Overview of the

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM (NADP)

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM

A Cooperative Research Support Program of the
State Agricultural Experiment Stations (NRSP-3)
Federal and State Agencies
and Private Research Organizations

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ILLINOIS

Illinois State WATER Survey (1895)

What is the NADP?

- A Cooperative Research Program
  - Owned and operated by our members
  - Decisions made by our members

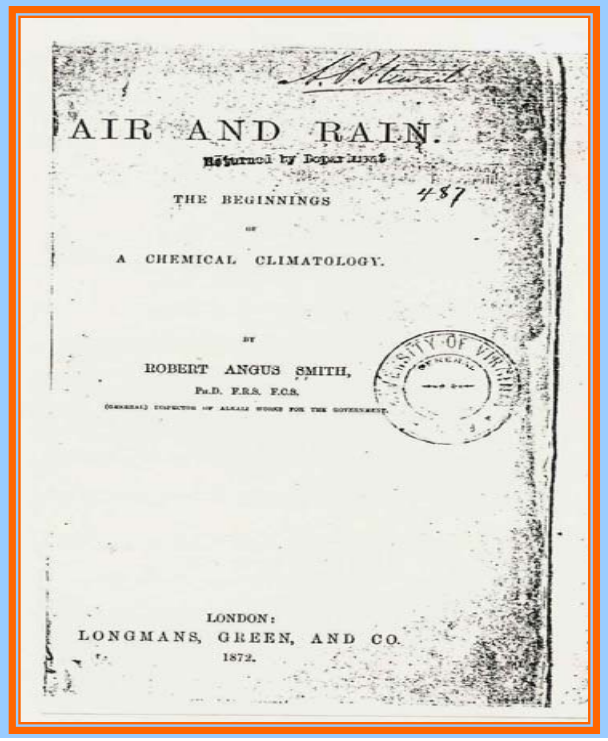
- Three networks
  - measure wet deposition of pollutants
  - National Trends Network (NTN)
  - Atmospheric Integrated Research Monitoring Network (AIRMON)
  - Mercury Deposition Network (MDN)

NADP's Goal

To monitor the chemistry of precipitation (rain and snow) consistently and as accurately as we can, for long periods to determine changes over time (trends).

Where did NADP come from?

- **The "Acid Rain" network**
- **Likens, Bormann, & Johnson, *Environment*, March 1972**


AIR AND RAIN.

THE BEGINNINGS

OF

A CHEMICAL CLIMATOLOGY.

BY

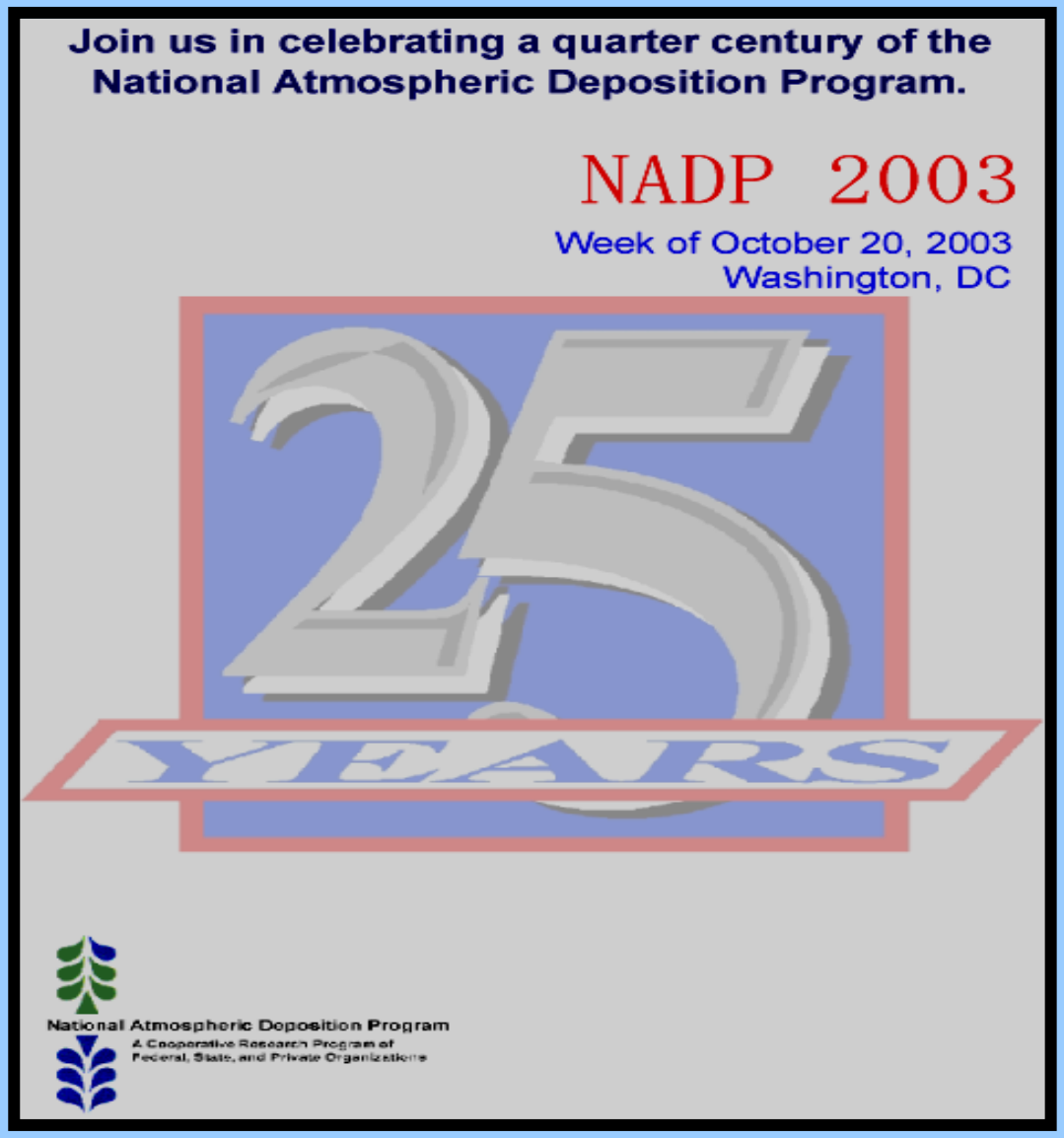
ROBERT ANGUS SMITH,

LONDON:
LONGMANS, GREEN, AND CO.
1872.

Air and Rain – the Beginnings of a Chemical Climatology

by Robert Angus Smith (1872)

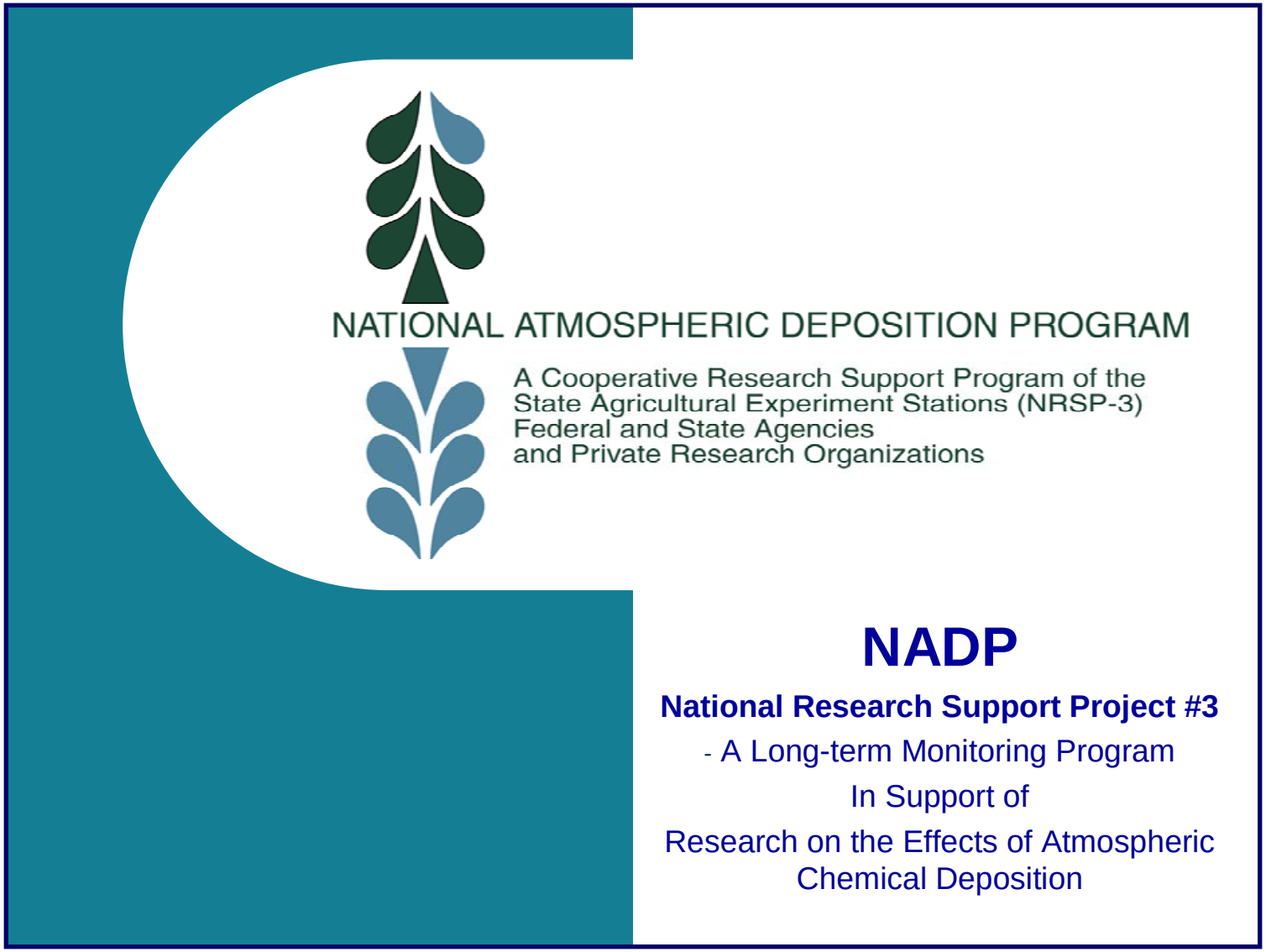
Long Record of Measurement



Who is NADP?

(Or is paying the bills?)

Officially….


NATIONAL ATMOSPHERIC DEPOSITION PROGRAM
A Cooperative Research Support Program of the
State Agricultural Experiment Stations (NRSP-3)
Federal and State Agencies
and Private Research Organizations
NADP
National Research Support Project #3
- A Long-term Monitoring Program
In Support of
Research on the Effects of Atmospheric
Chemical Deposition

Federal Agency Members

The National Park Service

energy.gov
U.S. DEPARTMENT OF ENERGY

TVA

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EPA United States Environmental Protection Agency

NAPAP

USDA Forest Service
Caring for the Land and Serving People

USGS
science for a changing world

USDA

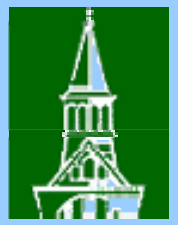
AIR RESOURCES LABORATORY

NOAA

noaaresearch OAR

U.S. FISH & WILDLIFE SERVICE

University Members

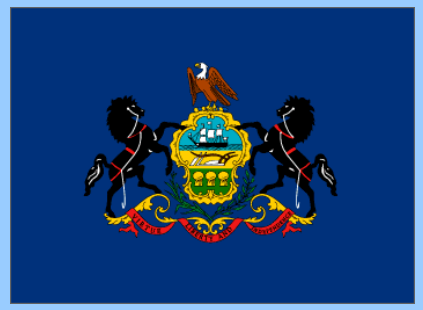


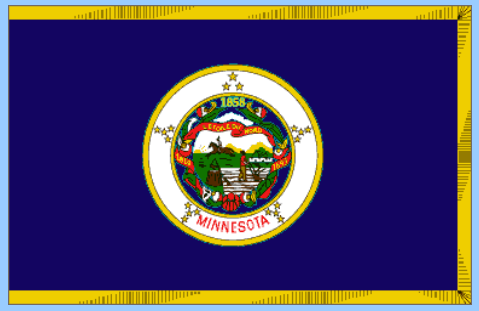
Tribal Organizations

STATE OF OREGON
1859

WISCONSIN
FORWARD
1848

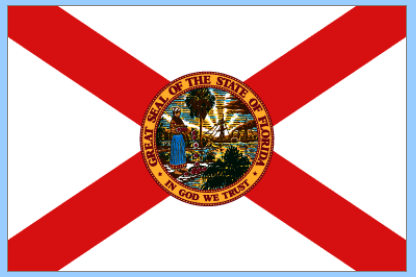
UNION, JUSTICE & CONFIDENCE




1858
MINNESOTA

MAY 20TH 1775
N C
APRIL 12TH 1776

INDIANA


GREAT SEAL OF THE STATE OF FLORIDA
IN GOD WE TRUST

Other Research Organizations

Environment Canada

Environnement Canada

Environnement Québec

Service météorologique du Canada

SMC

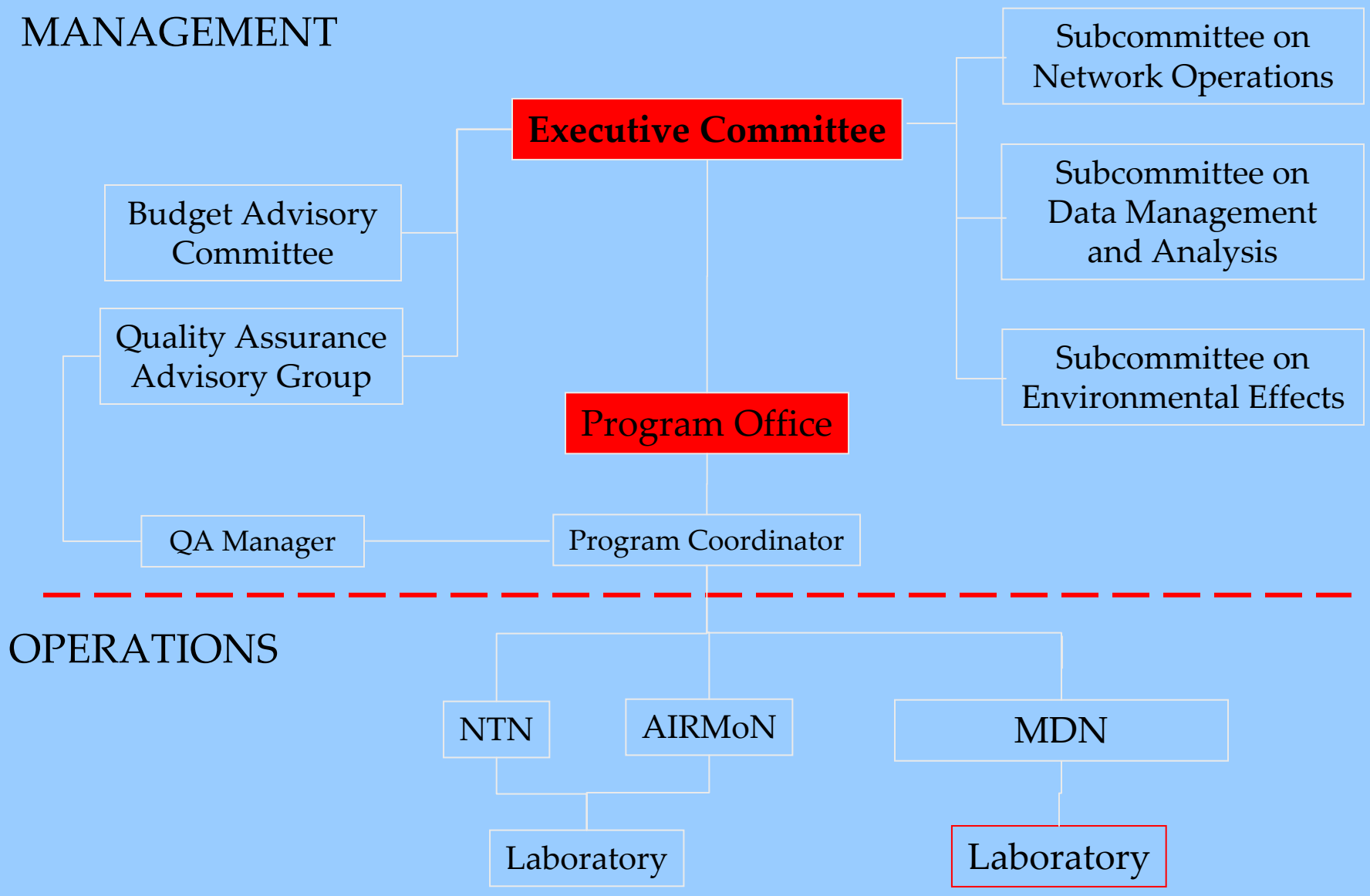
MSC

Meteorological Service of Canada

bp

Audubon Center of the North Woods

Organization



What Do We Measure?

National Trends Network (NTN)

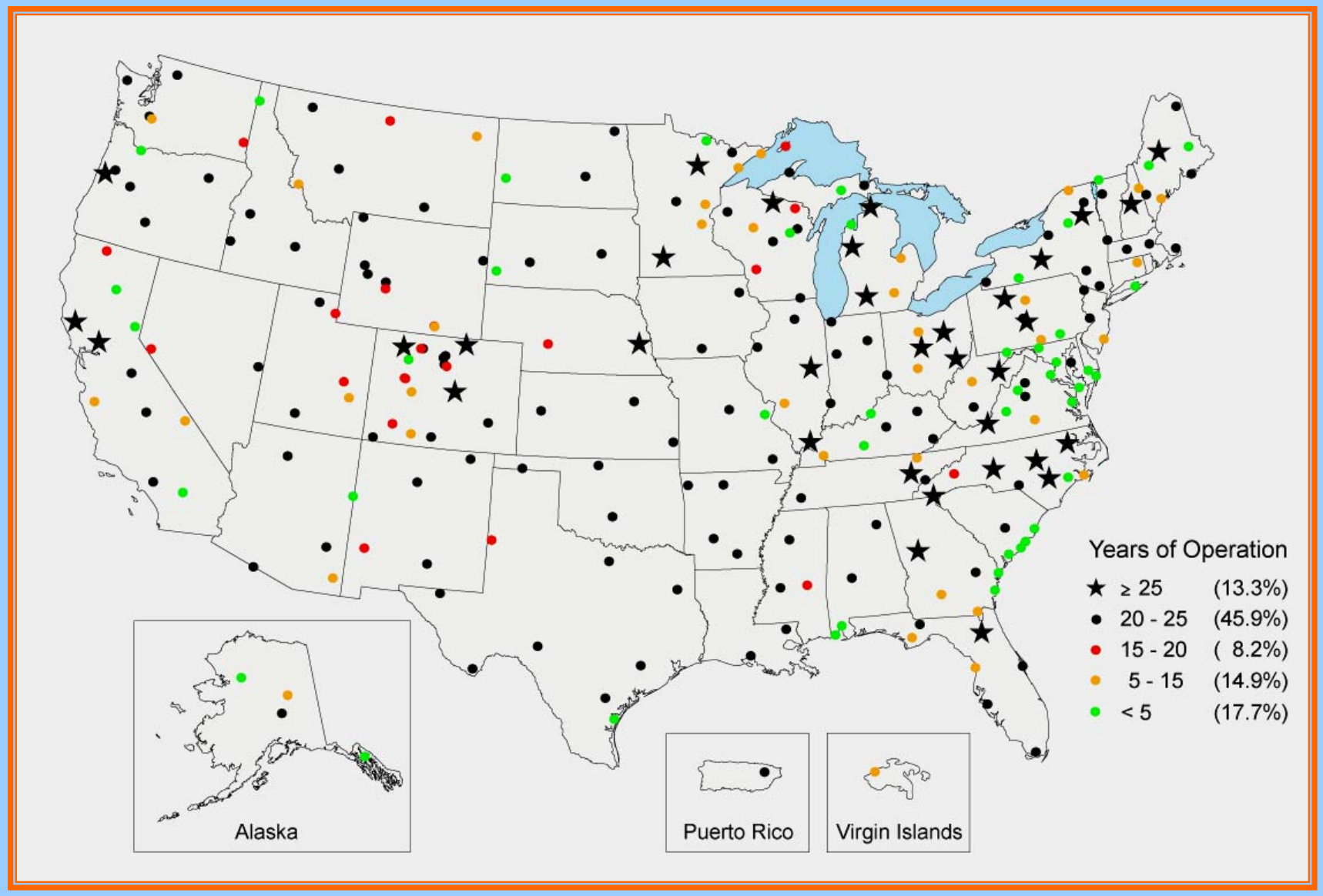
- **Collects one-week precipitation-only samples with NADP wet-dry collector**
- **Measures precipitation with gage**
- **<u>Analyses</u>**
  Acids
  Nutrients
  Base Cations

DAG3

Slide 16

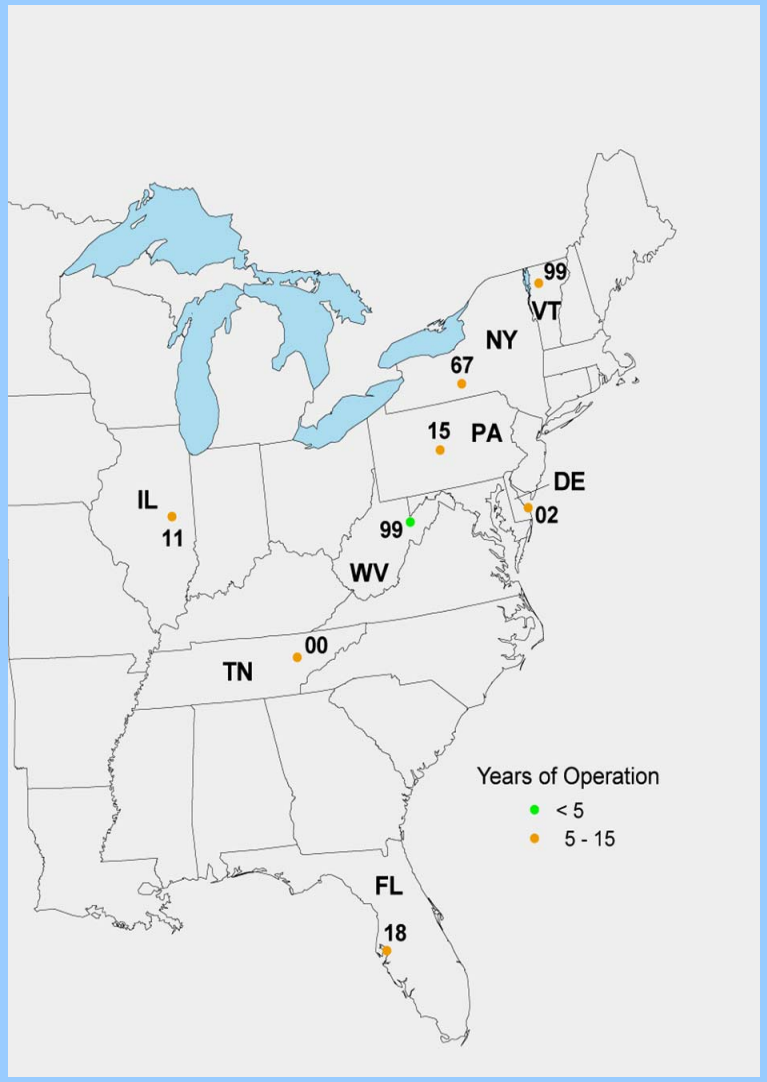
DAG3 need to add in the specifics here
DGay, 11/2/2006

NTN Sites



255 sites + 3 “precision” sites

Atmospheric Integrated Research Monitoring Network (AIRMoN)

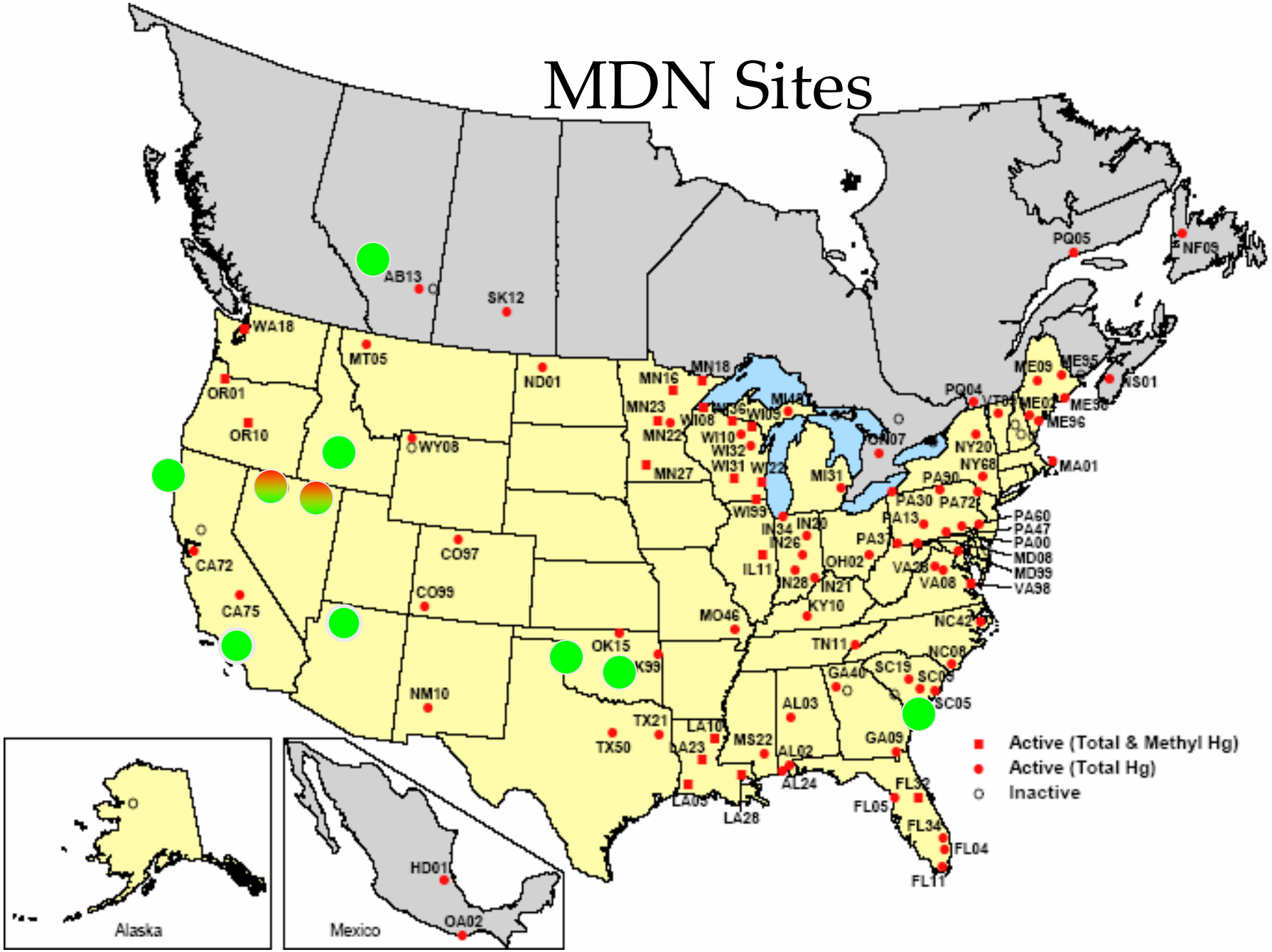


- Very similar to NTN, but collects daily when precipitation occurs
- Measures precipitation with NWS “stick gage”
- Measures same analytes as NTN
- Samples refrigerated from collection until analysis

Mercury Deposition Network (MDN)

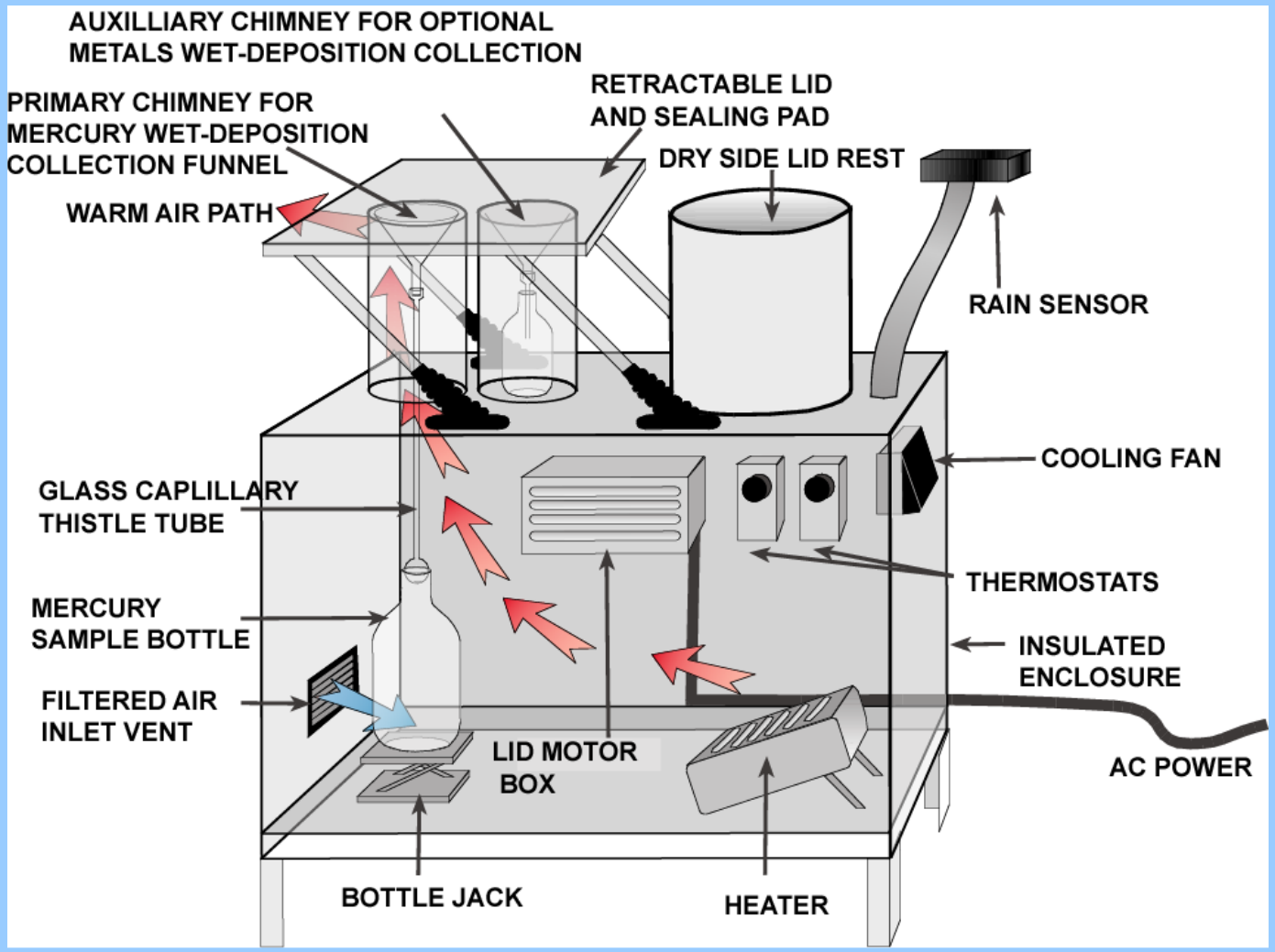
- **Collects one-week precipitation-only samples with MDN wet-dry collector**
- **Measures precipitation with gage**
- **<u>Analyses</u>**
  Total Mercury
  Methyl Mercury
  Other options

MDN Sites



AB13
SK12
WA18
MT05
ND01
OR01
OR10
WY08
CA72
CA75
CO97
CO99
NM10
OK15
TX21
TX50
MN16
MN18
MN23
MN22
MN27
WI08
WI36
WI09
WI10
WI32
WI31
WI22
WI99
MI48
MI31
ON07
IN34
IN20
IN26
IL11
IN28
IN21
OH02
KY10
MO46
TN11
GA40
SC19
SC05
NC08
NC42
VA08
VA28
VA98
MD08
MD99
PA00
PA47
PA60
PA72
PA30
PA90
PA13
PA37
NY20
NY68
PQ04
PQ05
NF09
ME09
ME95
ME02
ME98
ME96
NS01
MA01
AL03
AL02
AL24
MS22
LA10
LA23
LA09
LA28
GA09
FL32
FL05
FL34
FL04
FL11
HD01
OA02
Alaska
Mexico
Active (Total & Methyl Hg)
Active (Total Hg)
Inactive

Wet Deposition Collection



MDN43

QA Overview

Quality Assurance Management Plan (web)

Quality Assurance Project Plan (web)

Scheduled Blanks and Spikes

- Laboratory Blanks
- Field Blanks

3rd Party QA Program (USGS & EPA)

- Blind spike samples
- Inter-lab comparisons
- Precision/accuracy studies
- Site Audits

Independent QA Director

Data Methods

3rd Party Site Audits

Site Systems and Performance Survey Summary

Survey Date: 5/17/2002

NADP Site: **NTN CA66** Pinnacles National Monument-Bear Valley

Collocated AIRMoN site: N
Collocated MDN site: N

General Note

"X" and "-99" designate not applicable fields. Did precipitation impede survey: N

A. Electrical Power No problems noted.

1a. Power supply: AC
1b. Do electrical connections appear to be in good condition: Y
2a. Solar-powered site: N
2b. Estimated solar output capacity (amps): -99
3a. Battery capacity (cold crank amps): -99
3b. Does collector cycle successfully under battery power: X
4a. Does battery need water: X
4b. Was water added during visit: X

B. Precipitation Collector PROBLEMS NOTED....SEE 10b.

1. Collector manufacturer: ACM
2a. Snow roof: N
3a. Heated collector arms: N
3b. Heated lid: N / Heated base: N
4a. Collector on platform: N
4b. Height of platform: -99
5a. Distance ground to top of bucket (m): 1.3
5b. Orientation of wet-side bucket (degrees, magnetic: 255
6a. Is collector level: Y
6b. Was collector leveled during visit: X
7a. Is collector stable: Y
7b. Was collector stabilized during visit: X
8a. Sensor in correct orientation: Y
8b. Sensor orientation corrected during visit: X
9. Adjustments made to motorbox: N
10a. Replace motorbox: N
10b. Replace sensor: Y
11. Other adjustments made to collector: X
12. Additional adjustments needed: X

C. Raingage PROBLEMS NOTED....SEE 8a.

1. Raingage shield in place: NONE
2a. Distance collector to raingage (m): 5.3
2b. Height from ground to top of raingage (m): 1.3
3a. Raingage on platform: N
3b. Platform height (m): 0.4
4a. Backup raingage : TIPPING BUCKET
4b. Distance (m): 15.2 / Direction (deg.): 198
5a. Is raingage level: Y
5b. Was raingage leveled during visit: X
6a. Is raingage stable: Y
6b. Was raingage stabilized during visit: X
7a. Was gage out of tolerance (+/- 0.1") on 0" to 6" range: N
7b. Calibrated successfully: X
8a. Was gage out of tolerance (+/- 0.1") on 6" to 12" range: Y
8b. Calibrated successfully: Y
9a. Replace gage: N
9b. Replace event recorder: N
10a. Replace clock: N
10b. Replace pen nibs: N

Page 1 of 2

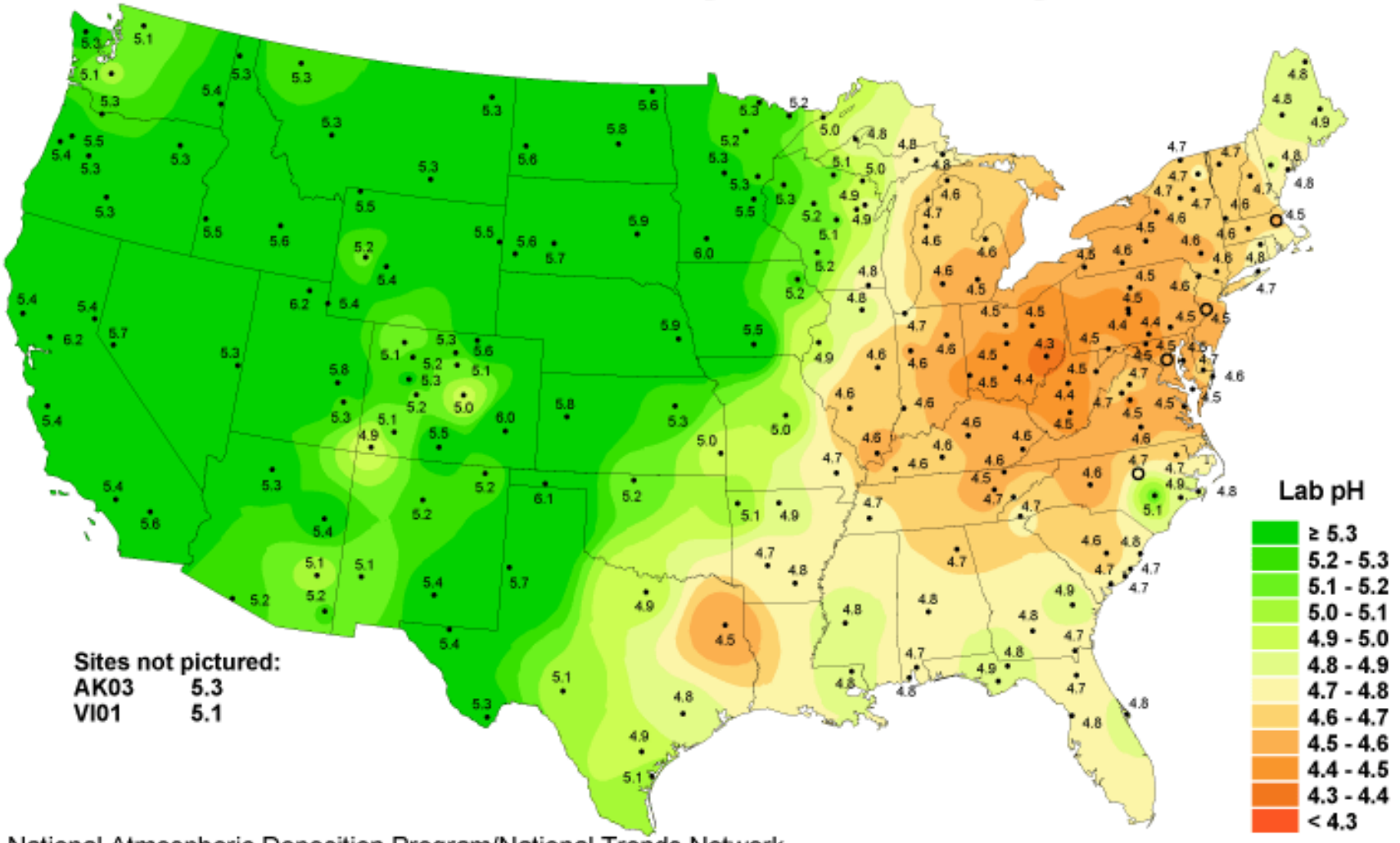
All of this information
(including data)
is on the web

http://nadp.sws.uiuc.edu

Results

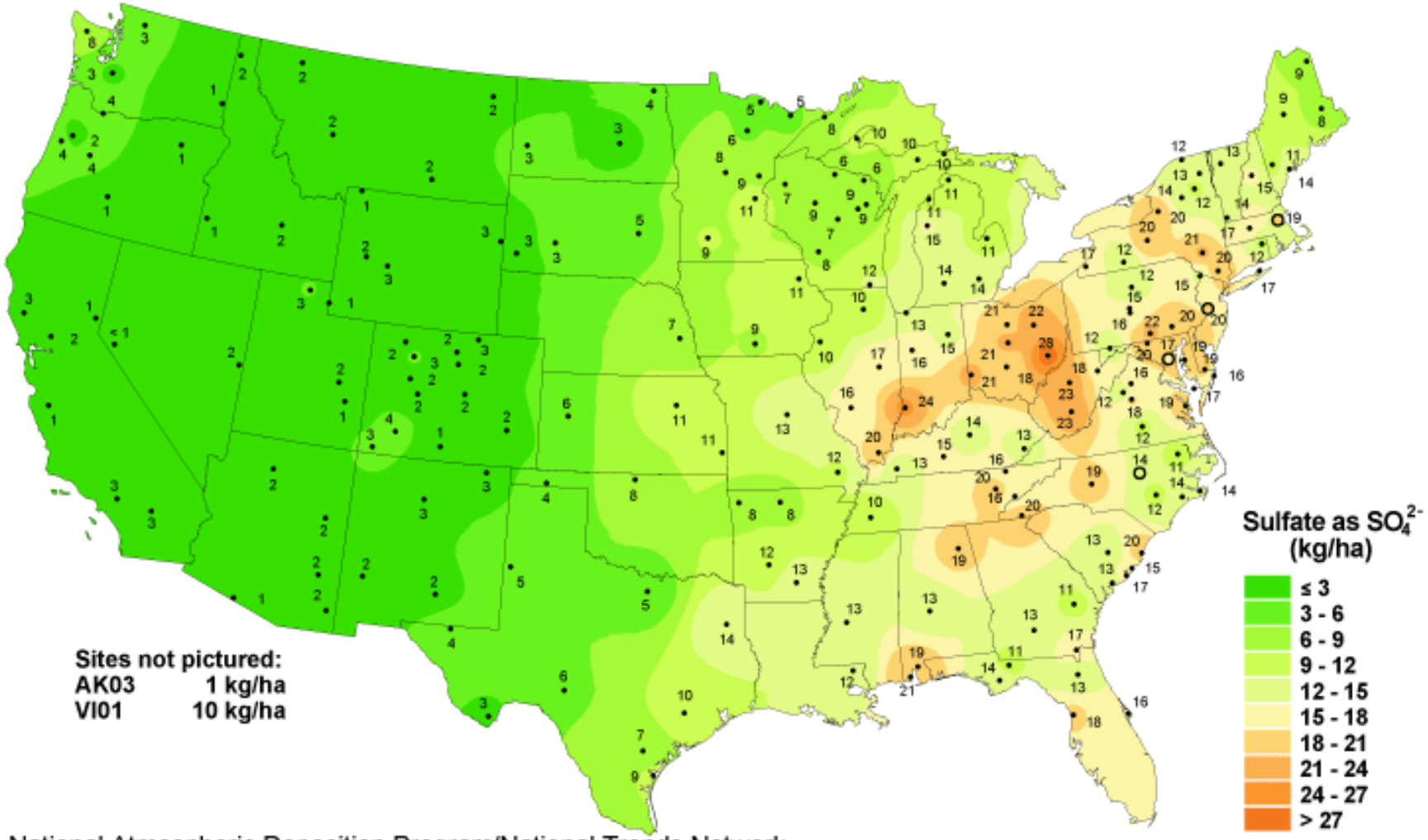
of all of this?

Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2005



National Atmospheric Deposition Program/National Trends Network
http://nadp.sws.uiuc.edu

Sulfate ion wet deposition, 2005



National Atmospheric Deposition Program/National Trends Network
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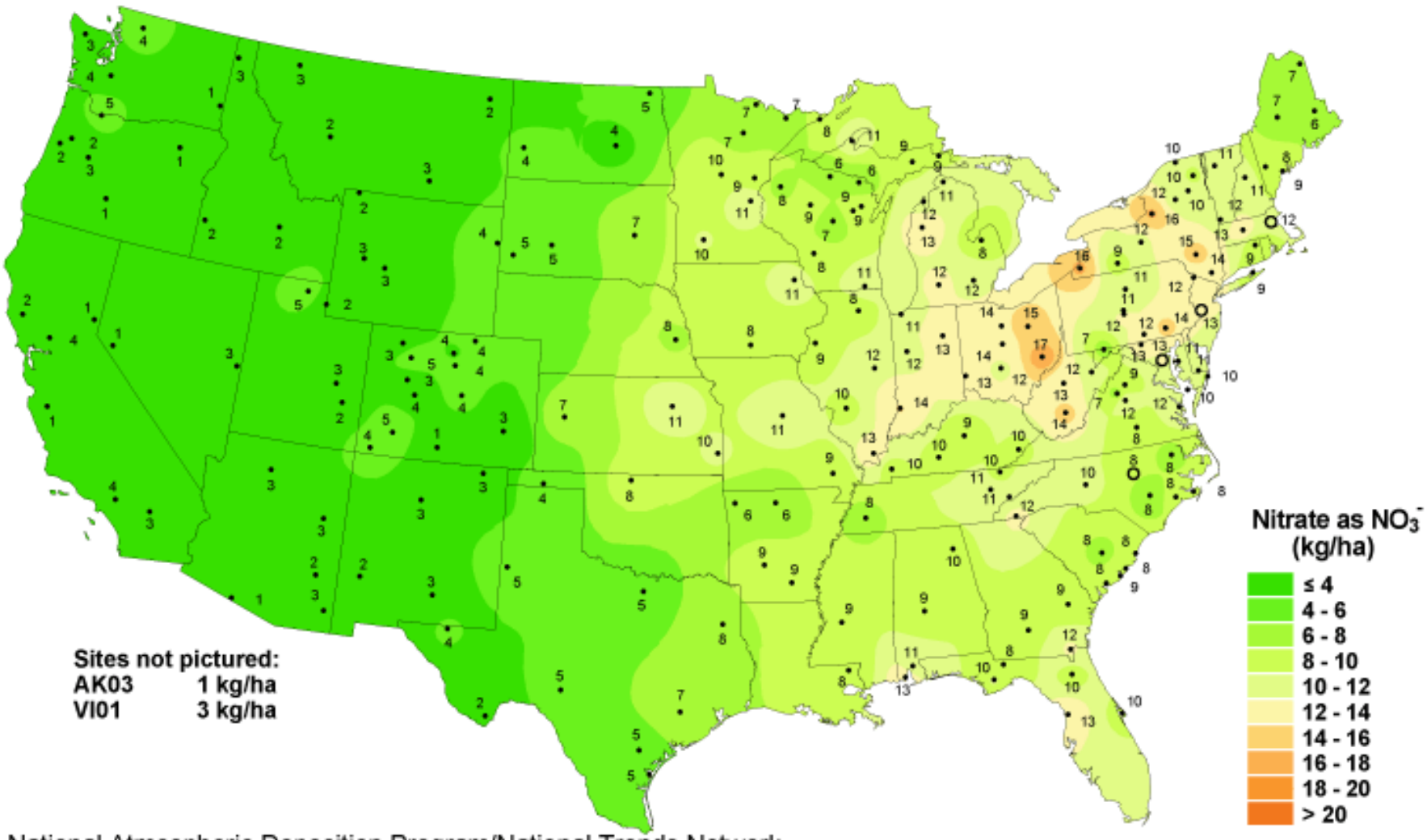
Nitrate ion wet deposition, 2005



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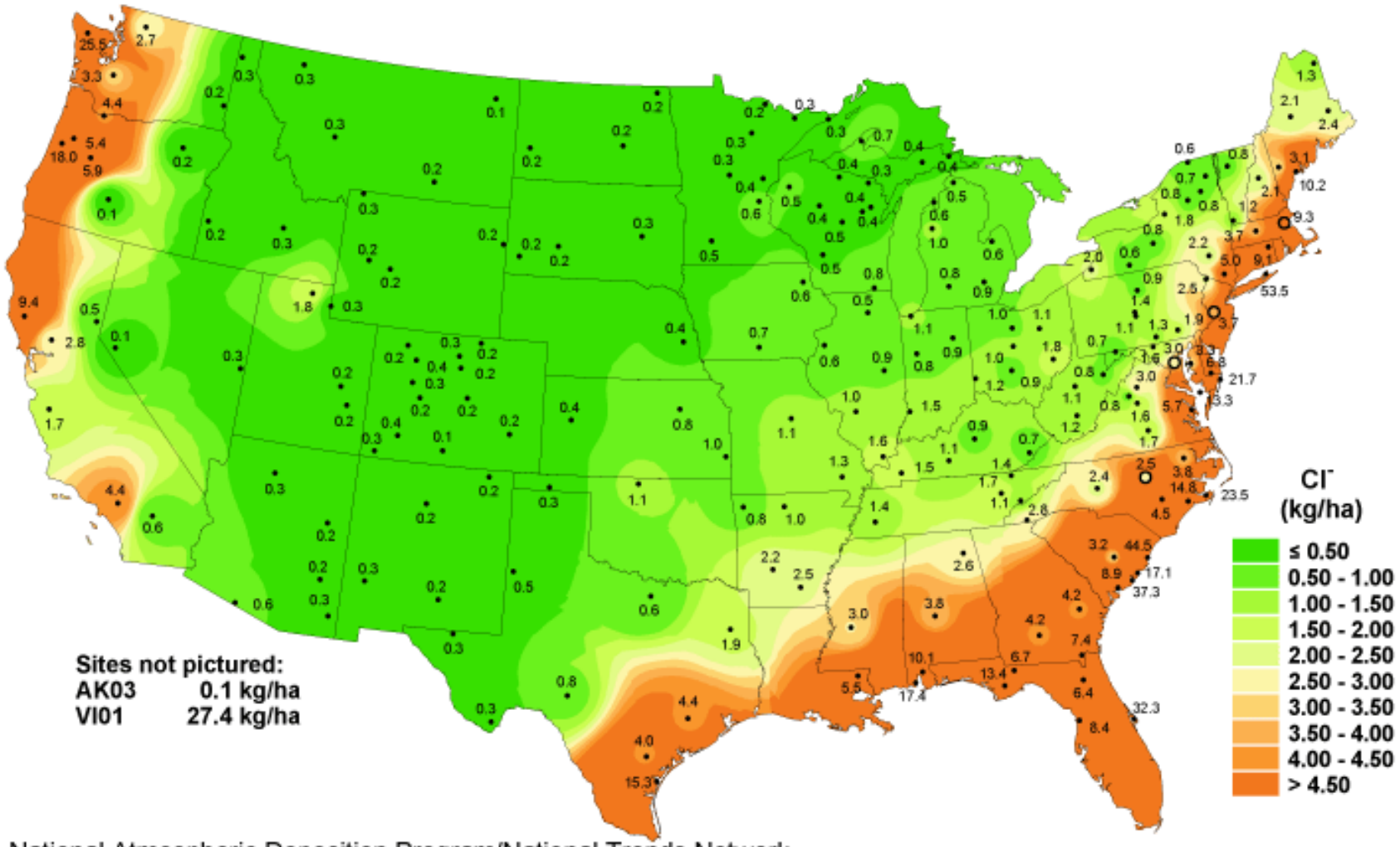
Chloride ion wet deposition, 2005



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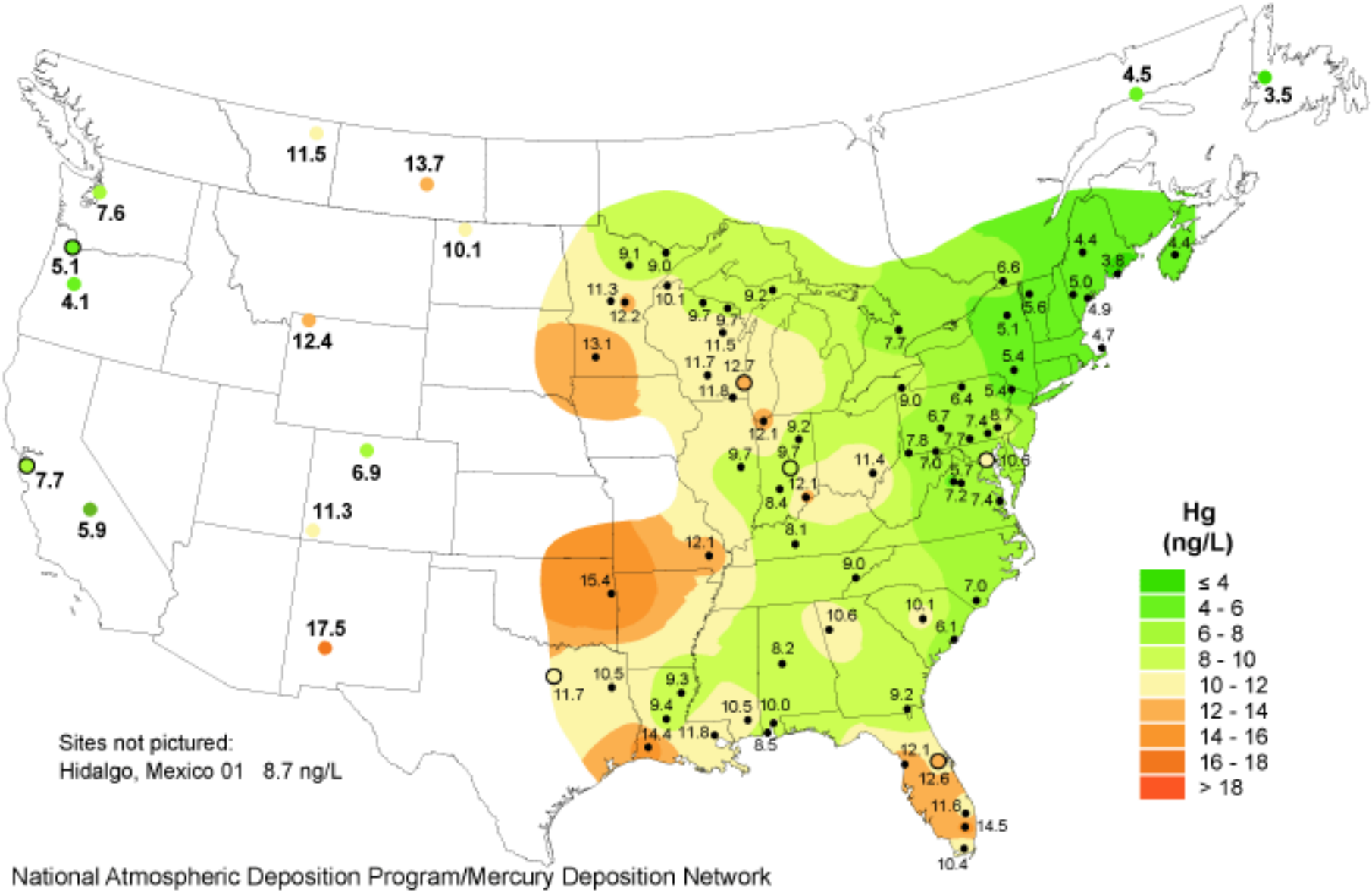
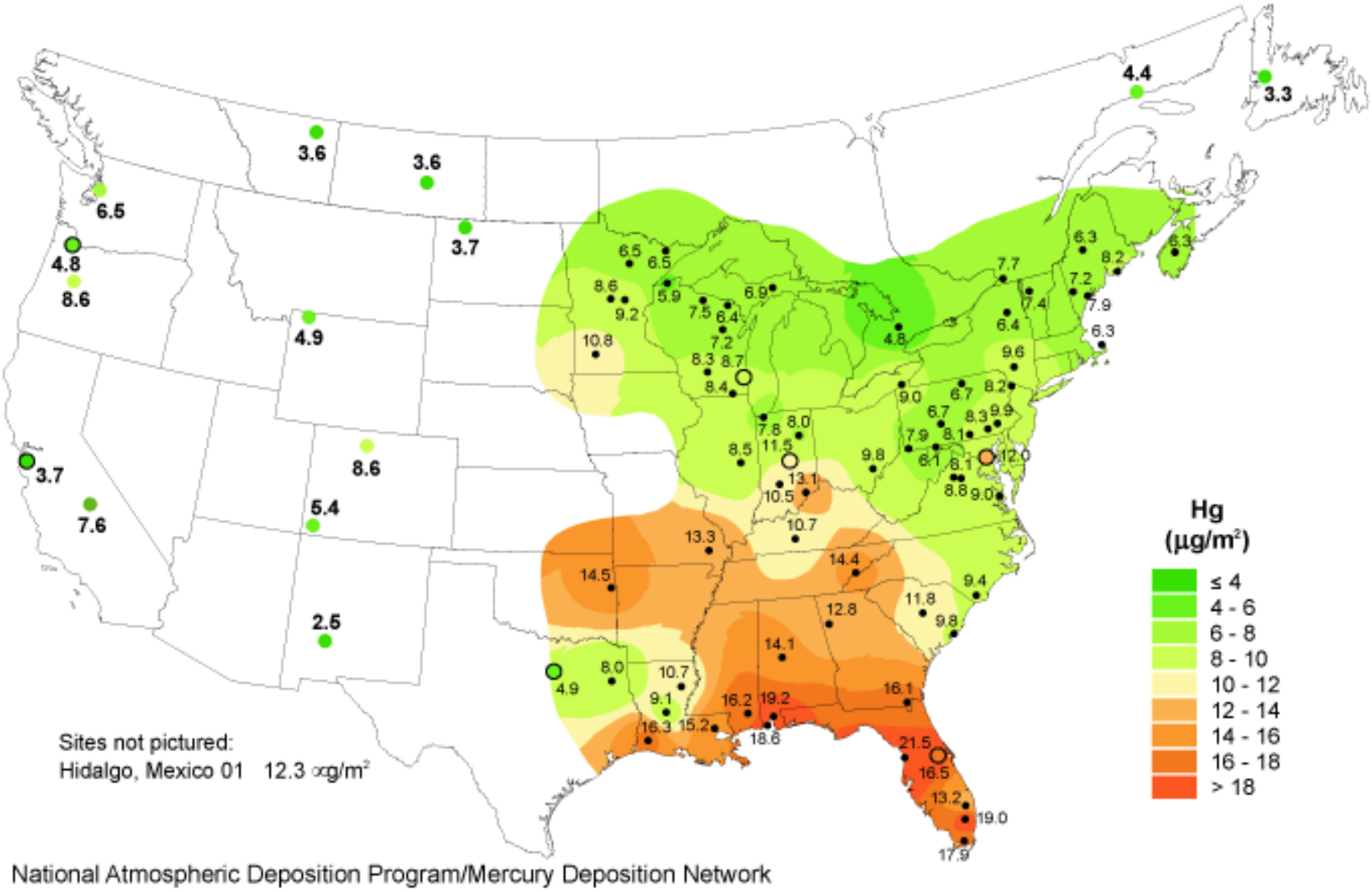
Total Mercury Concentration, 2005



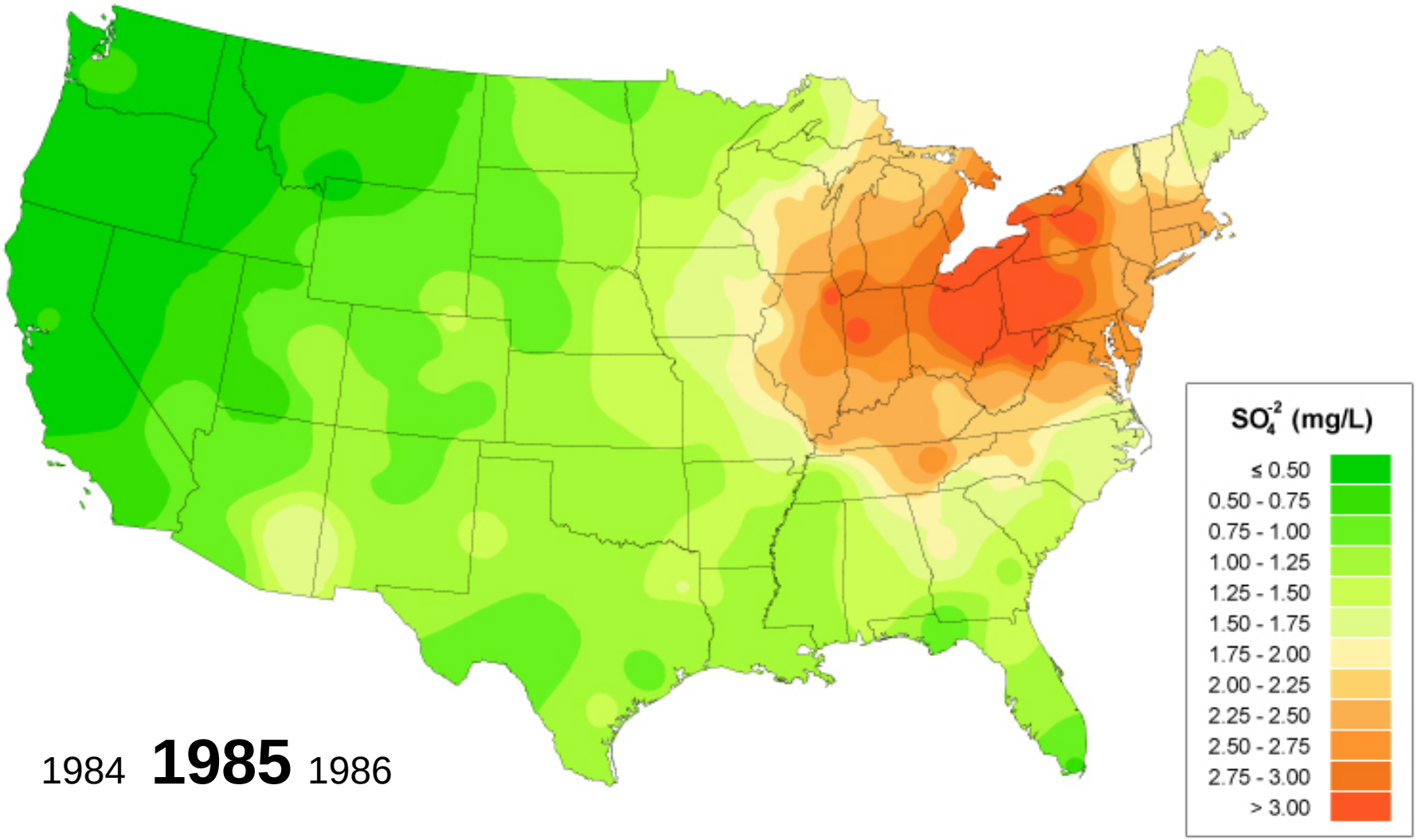
Total Mercury Wet Deposition, 2005



Sulfate Concentrations

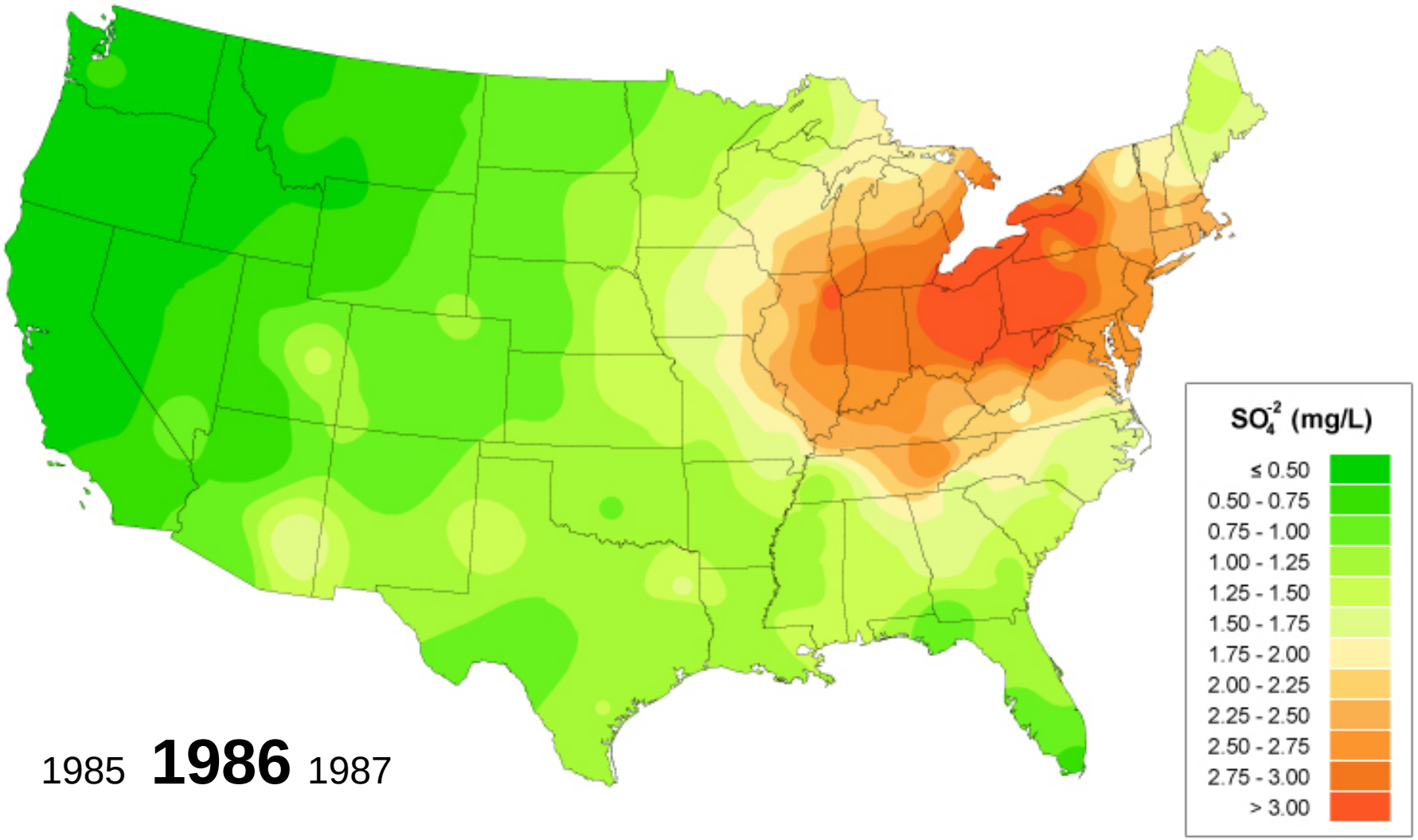
- $SO_4^=$ wet deposition,
- Three year running averages,
- 1985 to 2003

Sulfate Ion Concentrations 1985-2003



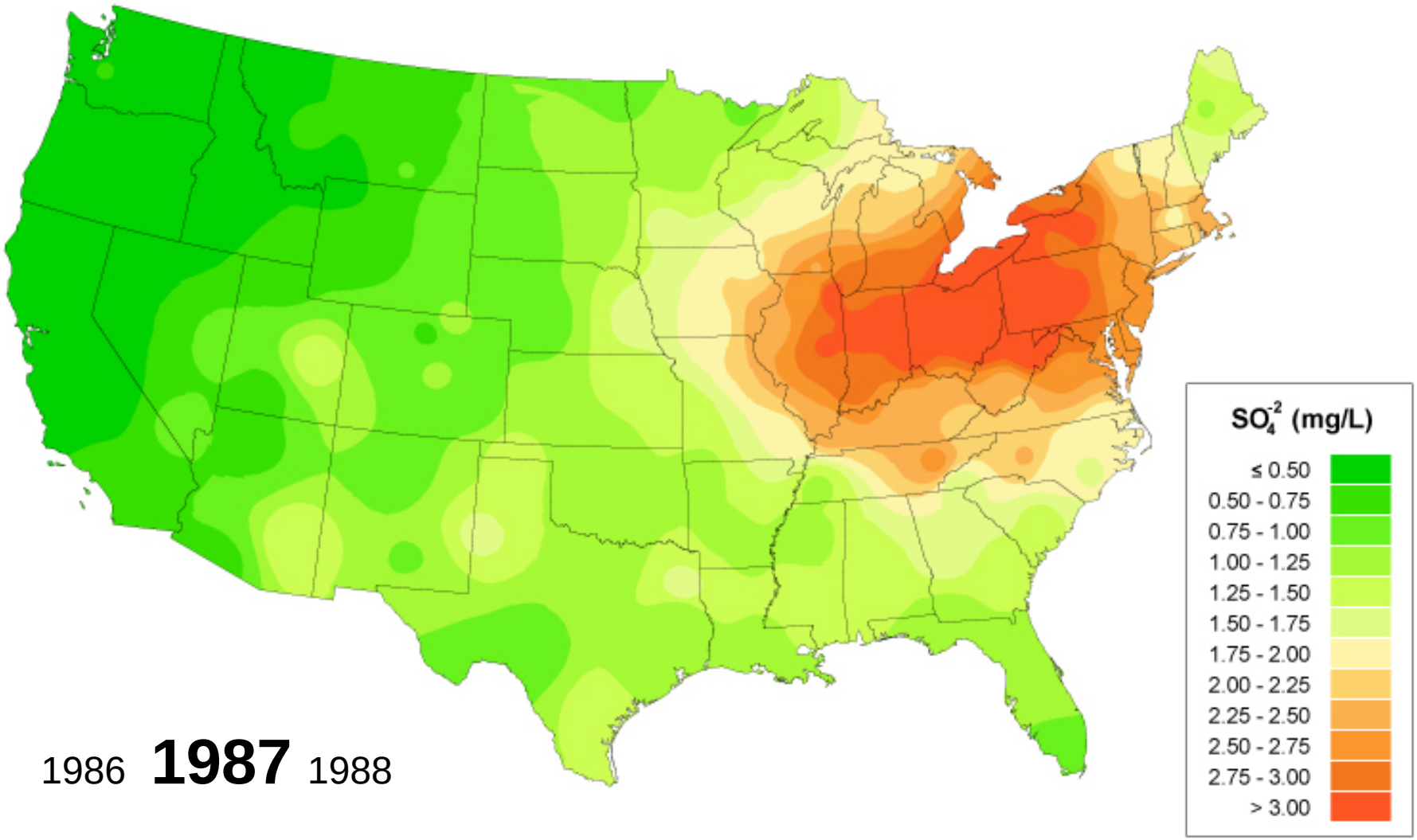
1984 **1985** 1986

Sulfate Ion Concentrations 1985-2003



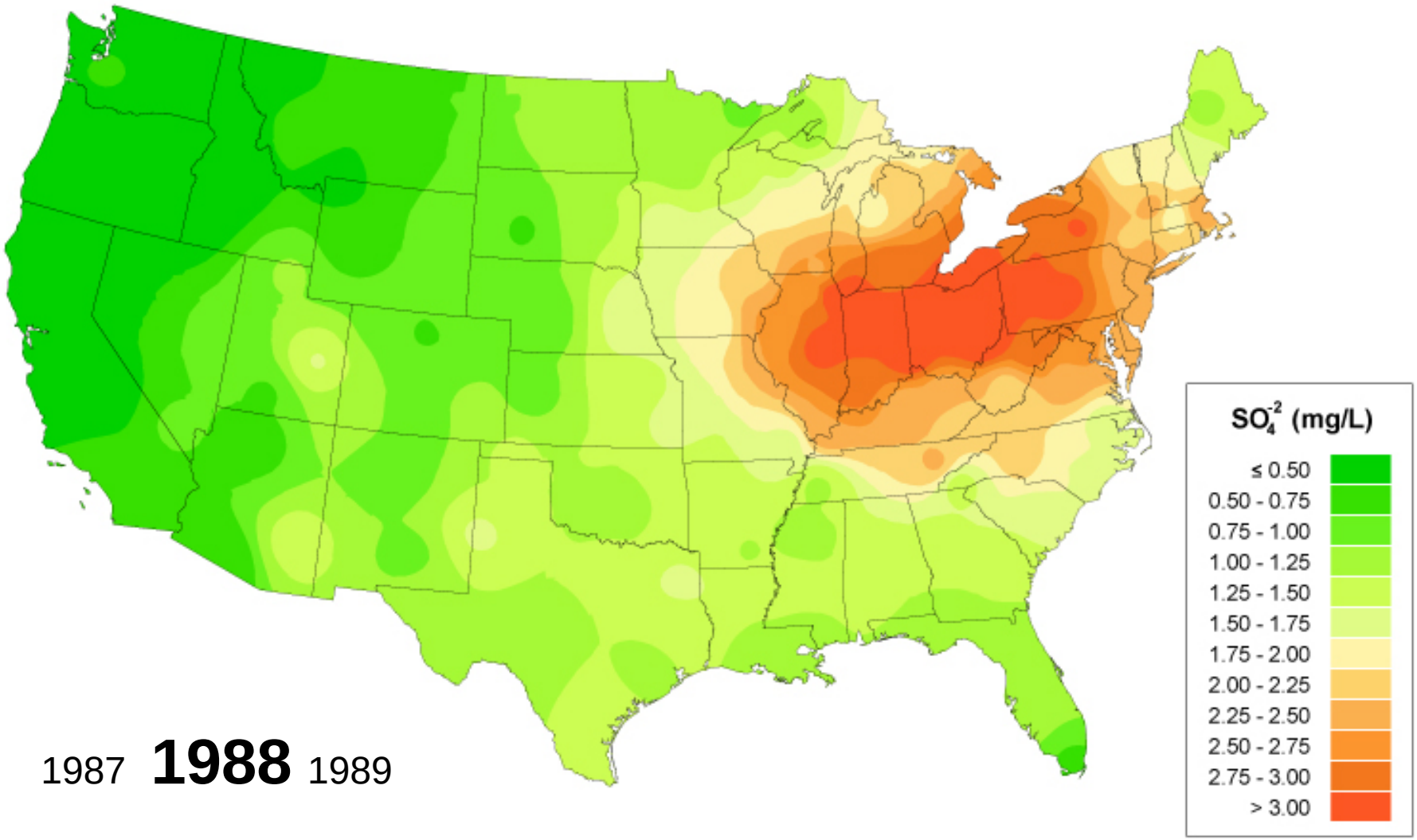
1985 **1986** 1987

Sulfate Ion Concentrations 1985-2003



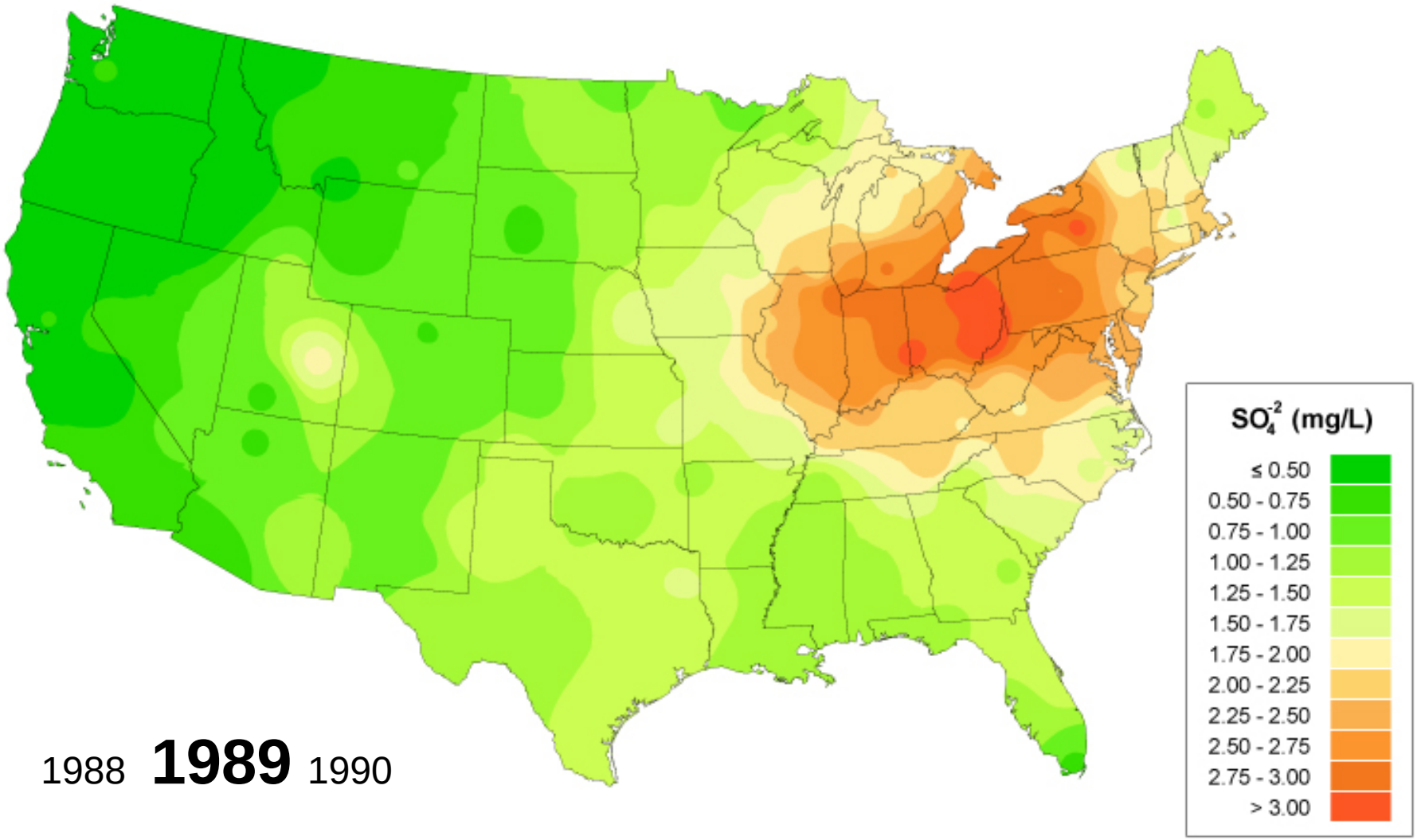
1986 **1987** 1988

Sulfate Ion Concentrations 1985-2003



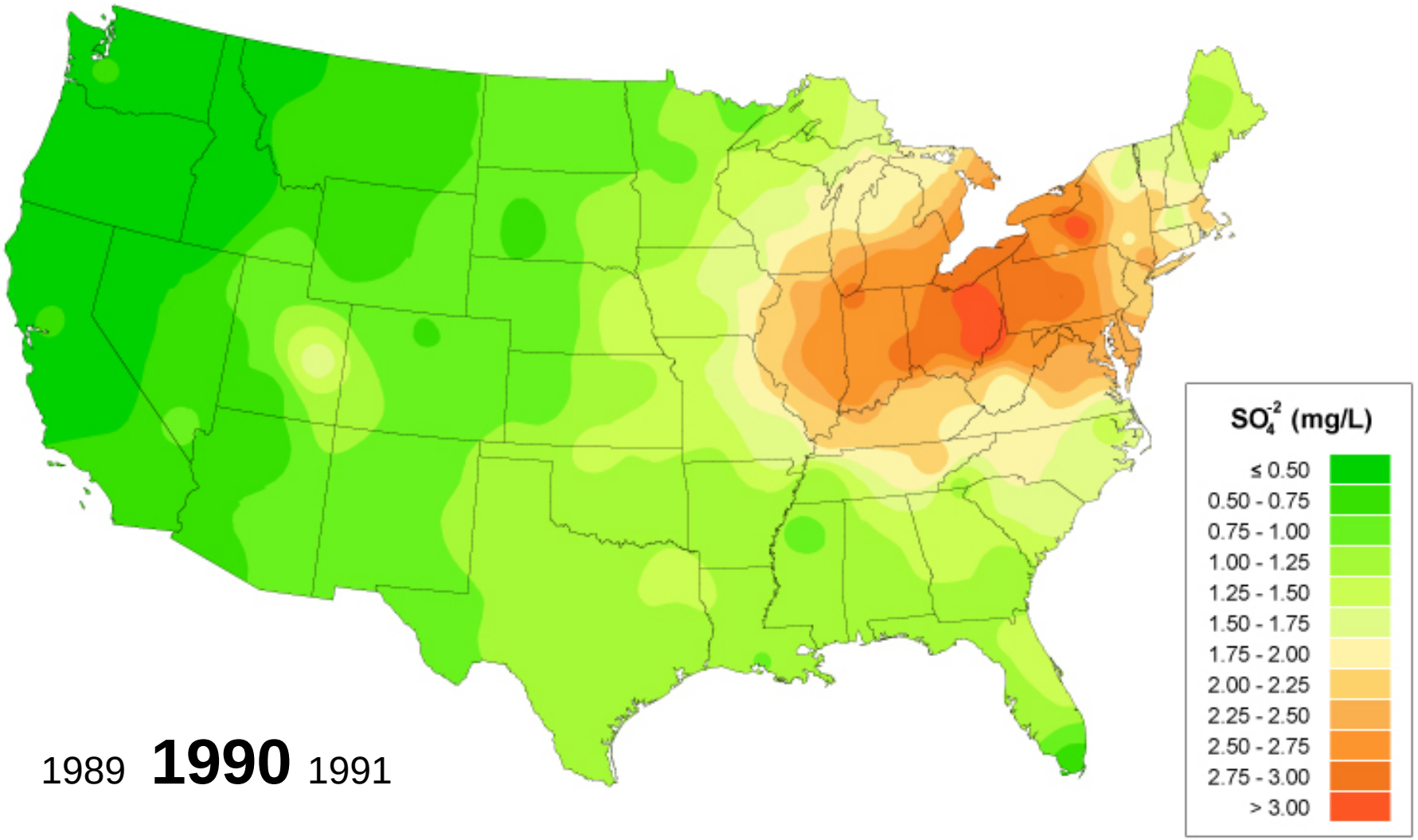
1987 **1988** 1989

Sulfate Ion Concentrations 1985-2003



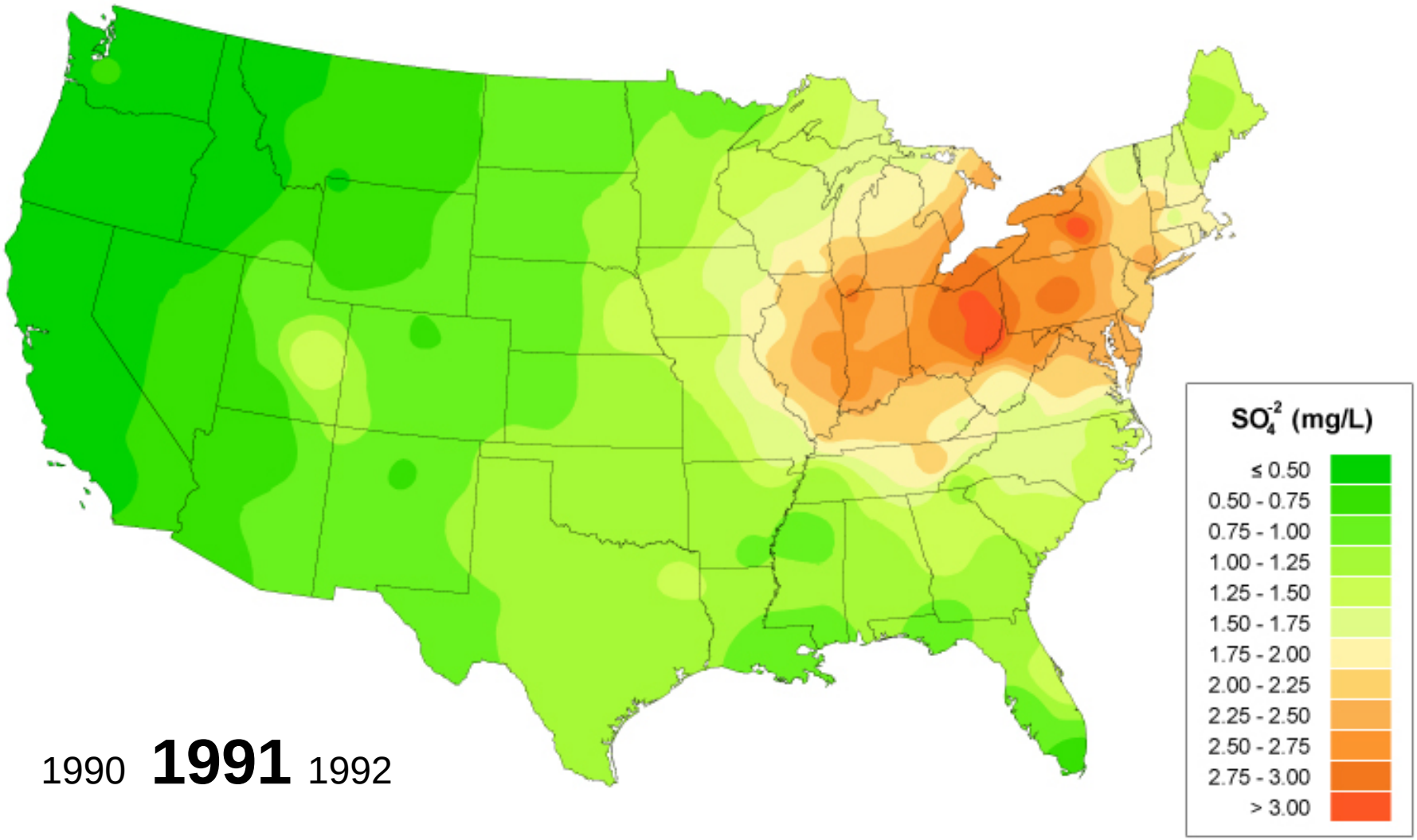
1988 **1989** 1990

Sulfate Ion Concentrations 1985-2003



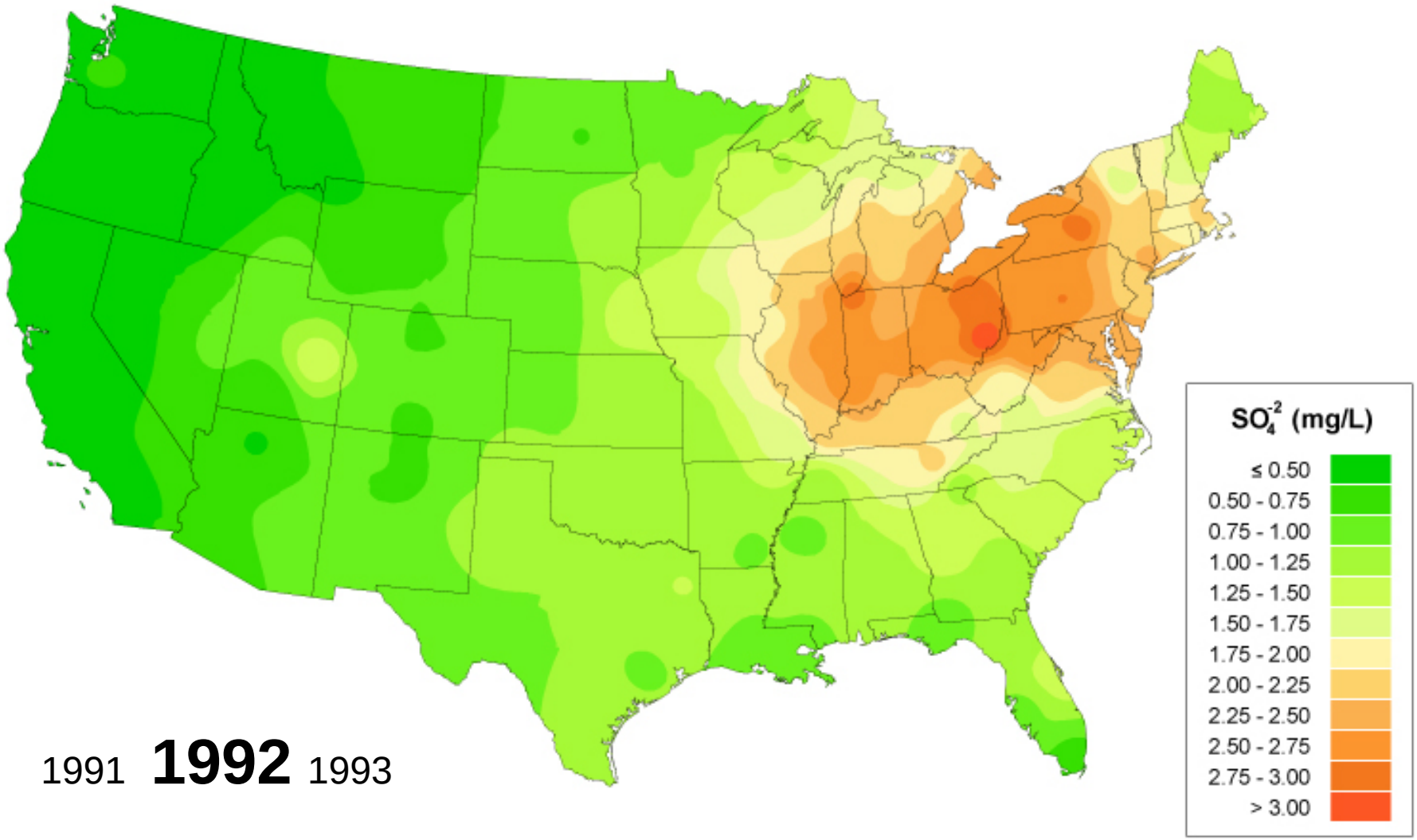
1989 **1990** 1991

Sulfate Ion Concentrations 1985-2003



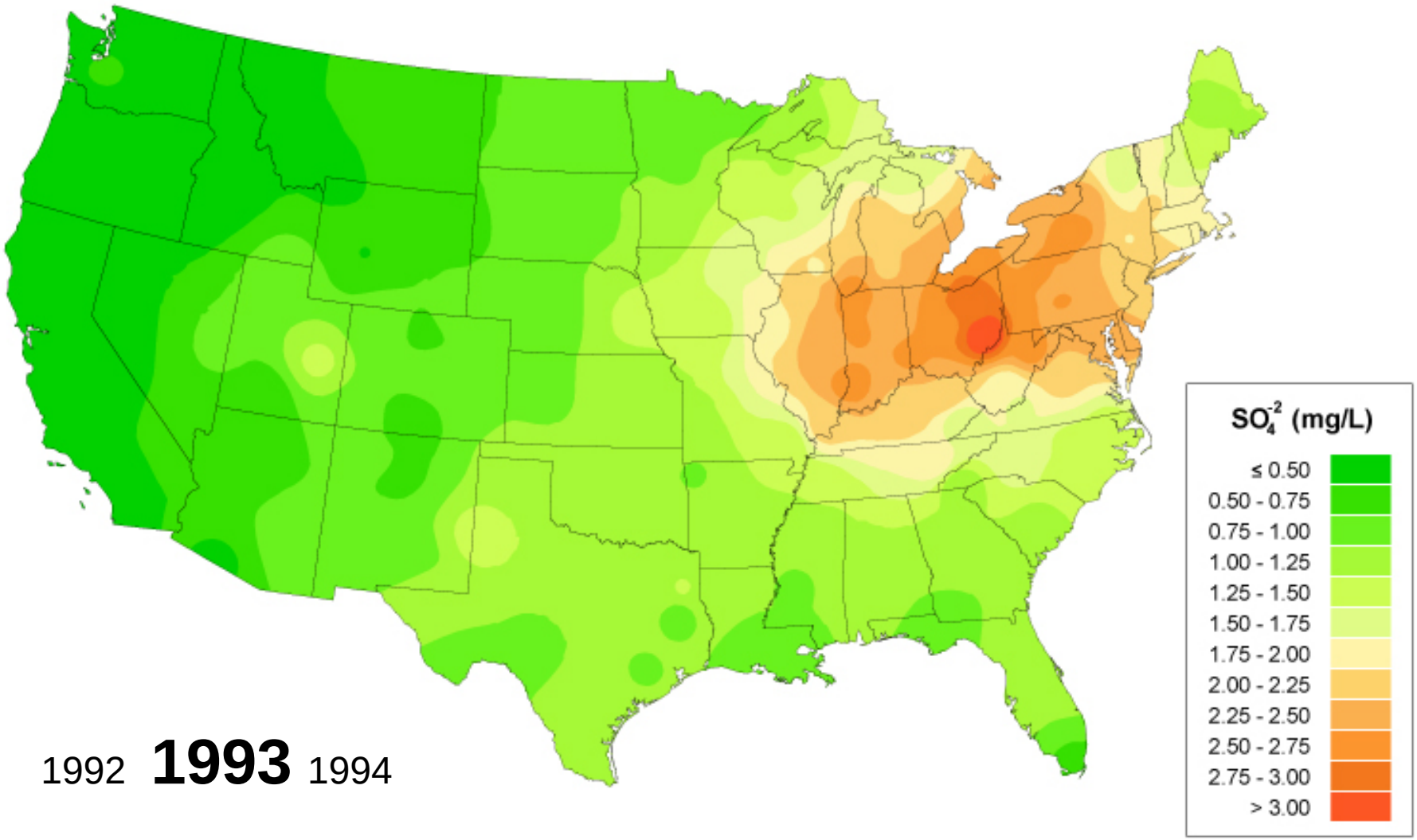
1990 **1991** 1992

Sulfate Ion Concentrations 1985-2003



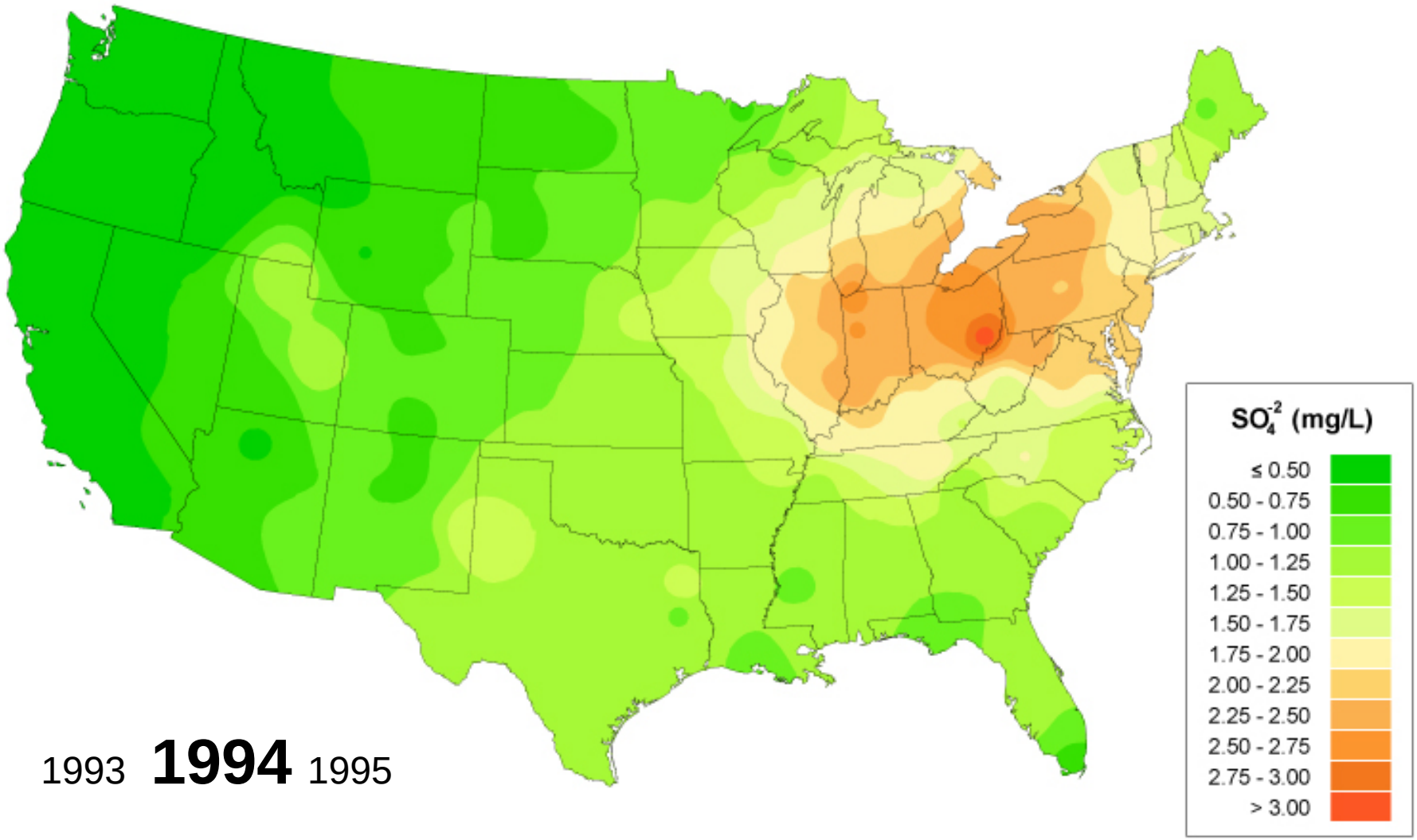
1991 **1992** 1993

Sulfate Ion Concentrations 1985-2003



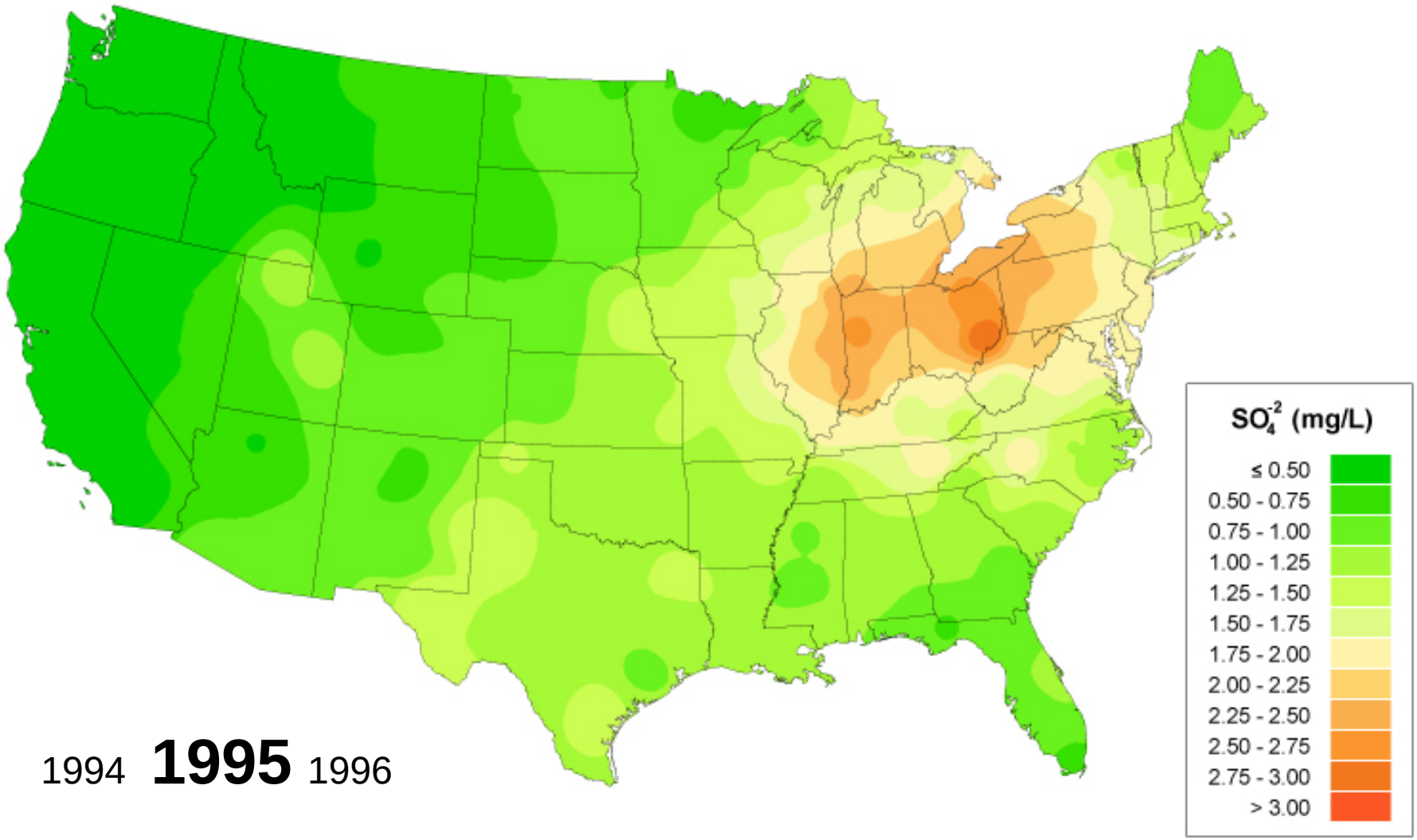
1992 **1993** 1994

Sulfate Ion Concentrations 1985-2003



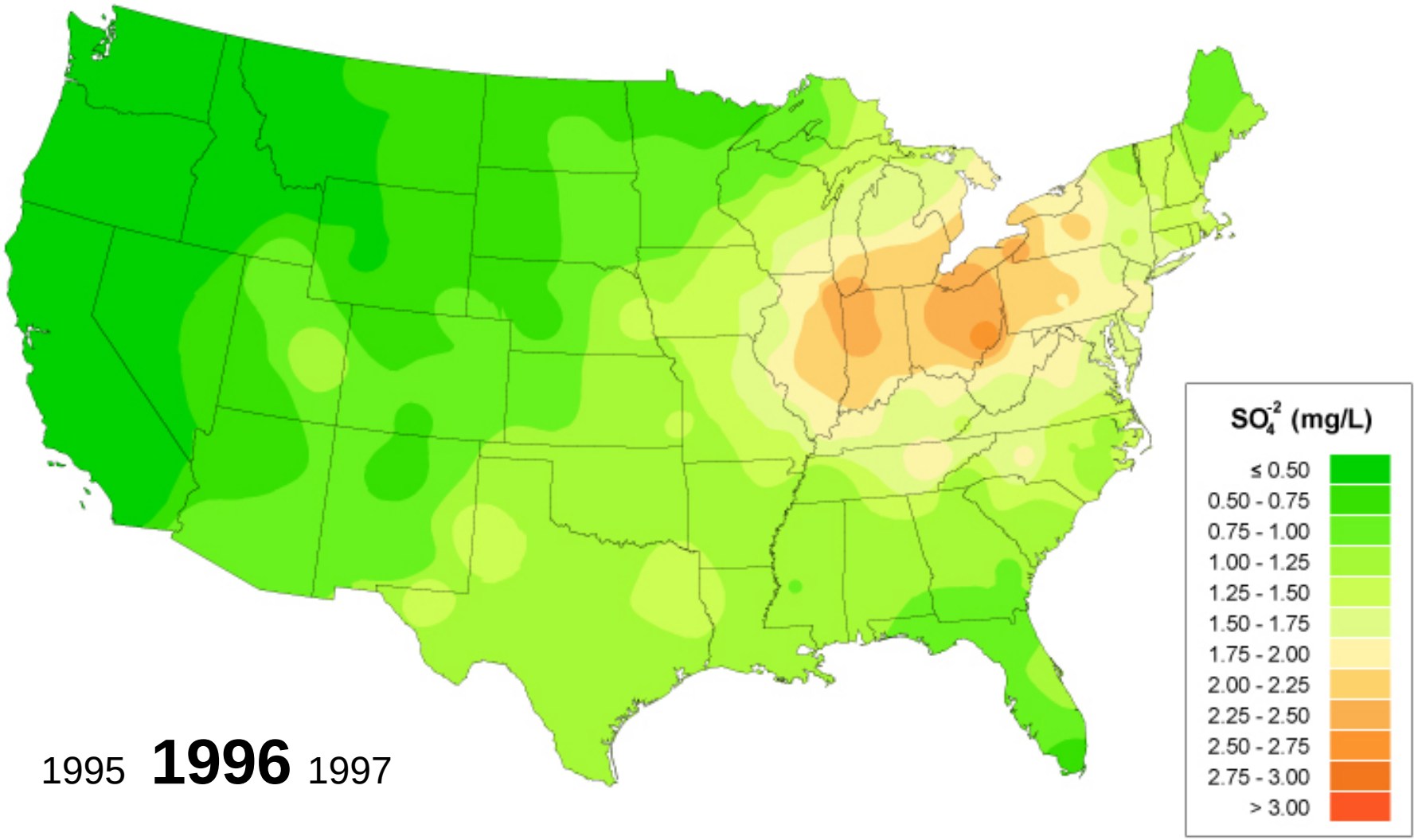
1993 **1994** 1995

Sulfate Ion Concentrations 1985-2003



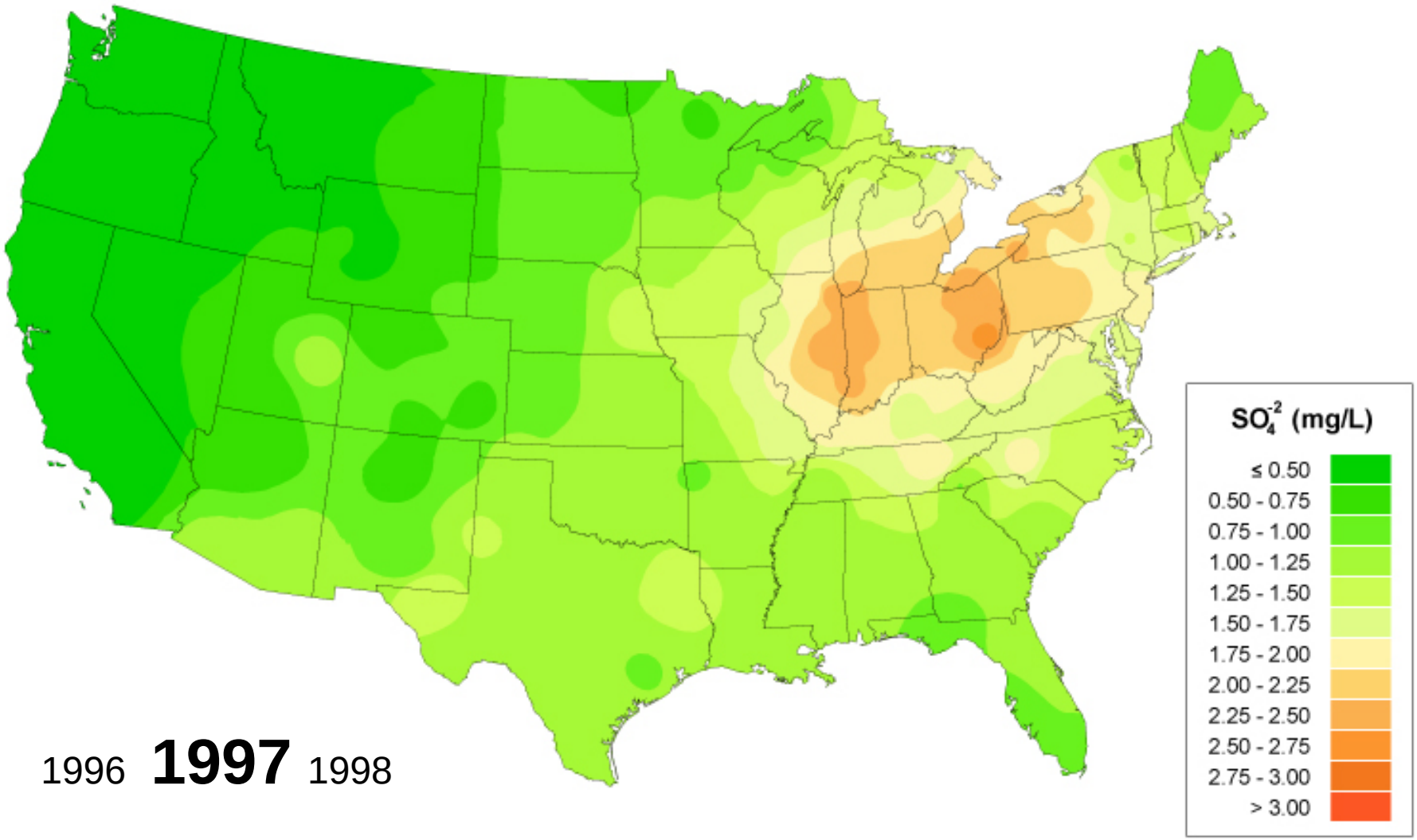
1994 **1995** 1996

Sulfate Ion Concentrations
1985-2003



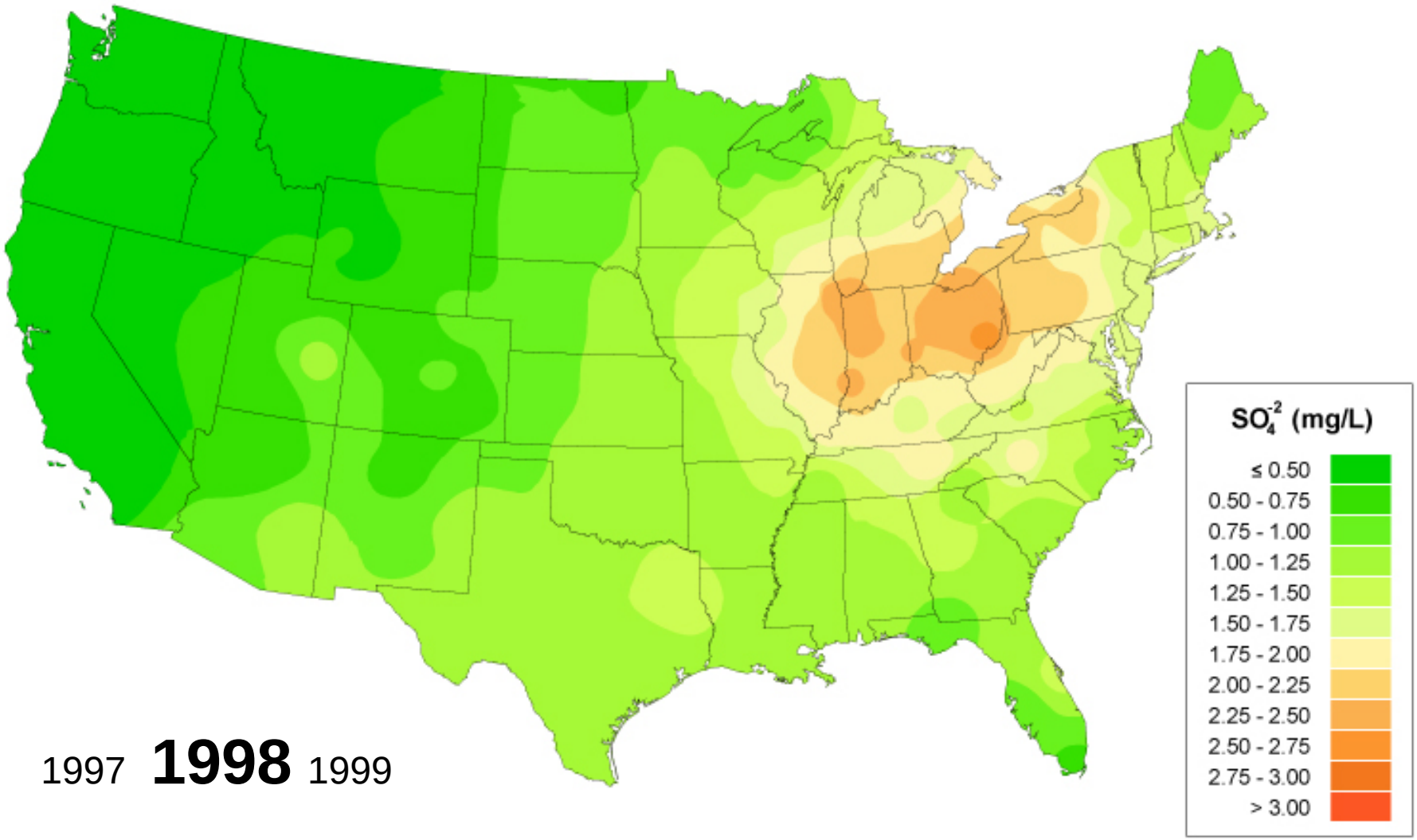
1995 **1996** 1997

Sulfate Ion Concentrations 1985-2003



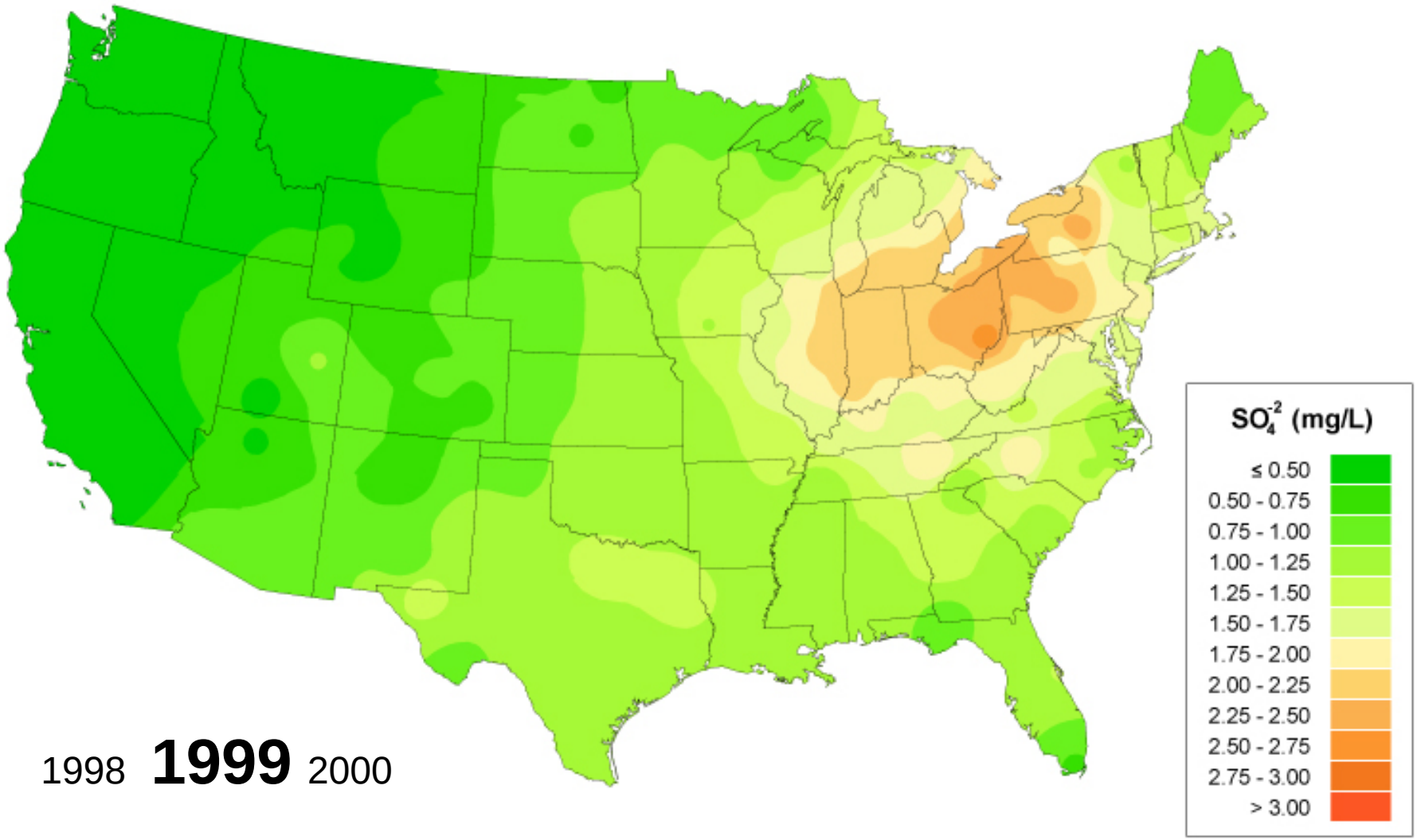
1996 **1997** 1998

Sulfate Ion Concentrations 1985-2003



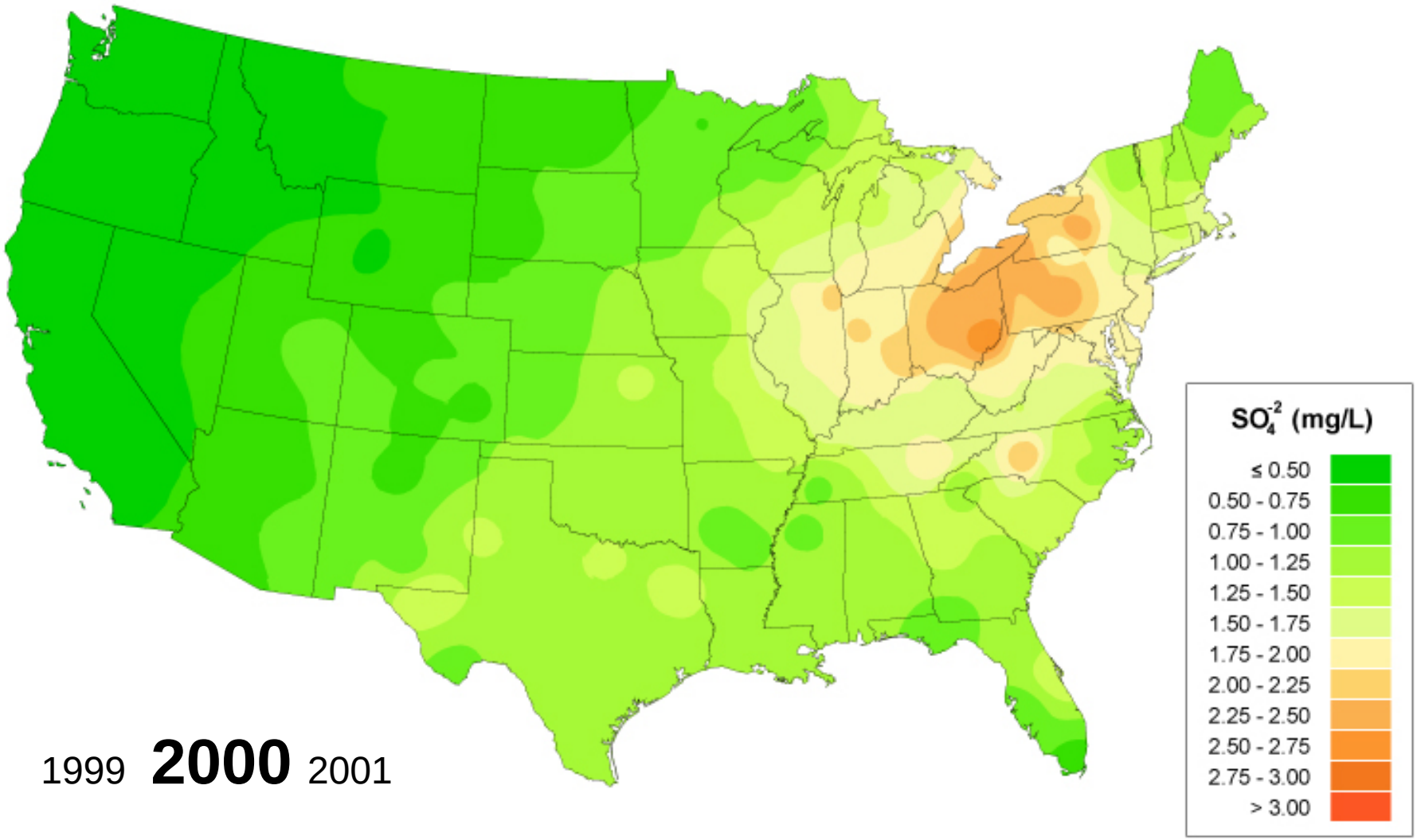
1997 **1998** 1999

Sulfate Ion Concentrations 1985-2003



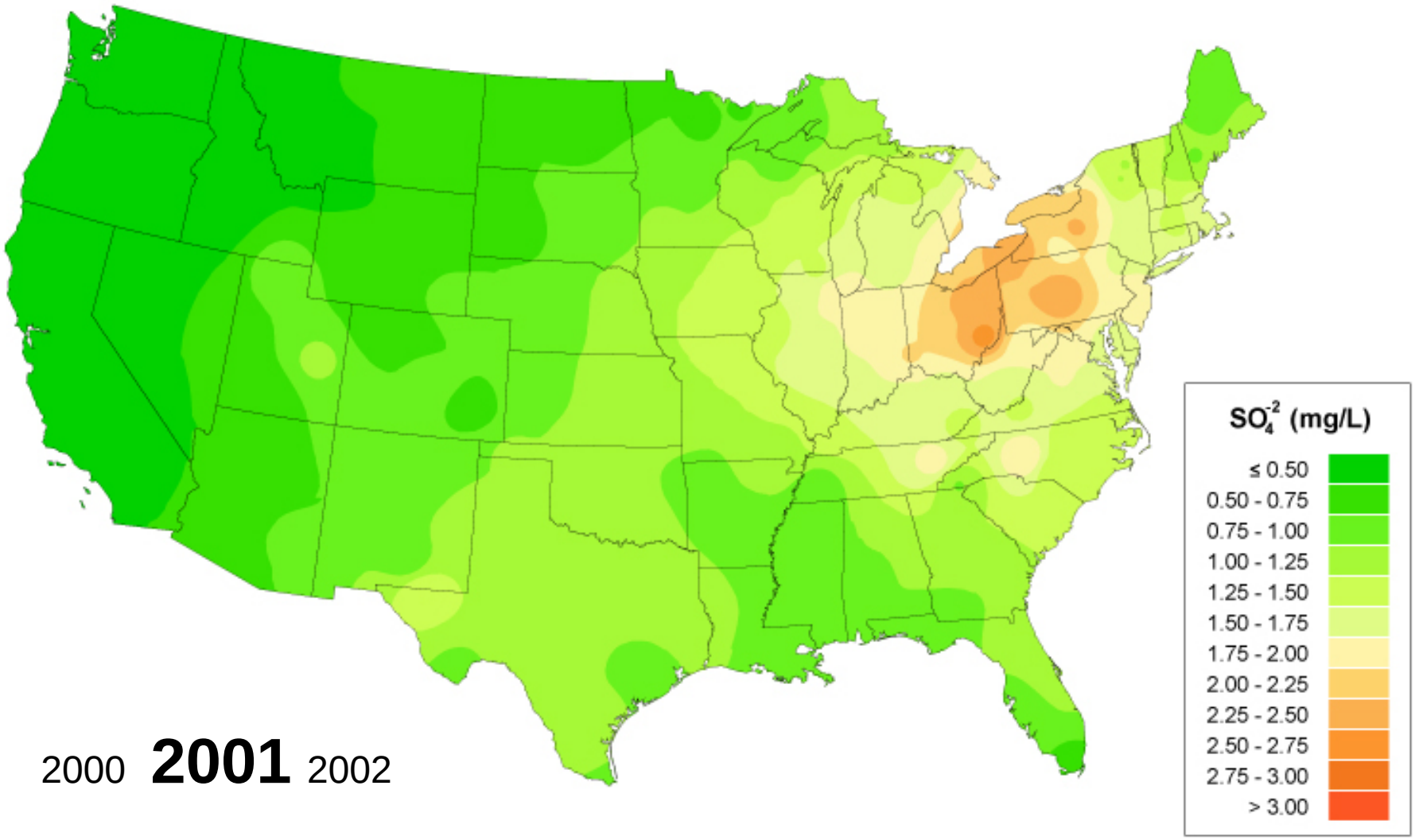
1998 **1999** 2000

Sulfate Ion Concentrations 1985-2003



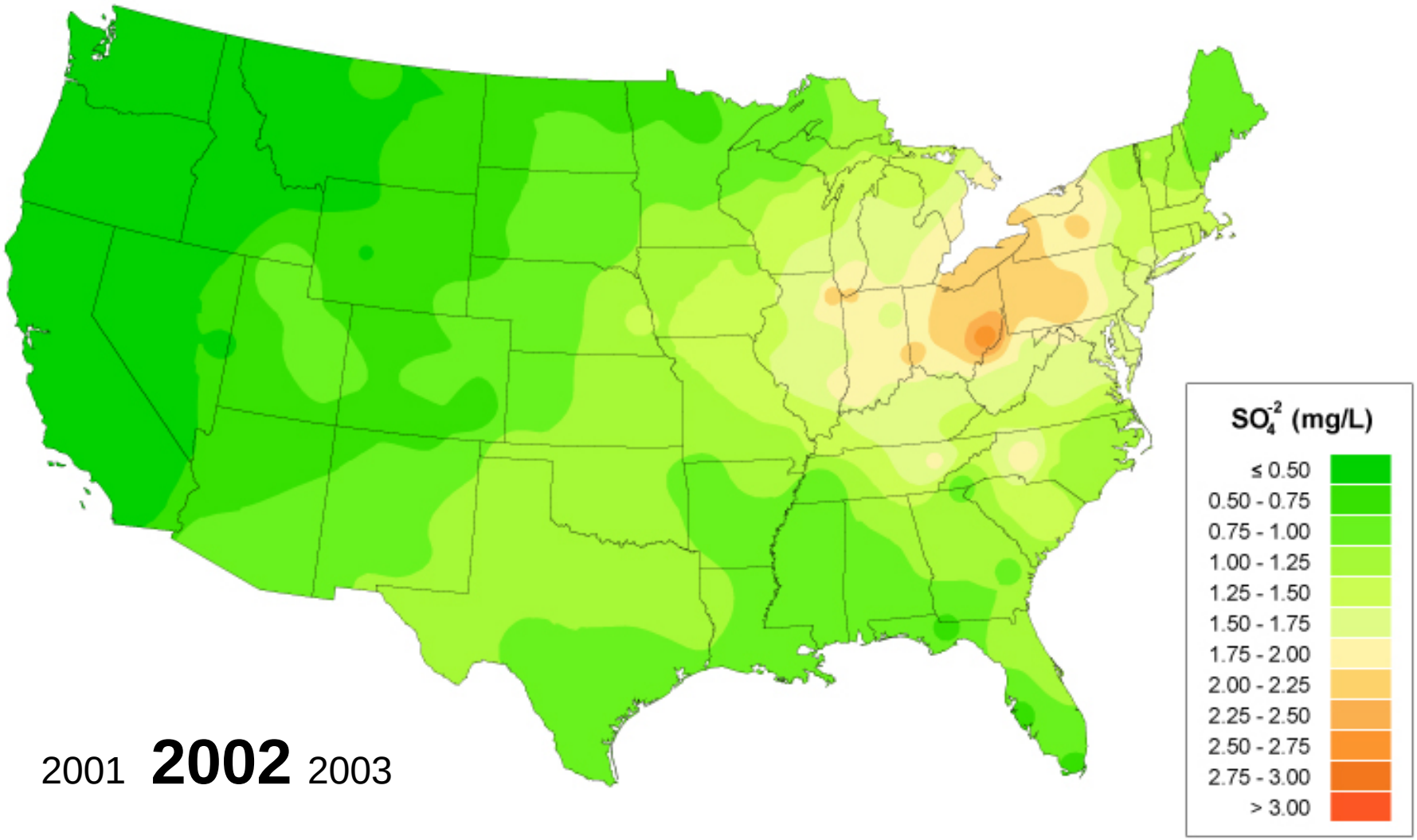
1999 **2000** 2001

Sulfate Ion Concentrations 1985-2003



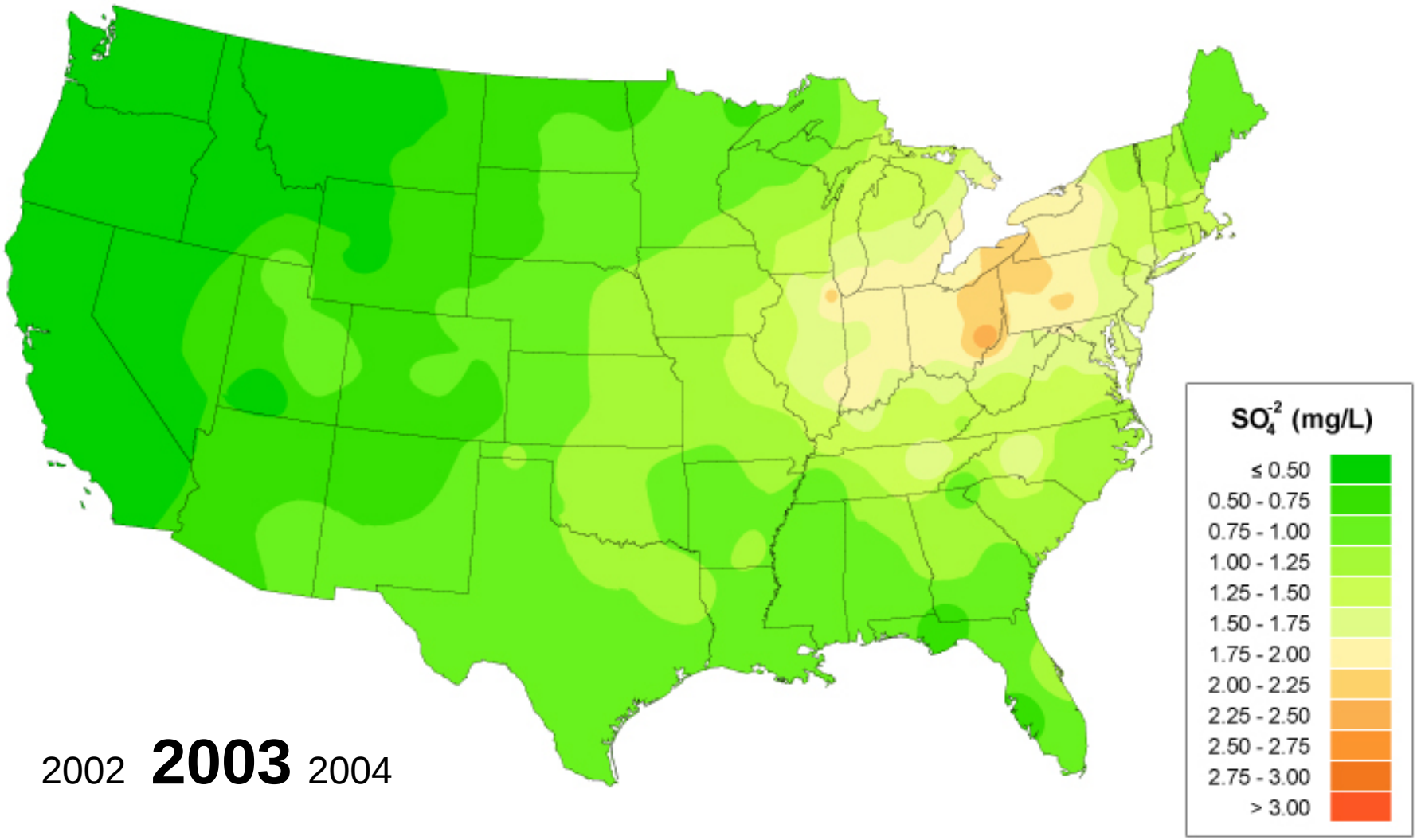
2000 **2001** 2002

Sulfate Ion Concentrations
1985-2003



2001 **2002** 2003

Sulfate Ion Concentrations
1985-2003

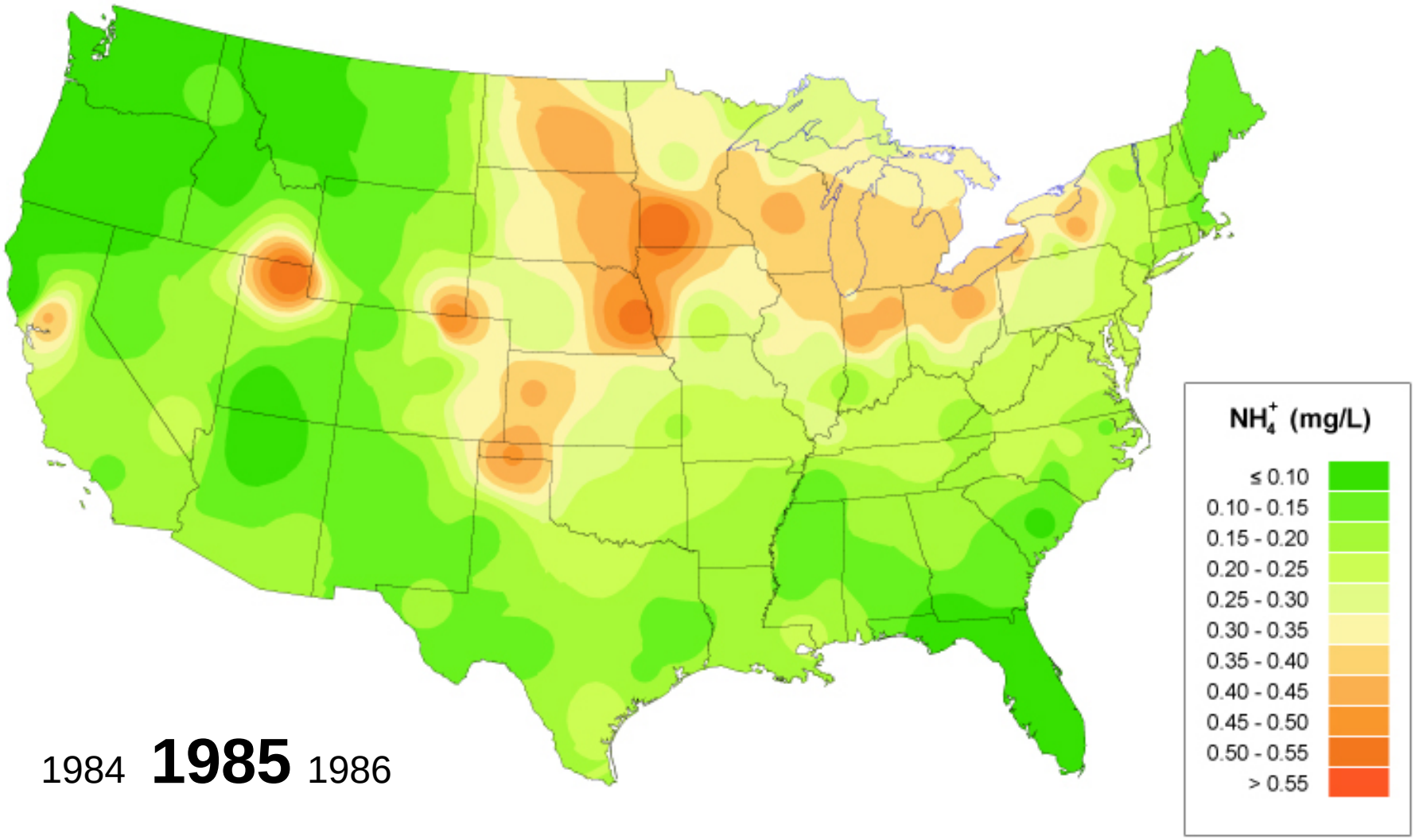


2002 **2003** 2004

Ammonium Concentrations

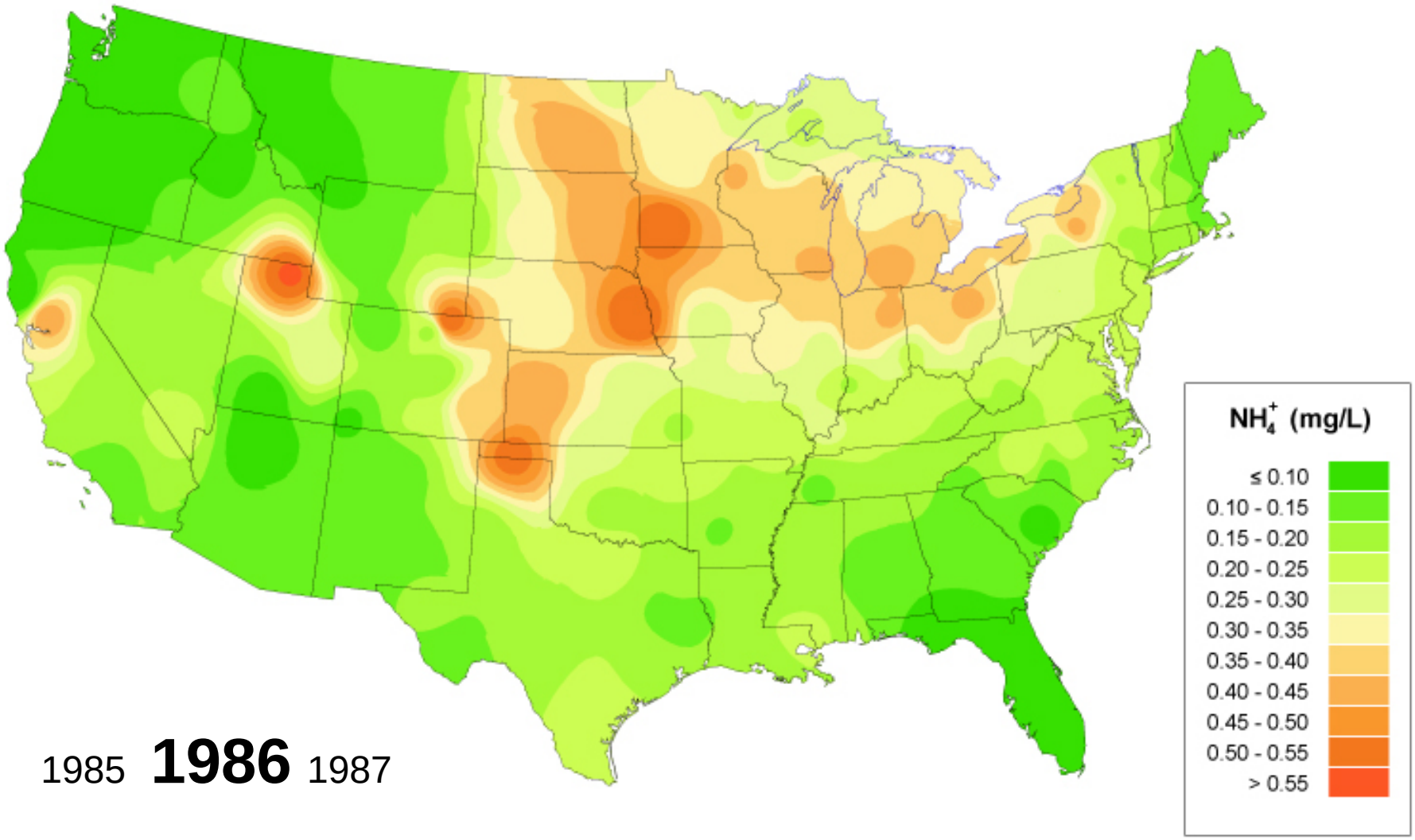
- NH_4^+ wet deposition,
- Three year running averages,
- 1985 to 2003

Ammonium Ion Concentrations 1985-2003



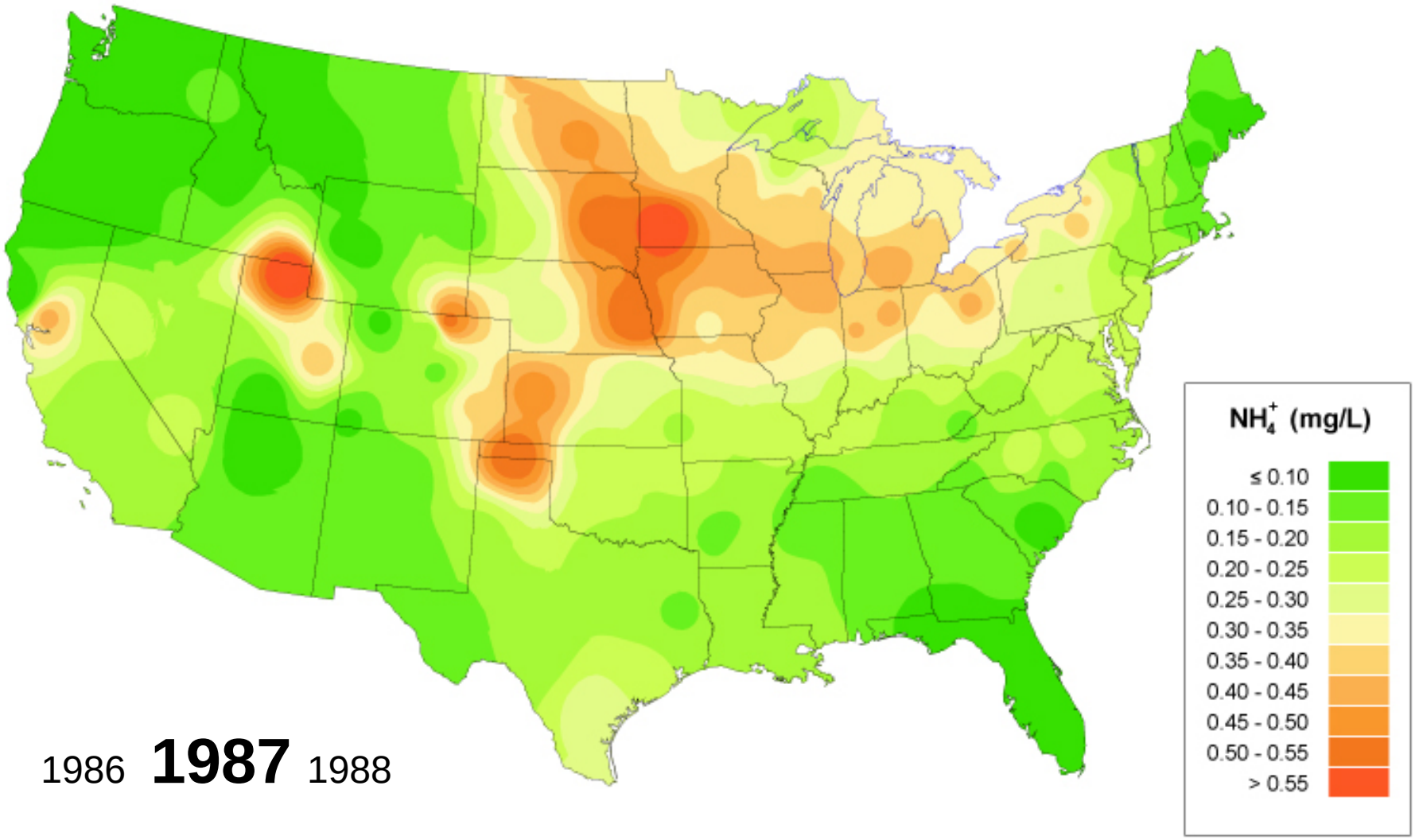
1984 **1985** 1986

Ammonium Ion Concentrations 1985-2003



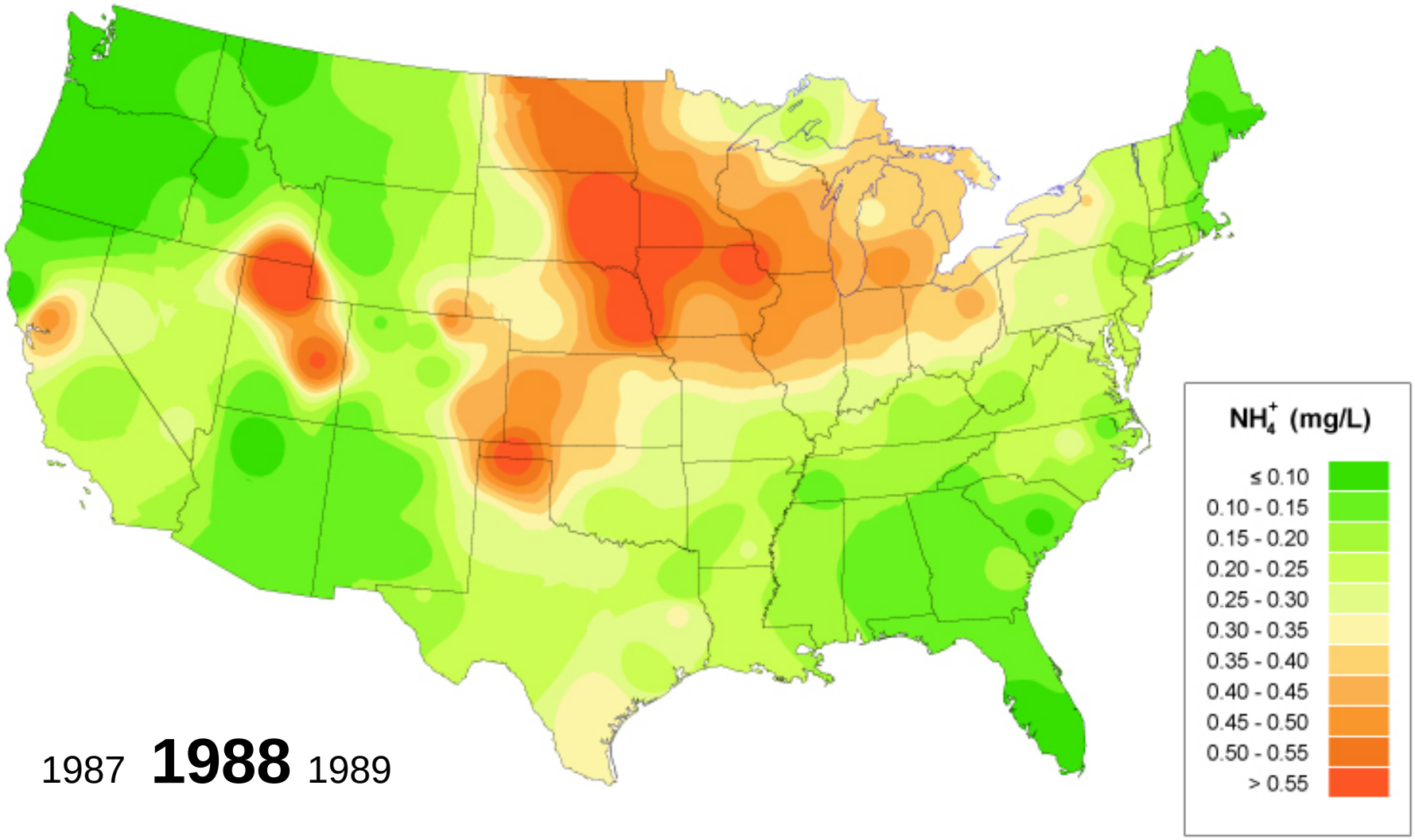
1985 **1986** 1987

Ammonium Ion Concentrations 1985-2003



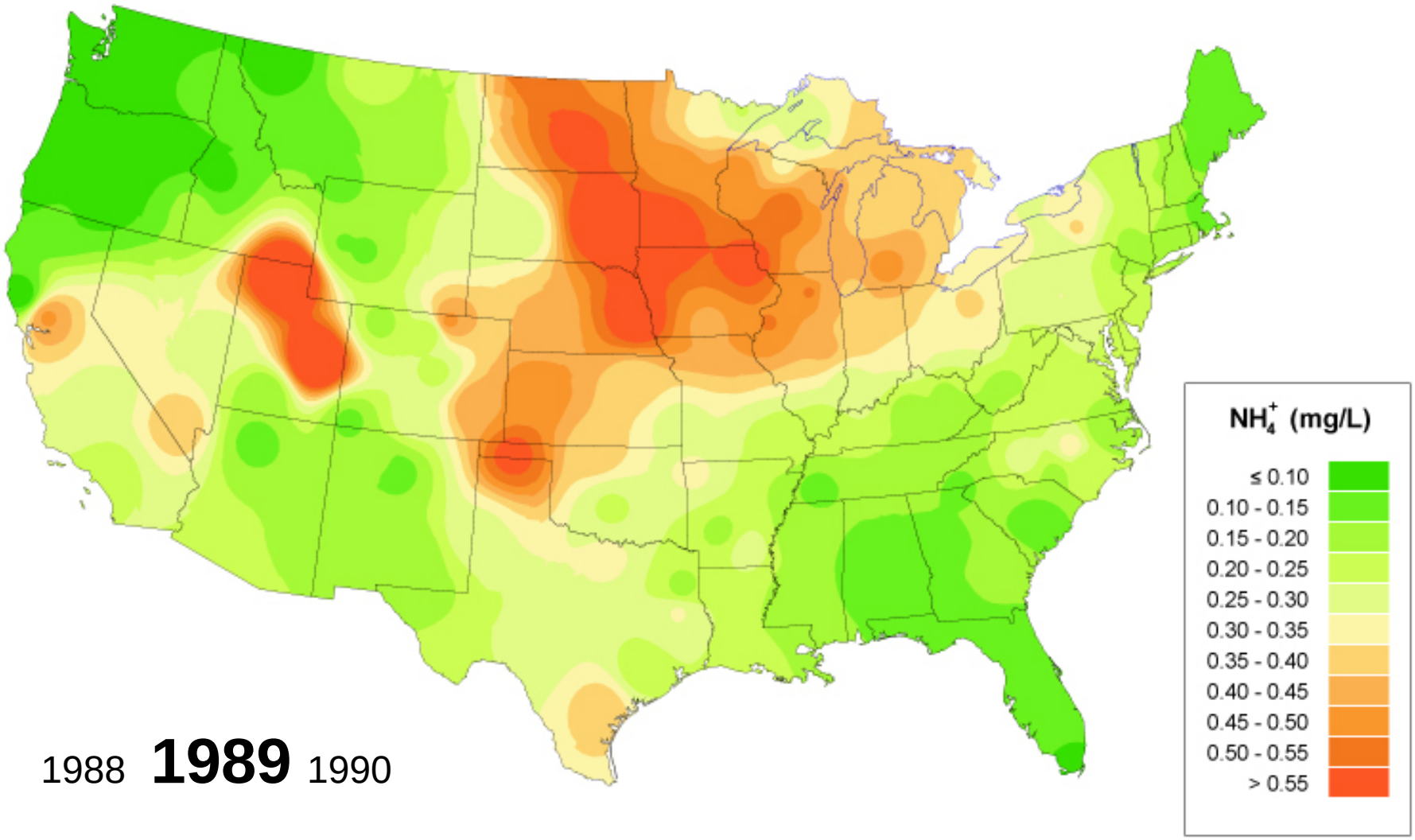
1986 **1987** 1988

Ammonium Ion Concentrations 1985-2003



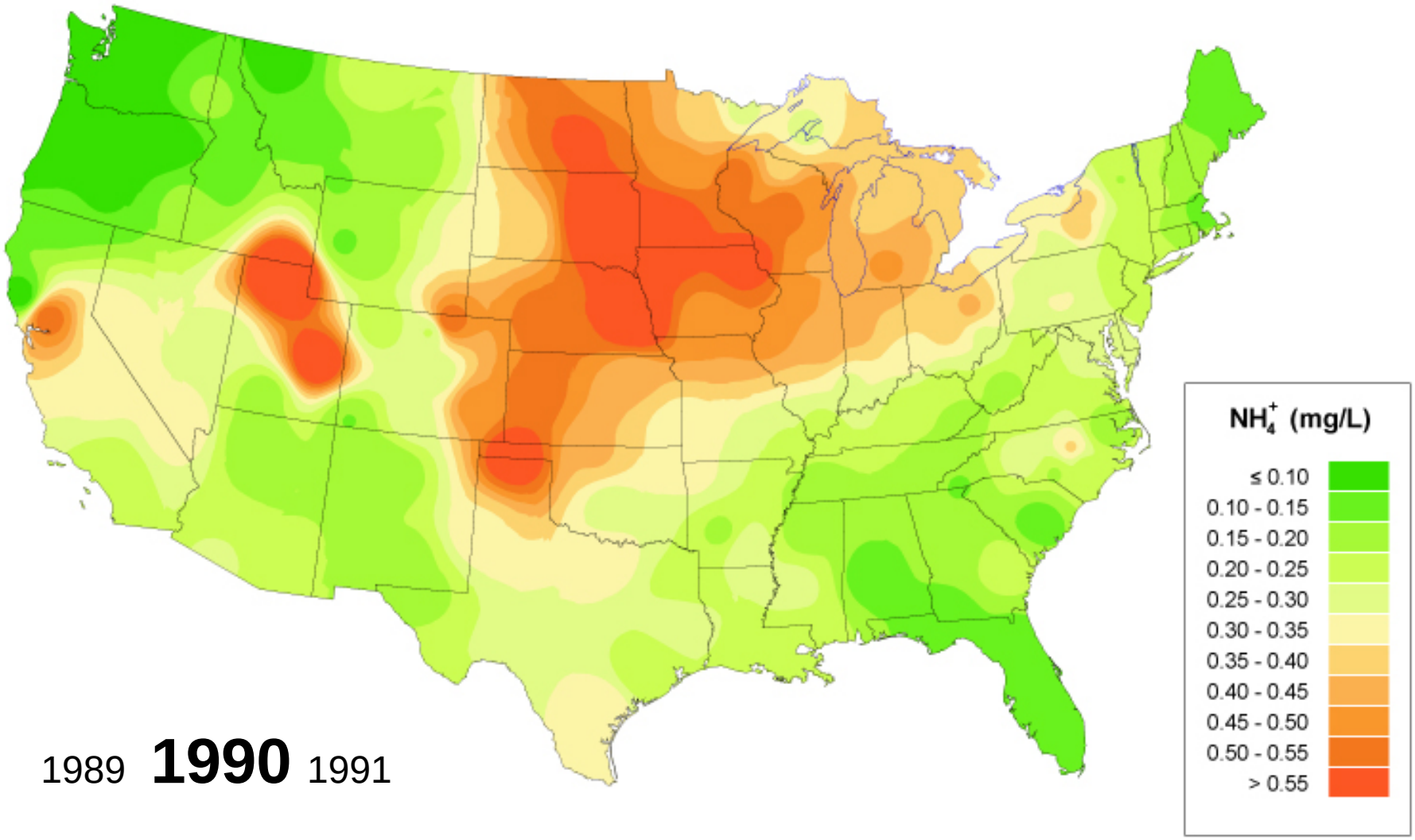
1987 **1988** 1989

Ammonium Ion Concentrations 1985-2003



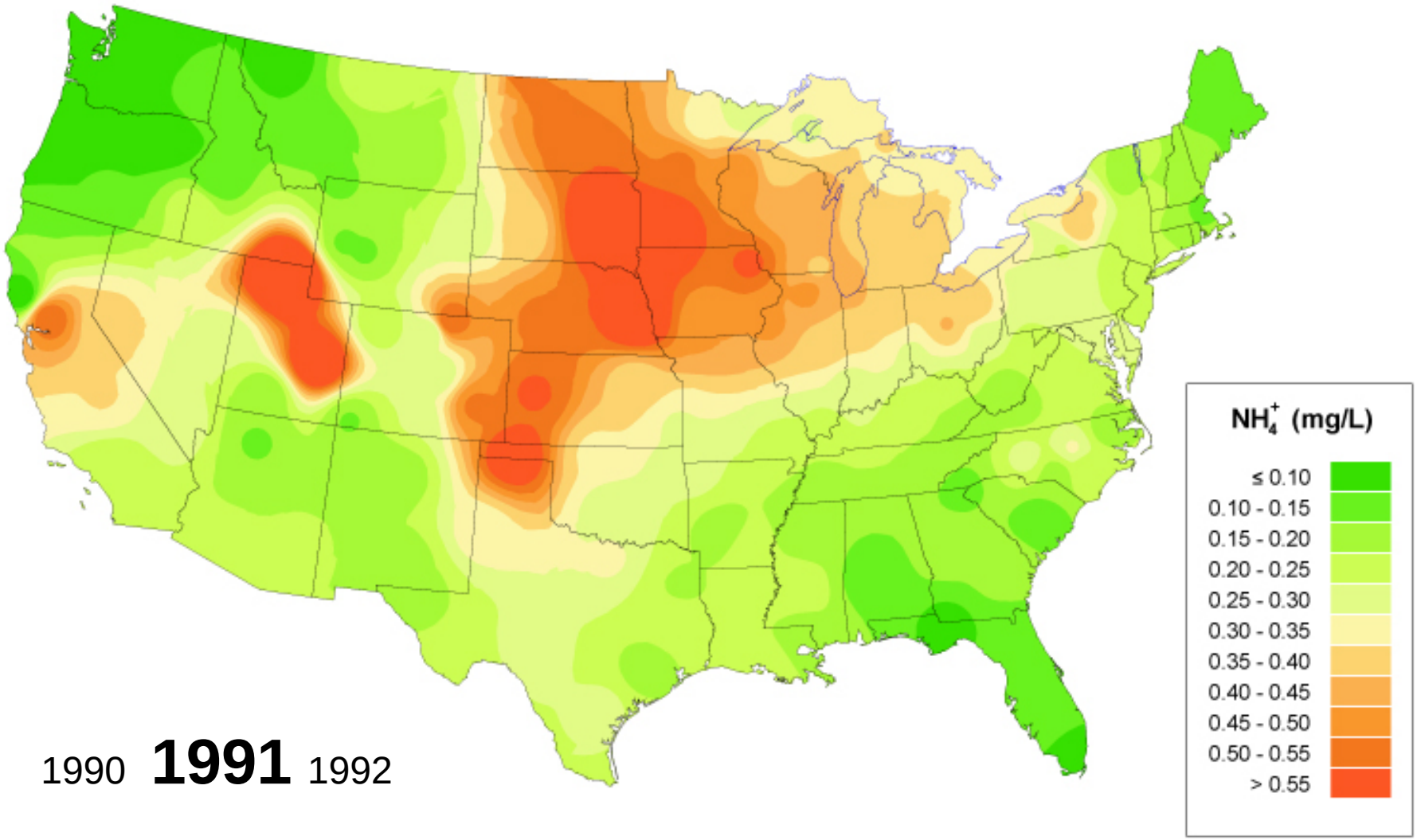
1988 **1989** 1990

Ammonium Ion Concentrations 1985-2003



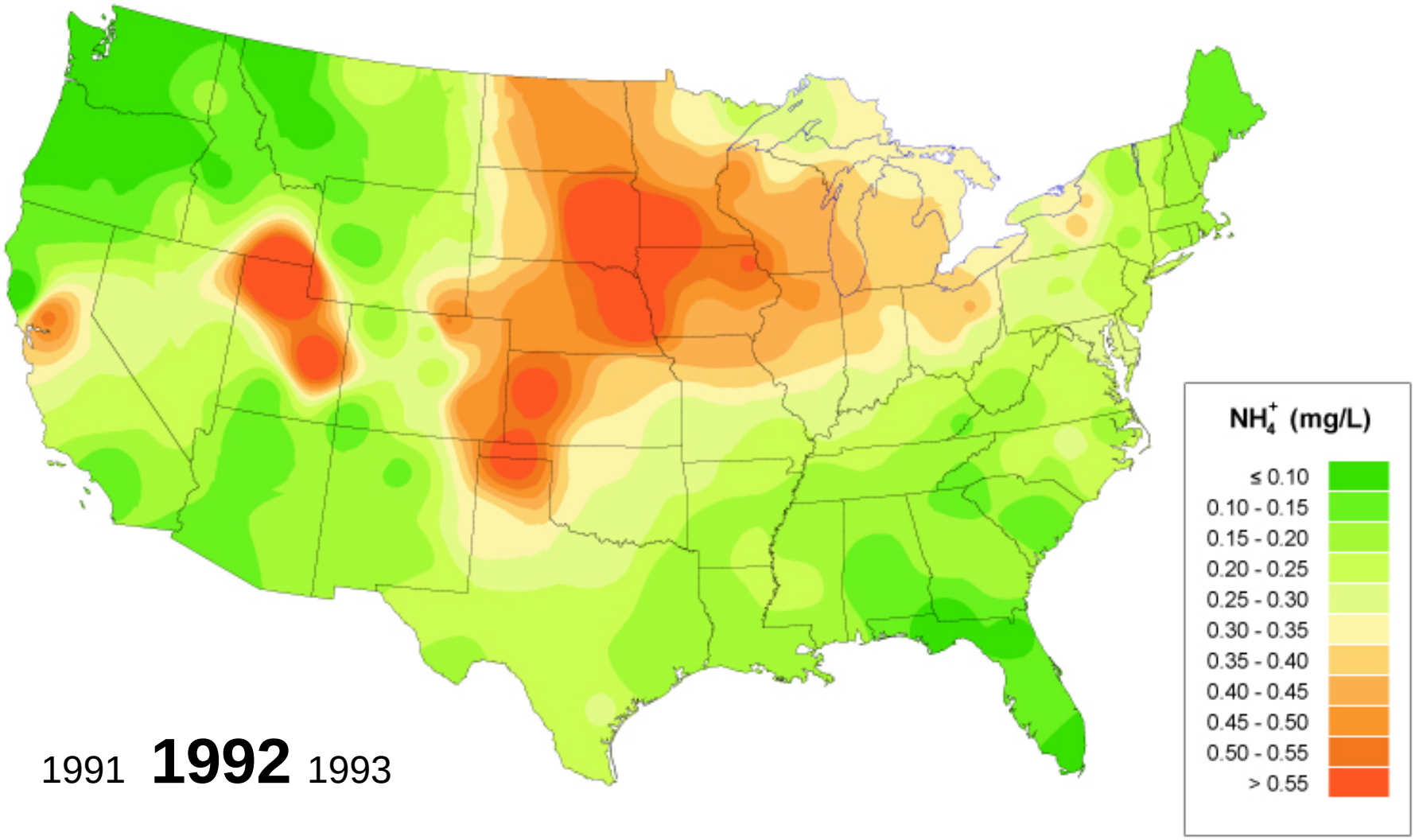
1989 **1990** 1991

Ammonium Ion Concentrations 1985-2003



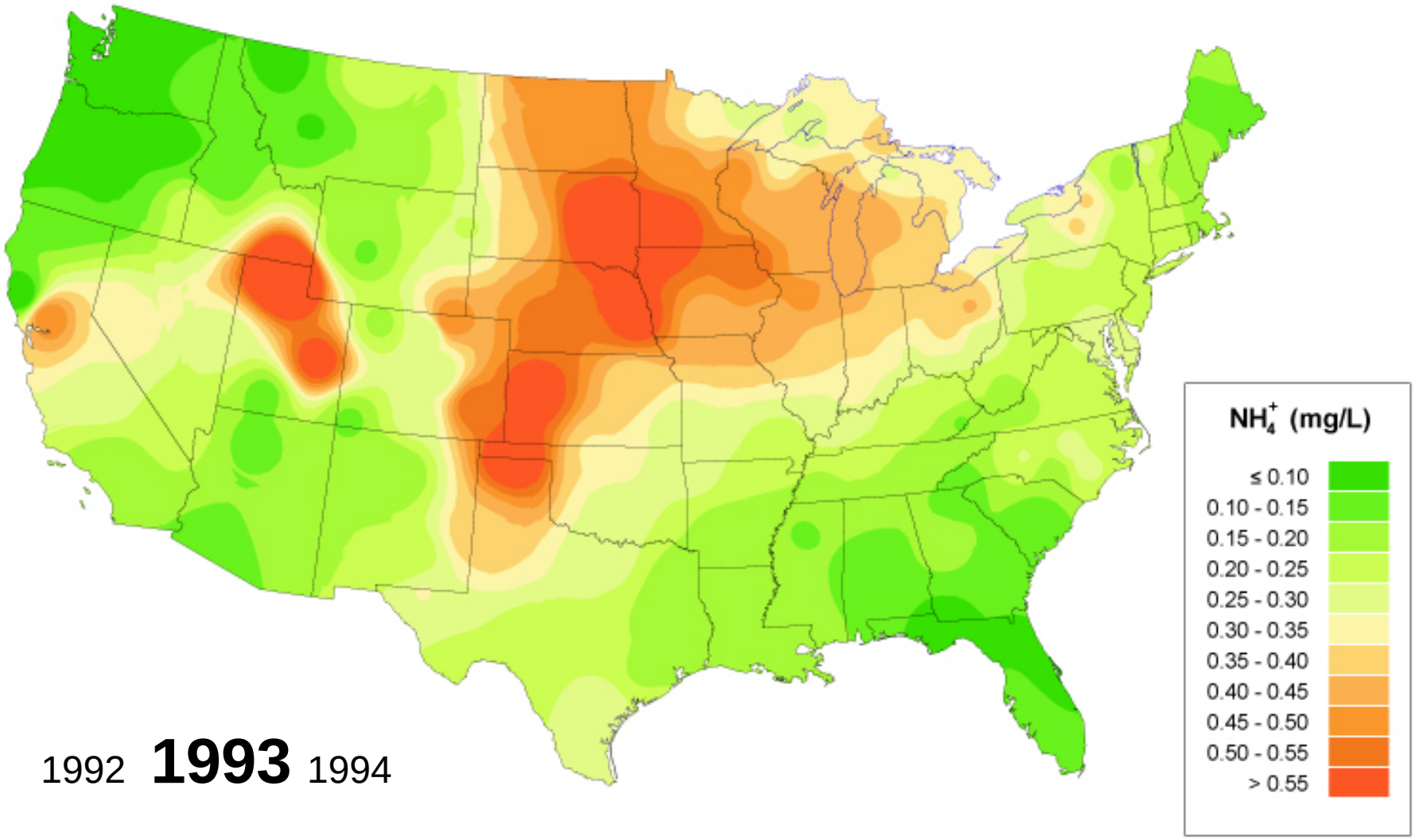
1990 **1991** 1992

Ammonium Ion Concentrations 1985-2003



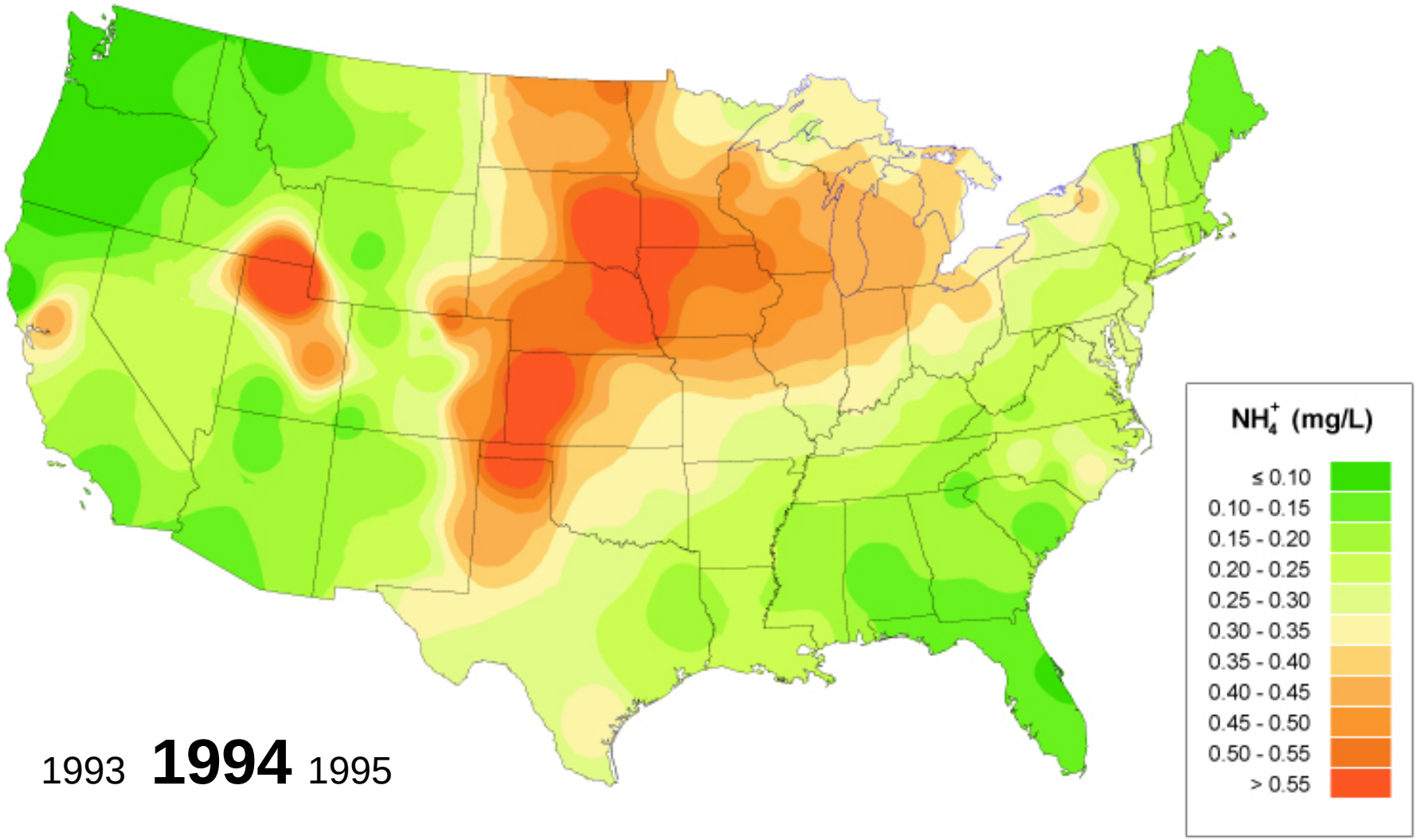
1991 **1992** 1993

Ammonium Ion Concentrations 1985-2003



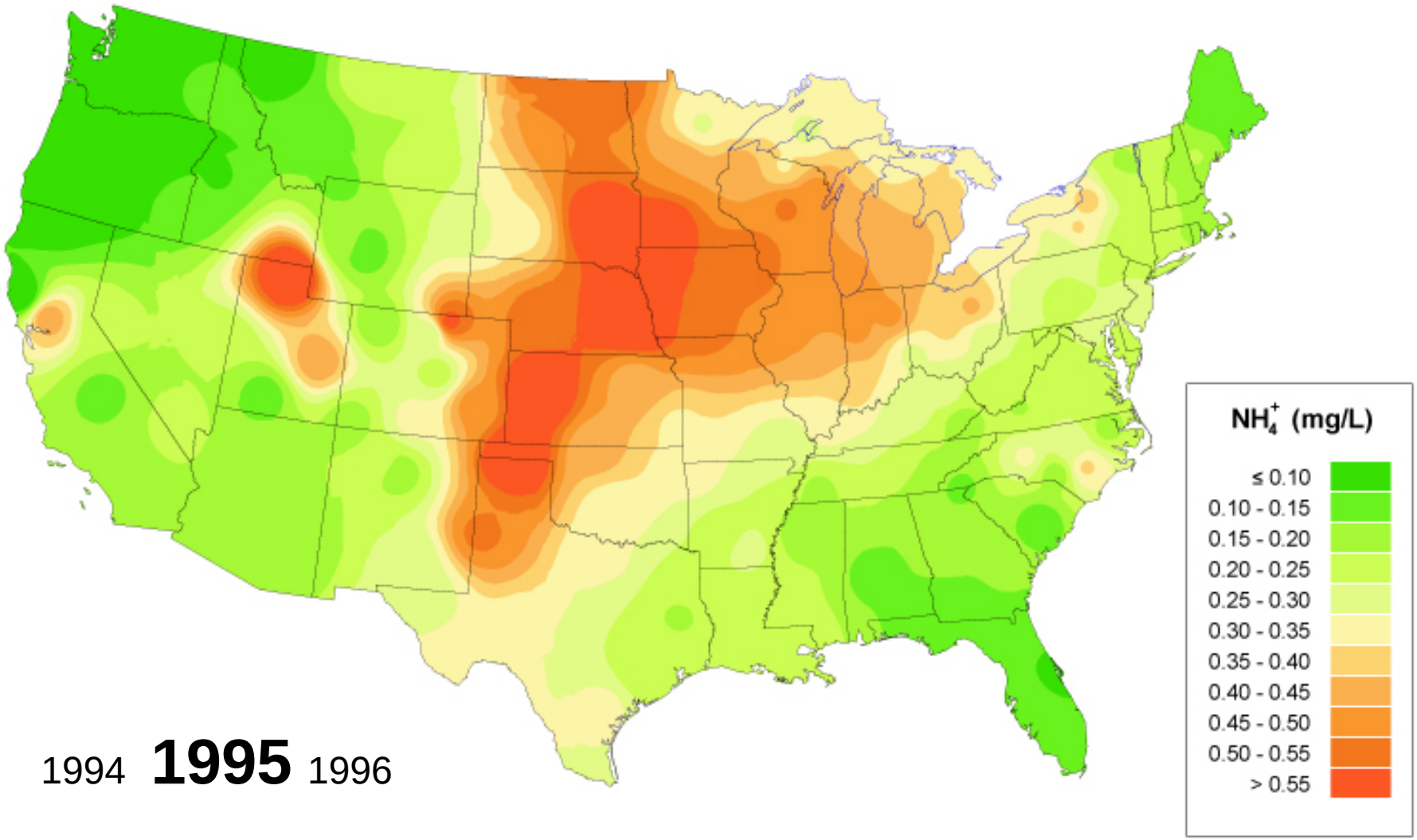
1992 **1993** 1994

Ammonium Ion Concentrations 1985-2003



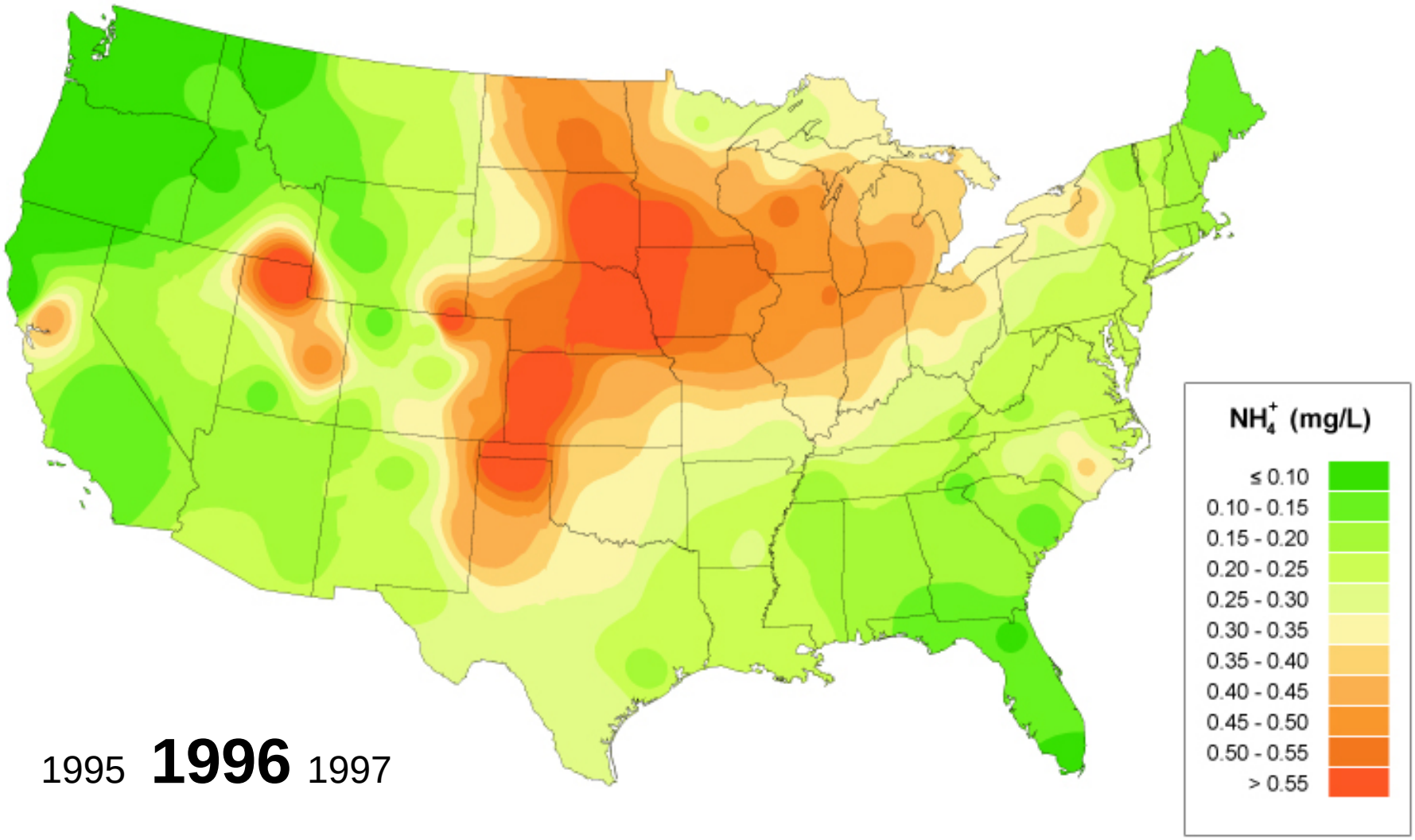
1993 **1994** 1995

Ammonium Ion Concentrations 1985-2003



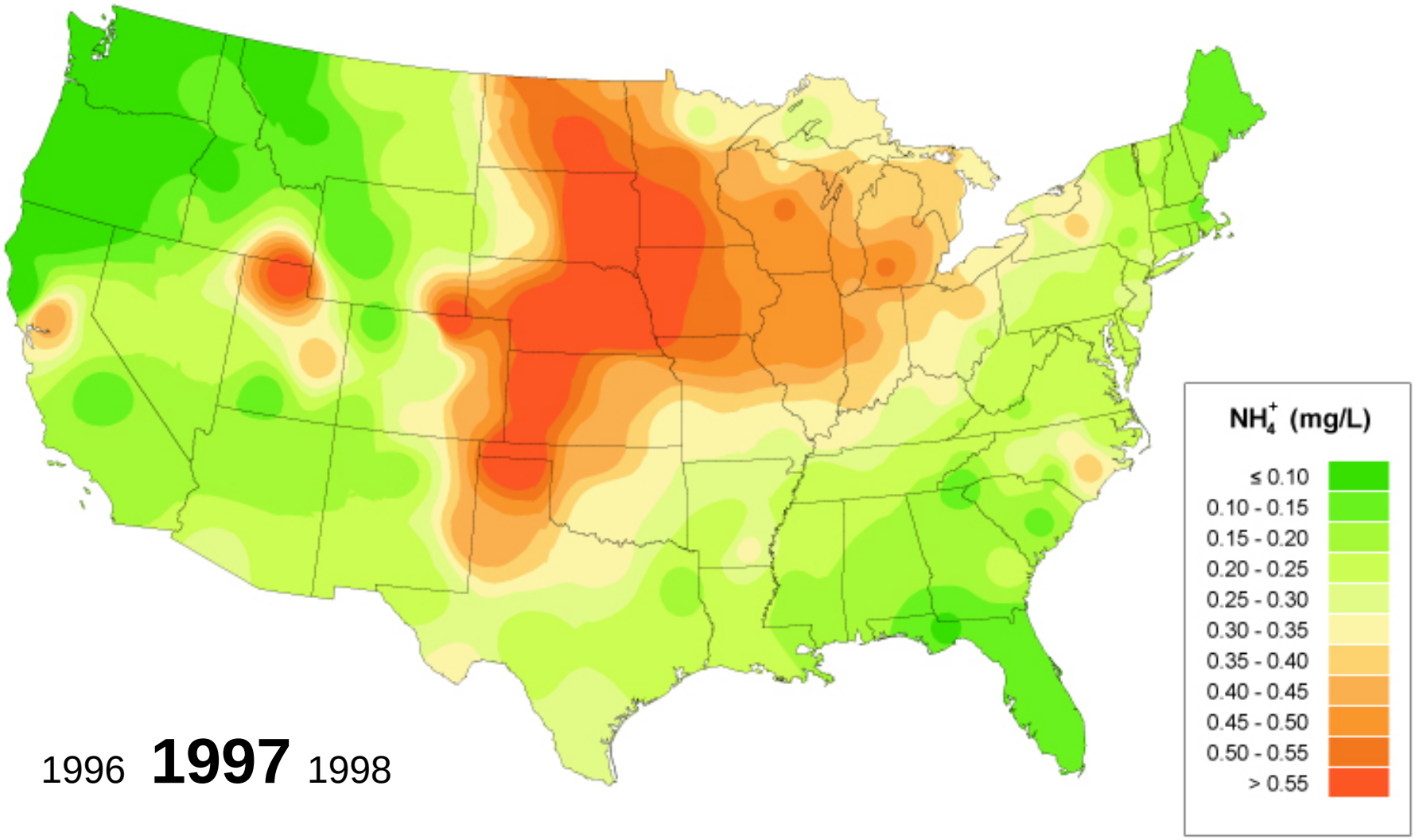
1994 **1995** 1996

Ammonium Ion Concentrations 1985-2003



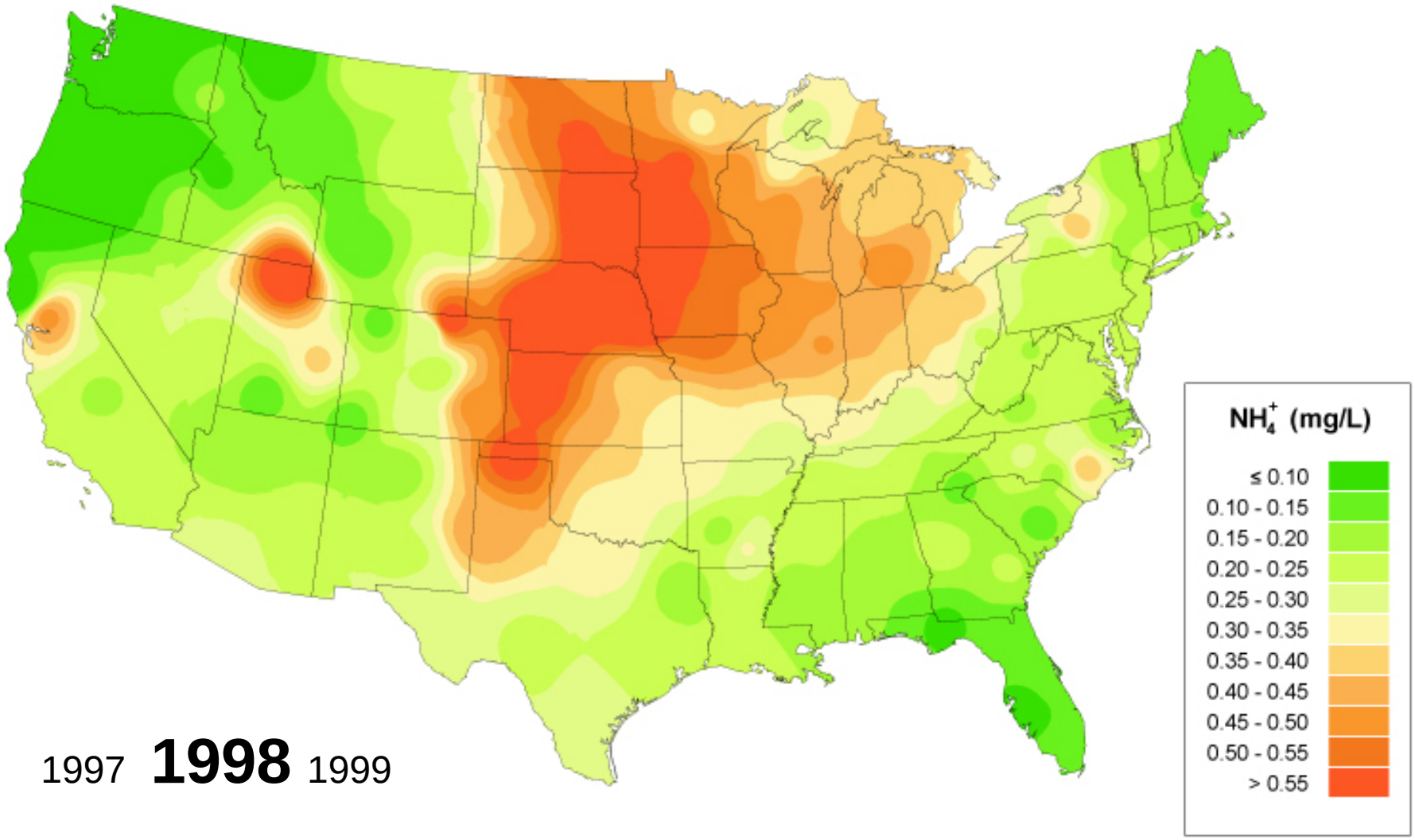
1995 **1996** 1997

Ammonium Ion Concentrations 1985-2003



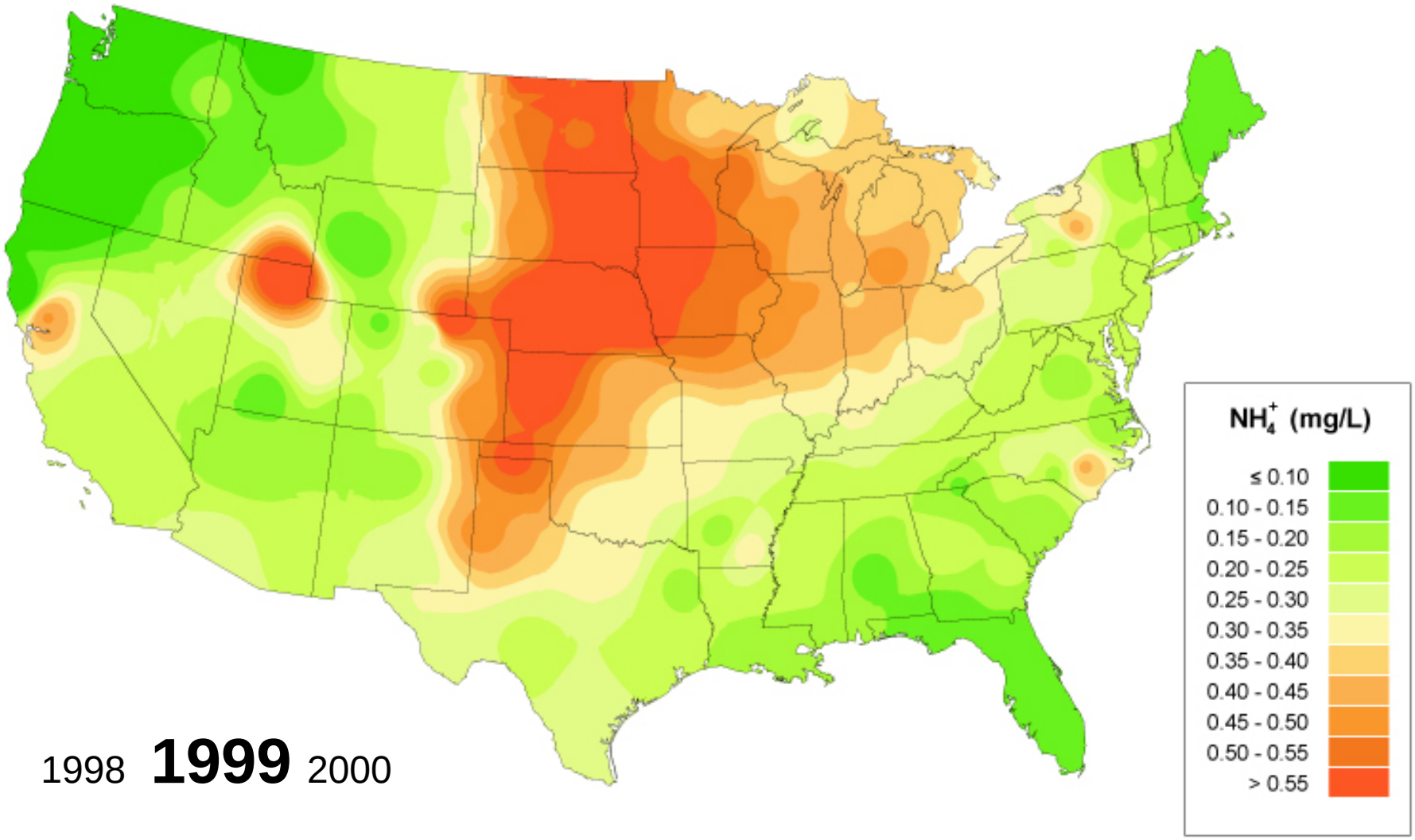
1996 **1997** 1998

Ammonium Ion Concentrations 1985-2003



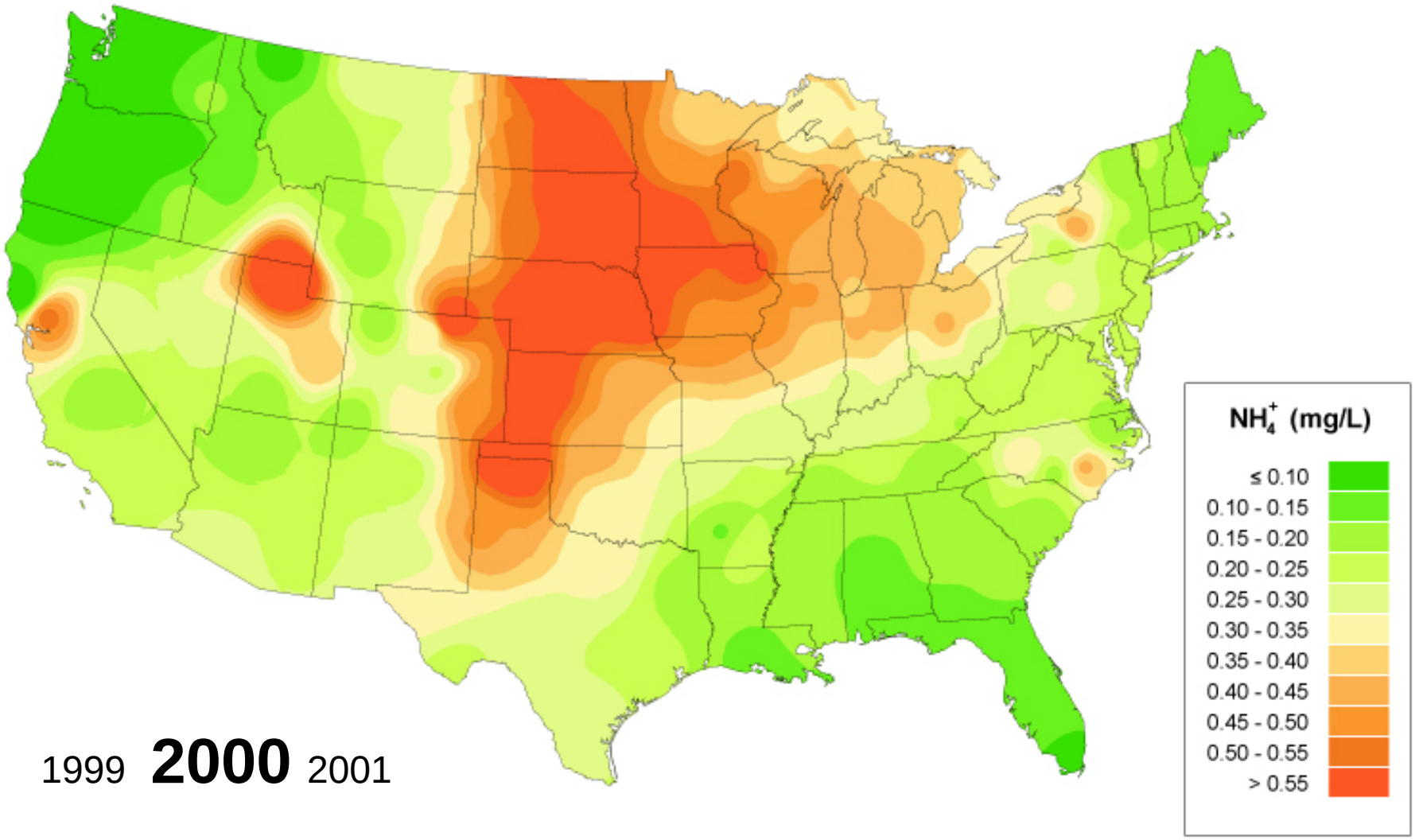
1997 **1998** 1999

Ammonium Ion Concentrations 1985-2003



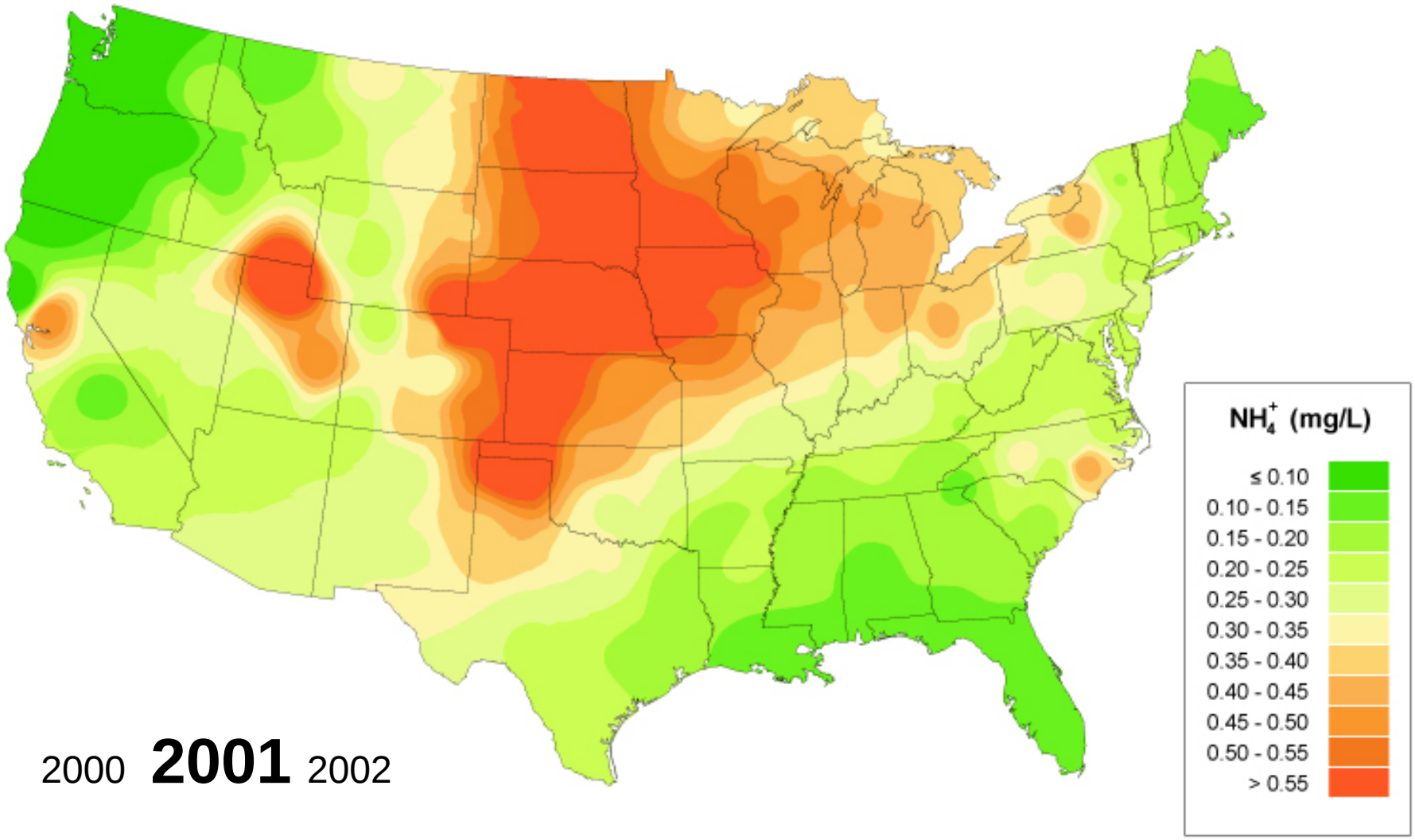
1998 **1999** 2000

Ammonium Ion Concentrations 1985-2003



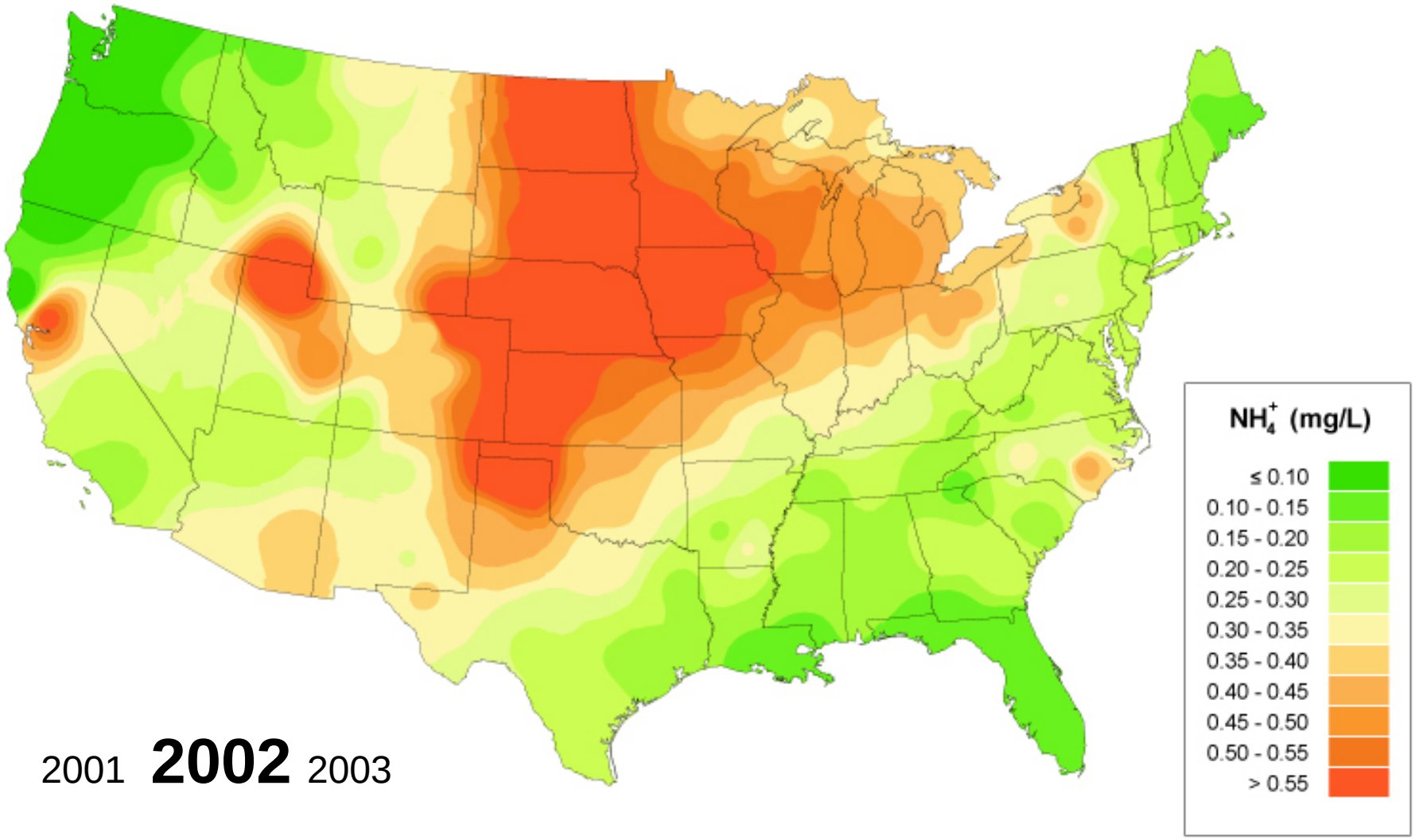
1999 **2000** 2001

Ammonium Ion Concentrations 1985-2003



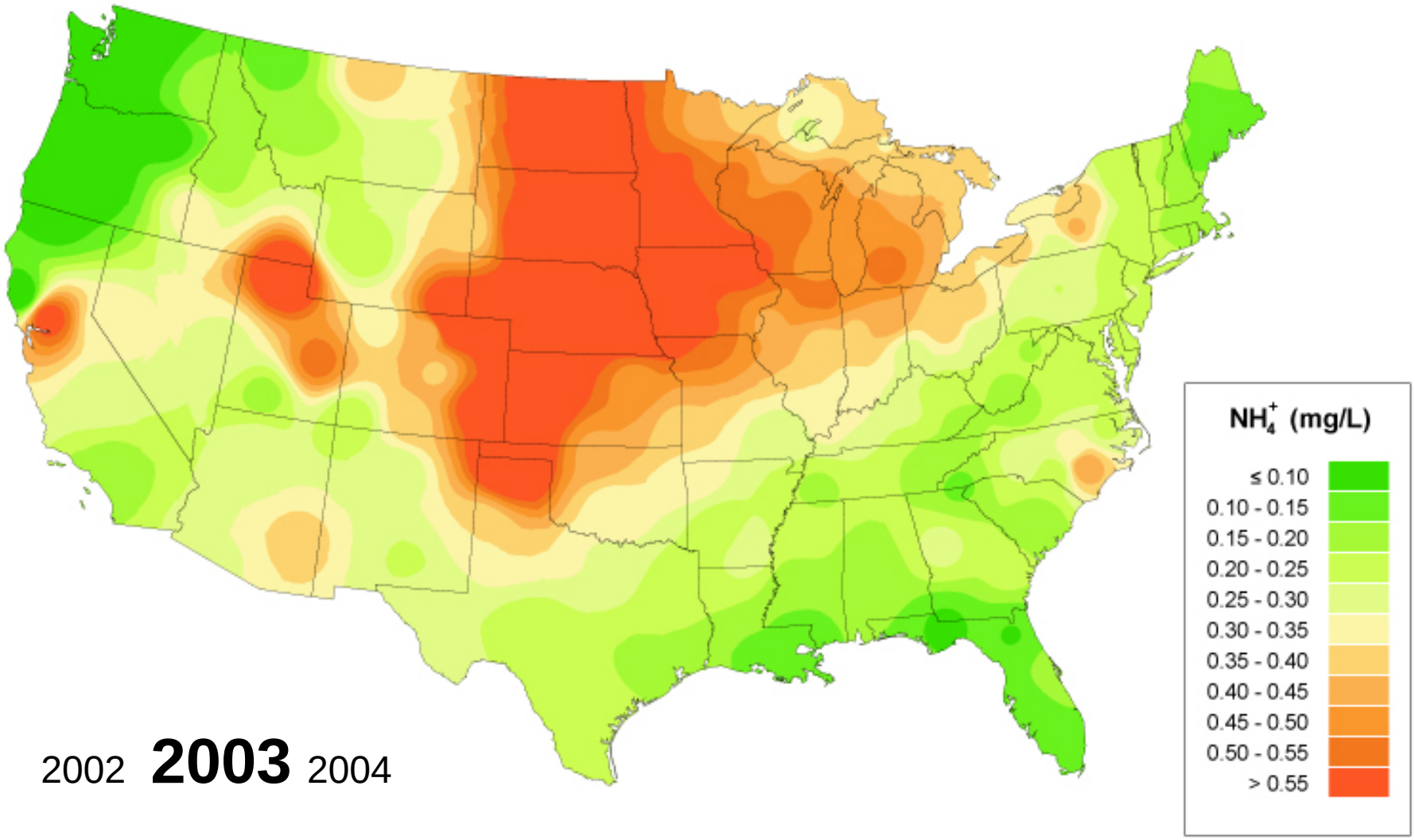
2000 **2001** 2002

Ammonium Ion Concentrations 1985-2003



2001 **2002** 2003

Ammonium Ion Concentrations 1985-2003

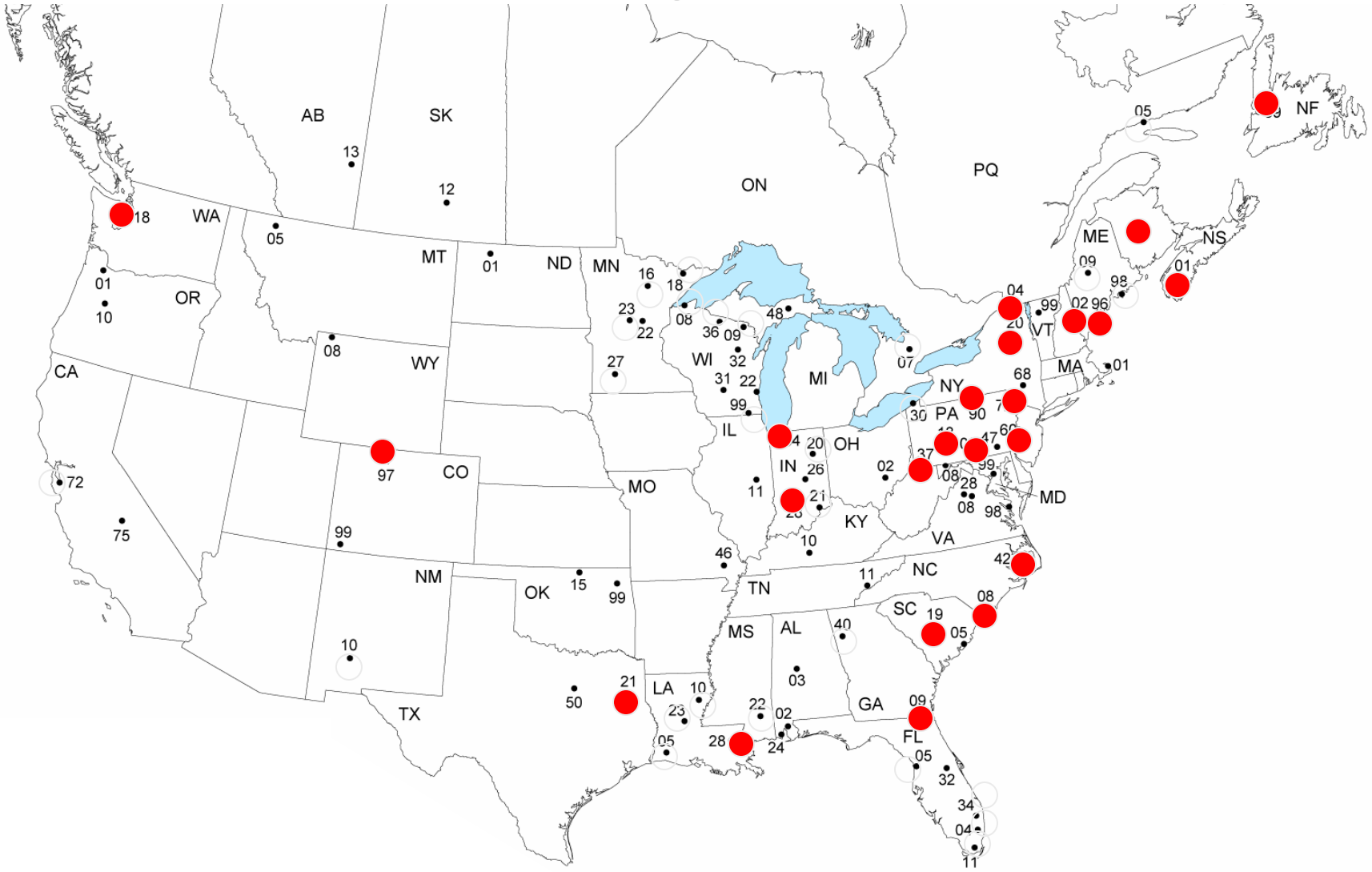


2002 **2003** 2004

WHAT ELSE

IS NADP DOING?

Trends in Mercury Concentrations



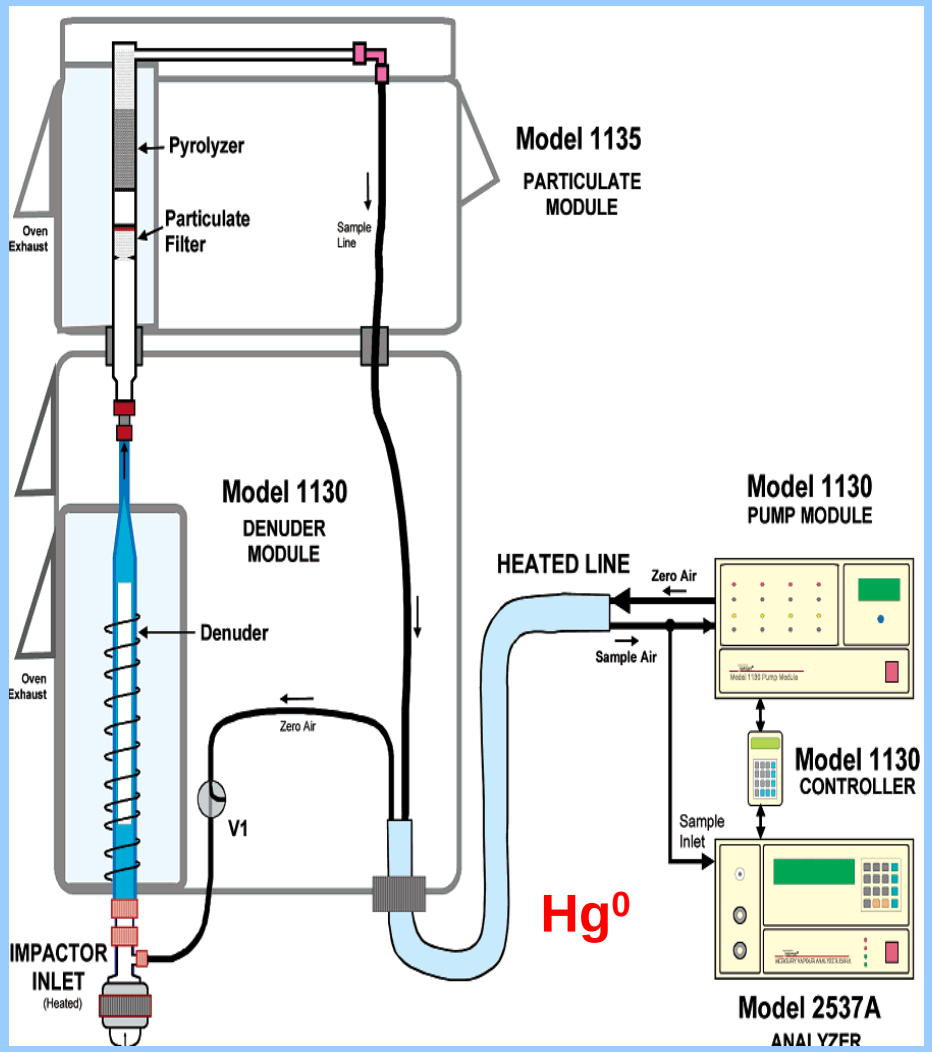
Estimates of Mercury *Dry Deposition*

- Measure atmospheric concentrations & meteorology
  - Hg^0, Hg^{2+} and particulate-bound Hg
  - Same general procedure as CASTNET
- Modeled dry deposition from these atmospheric concentrations
- Proposed MDN Initiative starting…

Atmospheric Concentrations: Tekran

PHg

RGM



Methods are:

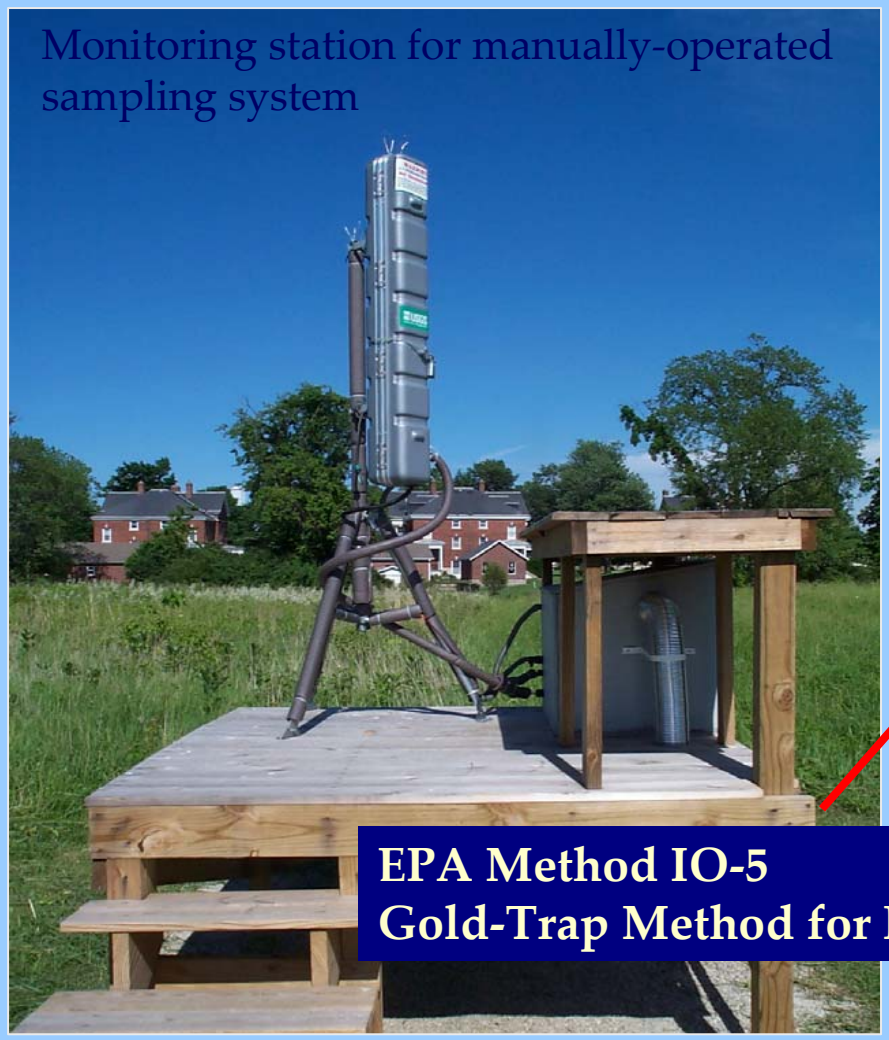
-Lab Tested

-Widely used

-QA challenged

-EPA Accepted

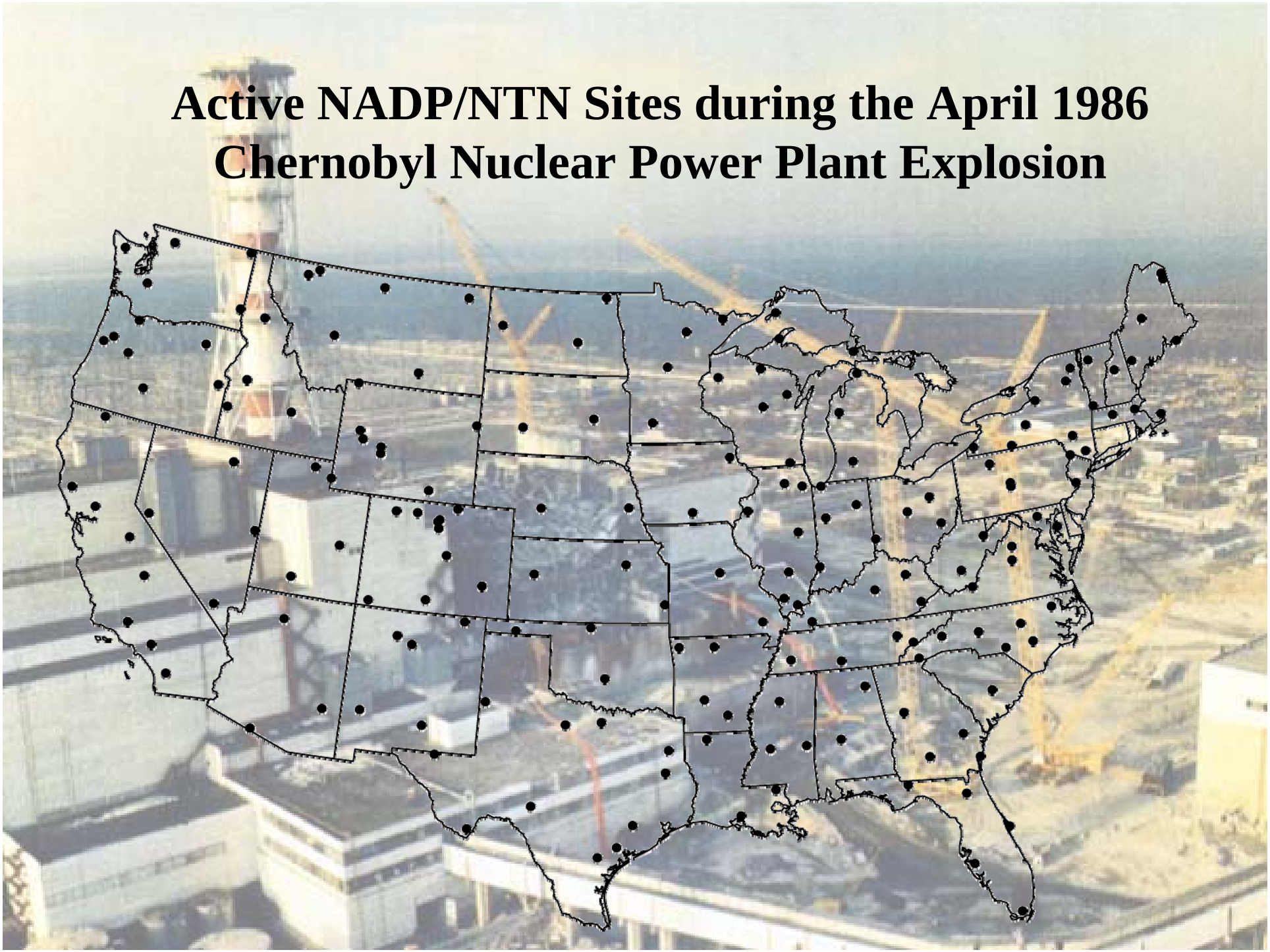
Atmospheric Concentrations: Manually Operated Mercury Species Sampling



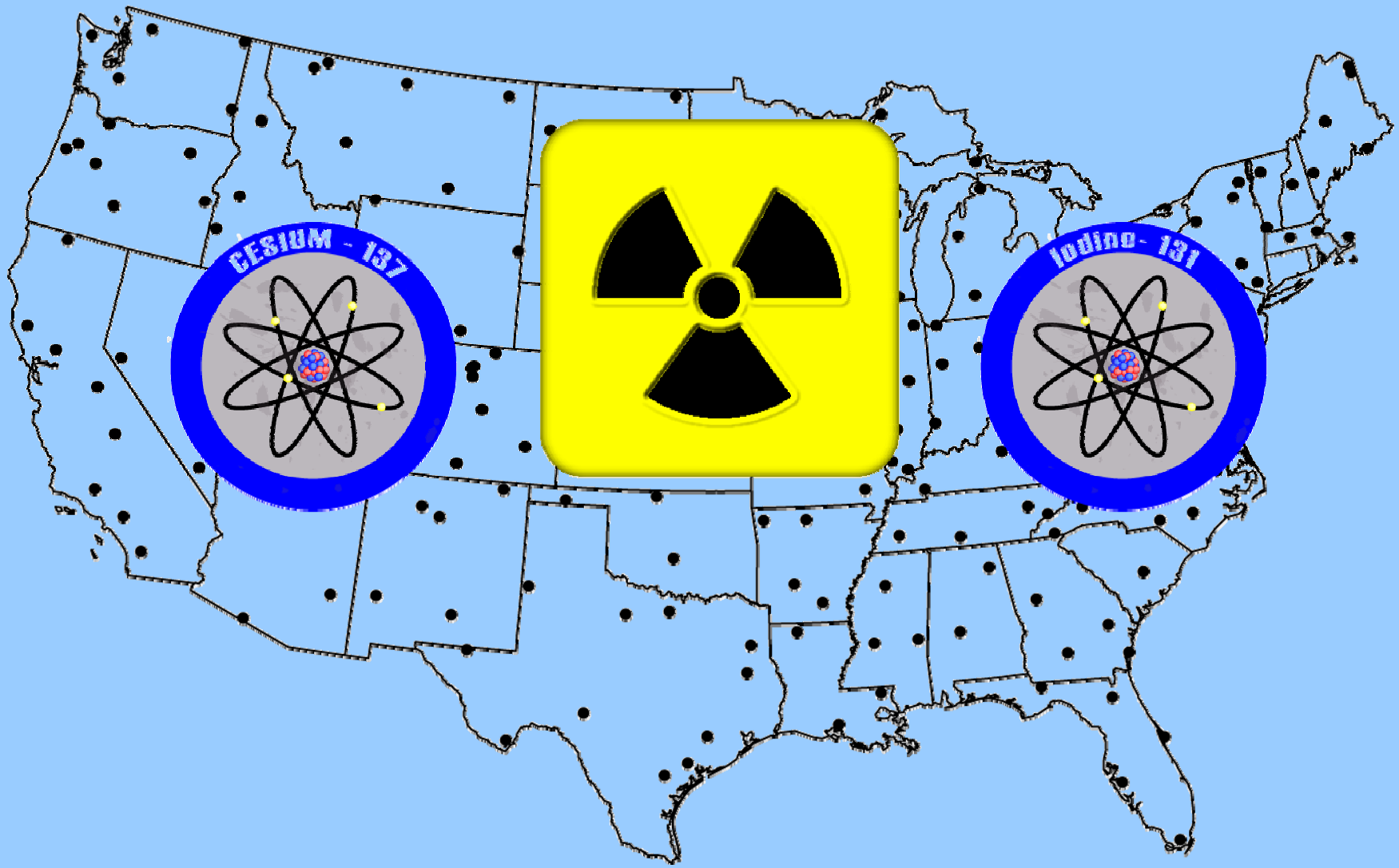
EPA Method IO-5
Gold-Trap Method for Hg^0 i

Sampling box for manual system

Active NADP/NTN Sites during the April 1986 Chernobyl Nuclear Power Plant Explosion

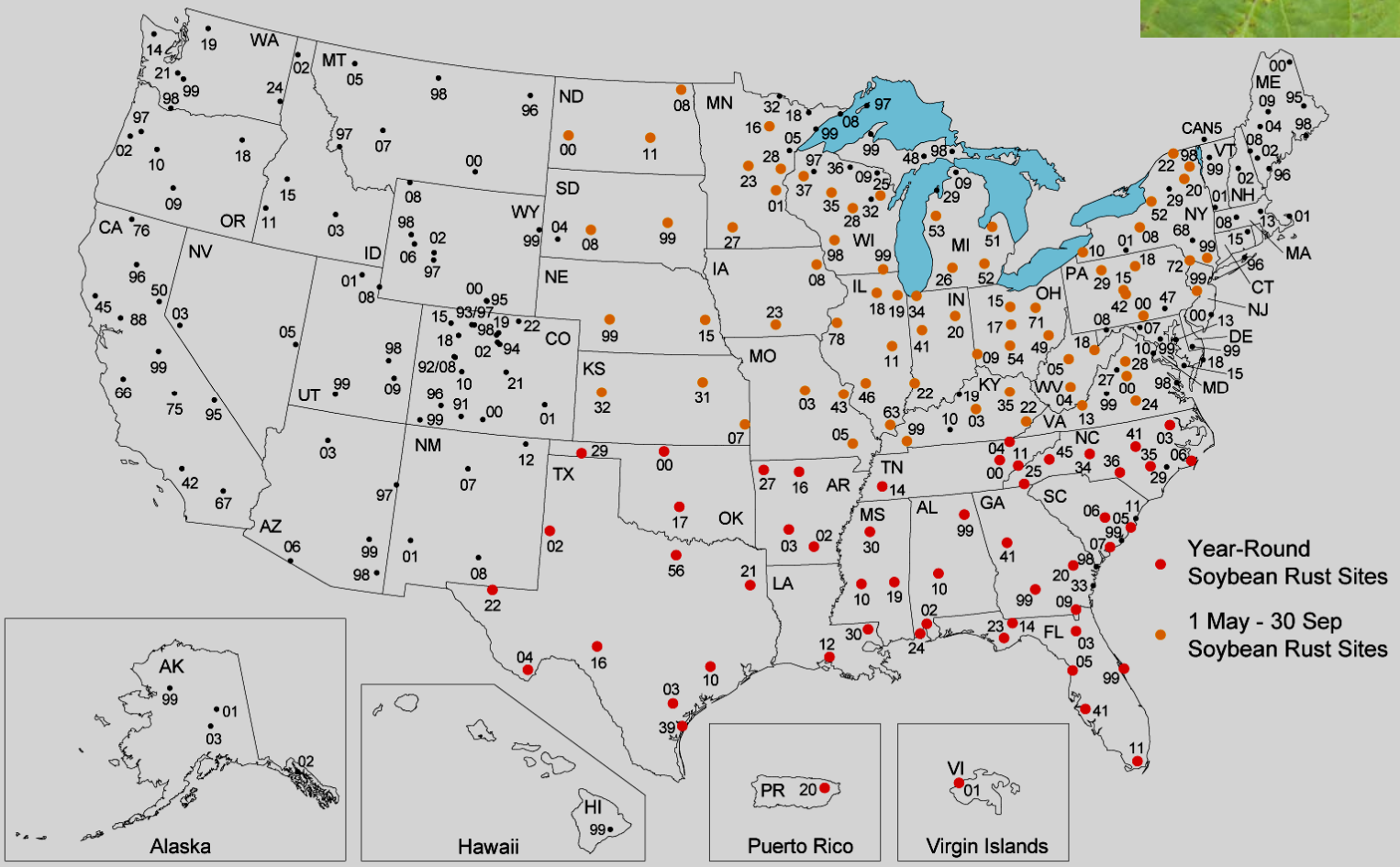


Radionuclides tested in NADP Precipitation Samples



US Department of Energy

Soybean Rust



Bottom Line for NADP

- Do measurements consistently and as accurately as possible
- Check our accuracy (QA)
- Help our members
- Data online for everyone

Overview of the

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM (NADP)

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NATIONAL ATMOSPHERIC DEPOSITION PROGRAM

A Cooperative Research Support Program of the
State Agricultural Experiment Stations (NRSP-3)
Federal and State Agencies
and Private Research Organizations

ILLINOIS

Illinois State WATER Survey (1895)