

Integrating Earth Observations Data Into Geospatial Databases That Support Public Health Decisions

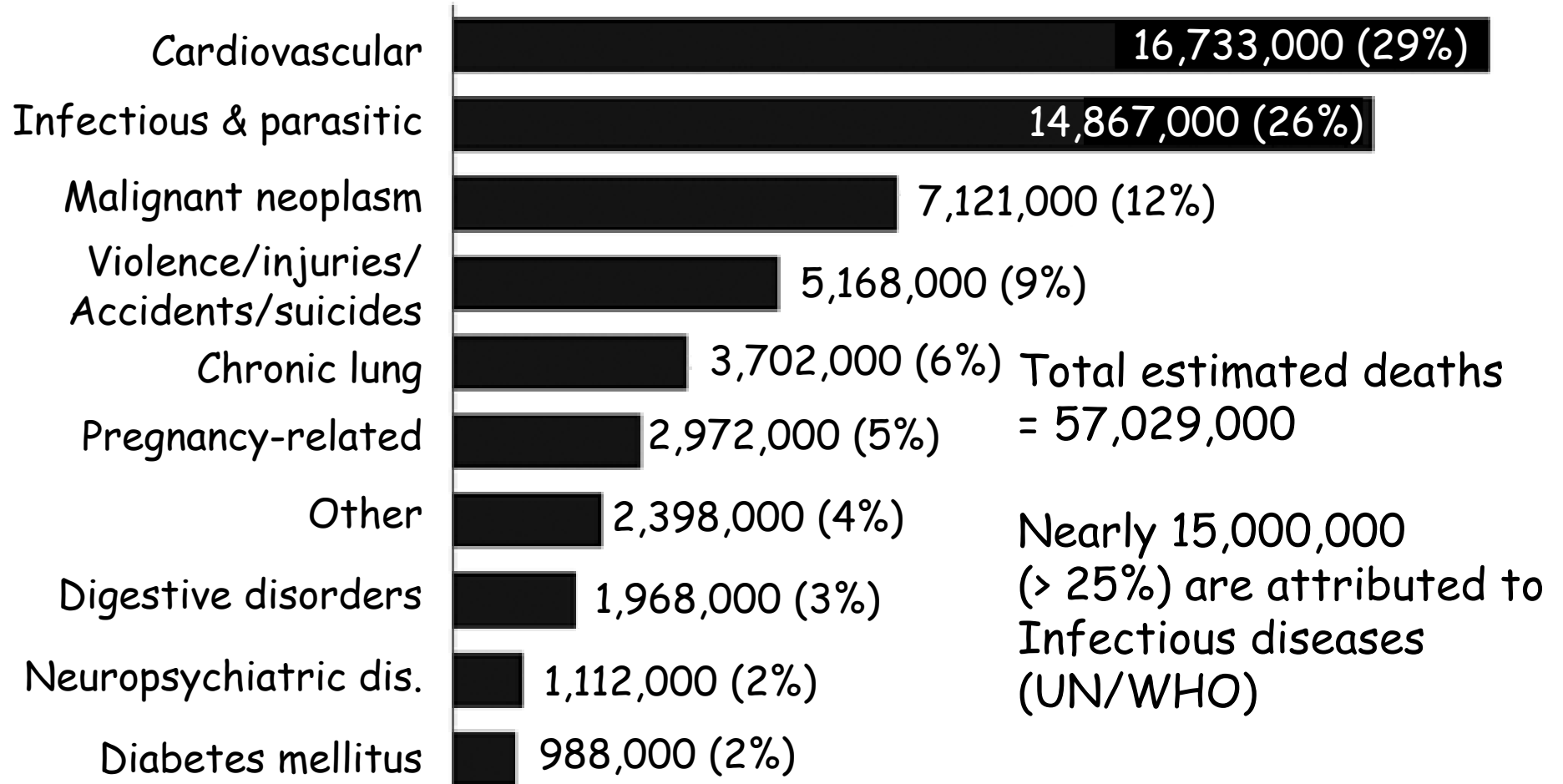
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University of New Mexico

ISPRS Commission IV Mid-term
Symposium
September 27-30, 2006
Hotel Marriott, Goa, India

Topic Outline

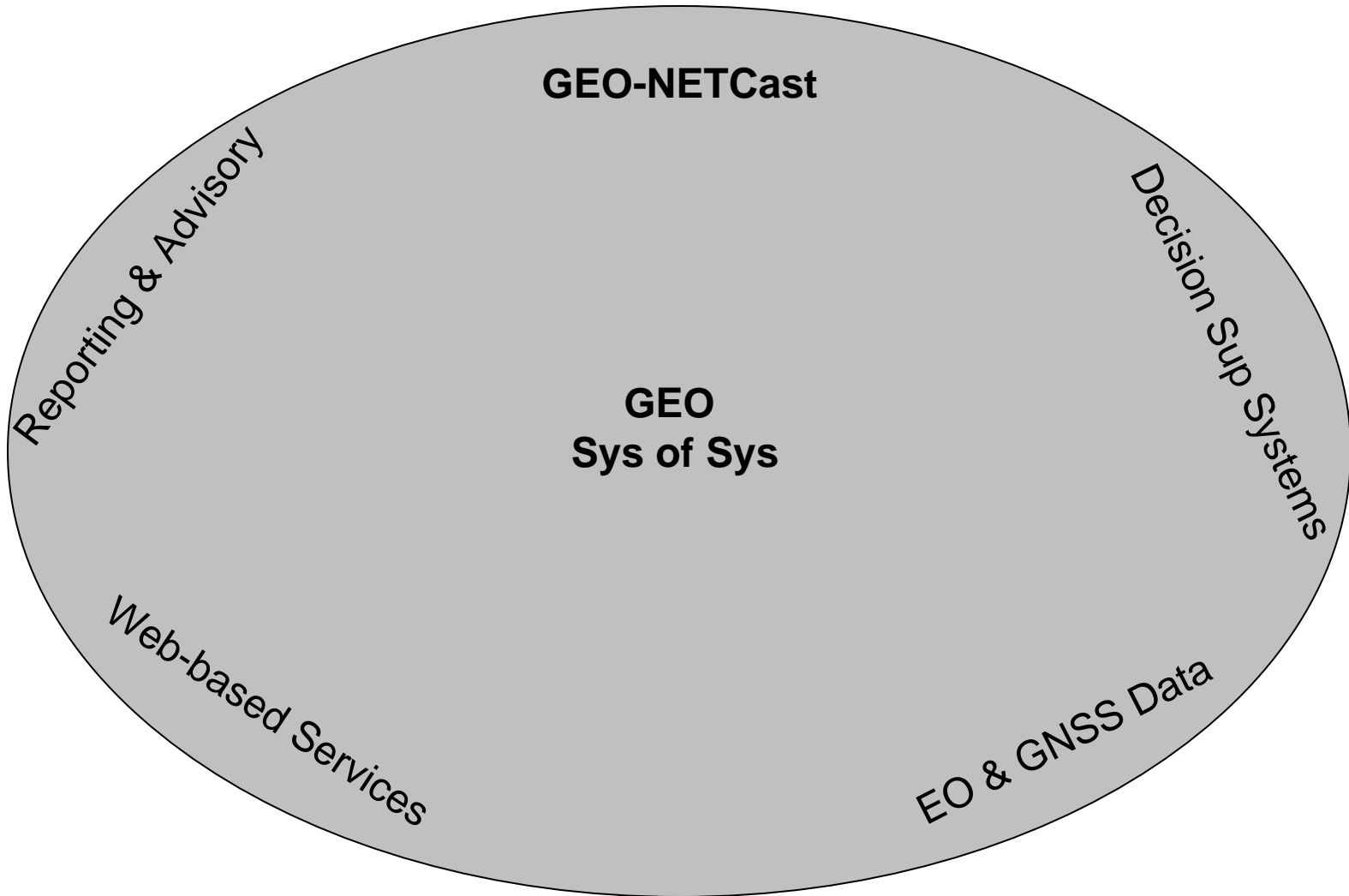
- Global Population at Risk
- Roles for Earth Observations and GIS
- Disease Surveillance & Forecasting (individual health)
- Modeling & Mitigating Epidemics (population health)
- Conclusions

Leading Causes of Death, Worldwide: Est. for 2002

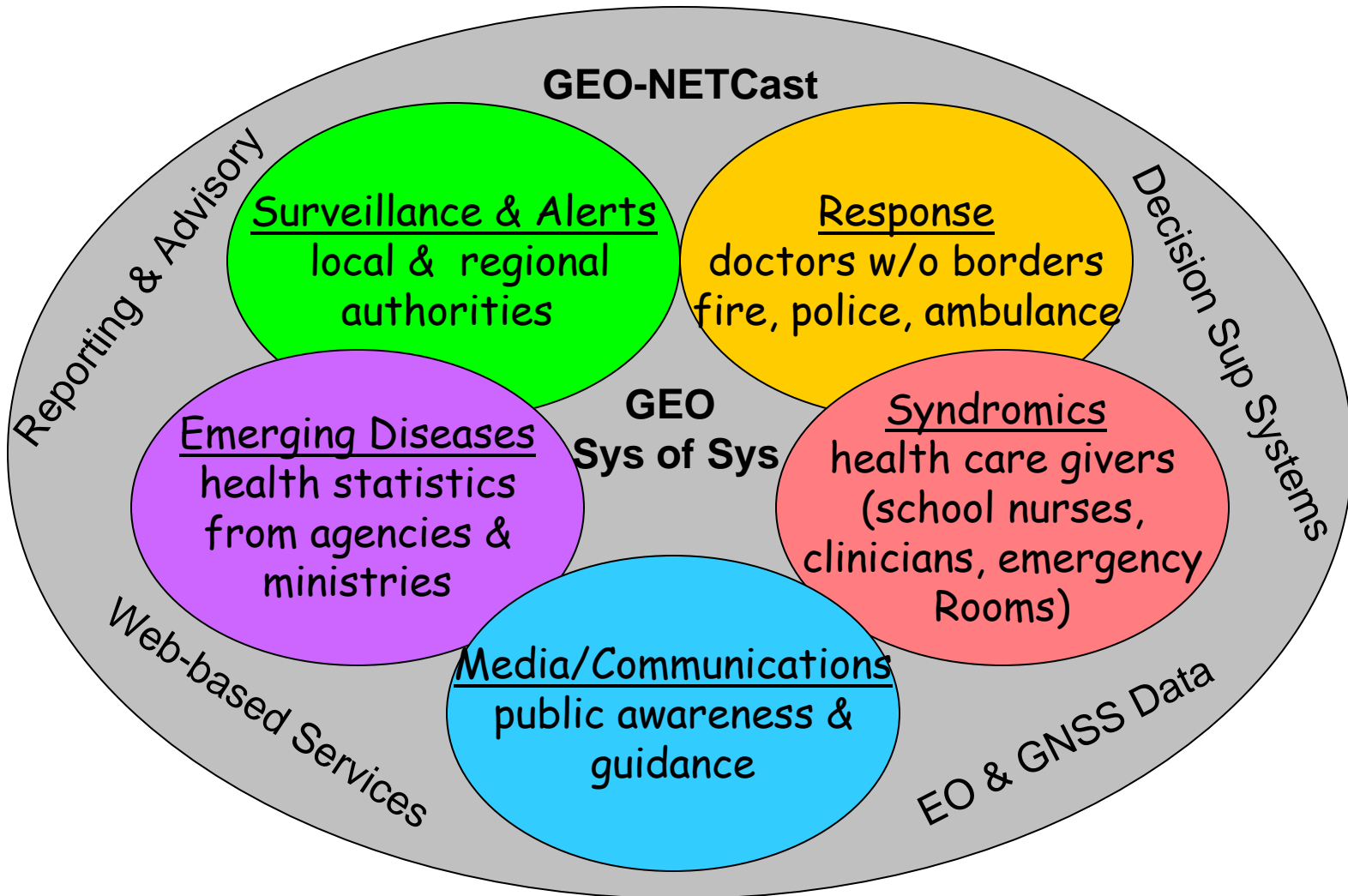


Source: Emerging Infectious Diseases, 2005
Centers for Disease Control and Prevention

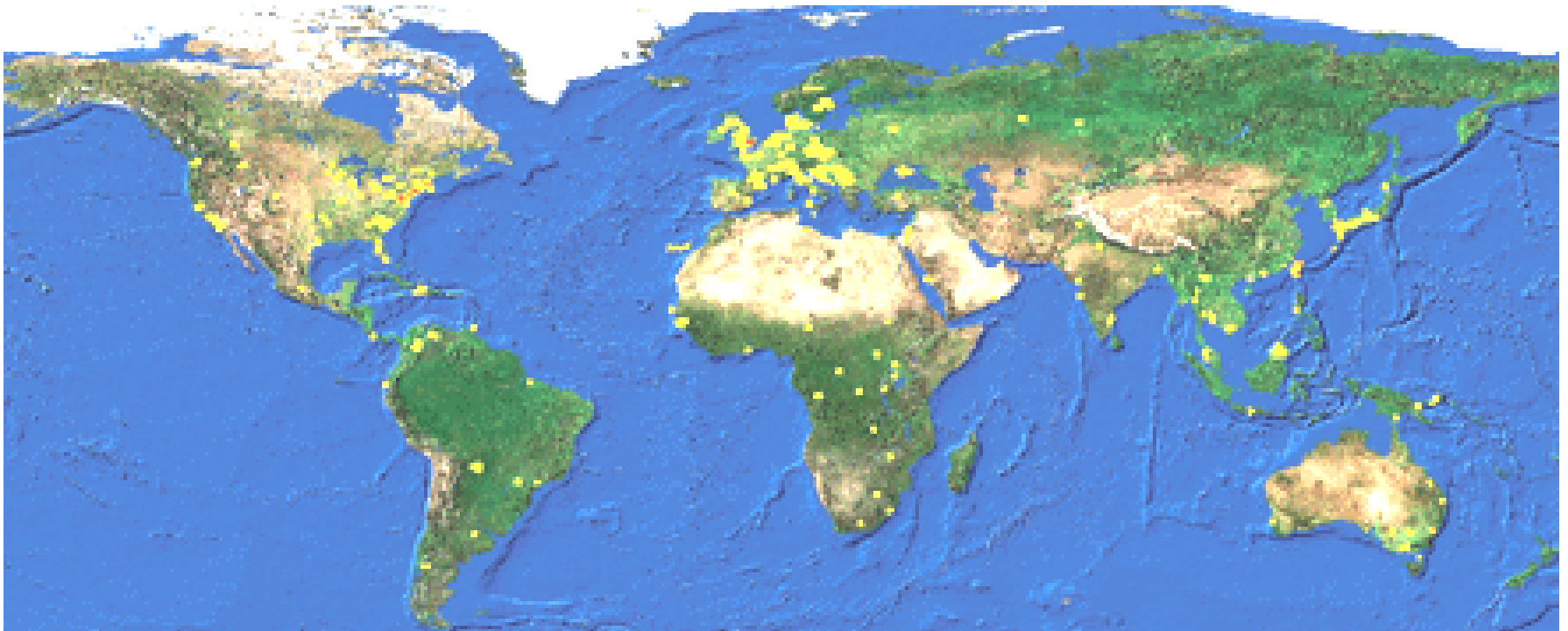
System of Systems
Societal Benefit Area = *Health*



Communities of Practice
Societal Benefit Area = *Health*

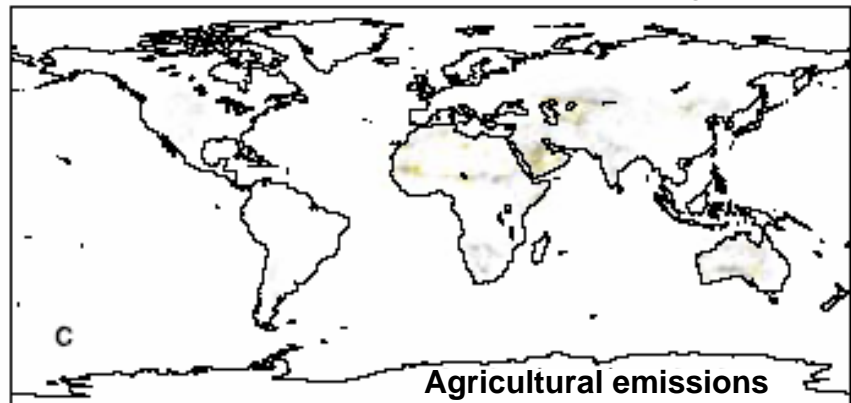
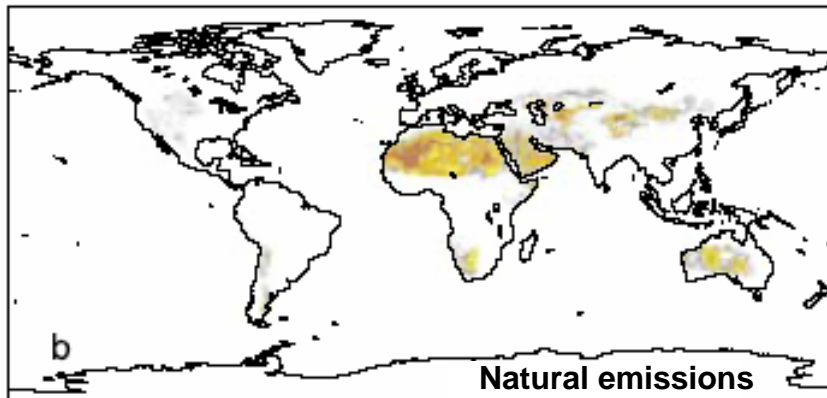
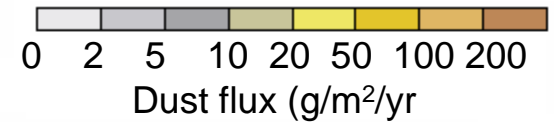
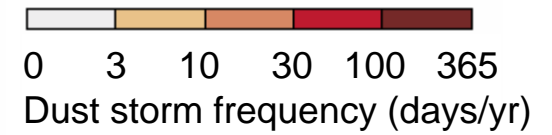
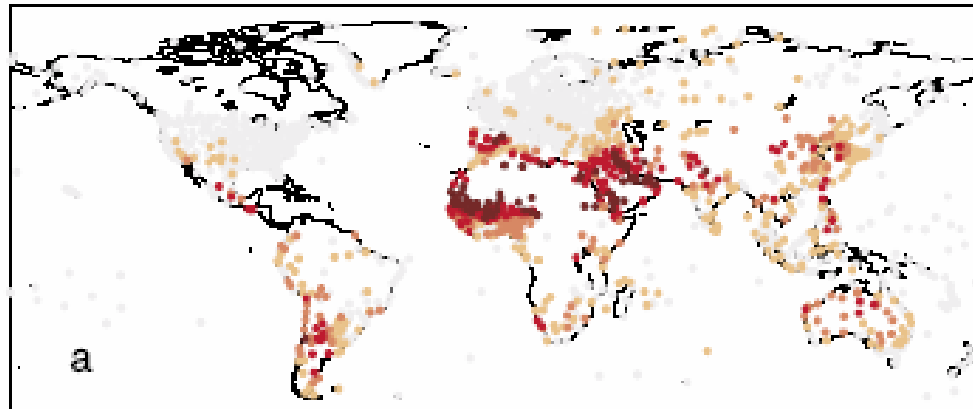


Locations of Emerging Infectious Diseases

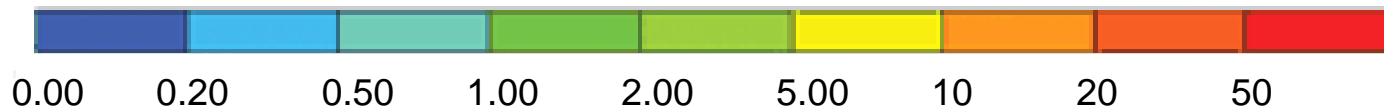
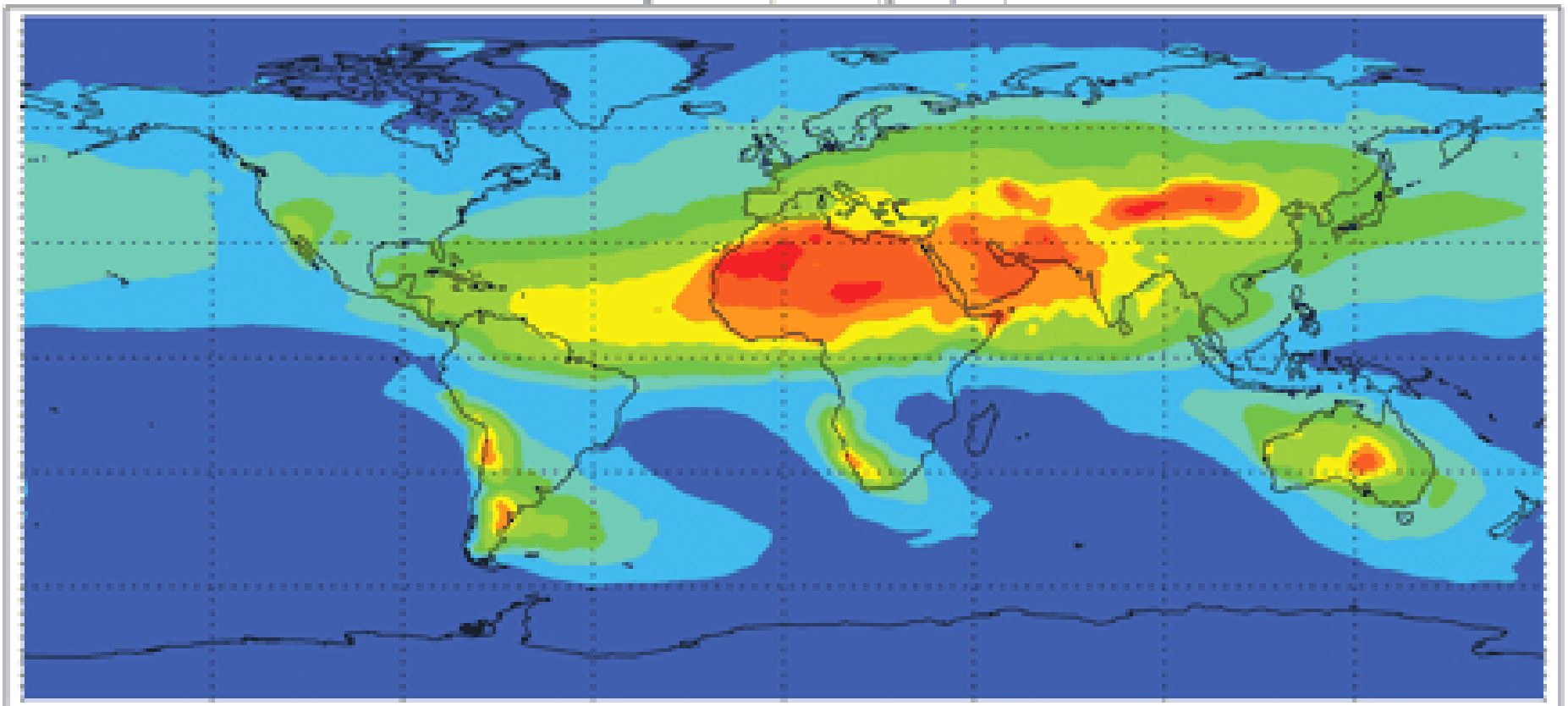


Source: U.S. Centers for Disease Control, 2005

Dust Storm Frequency And Estimated Emissions 1963-1992 (averaged)

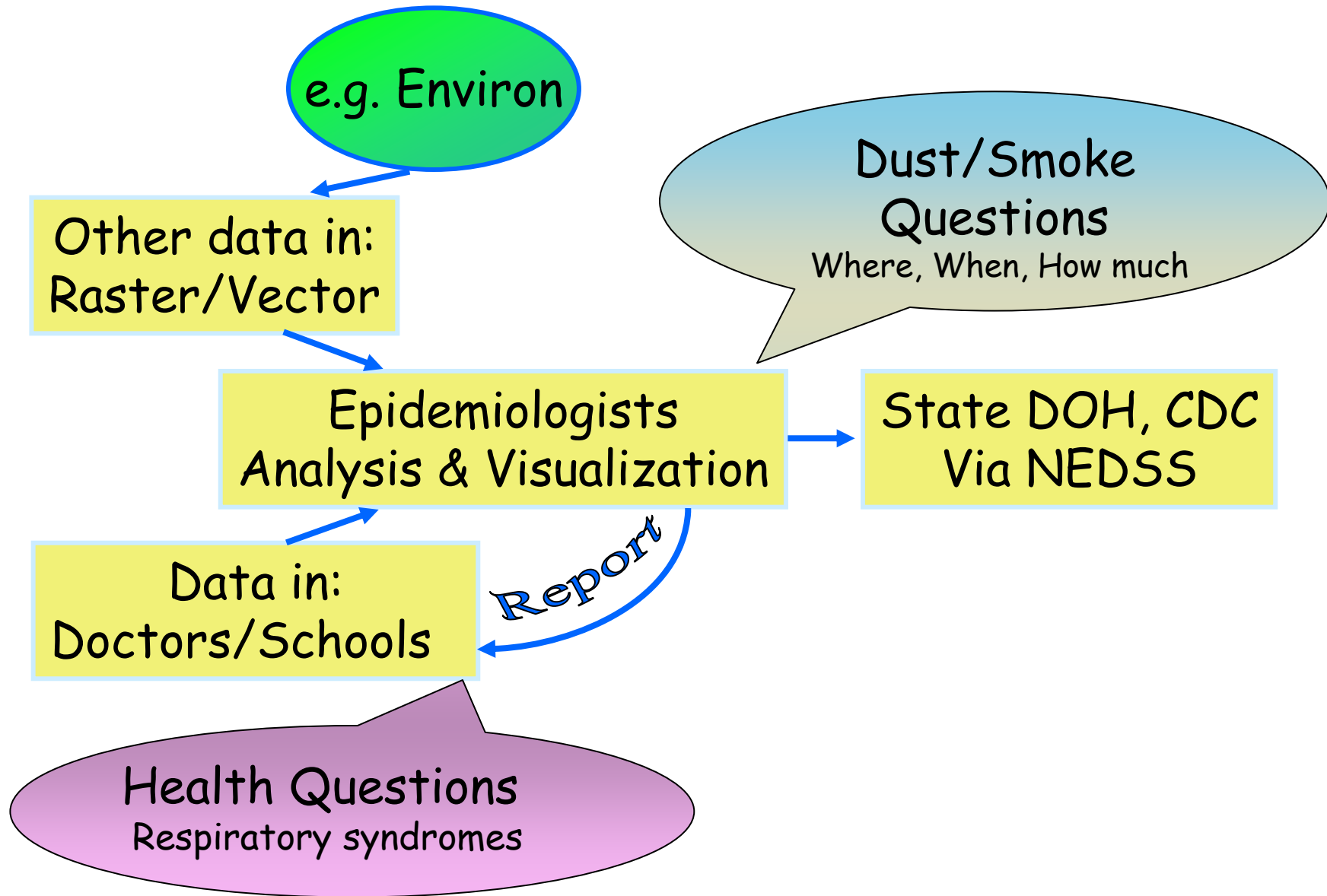


Average Dust Deposition ($\text{g}/\text{m}^2/\text{year}$)

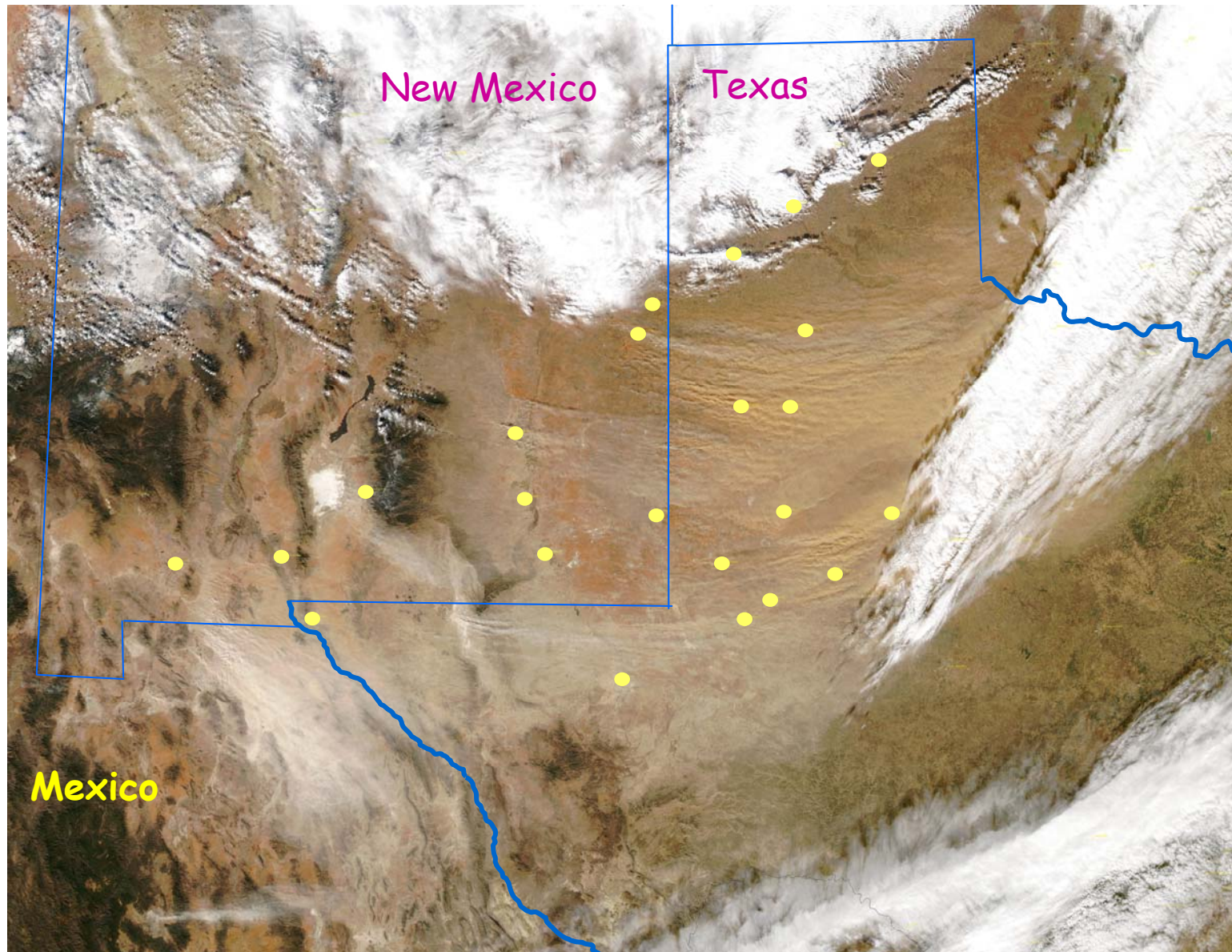


Source: *Science* 308 (1 April, 2005) p.70

General Data & Information System



New Mexico/Texas Dust Storm - Dec 2003

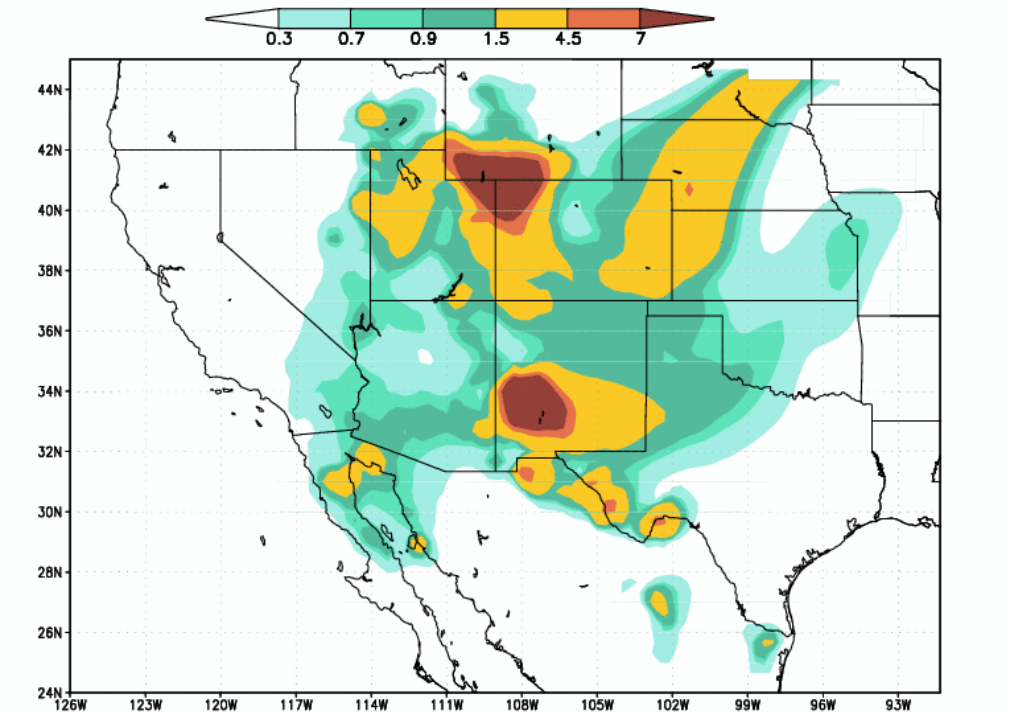


Observed Visibility vs Modeled Dust Concentrations Dec. 15-16, 2003



Texas

Continuous Air Monitoring Stations

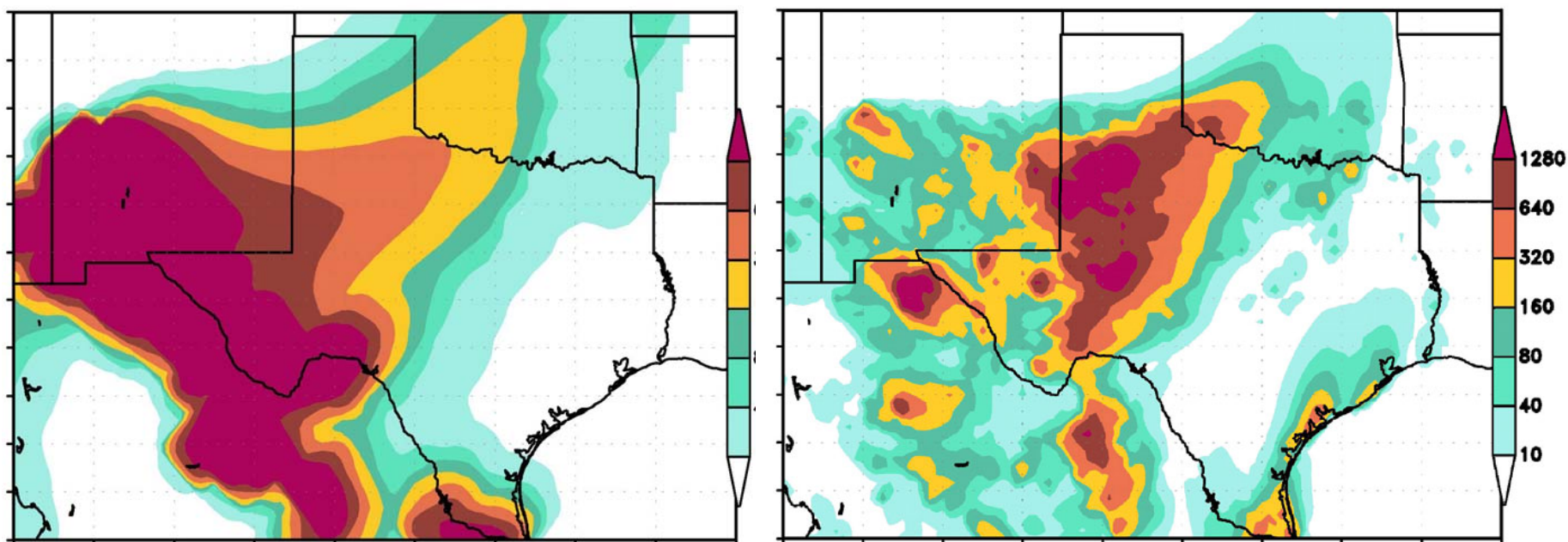


GRADS: COLA/IGES

2004-09-18-13.06

DREAM Baseline (no EO data included)

Comparison of DREAM Dust Concentrations at 20Z 15 Dec 03



Static Surface Inputs

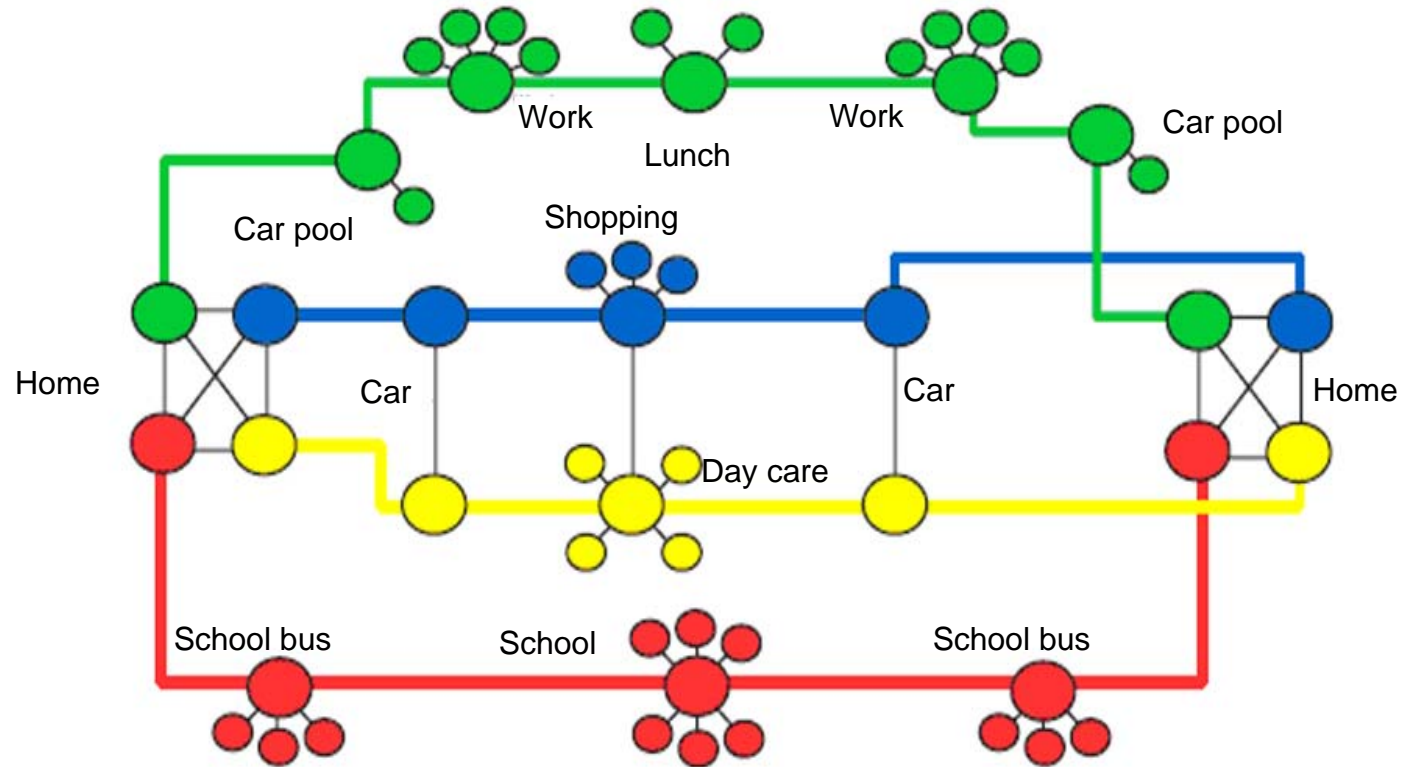
EO Surface Inputs

DREAM Performance Before & After EO Data Assimilation

Metrics	Wind Speed (m/s)	Wind Direction (°)	Temp. (K)	Definition (M: modeled; O: observed)
Mean observed	5.53	231.40	276.74	$\frac{1}{N} \sum_{i=1}^N O_i$
Mean modeled	4.65 4.37	226.60 230.38	275.56 277.48	$\frac{1}{N} \sum_{i=1}^N M_i$
Mean bias	-0.88 -1.16	-4.80 -1.02	-1.20 0.72	$\frac{1}{N} \sum_{i=1}^N (M_i - O_i)$
Mean error	1.97 2.03	51.76 47.85	4.09 2.67	$\frac{1}{N} \sum_{i=1}^N M_i - O_i $
Agreement index	0.74 0.75	0.74 0.76	0.71 0.95	$1 - \frac{\sum_{i=1}^N (M_i - O_i)^2}{\sum_{i=1}^N (M_i - \bar{O} + O_i - \bar{O})}$

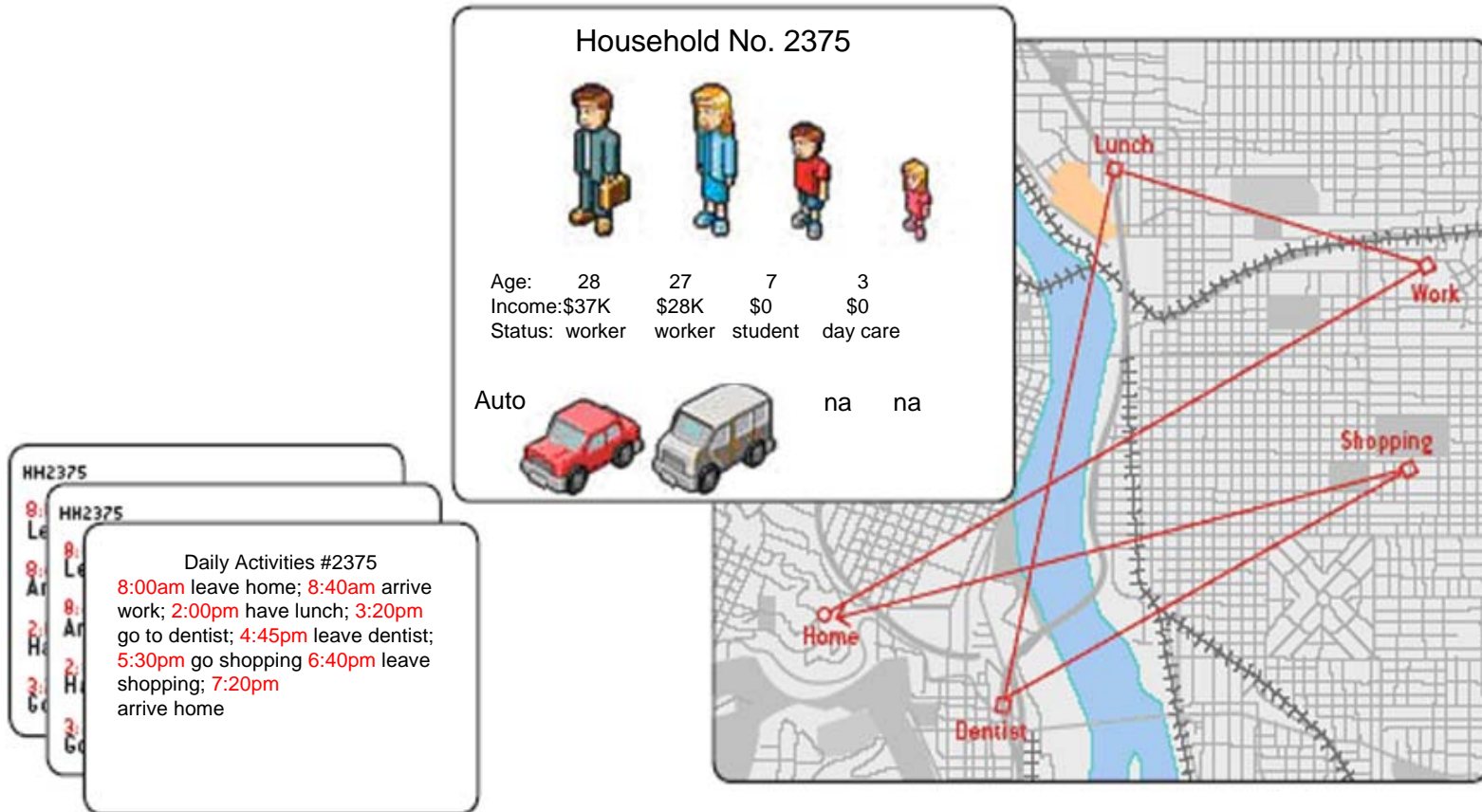
Blue values = before EO Data Assimilation
Red values = after EO Data Assimilation

One Family's Network of Daily Human Contacts

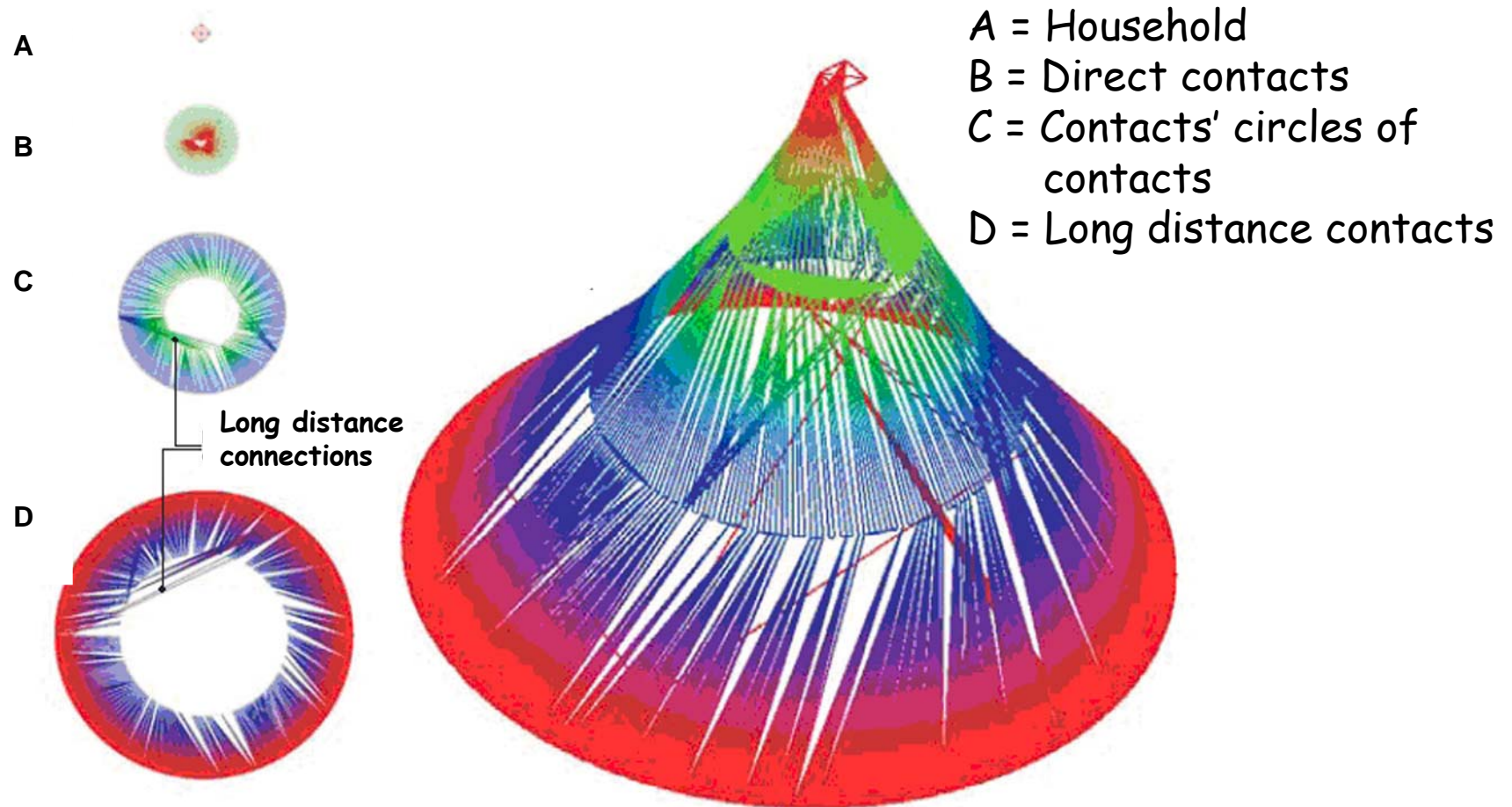


Green = father's daily contacts; **Blue** = mother's contacts;
Yellow = pre-school child's contacts; **Red** = school-aged child's contacts

Database of Family Members And Activities



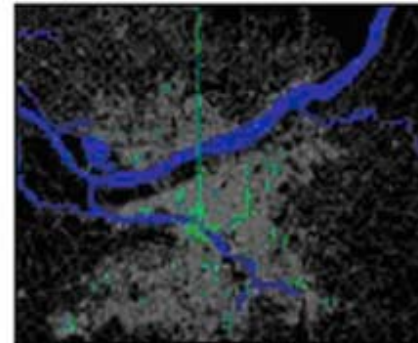
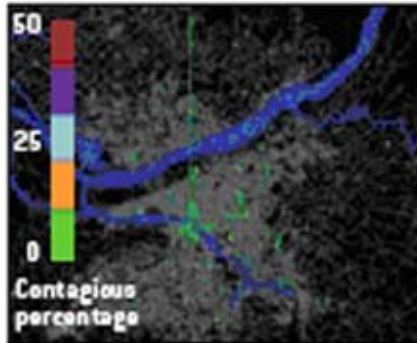
Spread to a Global Epidemic



Simulated Epidemic in Portland, Oregon

No response

Infected: 1,281
Dead: 0

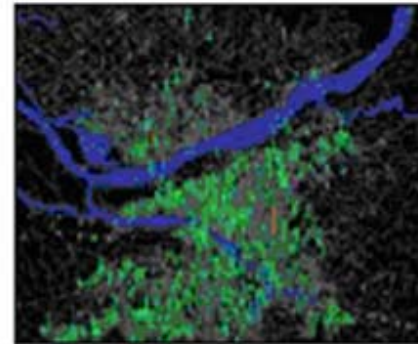
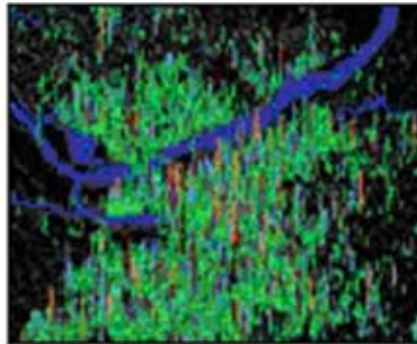


Targeted vaccination and quarantine starting day 14

Infected: 1,281
Vaccinated: 0
Dead: 0

Day 1: Undetected Smallpox Release

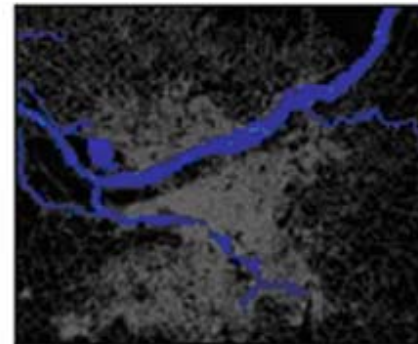
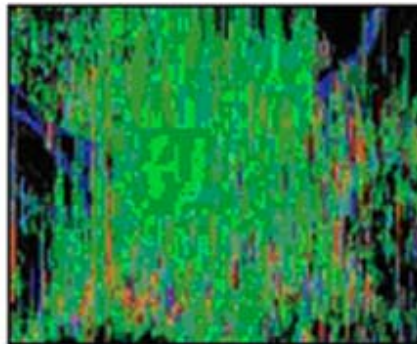
Infected: 23,919
Dead: 551



Infected: 2,564
Vaccinated: 30,560
Dead: 312

Day 35: Smallpox Epidemic

Infected: 380,582
Dead: 12,499



Infected: 2,564
Quarantined: 35,725
Vaccinated 37,207
Dead: 435

Day 70: Epidemic Uncontained or Contained

Contact Us

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