

# **From Air Pollution to Climate Change: The Role of Particles in our Lives**

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# Questions

- How do small ( $10^{-6}$  m diameter) particular matter suspended in the atmosphere affect our daily lives?
- **What do we know about the health impacts of high concentrations of aerosol particles?**
- How do aerosols affect the amount of rain in a region?
- Can small particles affect the long-term weather (climate) of a region such as North Dakota?

**Image by Fred Remer  
(Atmospheric Sciences Department)**



**June 30, 2015 over North Dakota**

# Air Quality Index (AQI)

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>...air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 - 50	Good	Green
51 - 100	Moderate	Yellow
101 - 150	Unhealthy for Sensitive Groups	Orange
151 - 200	Unhealthy	Red
201 - 300	Very Unhealthy	Purple
301 - 500	Hazardous	Maroon

# **Air Quality Health Effects**

**Each 10  $\mu\text{g}/\text{m}^3$  elevation in fine particulate air pollution was associated with:**

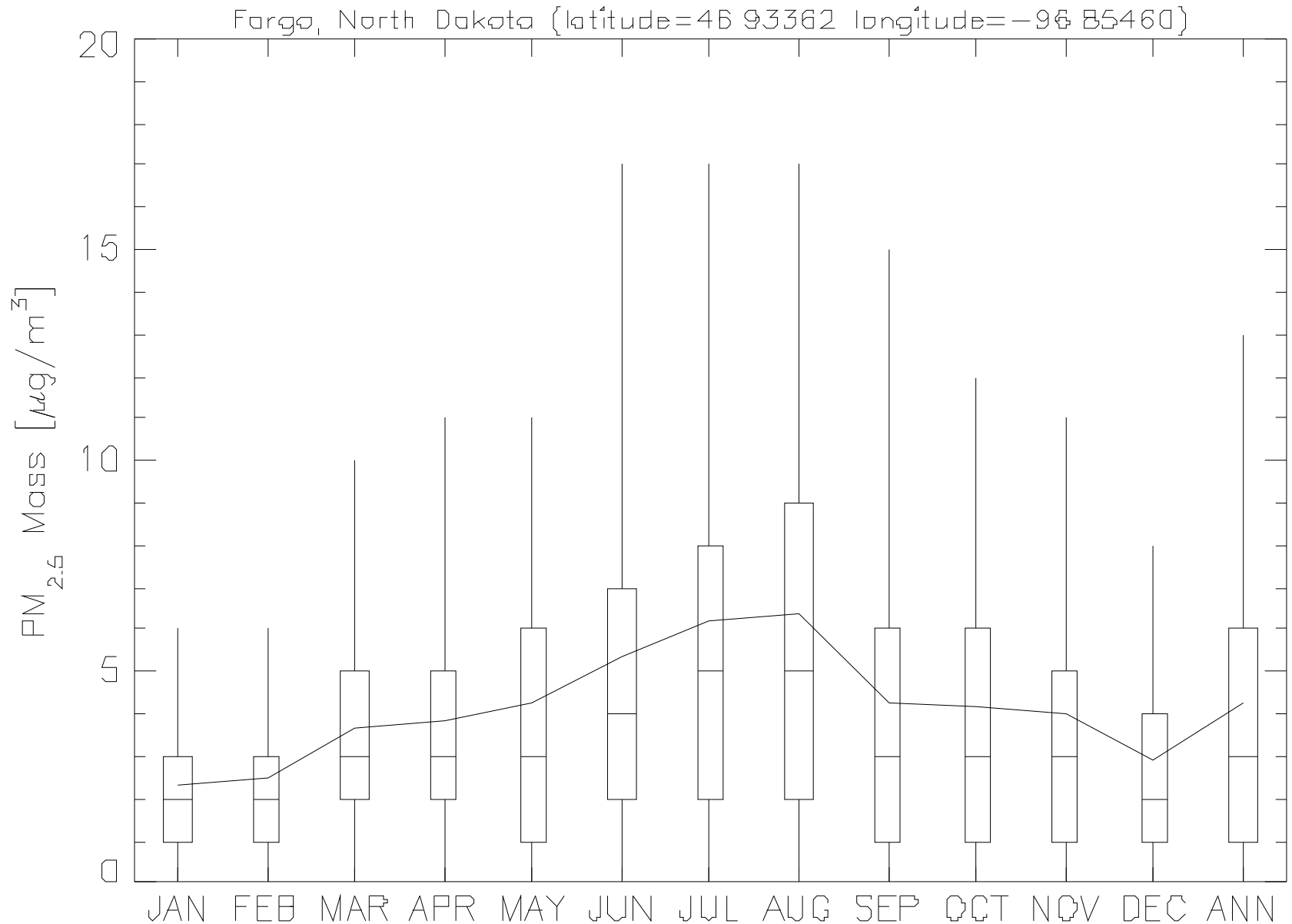
**4 % increased all cause morality**

**6% increased cardiopulmonary mortality**

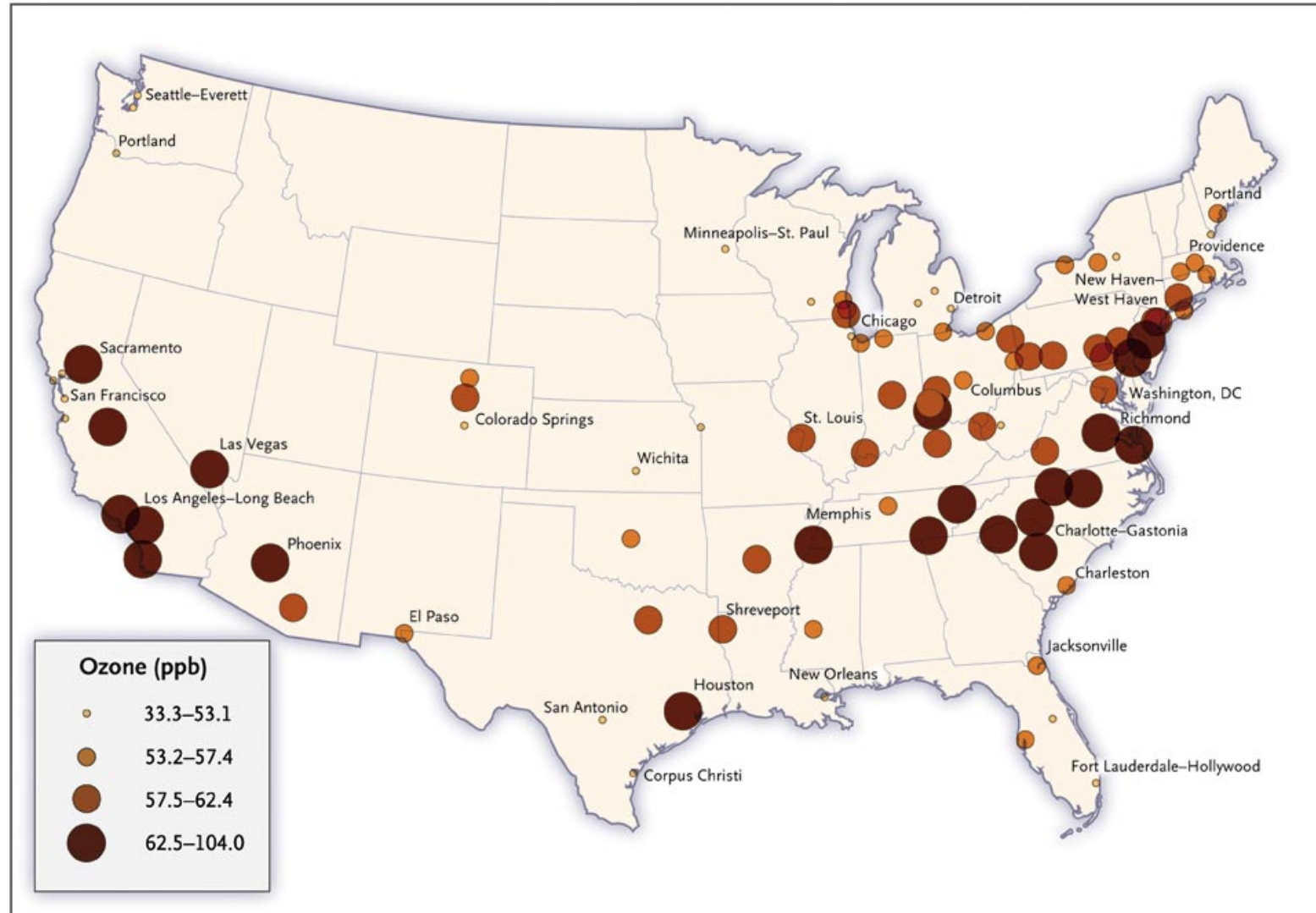
**8% increased risk lung cancer mortality**

**Source: Pope et al., 2002 JAMA, 287: 1132-1141**

# Fargo Air Quality Station 2000-2003



# Ozone Concentrations in the 96 Metropolitan Statistical Areas in Which Members of the American Cancer Society Cohort Resided in 1982



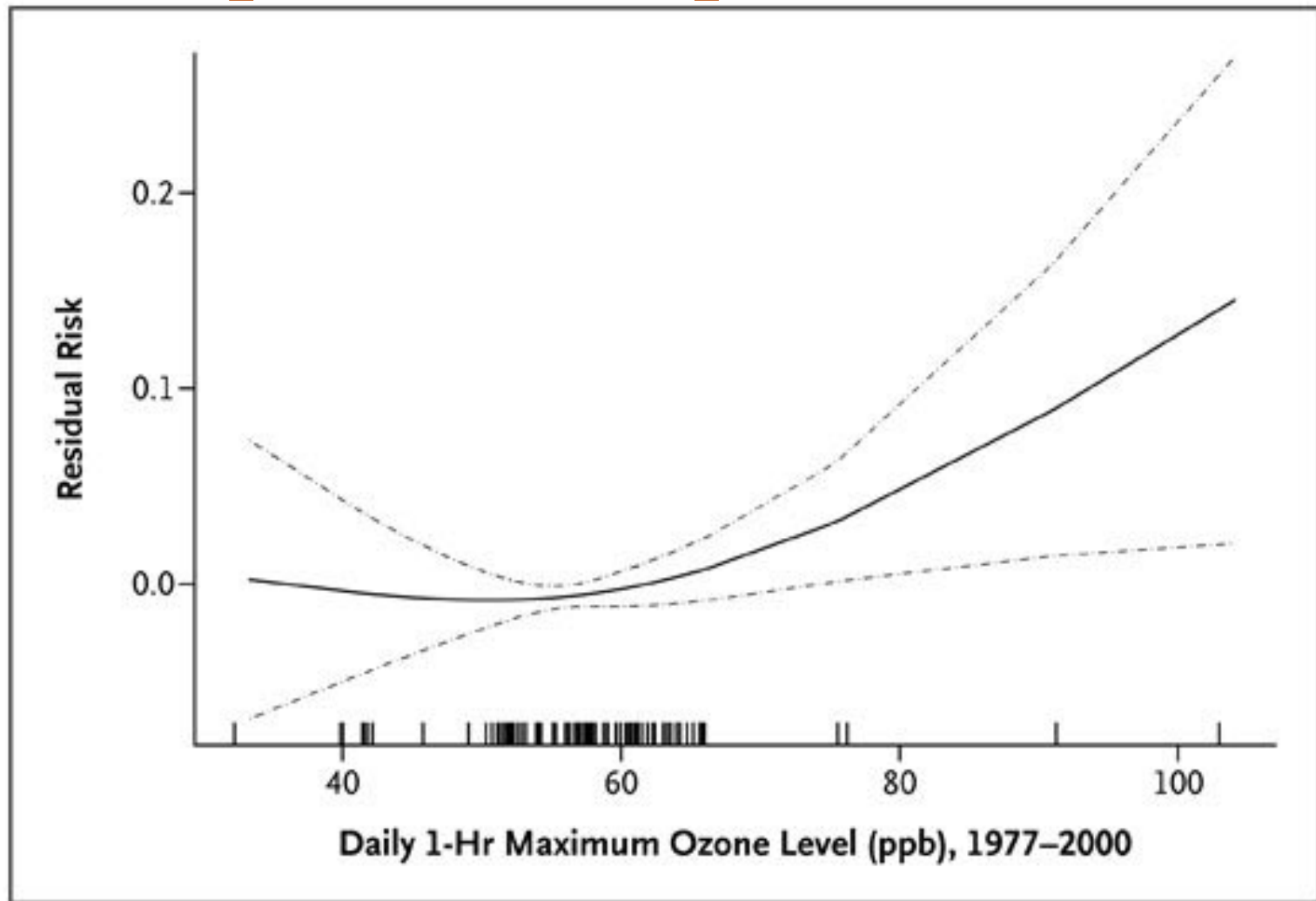
Jerrett M et al. N Engl J Med 2009;360:1085-1095

# Number of Deaths in the Entire Cohort and According to Exposure to Ozone

Cause of Death	Entire Cohort	Concentration of Ozone [ppb]			
		33.3-53.1	53.2-57.4	57.5-62.4	62.5-104.0
	N=448,850	N=126,206	N=95,740	N=106,545	N=120,359
Any Cause	118,777	32,957	25,642	27,782	32,396
Cardiopulmonary	58,775	16,328	12,621	13,544	16,282
Cardiovascular	48,884	13,605	10,657	11,280	13,342
Heart Disease	27,642	7,714	6,384	6,276	7,268
Respiratory	9,891	2,723	1,964	2,264	2,940

Jerrett M et al. N Engl J Med 2009;360:1085-1095

# Exposure-Response Curve



The curve is based on a natural spline with 2 df estimated from the residual relative risk of death within a metropolitan statistical area (MSA) according to a random effects survival model. The dashed lines indicate the 95% confidence interval of fit, and the hash marks indicate the ozone levels of each of the 96 MSAs. Ref: Jerrett M et al. N Engl J Med 2009;360:1085-1095

# Summary

- **Fine particulate air pollution was associated with increased mortality**
- **Ozone Pollution:**
  - **Not able to detect an effect of ozone on the risk of death from cardiovascular causes when the concentration of PM<sub>2.5</sub> was taken into account.**
  - **There is a significant increase in the risk of death from respiratory causes in association with an increase in ozone.**