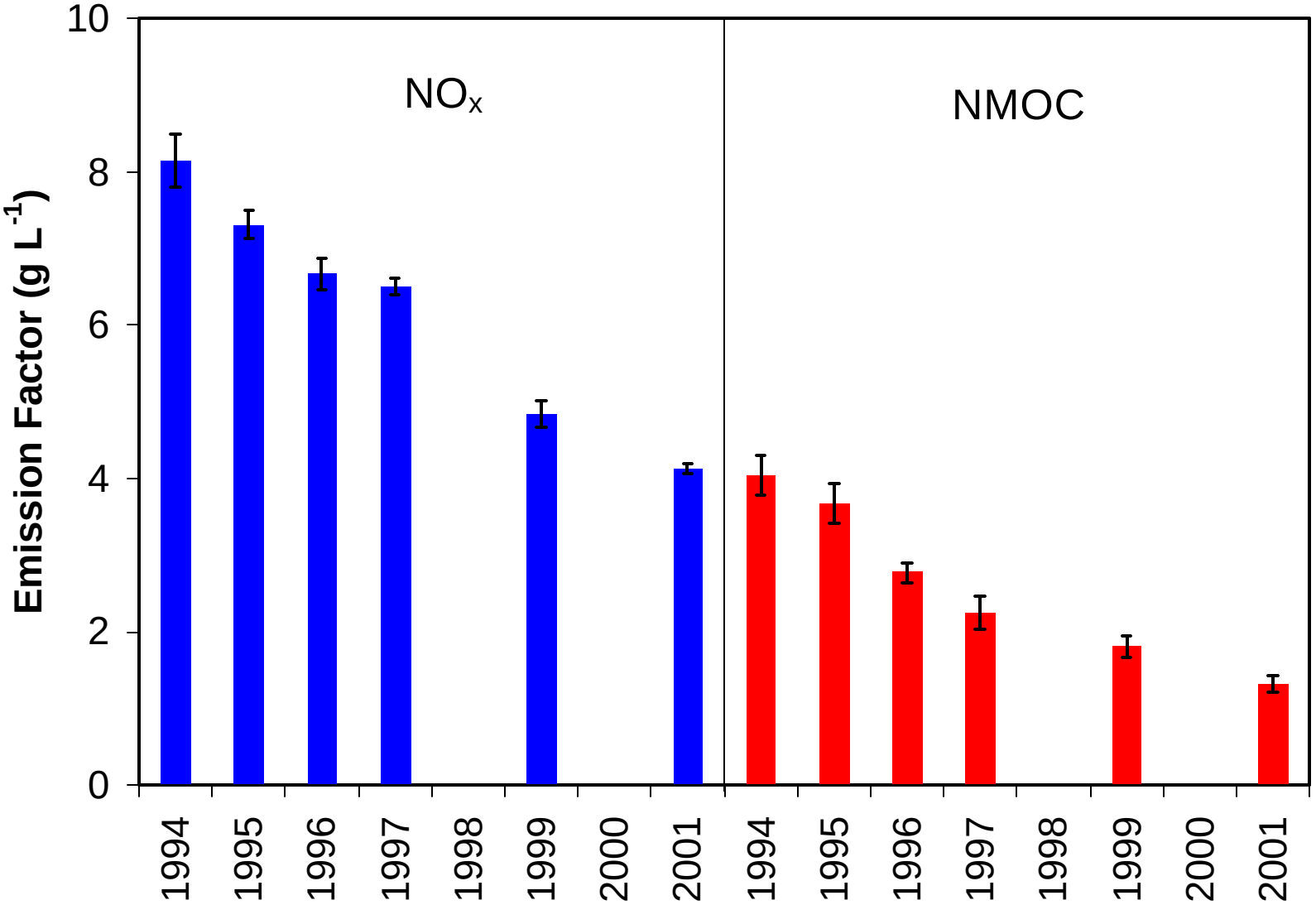
- Light-duty vehicle emissions
- Heavy-duty diesel truck emissions
- Temporal patterns
  - » decadal
  - » weekly
  - » diurnal

Caldecott Tunnel Sampling Site

- 3 tunnel bores, 2 lanes each, 4% grade
- Measurements from middle bore where heavy diesel trucks are not allowed

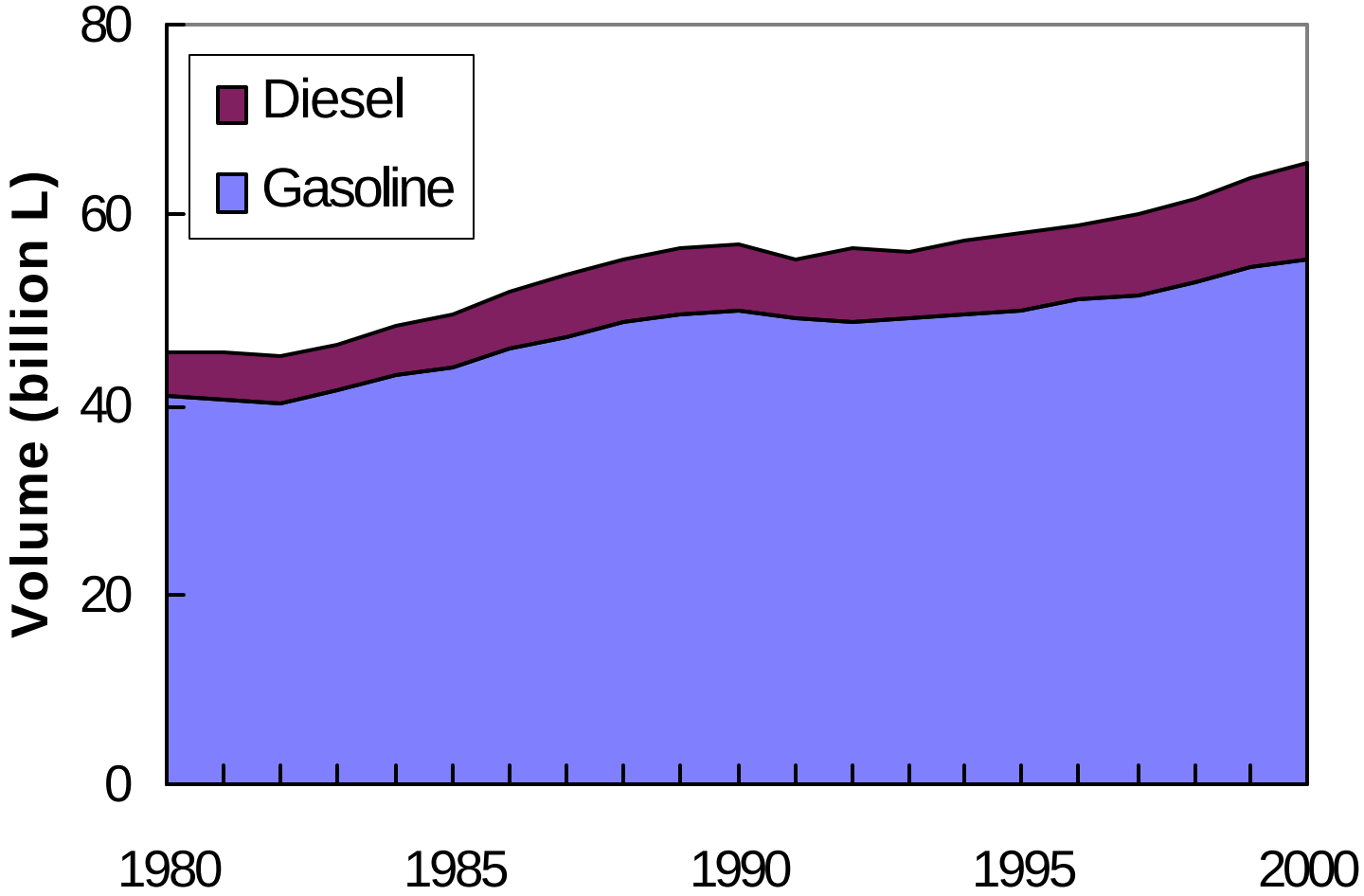


Emission Factor Trends

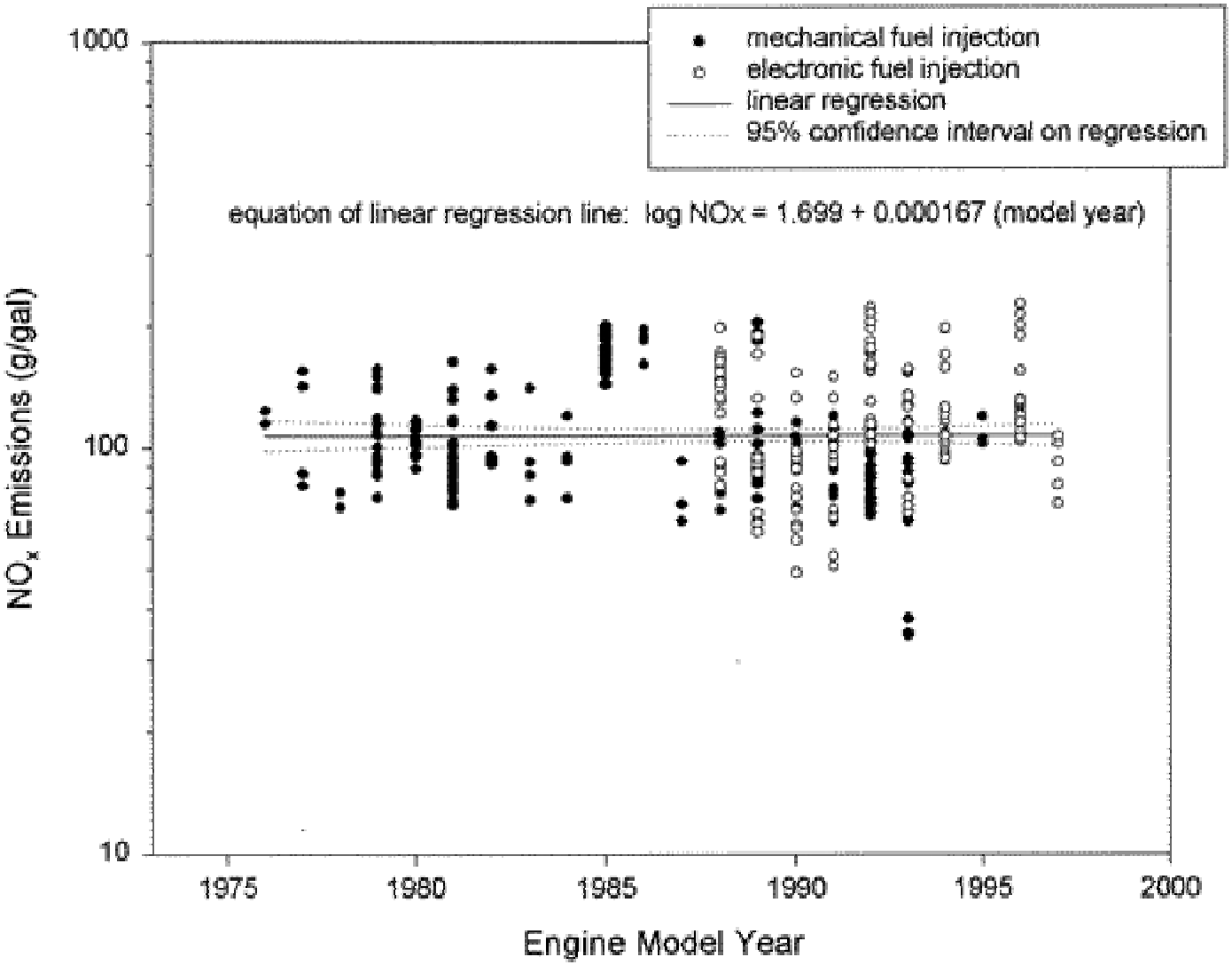


California Fuel Sales

(sales for on-road use only)



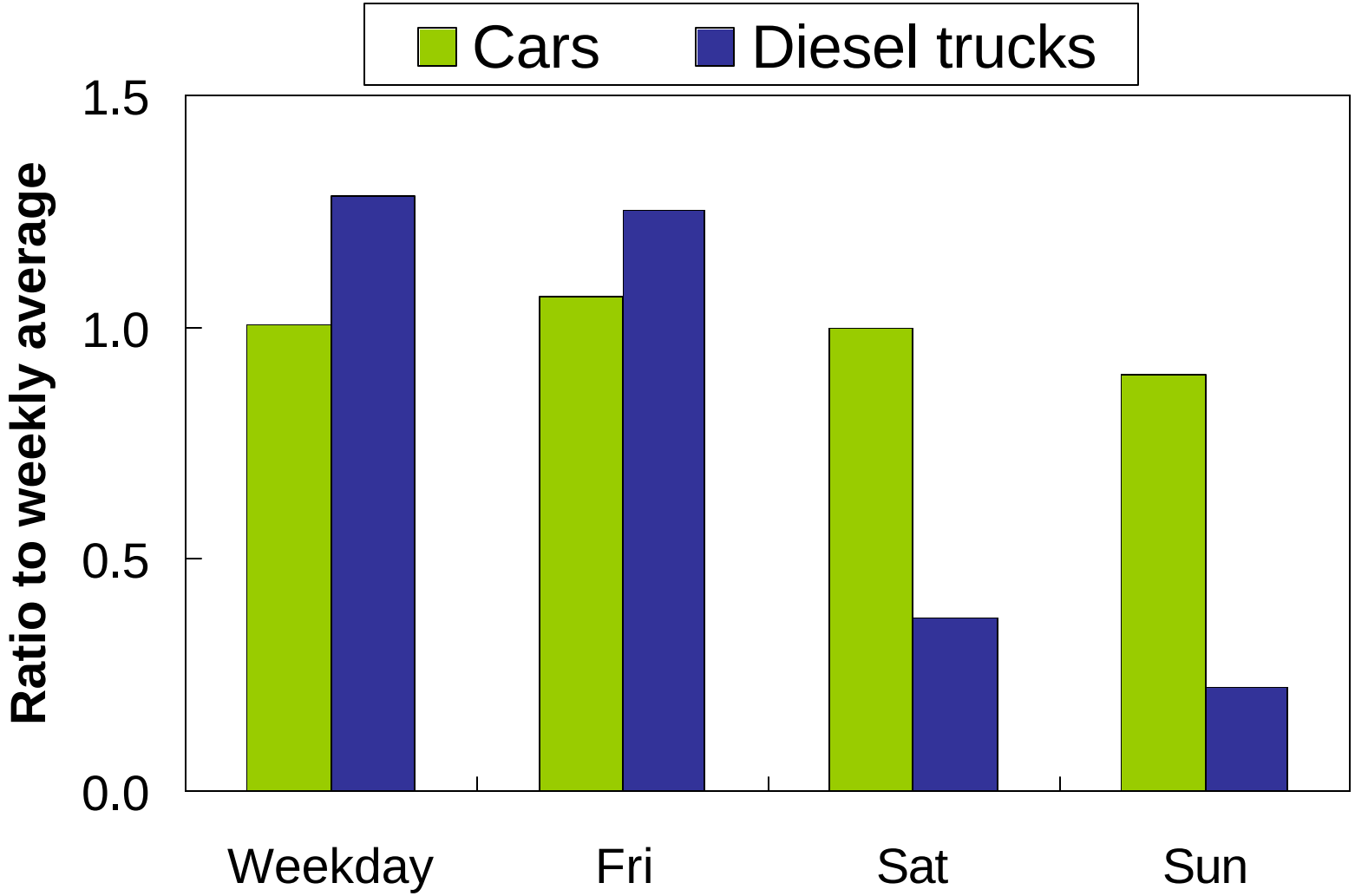
Diesel NO_x Emissions



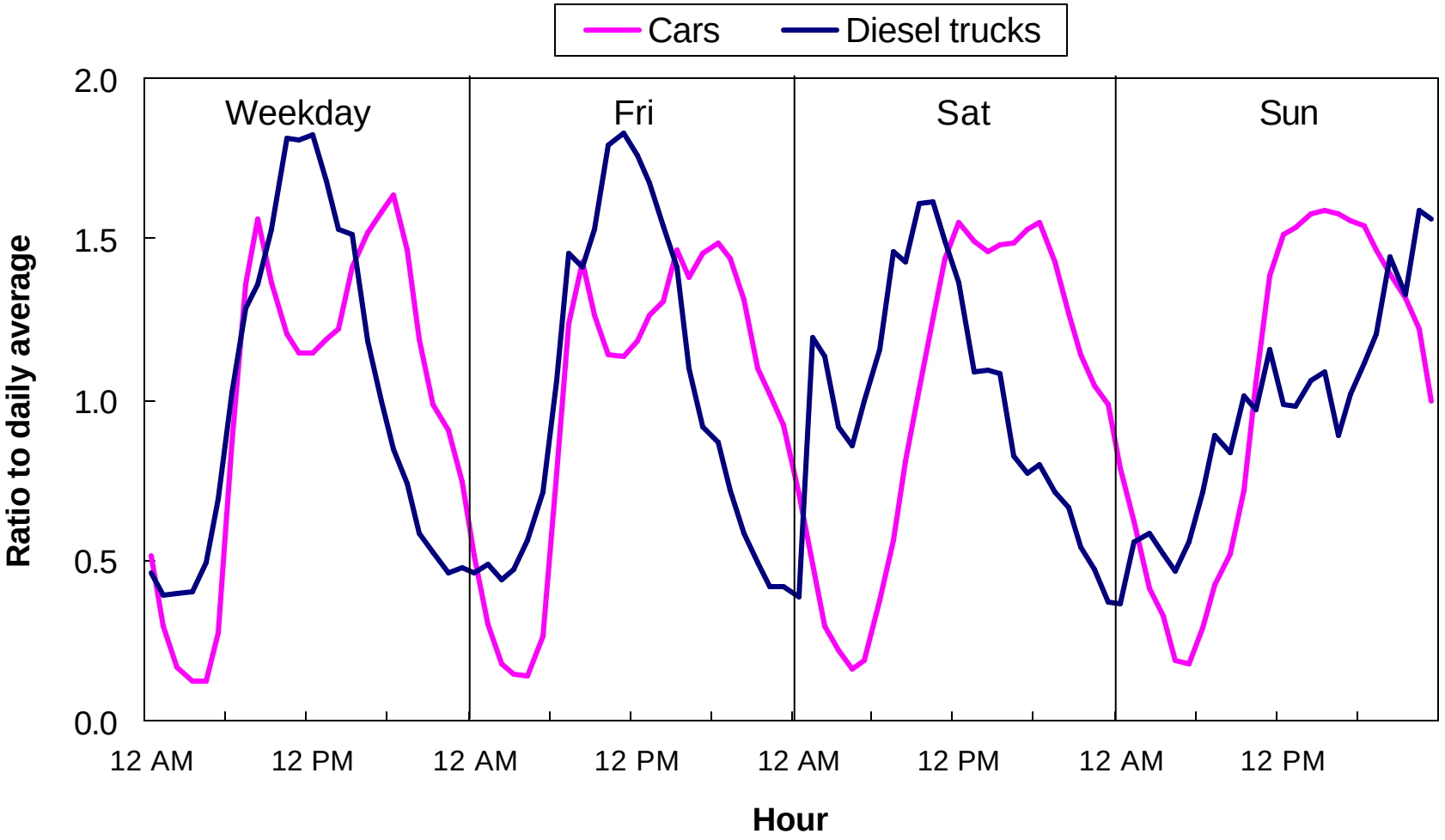
Weigh in Motion

- Traffic counts on highways that classify vehicles by number of axles and weight
  - » vehicles with 3 or more axles are almost always heavy-duty diesel
  - » 2-axle vehicles are mostly cars and light-duty trucks (vans, pickups, SUV)

Changes in Mass Emissions



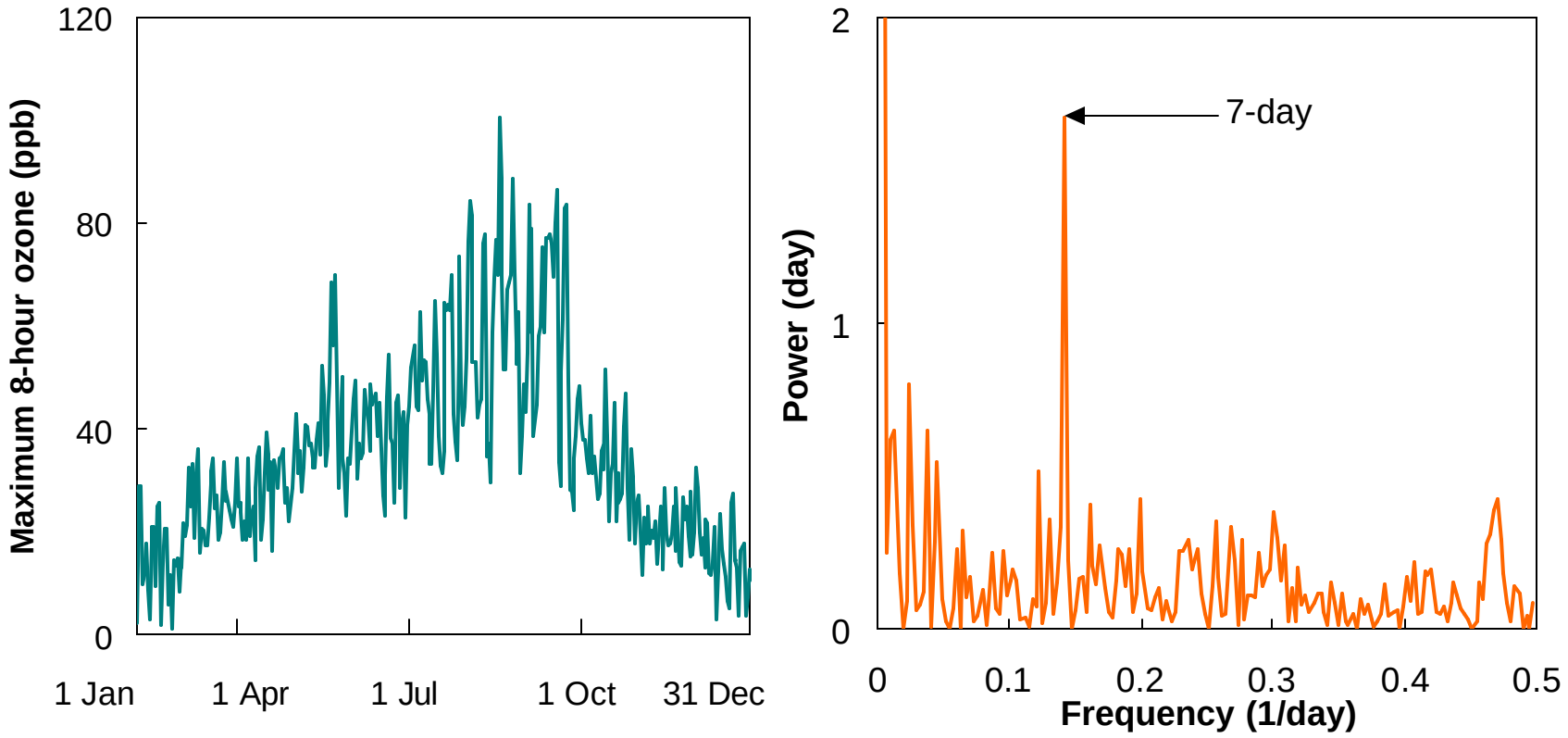
Changes in Emission Timing



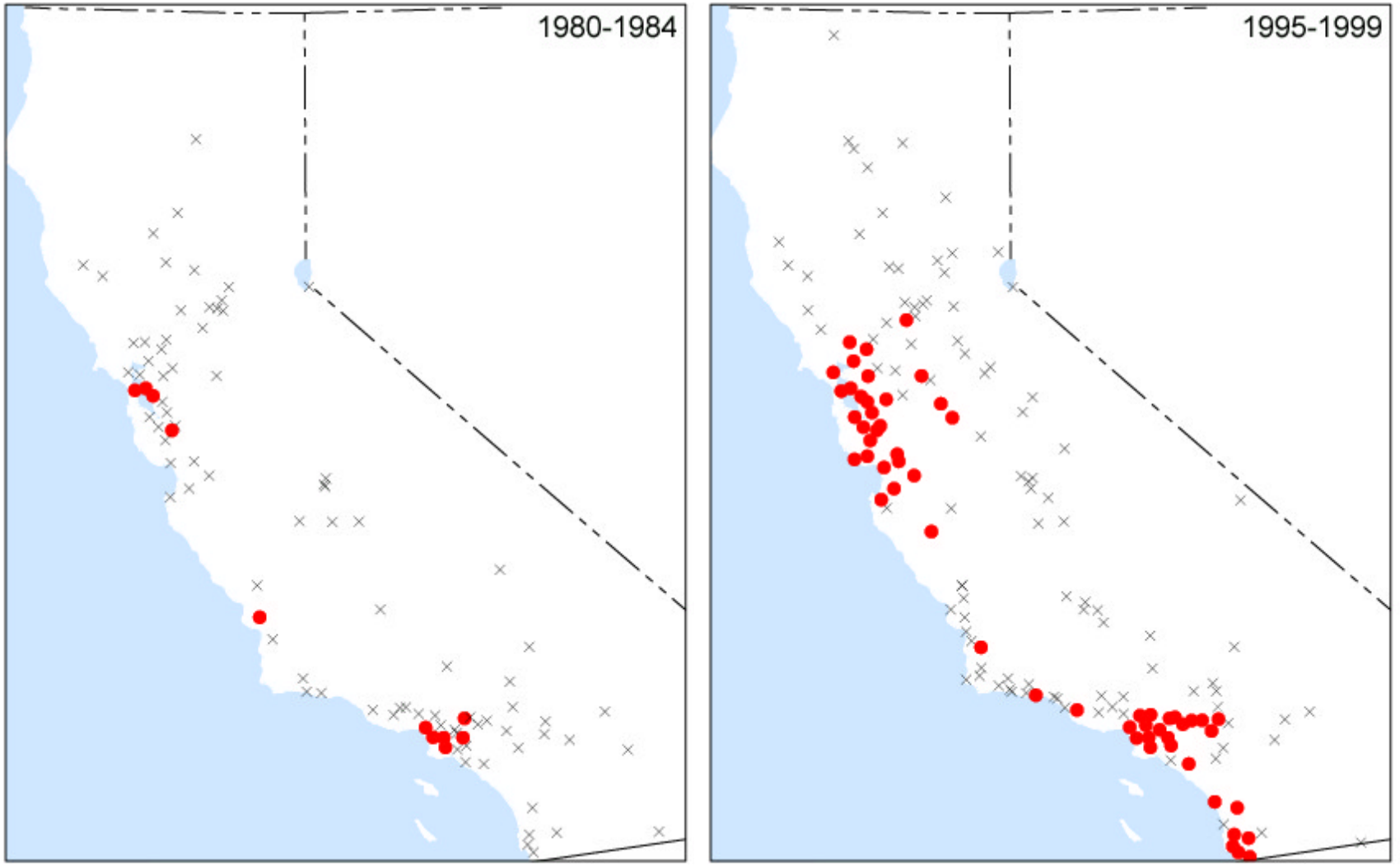
Weekend Ozone Hypotheses

- Higher VOC emissions (e.g., garden and recreational equipment, barbeques)
- Lower NO_x emissions (industry, power plants, diesel vehicles)
- Altered emissions timing/spatial pattern
- Increased photolysis rates (less soot)
- Carryover of previous day's pollutants

Spectral Analysis



Sites with Higher Weekend O_3



Conclusions

- Diesels now responsible for about half of all on-road NO_x emissions in California
- Progress in reducing NO_x from LDV has been offset by increased NO_x from diesels
- Assuming HD diesels comprise a fixed percentage of total vehicle travel is wrong on diurnal, weekly, and decadal time scales
- Increasing diesel NO_x consistent with spread of observed weekend O_3 effect (other hypotheses can't explain spread of effect in California over last 20 years)

Recommendations

- Improve representation of diesel truck traffic in emission inventories
  - » weigh-in-motion count data
  - » develop freight demand models
- Ensure sum of on- and off-road diesel use matches total fuel production
  - » applaud EPA's planned integration of on & off-road diesel engines in a unified emission model (MOVES)

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