The WMO Global Atmosphere Watch Precipitation Chemistry Program

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World Meteorological Organization
Weather • Climate • Water

GAW

GAW Operating Philosophy

- North American and European approach being exported globally
- Minimize uncertainty
  - Common siting protocols
  - Common field measurement protocols
  - Well established laboratory protocols
  - Limited set of approved field hardware
  - *One central laboratory serving many sites*
  - Established quality assurance/quality control protocols
  - Routine auditing
- Share all data
  - Available online
  - Easy to download
  - Proper attribution

GAW Operating Philosophy -- continued

- Data analysis and publications
  - Make common maps available online as budget permit
  - Focus on network operations, not publications, aside from network manuals and procedures
- Network philosophy
  - Data are worth more in aggregate than from single stations
  - Data must be of high, known, and uniform quality.
  - Avoidance of political discussions. Multiple agendas served
  - Focus on data collection and reporting
  - Encourage publications from contributing organizations and from anyone else who wants to use this information

WMO Global Atmosphere Watch
Current Activities

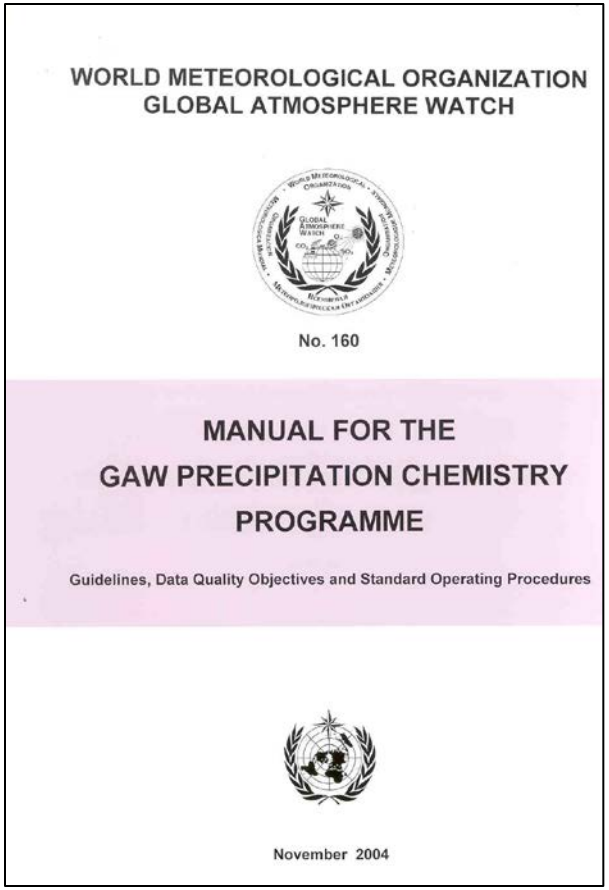
- Development and Maintenance of the
  - Guidance Manual
  - Quality Assurance/Science Activity Center
  - World Data Center for Precipitation Chemistry

  http://qasac-americas.org/ http://wdcpc.org

- Second Global Deposition Assessment

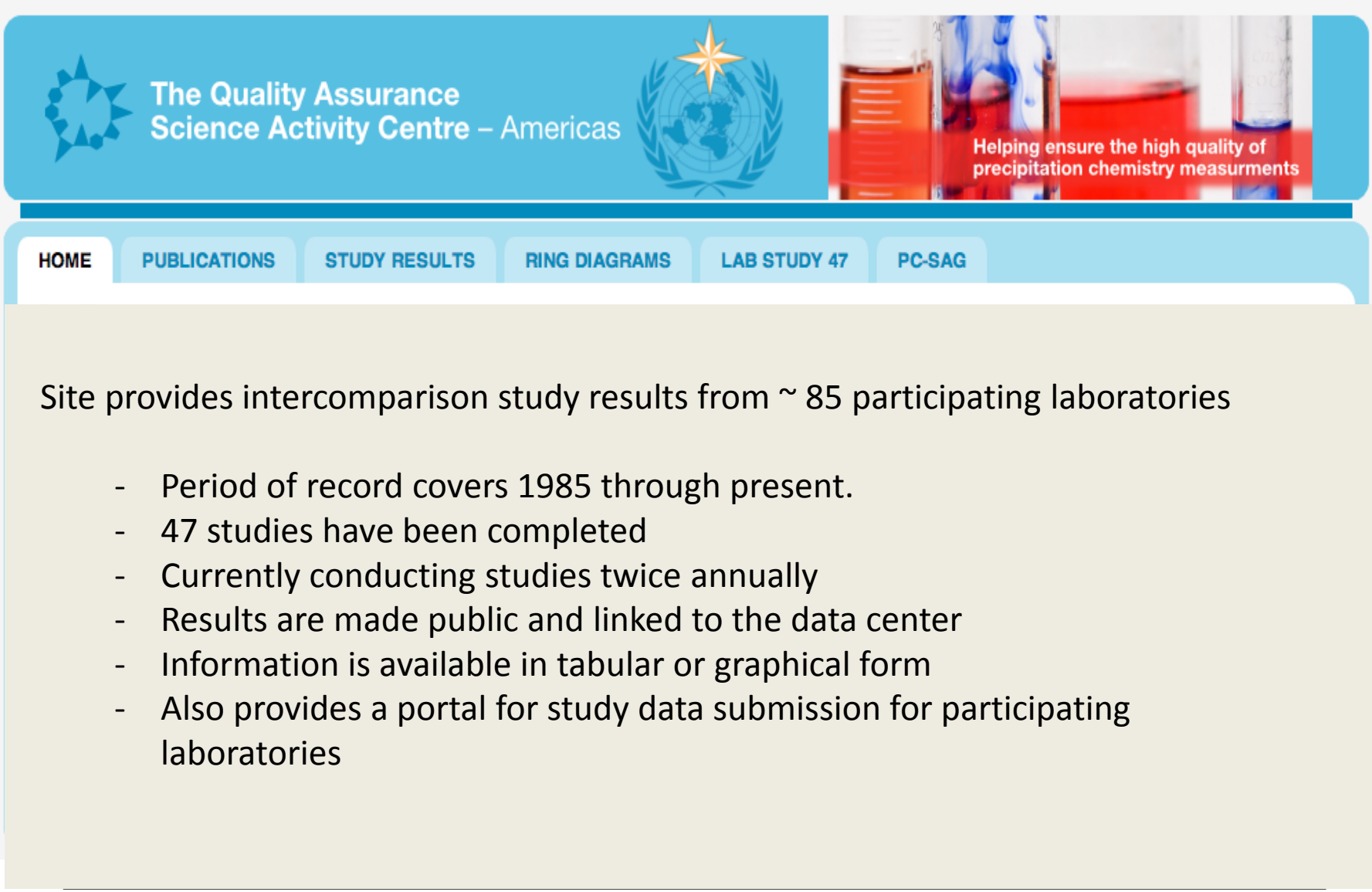
Manual for the GAW Precipitation Chemistry Programme

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



http://qasac-americas.org/sites/default/files/GAW-Precip%20Chem%20Manual%20No.160.pdf

QA SAC – AMERICAS Home Page



Site provides intercomparison study results from ~ 85 participating laboratories

- Period of record covers 1985 through present.
- 47 studies have been completed
- Currently conducting studies twice annually
- Results are made public and linked to the data center
- Information is available in tabular or graphical form
- Also provides a portal for study data submission for participating laboratories

The Quality Assurance Science Activity Centre – Americas

HOME | PUBLICATIONS | STUDY RESULTS | RING DIAGRAMS | LAB STUDY 47 | PC-SAG

LIS Study 47

- Study Summary
- Ring Diagrams
- Study Data HTML
- Study Data CSV

LIS Study 47

Select Data Sets

1. Choose Action:

- Download
- View

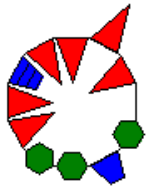
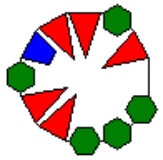
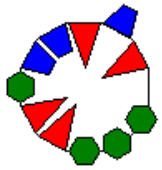
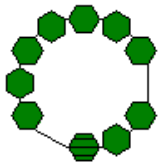
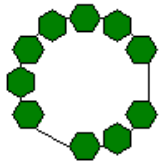
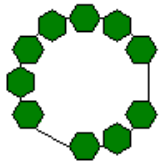
Would you like to download data files or view data?

2. Choose Data:

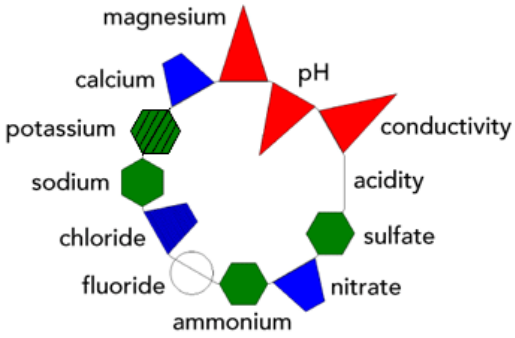
- Ring Diagrams
- HTML Table

Lab Intercomparison Study Data

All labs, LIS 2012 47 Ring Diagrams

Lab	Sample #1	Sample #2	Sample #3
700001 USA			
700003 USA			

Measurement Key



An example of two U.S. labs, one that performs well and one with some analytical problems.

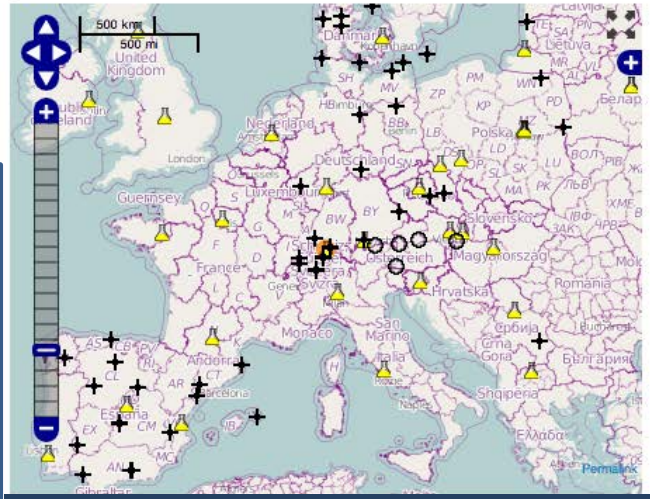
World Data Center for Precipitation Chemistry

HOME | DATA | PUBLICATIONS | CONTACT

Precipitation Chemistry Labs and Stations

Select Lab
Select Station
Select WMO Region

Lab 700035 Switzerland



Lab 700035 Switzerland

Location: Region 6, Europe

Swiss Federal Laboratories for Materials Science & Technology (EMPA)
Überlandstrasse 129
Dübendorf

CH-8600 SWITZERLAND

Website:
http://www.empa.ch/plugin/template/empa/704/*/---/l=1

Stations Served:
- Tänikon
- Payerne
- Jungfraujoch
- Chaumont
- Rigi
- Jungfraujoch
- Payerne
- Rigi
- Tänikon

Intercomparison Data:
Select LIS Study

Laboratory Information

- Lab Website link
- List of stations served by the lab
- Link to Ring Diagrams for lab

The World Meteorological Organization
2013 Global Precipitation Chemistry and Deposition Science Assessment

A project of the Global Atmosphere Watch Scientific Advisory Group for Precipitation Chemistry

R. Vet, R. Artz, S. Carou, V. Bowersox, C.-U Ro, M. Shaw, W. Aas, A. Baker, F. Dentener, C. Galy-Cacaux,R. Gillett, S. Gromov, H. Hara, T. Khodzher, N. Reid, K. Pienaar, S. Nickovic, and P.S.P. Rao

- Sulfur
- Nitrogen
- Mineral Base Cations and Sea Salt
- Acidity and pH
- Organic acids
- Phosphorus

World Meteorological Organization

Weather • Climate • Water

The WMO 2013
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:

- What do measurements and model estimates of precipitation chemistry, precipitation amount and wet, dry and wet+dry deposition of sulfur, nitrogen, mineral base cations, sea-salt, organic acids, acidity (pH), and phosphorous show globally and regionally?
- How has wet and dry deposition of major ions changed since 2000 and, where information and data are available, since 1990 as a result of changing precursor anthropogenic emissions?
- What are the major gaps and uncertainties in our knowledge?

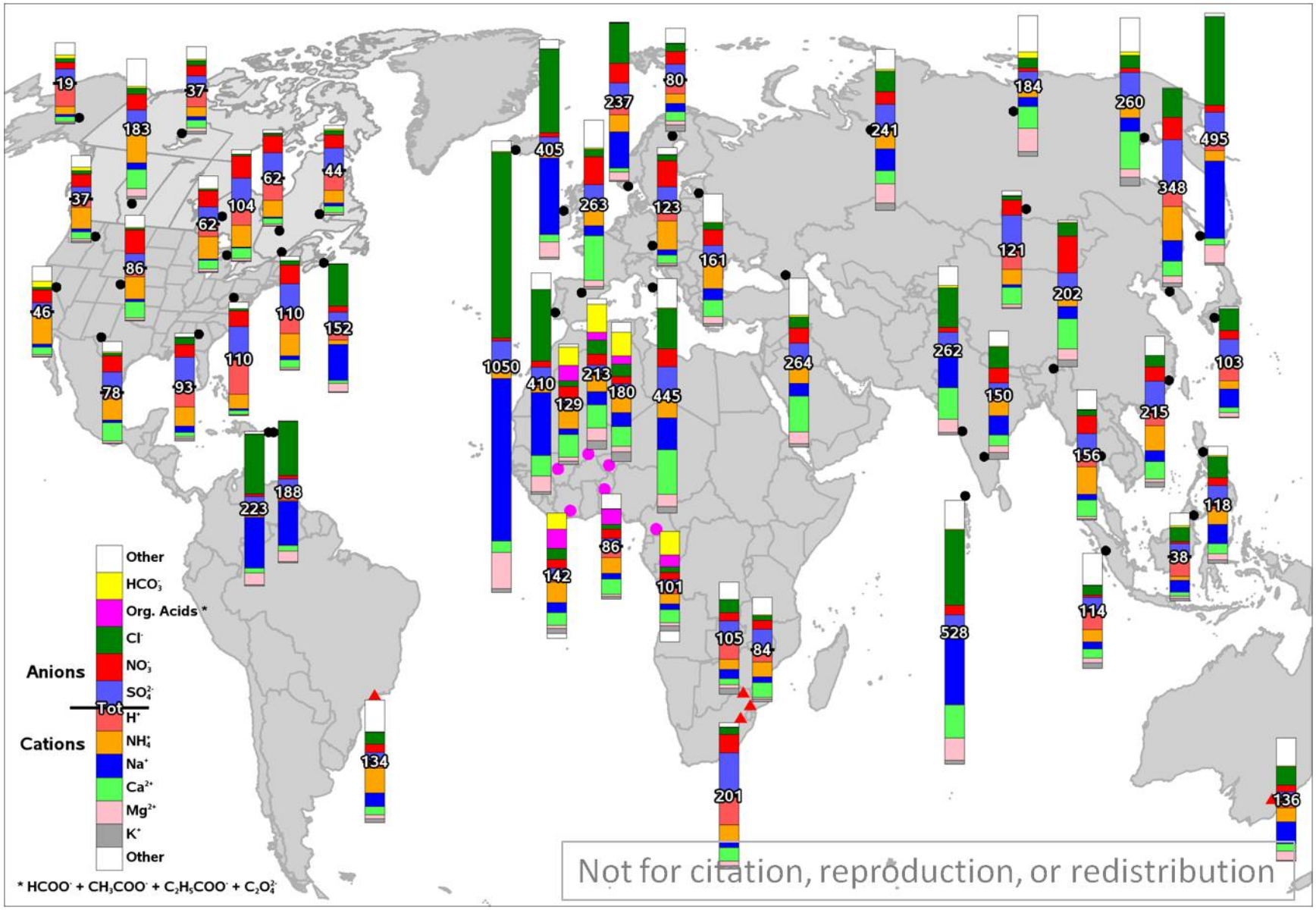
Approach:

- Assessment co-led by Environment Canada (Vet and Carou) and NOAA/ARL (Artz)
- 2000 to 2002 and 2005 to 2007
- Global and Regional scales, including oceans
- Combined measurement and modelling results to provide global coverage

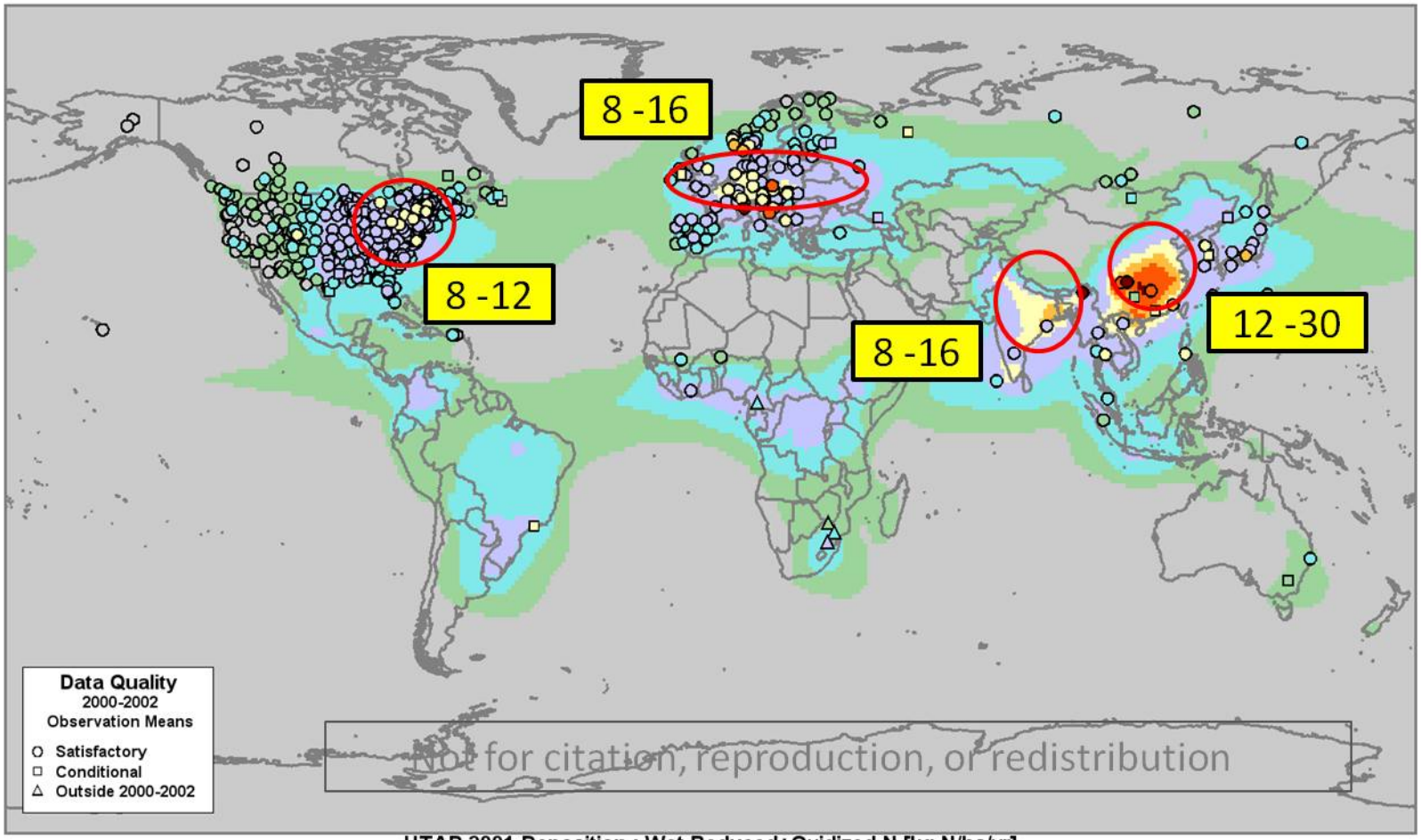
Target Audience:

- Nitrogen cycling – both oxidized and reduced for air quality and eutrophication applications
- Critical loads community
- Climate change modelers to close mass balances
- Global reference data sets for the modeling community

Measurement Results: 2005-2007 Mean Global Ion Composition (µeq/L)



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



Emerging Issues in the Global Community

- The need for total phosphorus data is not going away. The drivers tend to be associated with large particle deposition, driven by studies near freshwater lakes in North America and in the eastern Mediterranean Sea. Current methods are lacking. Dust is a problem.

- Weak acids are important to measure in the absence of strong mineral acids to get a decent ion balance. Increasingly, this is important in North America and Europe. It remains important in much of the rest of the world.

- Strong focus on Total (wet plus estimated dry) deposition globally
  - Ambient measurements sometimes available
  - Inferential models are here to stay

Emerging Issues in the Global Community - continued

- Organic Nitrogen is chemically unstable.
  - Recommended approaches require shorter samples (e.g. daily) and preservatives.
  - Important chemical species should be determined first followed by method development and network rollout

- Coupling of measurement and modeling programs will continue
  - HTAP
  - EMEP
  - CMAQ/AURAMS