

Near-Real-Time Aerosol Data from the WMO Global Atmosphere Watch

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with valuable contributions from

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WMO GAW

- **Backbone provided by National Meteorological Agencies**
- **Contributions from many affiliated networks and stations, not just weather bureaus**
- **No central funding for measurements or data centers**
- **Not organized as a provider of NRT data**

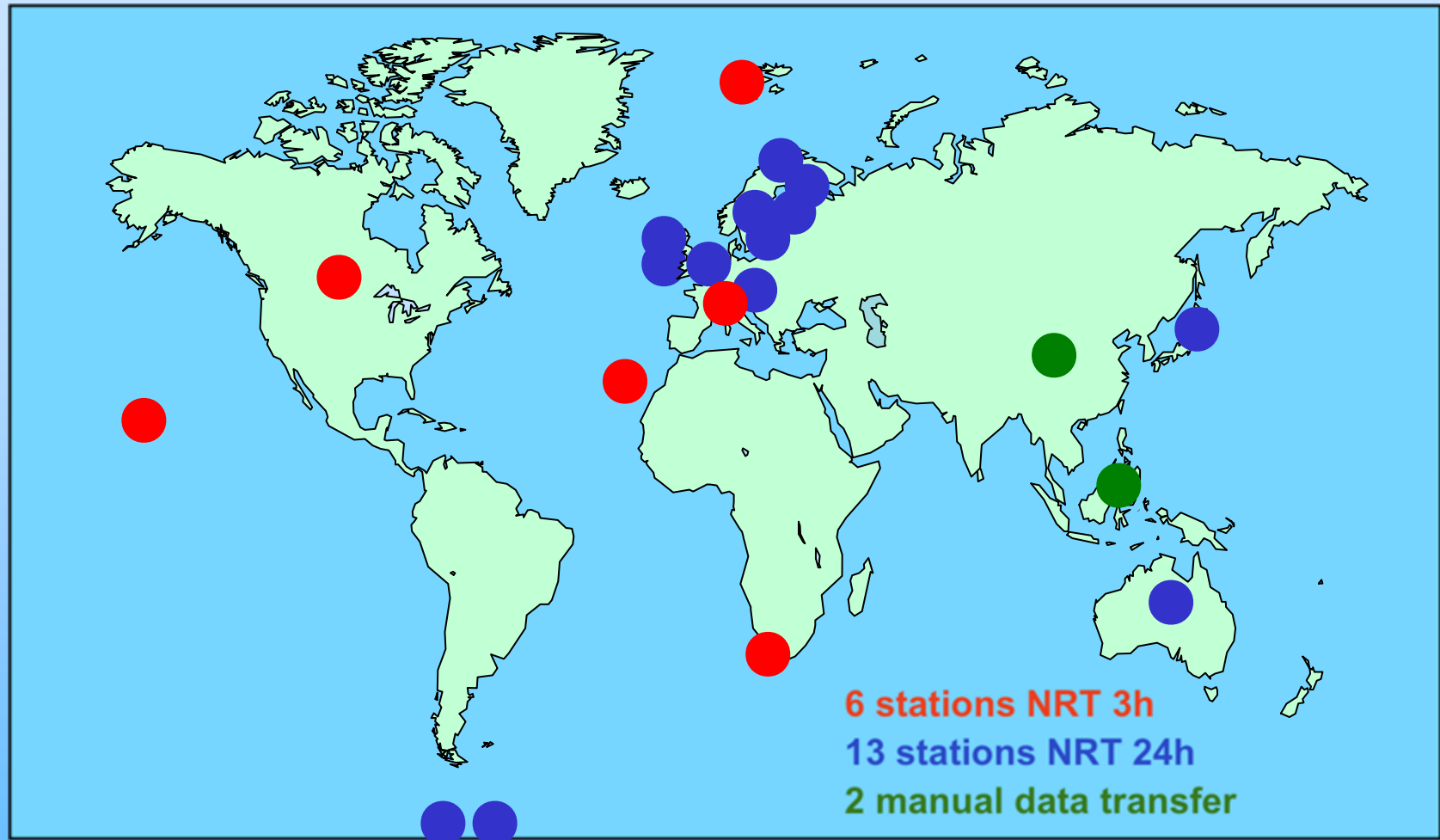


GAW Aerosols

- **Science Advisory Group for Aerosols**
- **World Calibration Center for Aerosol Physical Properties (IfT)**
- **World Data Center for Aerosols (NILU)**
- **Three measurement areas**
 - Aerosol optical depth
 - Aerosol vertical profiles (Lidar)
 - In-situ aerosol properties
 - Optical (light scattering and absorption)
 - Chemical (mass concentration, speciation)
 - Microphysical (number conc., size dist., CCN)
- **Emphasis on regional (non-urban) sites**
- **Primary focus on climate, recognizing applications in air quality.**



GAW Precision Filter Radiometer Network

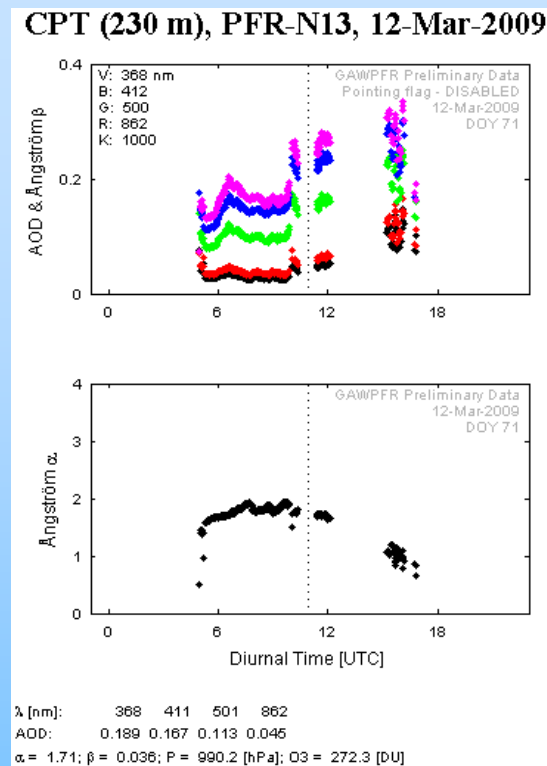


- Automated, tracking sun photometer, observations 1 min⁻¹
- 4 channels at 862, 500, 412, 368nm, 5nm bandwidth
- Potential for ~30 stations providing NRT data
- Coordinated by World Optical Depth Research and Calibration Centre, <http://www.pmodwrc.ch/worcc/>

Status of GAW AOD Network

- **PFR Network**

- NRT data currently available from WORCC/Davos
- Automated NRT screening (instrument health, clouds, outliers) by WORCC
- In future, NRT data from WDCA
- Active comparisons with AERONET at overlap sites



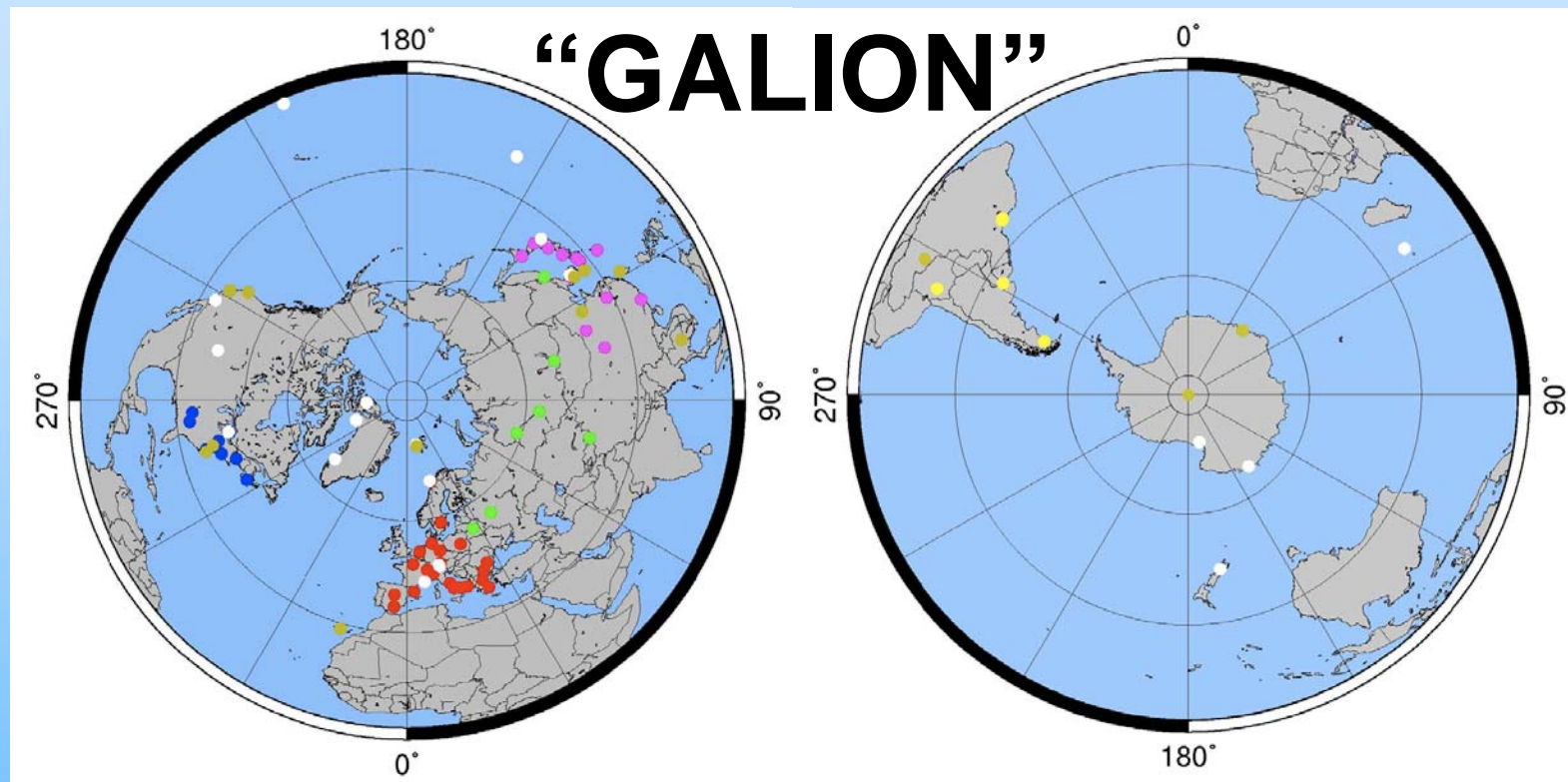
- **Other national/regional networks (~10)**

- Cross-calibration and data harmonization needed

- **Goal: an integrated global AOD network as a component of GCOS**



GAW Aerosol LIDAR Observing Network



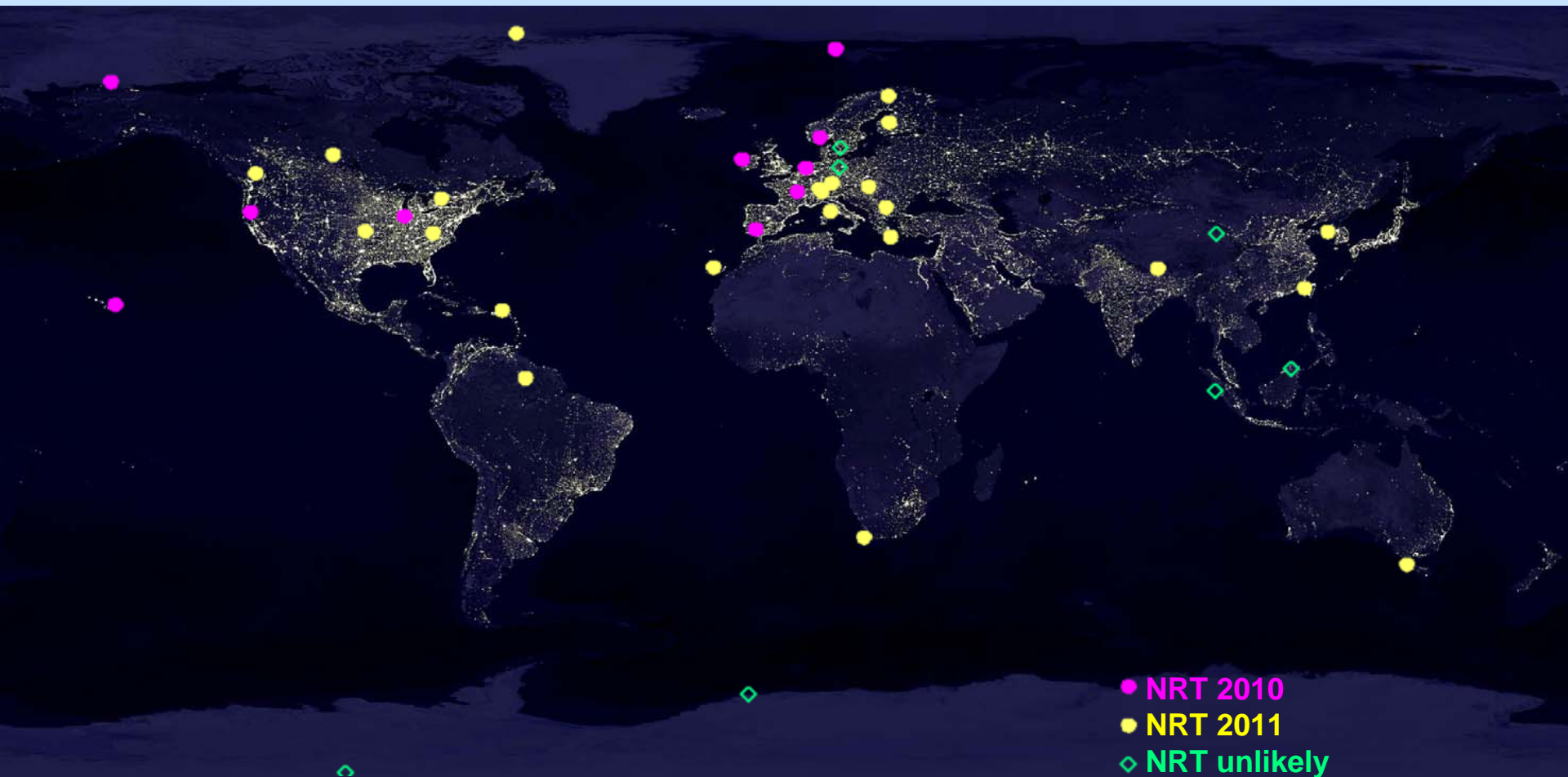
- **A federation of seven regional networks**
 - AD-NET violet, ALINE yellow, CISLiNet green, EARLINET red, MPLNET brown, NDACC white, REALM blue
- <ftp://ftp.wmo.int/Documents/PublicWeb/arep/gaw/gaw178-galion-27-Oct.pdf>

GALION: Aerosol Vertical Profiles

- **Objectives**
 - develop aerosol vertical profile climatology
 - provide input to forecast models of "chemical weather"
- **Basic measurement scheme (minimum)**
 - measurements every Monday and Thursday
 - within a few hours of sunset
 - more frequent observations during special events (e.g., volcano!)
- **Federation of multiple networks with a variety of instruments**
 - simpler automated backscatter lidars ...
 - advanced, multi-wavelength Raman or high-spectral resolution
- **Products**
 - all sites: backscatter profiles
 - some sites: complex retrievals of aerosol microphysical properties
 - Currently providing limited NRT data for dust forecasting and model evaluation (WMO SDS-WAS)
- **Next steps in developing GALION**
 - Quality assurance plan
 - Data management plan
 - Database development
 - NRT data access plan
 - Workshop in Geneva, 20-23 Sept 2010



GAW In-situ NRT Data Availability



- Map shows ground stations with continuous light scattering measurements (~35 by 2011)
- Most also have light absorption measurements

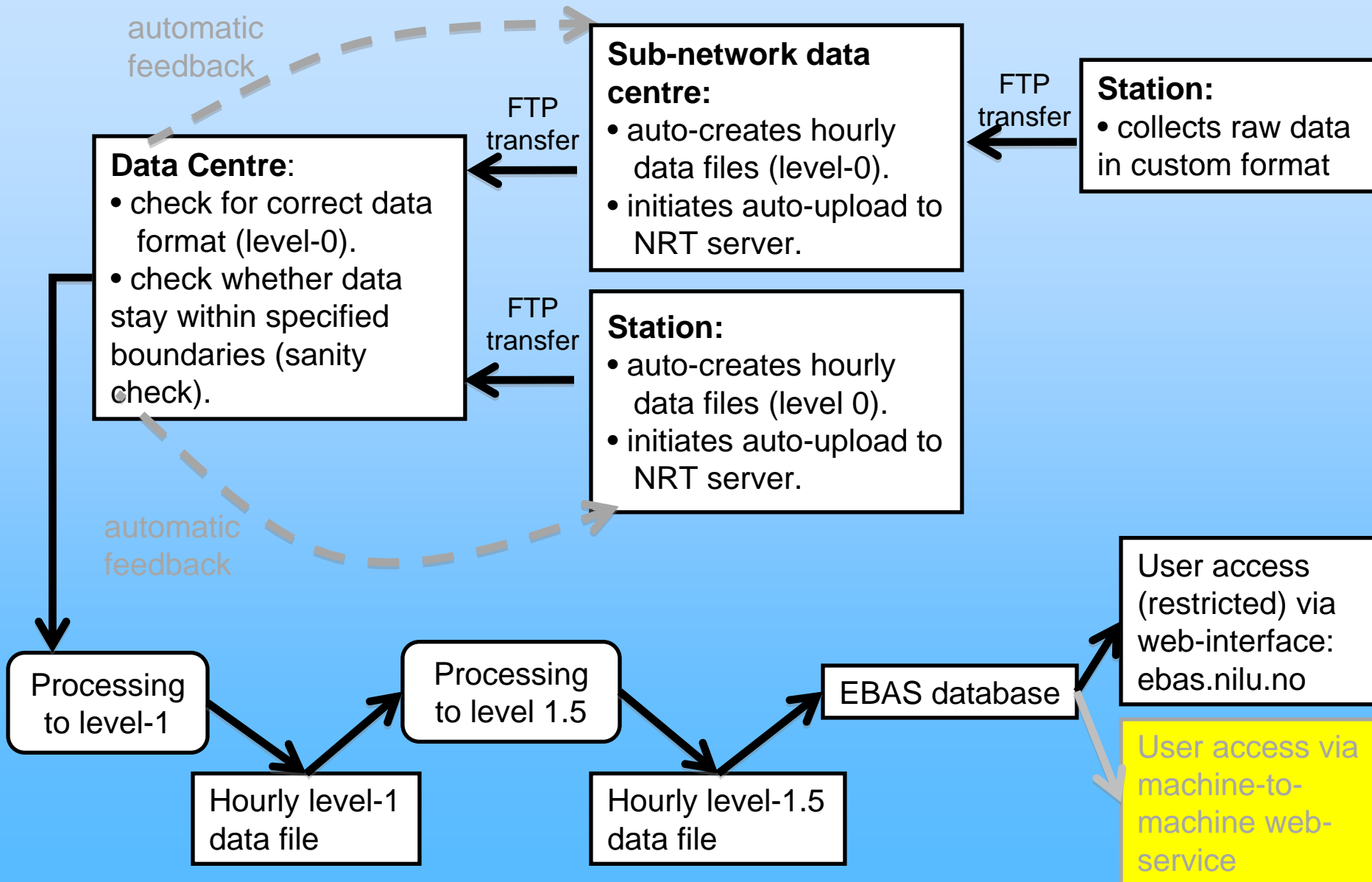


Summary of GAW In-situ Aerosol Data

- **NRT measurements of aerosol properties**
 - Optical (light scattering and absorption)
 - Microphysical (number conc., size dist.)
 - Chemical (a few stations will have on-line aerosol mass spectrometers in a few years)
- **Centralized processing at WDCA**
 - Zero/calibration checks removed, sanity checks applied, outliers flagged, inversions run
- **Hourly-averages available within 1-6 hr, higher time resolution possible**



WDCA NRT Data Flow



Interactive NRT Web Interface

The screenshot displays the EBAS web interface in a Mozilla Firefox browser. The page features a header with logos for NILU, EUSAAR, and emep. Below the header, there are six filter panels: Nations, Stations (Info), Projects (Info), Instrument (Info), Components (Info), and Matrix (Info). The 'Projects (Info)' panel is currently selected, showing 'EUSAAR_NRT' as the active project. Below the filters, there are date range selectors for 'From 1970' and 'To 2010', along with 'Show map', 'List datasets', and 'Reset' buttons. A map of Europe and North America is shown with red pins indicating station locations. To the right of the map, there is a 'Login' section indicating the user is logged in as 'markus' and a list of 'Additional Resources' including air mass trajectories, measurement networks, and site descriptions.

Nations	Stations (Info)	Projects (Info)	Instrument (Info)	Components (Info)	Matrix (Info)
All	All	EUSAAR_preliminary	All	aerosol_absorption_coeff	All
France	Barrow	GAW-WDCA_preliminary	dmsp	aerosol_absorption_coeff	aerosol
Ireland	Birkenes	NILU_NRT	MAAP	aerosol_light_backscatter	instrument
Netherlands	Bondville	EUSAAR_NRT	nephelometer	aerosol_light_backscatter	pm1
Norway	Cabauw	GAW-WDCA_NRT	PSAP	aerosol_light_backscatter	pm10
Spain	Ei Arenosillo	NOAA-ESRL	smps	aerosol_light_backscatter	
USA	Mace Head	GEOMON		aerosol_light_rayleighscat	
	Mauna Loa	IDAF		aerosol_light_scattering_c	

Available datasets: 956

From 1970 To 2010 Show map List datasets Reset

Login

You are logged in as: markus
Logout

- [QI for instruments](#)
- [Data policy and restrictions](#)

Additional Resources

- [Air mass trajectories](#)
- [Measurement network \(EMEP\)](#)
- [Measurement network \(GAW\)](#)
- [Site descriptions](#)
- [Data submission](#)
- [EMEP/CCC reports](#)
- [Presentations](#)
- [Quality assurance](#)
- [EMEP manual](#)
- [EMEP laboratory intercomparisons](#)
- [TFHM](#)
- [HTAP](#)

<http://ebas.nilu.no/default.aspx>



WDCA NRT Data Plots

[Home](#) Time span Display settings Download data

Dataset List latest available (current year only) one month Jan 2010

one year 2010 from/to date 2010-03-03 00:00 2010-03-13 01:00

Plot Statistics Data Values

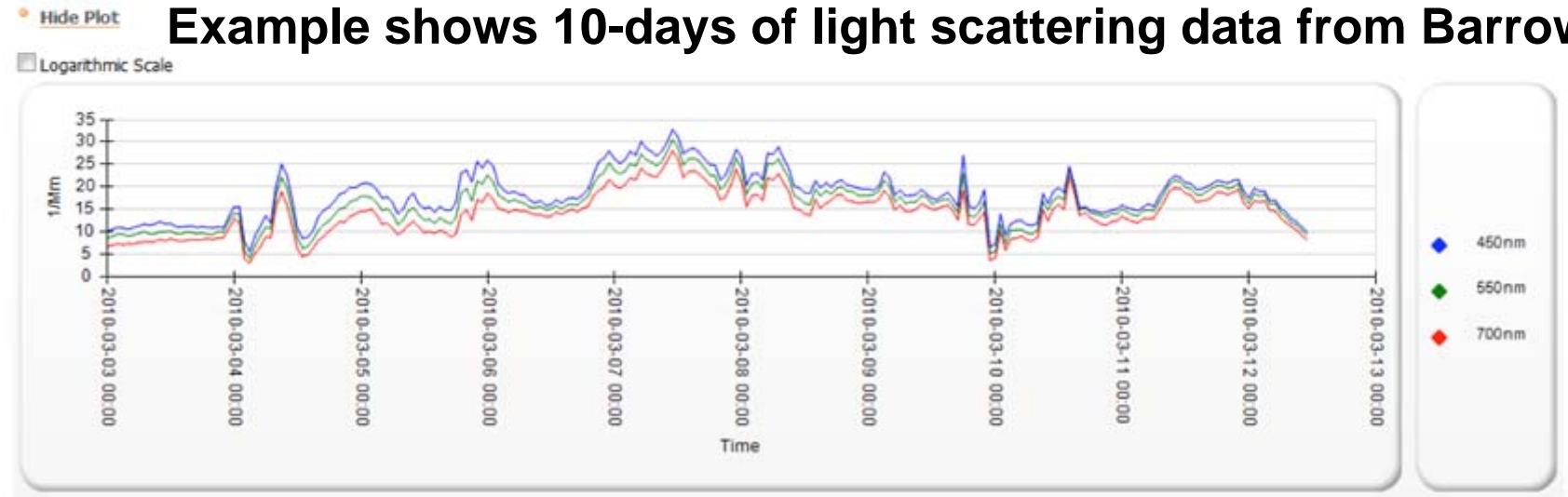
Apply settings

Plot as single parameter

EMEP-code: US0008R	Station: Barrow	Country: USA
Instrument: nephelometer	Component: aerosol_light_scattering_coefficient	Matrix: pm10
Unit: 1/Mm	Projects:	Data Originator: Ogren, John
Start Date: 2010-02-22	End Date: 2010-03-12	

Remarks:

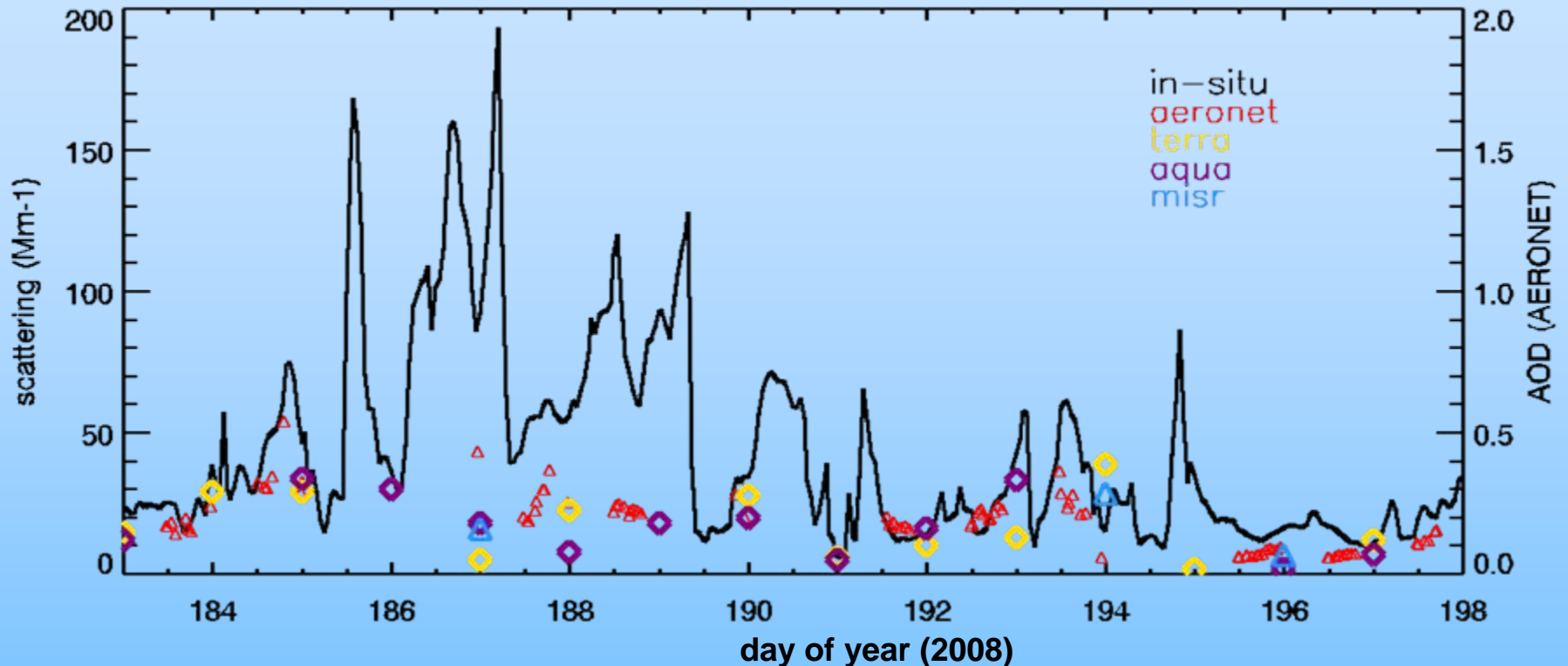
Example shows 10-days of light scattering data from Barrow



<http://ebas.nilu.no/default.aspx>



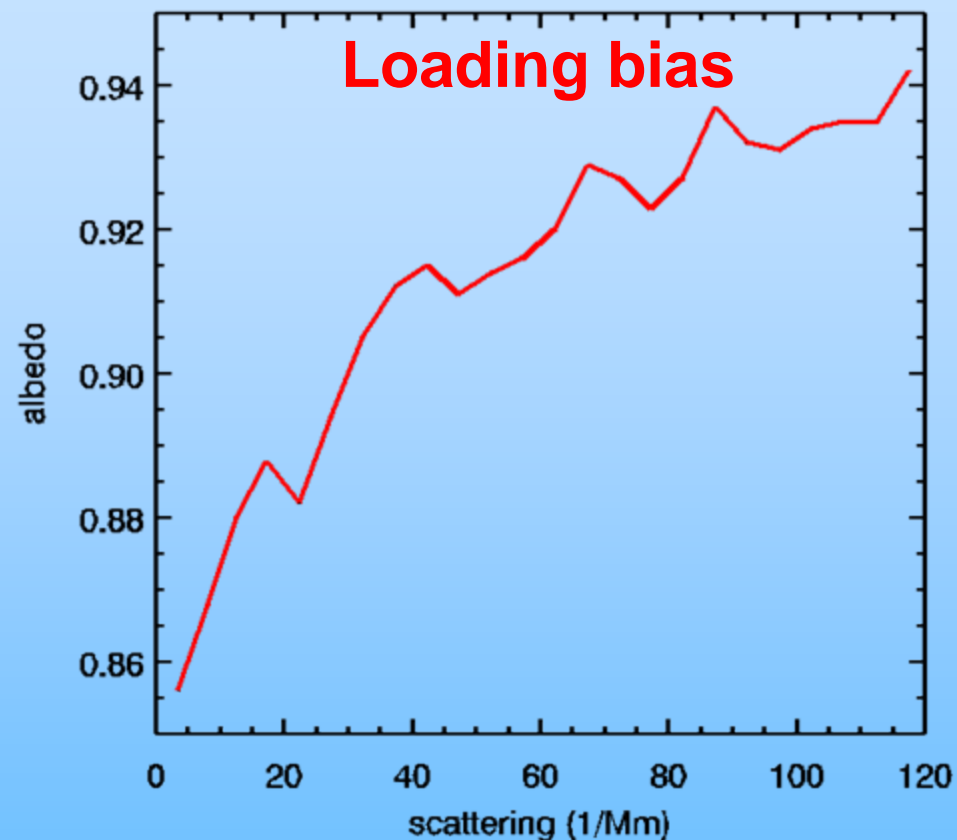
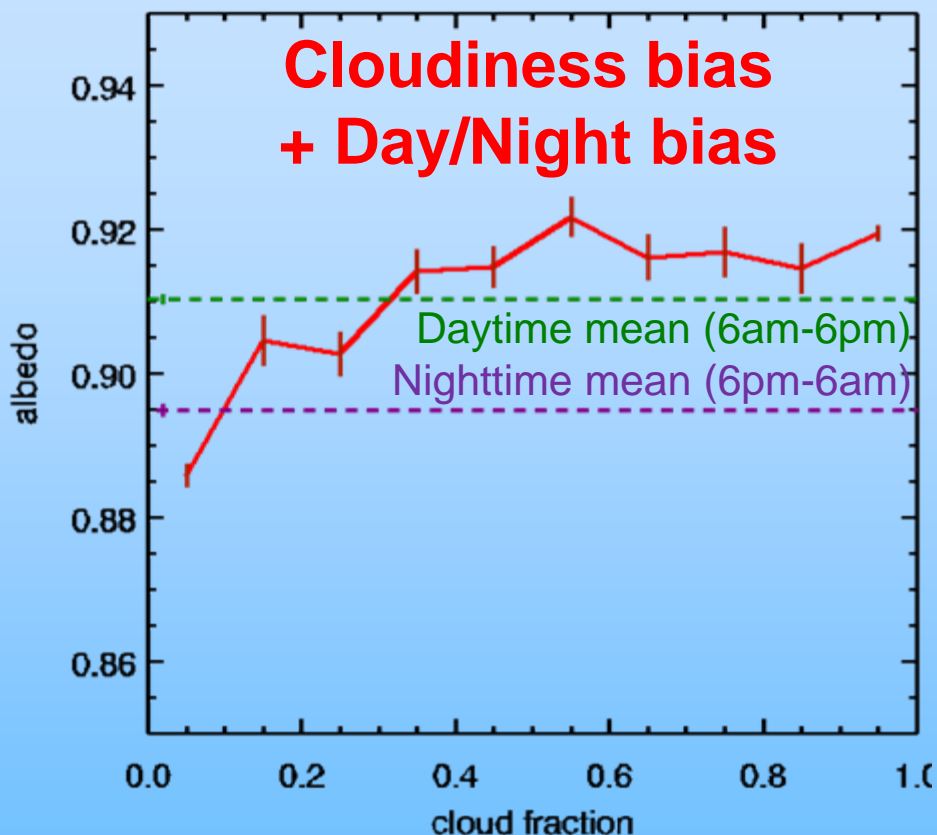
In-situ Data Resolve Temporal Gradients



- **Bondville, IL - July 1-15, 2008**
- **Hourly averaged in-situ scattering coeff. (550 nm)**
- **Hourly averaged sun photometer AOD (500 nm)**
- **“Daily” averaged AOD from satellites**



In-situ Data Reveal Sampling Biases



- **Single-scattering albedo calculated from in-situ aerosol scattering and absorption measurements**
- **Based on hourly averaged 2008 data from Bondville, Illinois**
- **Cloud fraction values are for daytime only, from SURFRAD network**



Discussion Topics

- **Desired/acceptable time lag for NRT data**
- **Value of homogeneity of data formats**
- **Approaches for synthesizing AOD + lidar + in-situ observations**
 - Dealing with disparity of spatial and temporal resolutions
- **Dealing with relative humidity**
 - Remote sensing at ambient RH
 - In-situ at low RH
- **Data policy needed**
 - Acknowledgement of data providers
 - Feedback from users to providers
 - Prevent use of NRT data in lieu of final, quality-controlled data
 - Prevent transfer to third-parties that haven't agreed to data policy



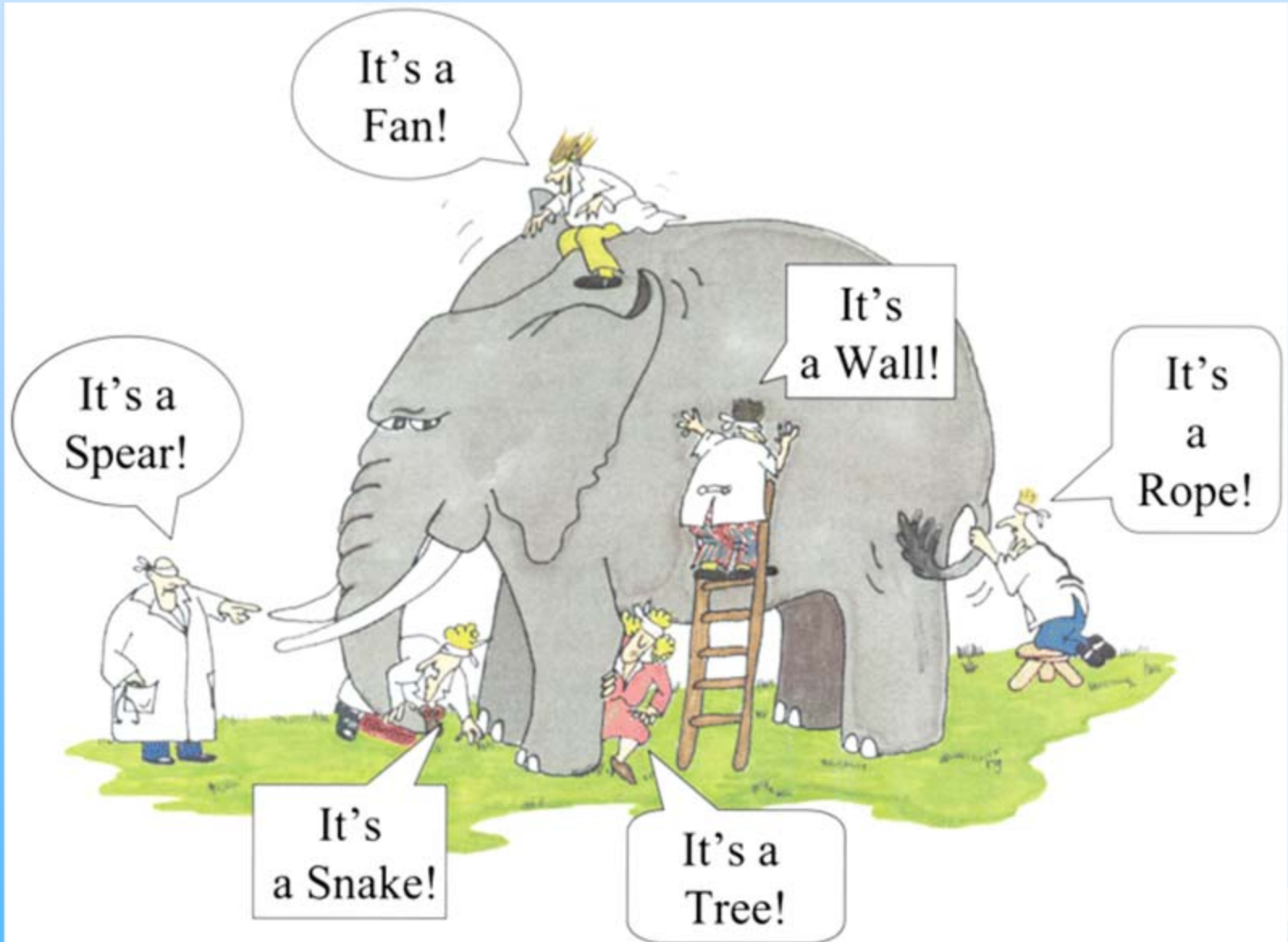
Credits



- The WDCA near-real-time infrastructure was developed through the EU FP6 project EUSAAR in collaboration with the stations:
 - Cabauw, Netherlands (TNO)
 - Mace Head (National University of Ireland, Galway)
 - Puy de Dôme (Laboratoire de Météorologie Physique, Université Clermont-Ferrand)



Parting thought...



SUPPLEMENTAL SLIDES



Lessons from Volcano

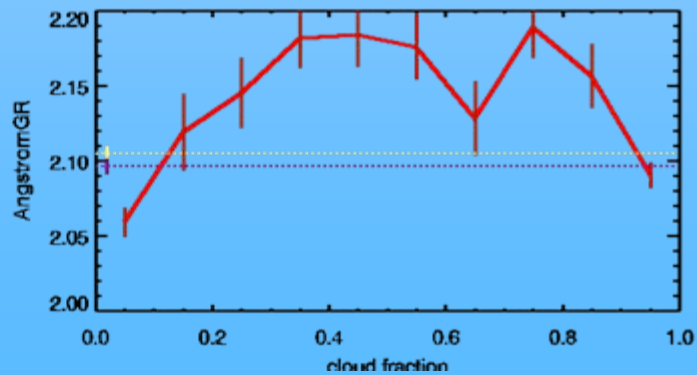
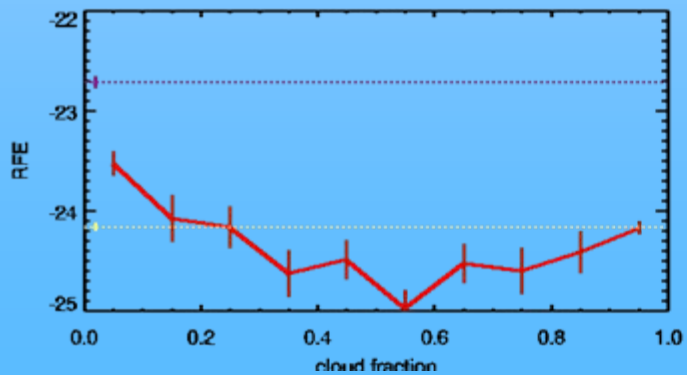
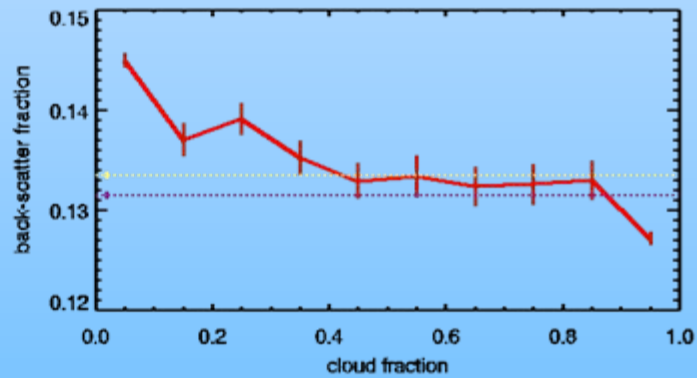
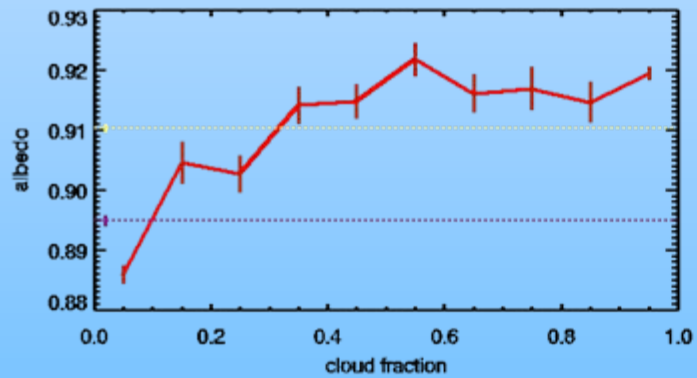
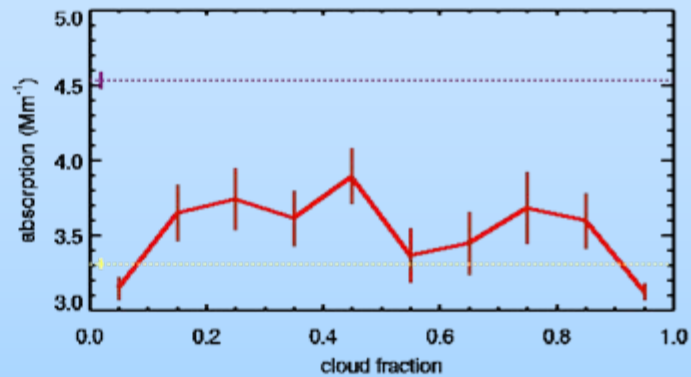
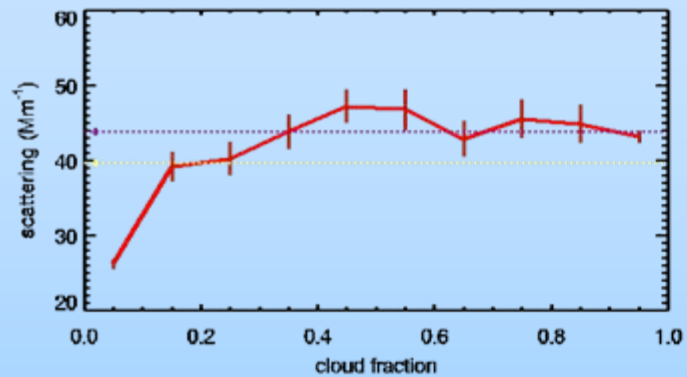
- **We weren't prepared to present all the observations!**
- **Station-specific web plots often needed an expert to interpret**
- **Syntheses were the most useful way to present data**
 - Gelsomina Pappalardo (EARLINET)
 - Robin Hogan (U. Reading)
- **UMBC “Smog Blog” might be a useful format**
- **Need a web page that explains and synthesizes**
 - Model forecasts
 - Satellite observations
 - Lidar observations
 - Sun photometer observations
 - In-situ observations
- **What organization(s) have sustained interest and funding to create and maintain such a web page?**
- **What other events generate such public interest in aerosols? (fires, dust storms, radioactive releases)**



Outline

- **Intro (GAW)**
- **AOD (GAW-PFR)**
 - description, map, data example
- **Lidar (GALION)**
 - description, map, data example
- **In-situ (scattering, absorption, numbers)**
 - description, map, data example
- **WDCA**
 - Interactive web-based GUI
- **Discussion**
 - Questions for users
 - Value of homogeneity of data formats
 - Optimal update frequency
 - Acceptable usage, data policy
- **Conclusions**

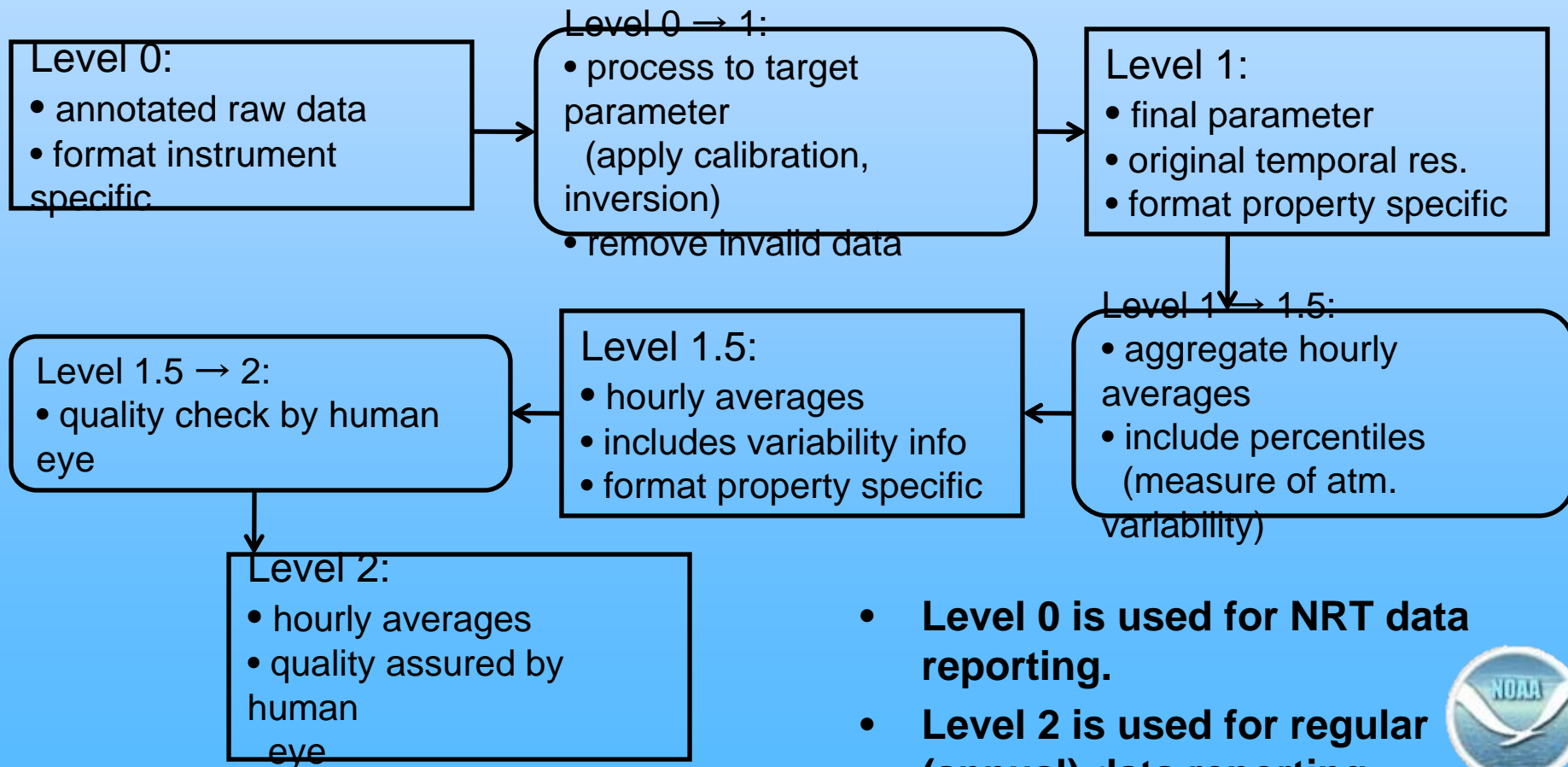




Data formats used for NRT data collection

4 data levels and pertaining file formats have been defined:

- All format definitions use EBAS NASA-Ames format: NASA-Ames 1001 format with additional specifications accommodating GAW required metadata (ASCII based, user friendly).
- Format is generic and easily adapted to new parameters / instruments.



- **Level 0 is used for NRT data reporting.**
- **Level 2 is used for regular (annual) data reporting.**



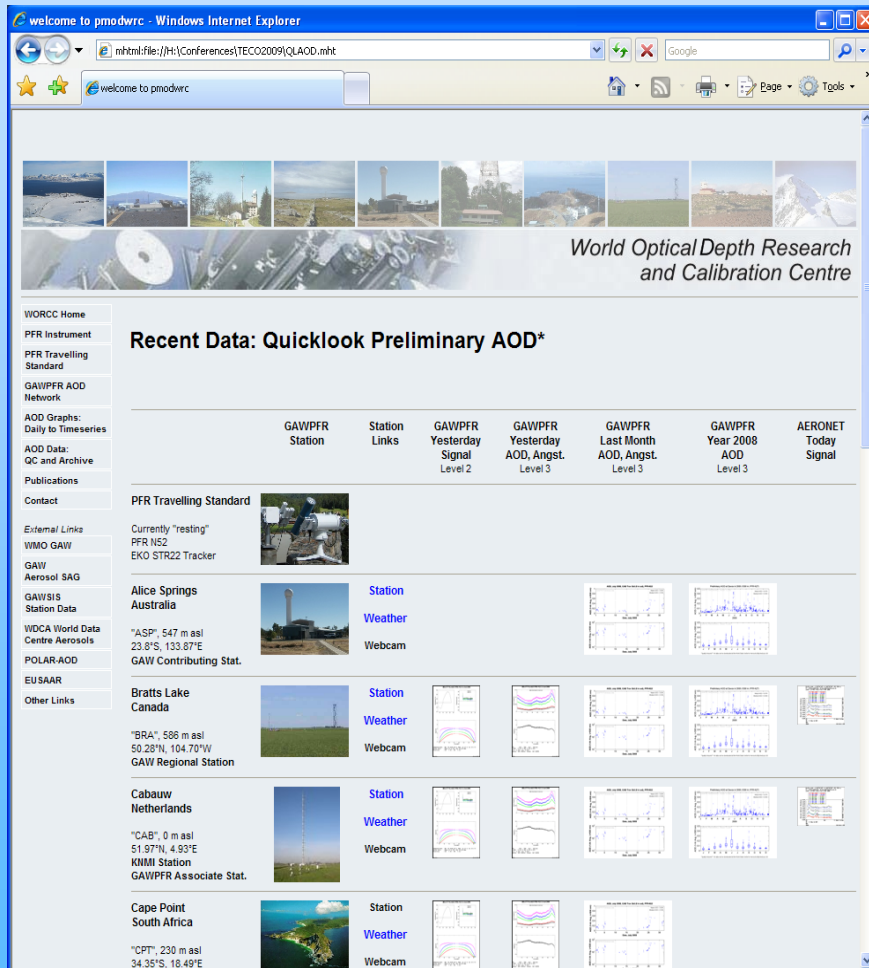
More Features, Credits

- **Data ownership and project association clearly visible in data files and web interface.**
- **In order to allow users to assess the data quality of their instruments, also instrument status variables (e.g. supply voltages, sample flows, pressures, temperatures) are accessible.**
- **Data providers ("instrument owners") may flag data sequences invisible to other users if they consider data quality doubtful.**
- **The WDCA near-real-time infrastructure was developed through the EU FP6 project EUSAAR in collaboration with the stations:**
 - Cabauw, Netherlands (TNO)
 - Mace Head (National University of Ireland, Galway)
 - Puy de Dôme (Laboratoire de Météorologie Physique, Université Clermont-Ferrand)



Quick-look access at WORCC

<http://www.pmodwrc.ch/worcc/>



Quick-look plots

Annual mean plot

- Daily summary plots
- Numerical values with metadata are available on request.
- Hourly means in NARSTO format are available from WDCA, updated annually.



Precision Filter Radiometer



PFR at Cape Point, South Africa

PFR specifications

- Automated, solar spectral radiometer (Sun-photometer)
- 4 channels at 862, 500, 412, 368nm, 5nm bandwidth
- Measurement rate 1 minute
- Data logger with 30 day storage capacity, PC or TCP/IP access
- Built on demand by PMOD/WRC

