Atmospheric Deposition Measurement and Program Management

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Air Resources Laboratory

Air Resources Laboratory Review

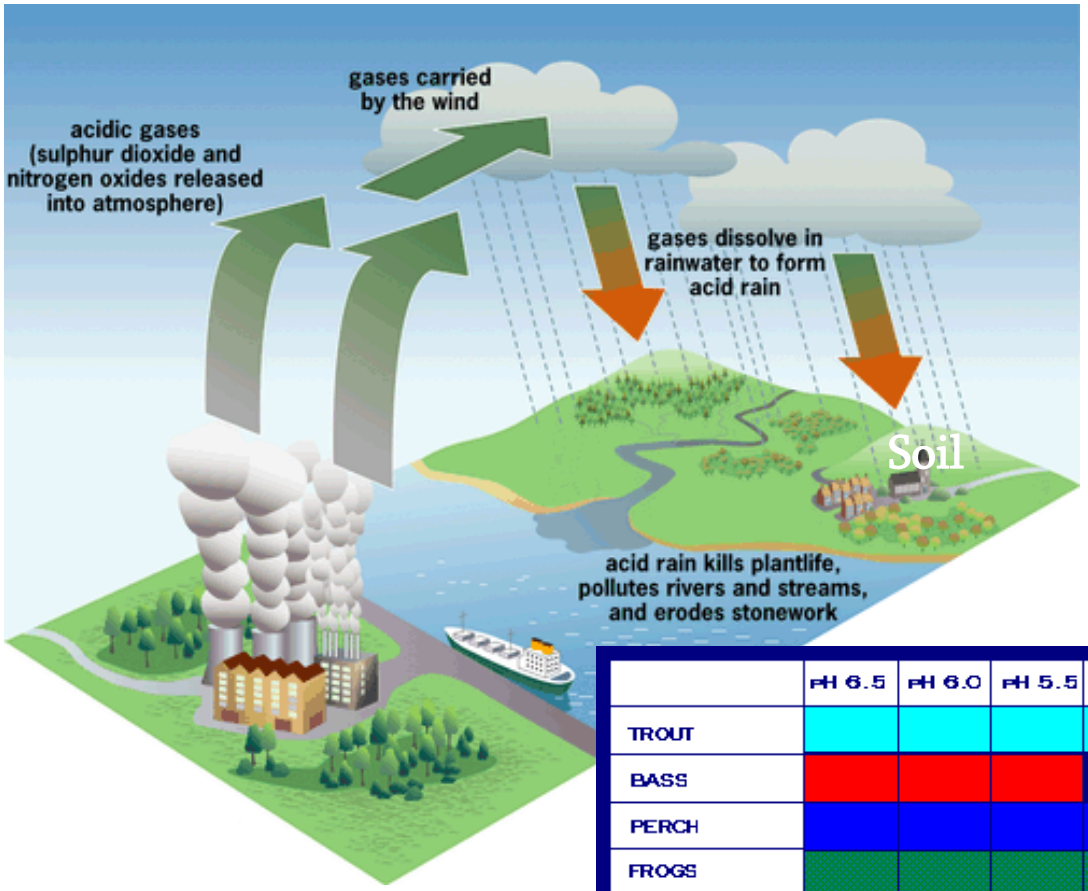
May 3-5, 2011

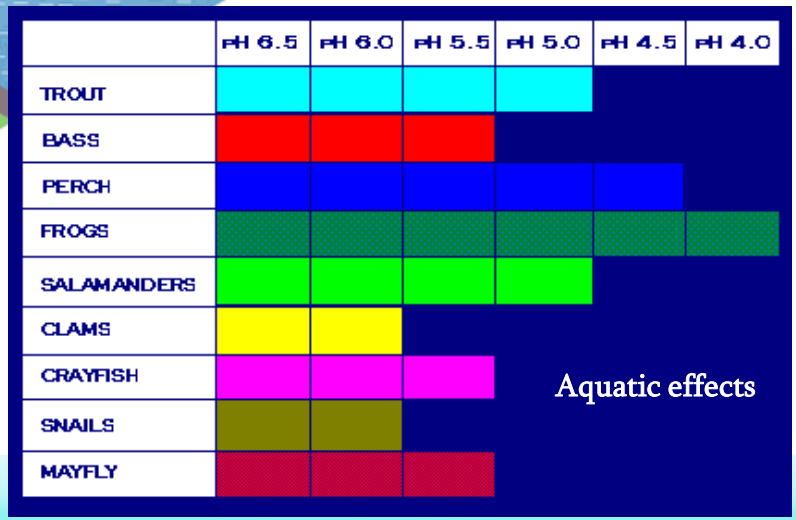
Goal

- Provide sound scientific information on the deposition of major ions*, heavy metals, and toxic substances in precipitation to the surface of the earth.

*Sulfate, Nitrate, Chloride, Phosphate, Sodium, Calcium, Magnesium, Potassium, Ammonium, pH

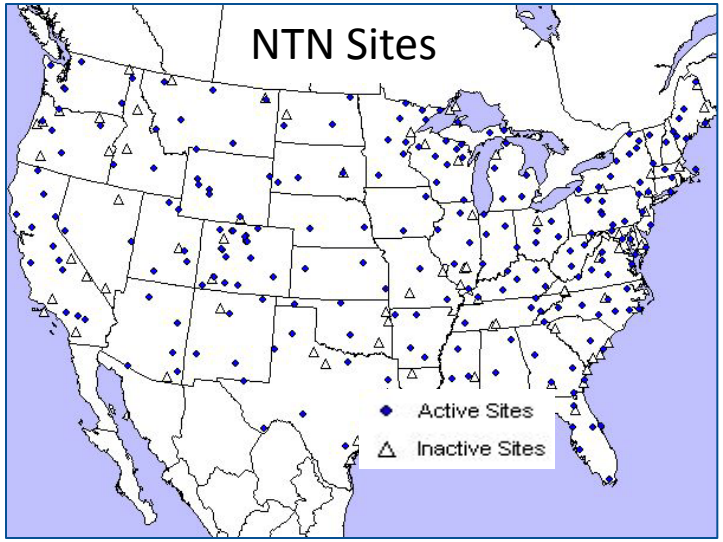
“Acid Rain”: The precursor to the “Nitrogen Cascade”

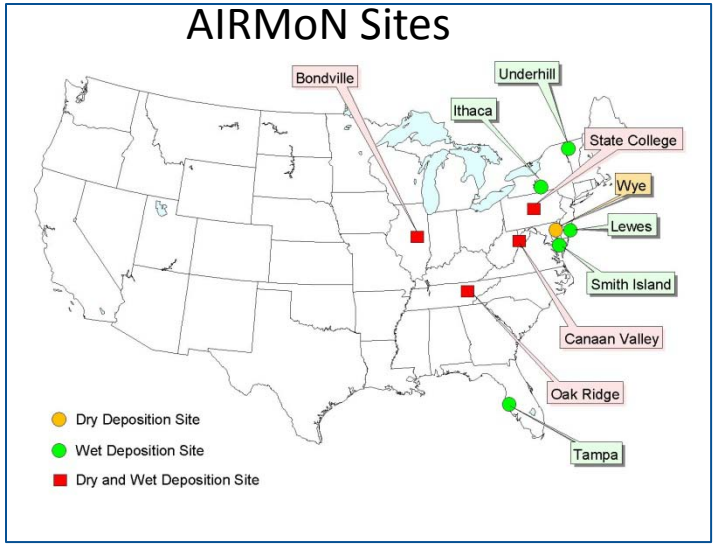




Approach: ARL Collaboration in Measurements and Data Interpretation

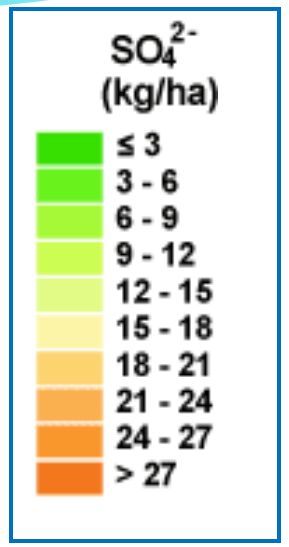
- Short-term measurements
- U.S. Long Term Monitoring
  - NADP/NTN
  - NADP/AIRMoN-wet
  - ~~AIRMoN-dry~~
  - NADP/AMNet
- International Activities
  - North America: CEC, IJC
  - Global
    - WMO Global Atmosphere Watch
    - GAW linkages with other programs



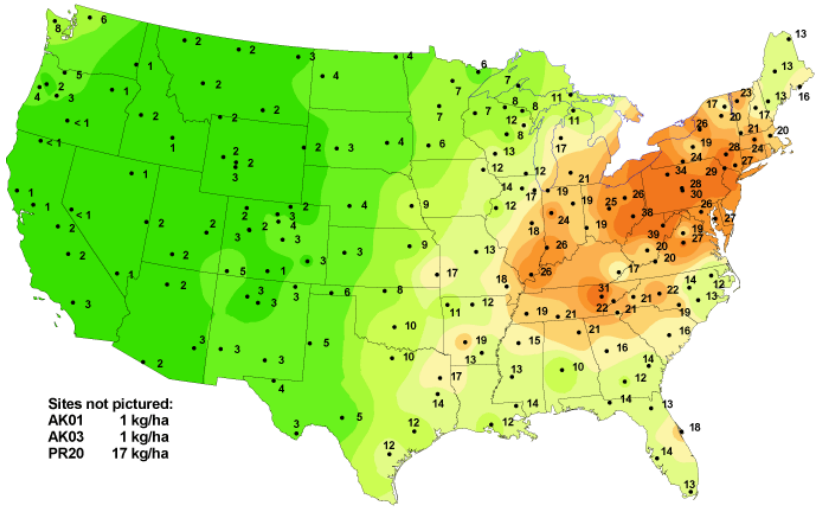


National Atmospheric Deposition Program

- ARL Contributions
- National Trends Network Products

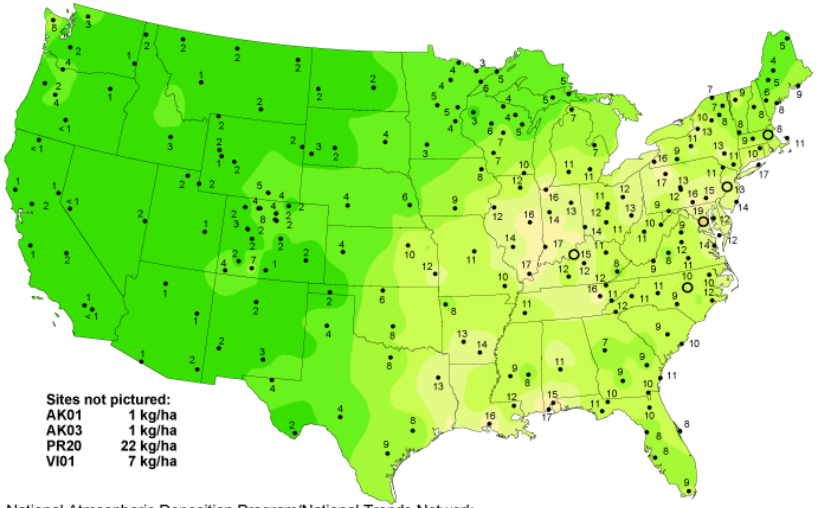


Sulfate ion wet deposition, 1994



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

Sulfate ion wet deposition, 2009



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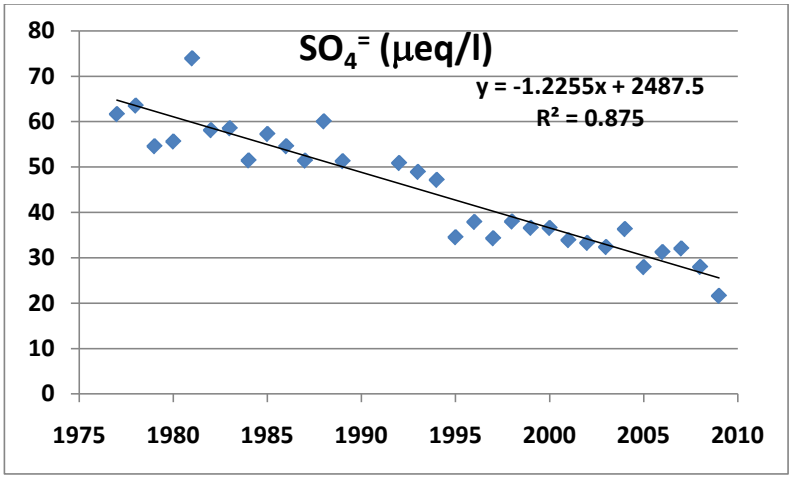
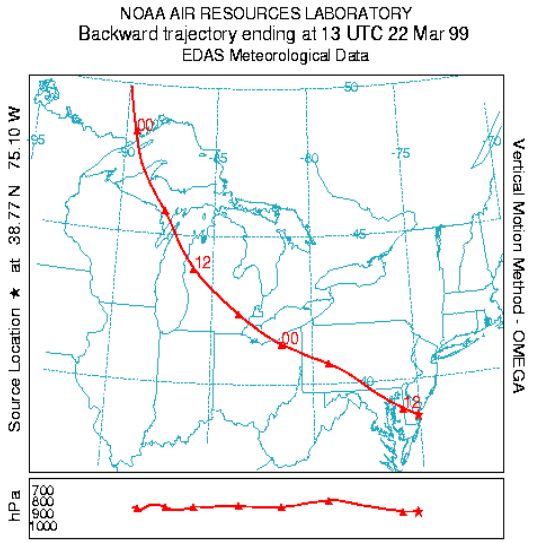
AIRMoN-wet Network

- Seven stations
- 35 year records
- Top quality



Common Applications

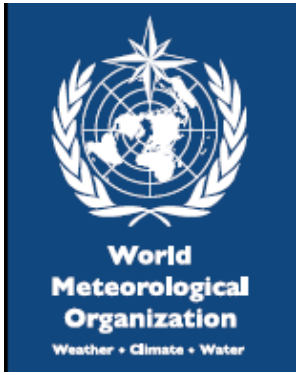
- Comparisons of chemistry between daily and weekly samples
- Trend analysis
- Source-receptor relationships
- Air quality model development
- Atmospheric chemistry and deposition
- Ecosystem studies
- Coastal nitrogen deposition
- Agricultural studies involving pathogens



International Joint Commission -- International Air Quality Advisory Board

- The IJC was established in 1909 following ratification of the Boundary Waters Treaty.
- IJC Commissioners are political appointees.
- IAQAB is an advisory board that reports to IJC.
- ARL serves in a personal advisory capacity to IJC with nine other scientists from the US and Canada.
- Contemporary issues are primarily associated with energy consumption and production

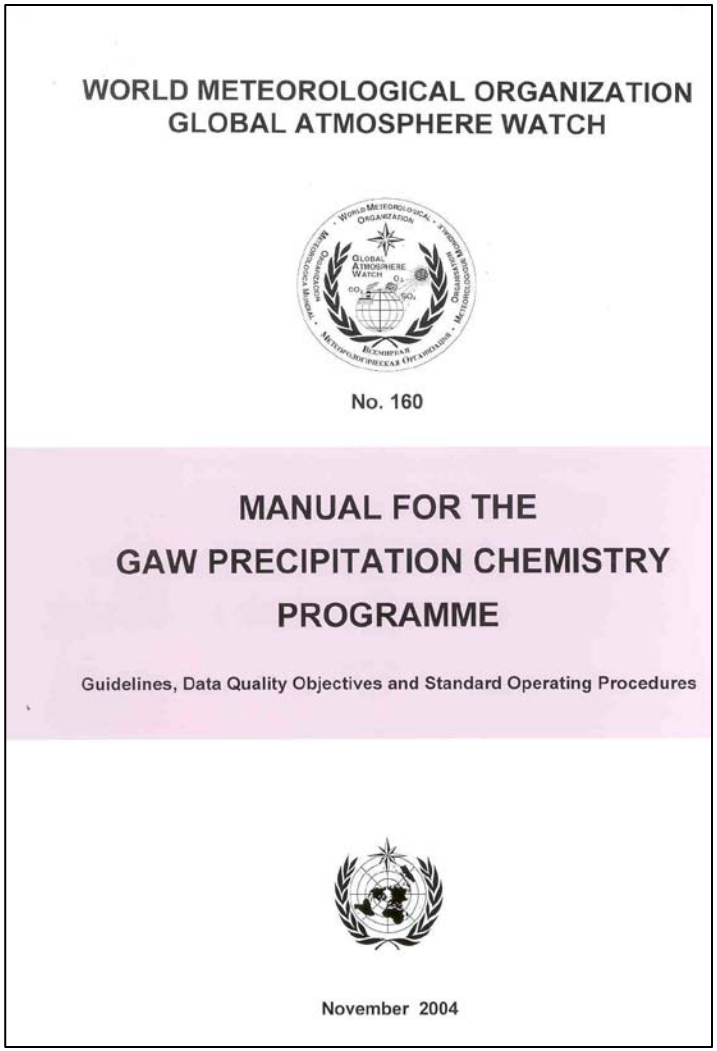
World Meteorological Organization – Global Atmosphere Watch Science Advisory Group for Precipitation Chemistry



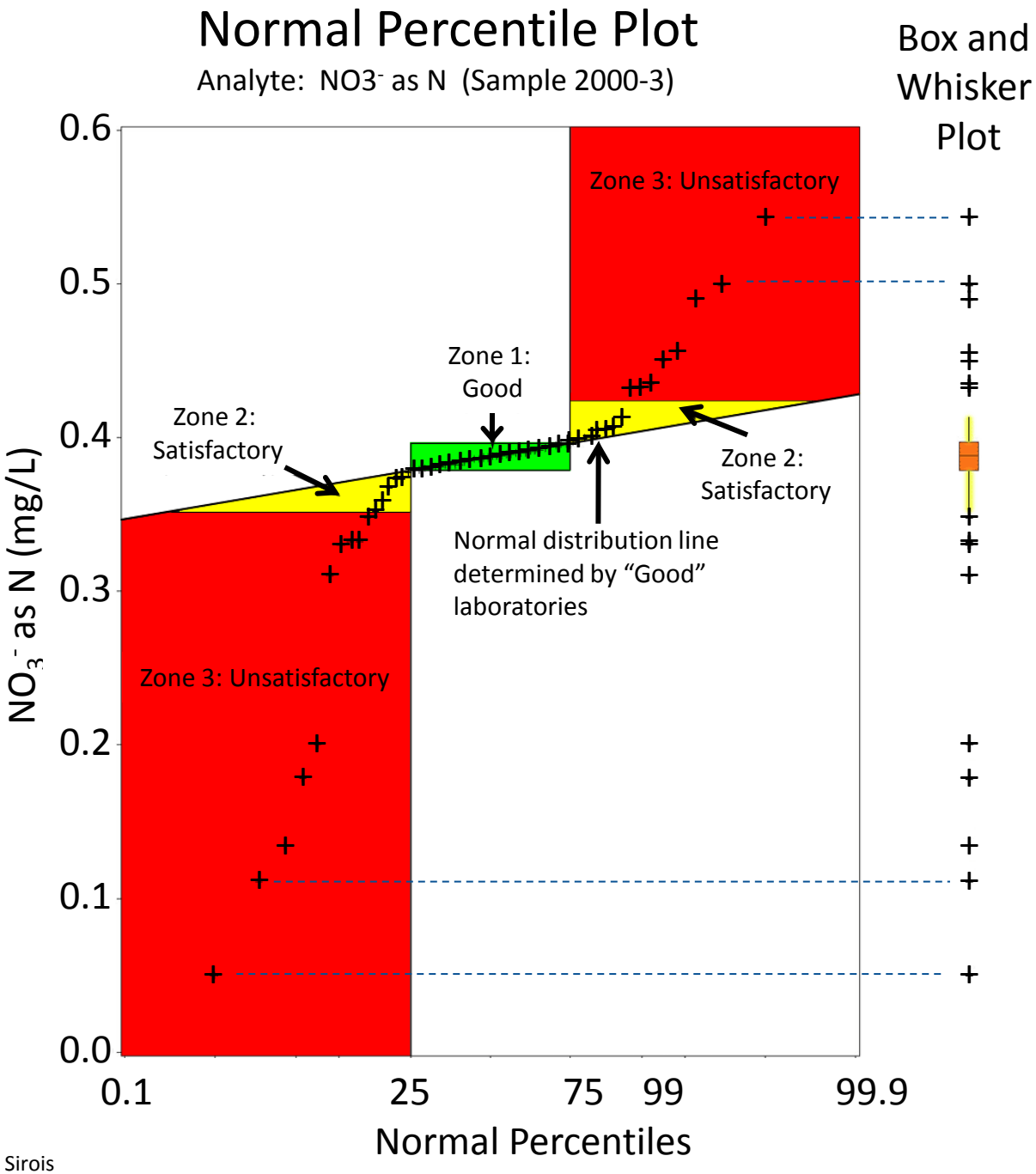
- Chaired by ARL since 1998
- Oversight of approximately 200 official and 400 unofficial sites globally
- Implementation of WMO guidelines through:
  - Development of a guidance document outlining standard operating procedures
  - Institution of a comprehensive quality assurance program
  - Development of regional programs
  - Use of information in scientific assessments
  - Conducting special studies

Manual for the GAW Precipitation Chemistry Programme

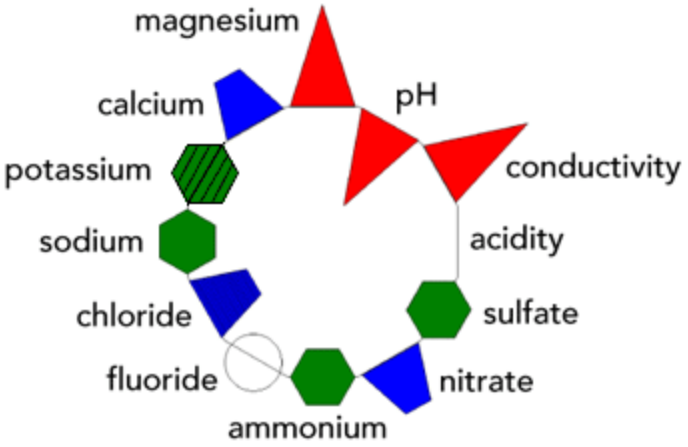
1. **Introduction**
2. **Station Siting**
3. **Field Protocols**
4. **Laboratory Operations**
5. **Data Management**
6. **Quality Control and Quality Assurance**



WMO/GAW Laboratory Intercomparison Studies



Original unpublished figure courtesy of Robert Vet and Alain Sirois



Ring Diagram Overview

GOOD - Green Hexagon

SATISFACTORY - Blue Trapezoid

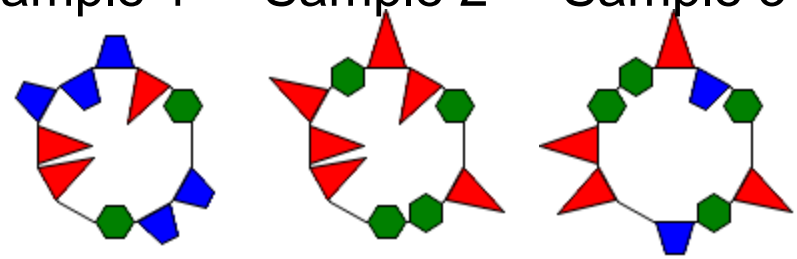
UNSATISFACTORY - Red Triangle

DETECTION LIMIT - Open Circle

Lab Intercomparison Study Data

Lab 700153 India, LIS 2010 43 Ring Diagrams

Sample 1 Sample 2 Sample 3

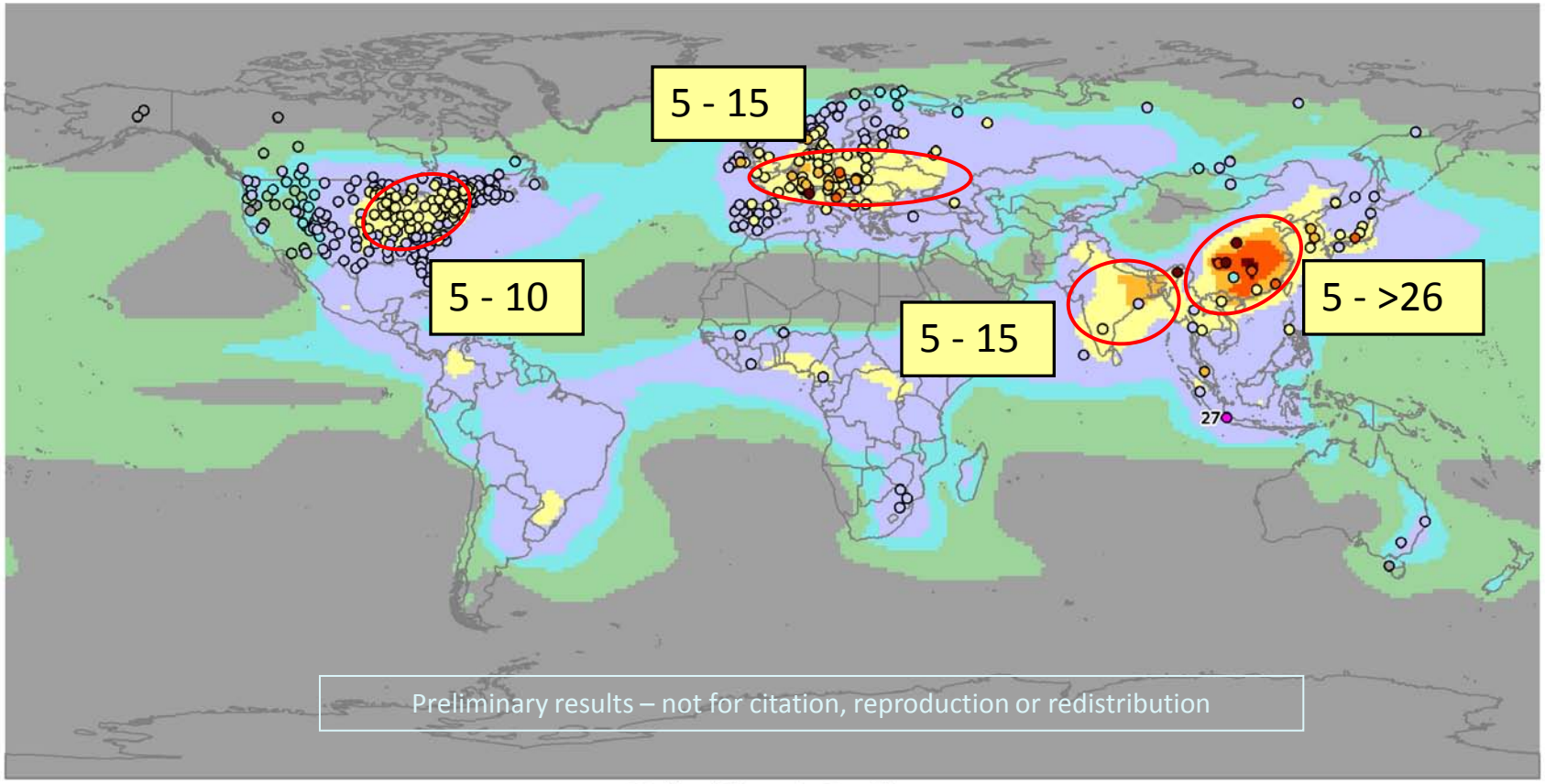


The ring diagrams are a useful way to summarize the essential lab-by-lab results of the Laboratory Intercomparison Studies, for potential users of the measurement data

The WMO 2011 Global Precipitation Chemistry and Deposition Science Assessment

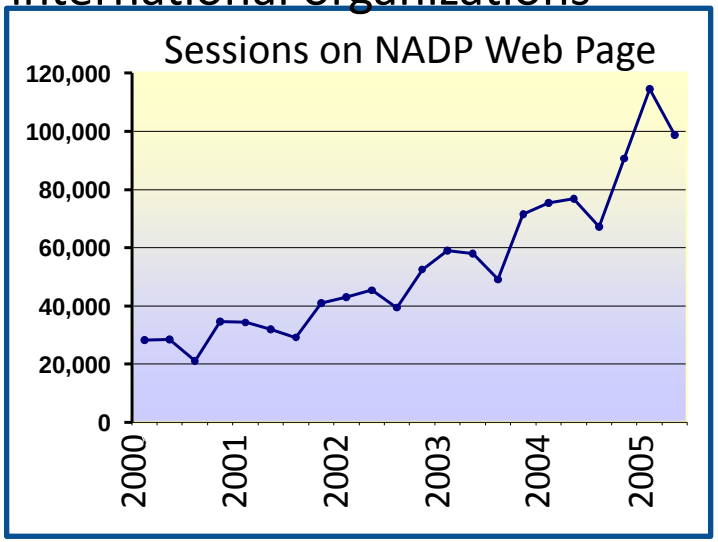
- **Objective:** To review and synthesize the state of the science of the ion composition of precipitation and ion deposition on global and regional scales.
- **Key Science Questions on a Global and Regional Scale:**
  - Spatial distribution of major ions?
  - Acid-base chemistry and ion composition?
  - Wet, dry and total deposition?
  - Trends?
  - Gaps and uncertainties?
- **Approach:**
  - 2000 to 2007
  - Global and Regional scales (Africa, Asia and Oceania, Australia, Europe, North America, South America, Polar Regions, Oceans)
  - Non-urban sites
  - Combined measurement and modeling results
  - To be published in Atmospheric Chemistry and Physics (ACP) in 2011

$N_{oxidized}$ + $N_{reduced}$ *wet deposition (kg N/ha/yr) – 2000-2002 annual wet deposition and 2001 modeled wet deposition*



Indicators of Success

- Publications
  - Atmospheric Environment, Journal Air & Waste Management Association, Journal of Geophysical Research, Environmental Science and Technology, Environmental Management, Geophysical Research Letters
- Datasets
  - AIRMoN-dry - late 1980s - 2000
  - MAP3S/AIRMoN-wet 1976-2010
- Air quality model applications -- CMAQ
- Membership (and leadership) in national and international organizations
  - NADP
  - IJC
  - WMO Global Atmosphere Watch
- Emerging Global Assessment Applications
  - International Nitrogen Initiative
  - GESAMP
  - IPCC



Collaborators

National Atmospheric Deposition Program

United States Environmental Protection Agency

National Park Service

USGS science for a changing world

USDA United States Department of Agriculture

Illinois

Penn State

Cary Institute of Ecosystem Studies

WMO OMM

World Meteorological Organization – Global Atmosphere Watch

Environment Canada

NILU Norsk institutt for luftforskning Norwegian Institute for Air Research

EANET Acid Deposition Monitoring Network in East Asia (EANET)

Yunibesiti ya Bokone-Bophirima North-West University Noordwes-Universiteit

Росгидромет Roshydromet Federal Service for Hydrometeorology and Environmental Monitoring

International Joint Commission • Commission Mixte Internationale 1909

CEC · CCA · CCE

Future Directions

- Products
  - Continue to make available quality assured and current datasets
  - Manuscripts for peer-reviewed publications
  - Atmospheric concentration and deposition assessments
  - Additional data analysis
- Guidance
  - Instruction manuals
  - Expert visitations
  - Contributions to policy-relevant issues
- New analytes and the WMO
  - Mercury
  - Dry deposition