Intro to AERONET and DRAGON Campaigns

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For DISCOVER-AQ
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AERONET-Internationally Federated Net

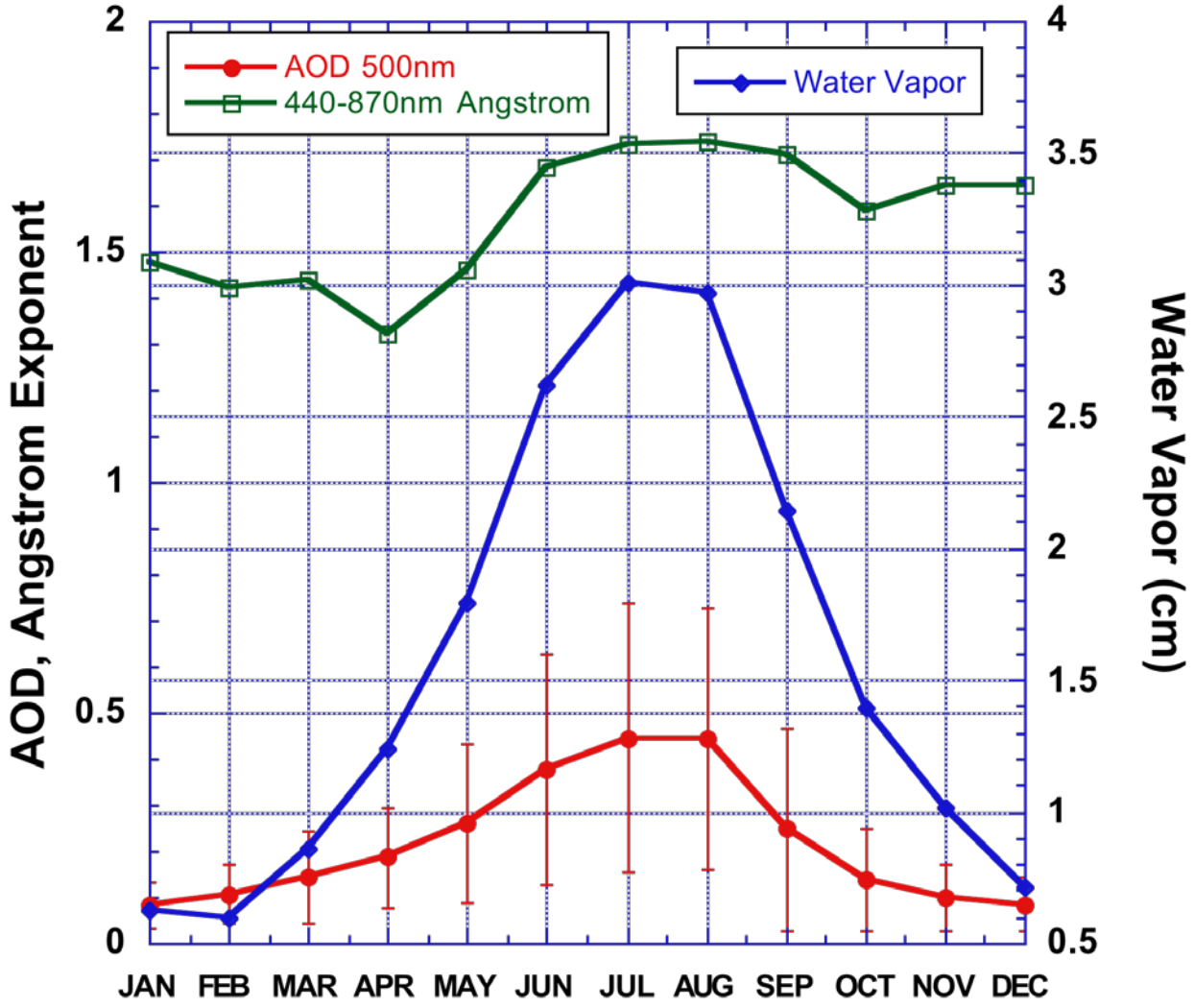
Provide a long term data set to:
•Characterize aerosol optical properties
• Validate Satellite & model aerosol retrievals
• Synergism with Satellite obs., climate change

- 450 instruments
- ~250-275 Operational sites
- Network Partners
  - GSFC
  - Photons (France)
  - RIMA (Spain)
  - CSIRO (Australia)
  - AEROCAN (Canada)
- Expansion to Asia, Africa high latitudes and over water sites

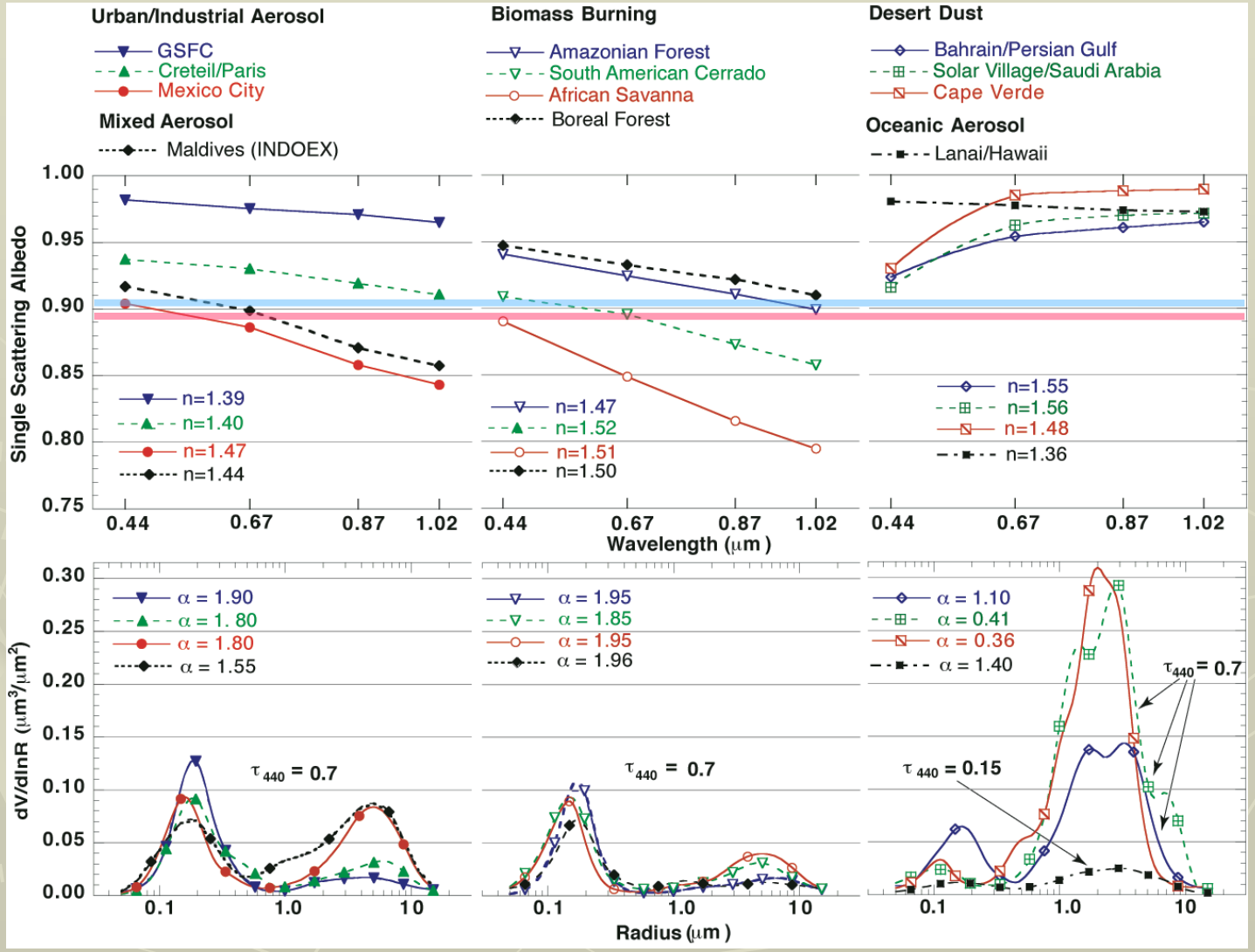
Open data access via website: http://aeronet.gsfc.nasa.gov/

Parameters measured: τ, ω_o, Θ, size, n, κ and WV, clds, L_n

Overall Monthly Averages (1993-2008)
Greenbelt, MD (NASA GSFC)



Aerosol Climatology from AERONET



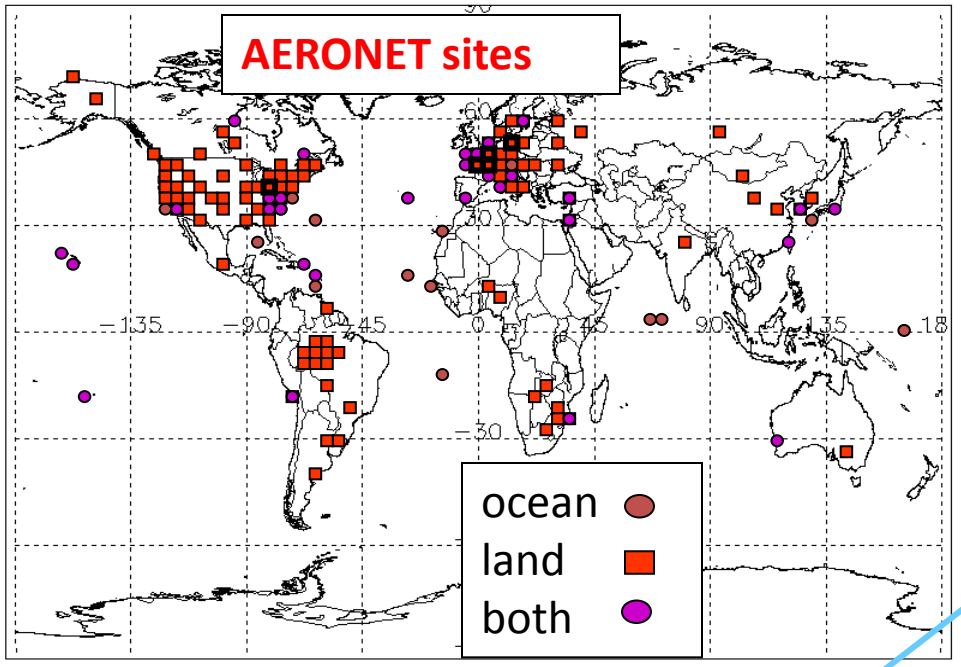
Cooling

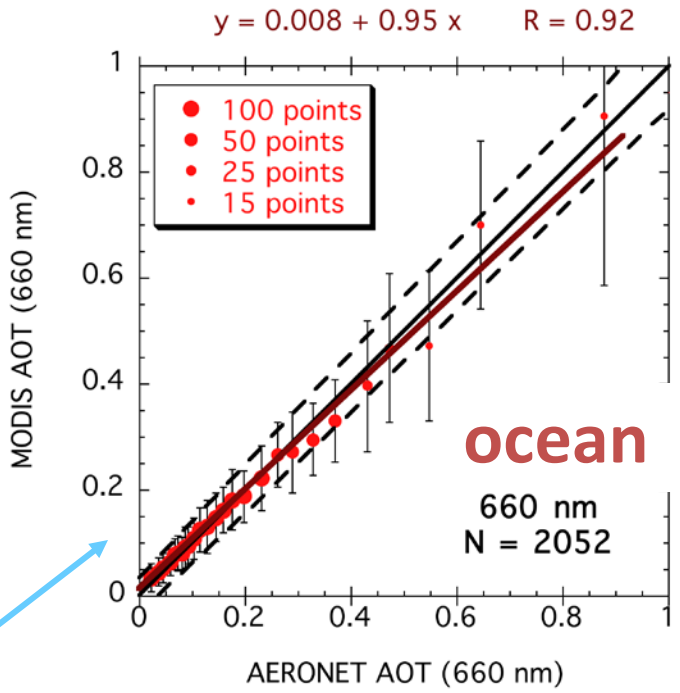
Heating

Hansen et al. (1997)

Dubovik et al. (2002)

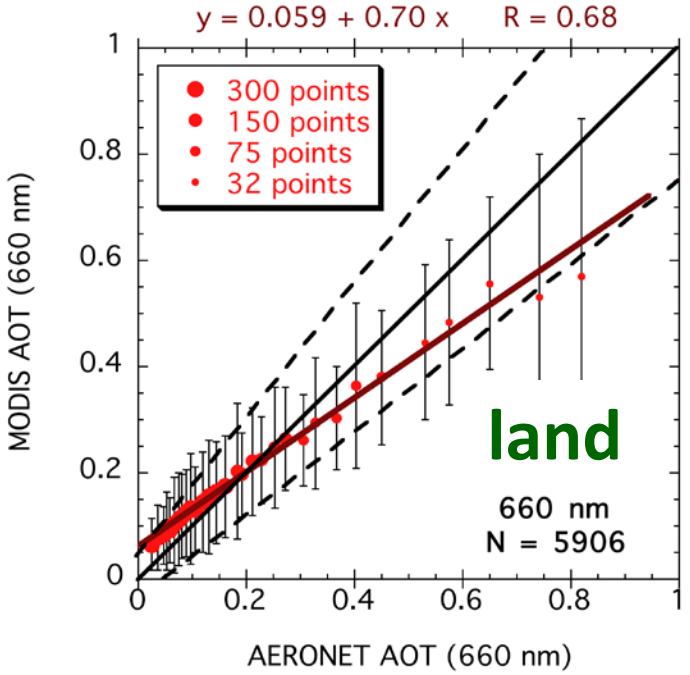
MODIS aerosol validation 2000-2002



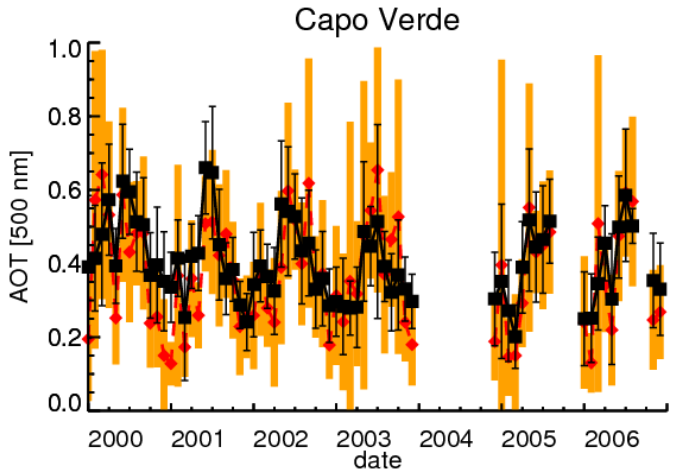


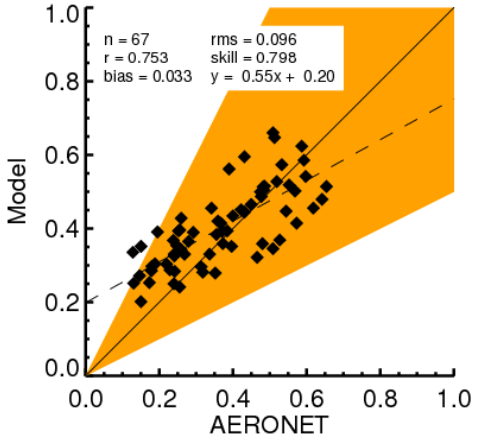
66% of MODIS aerosol retrievals
over ocean fall within expected uncertainty

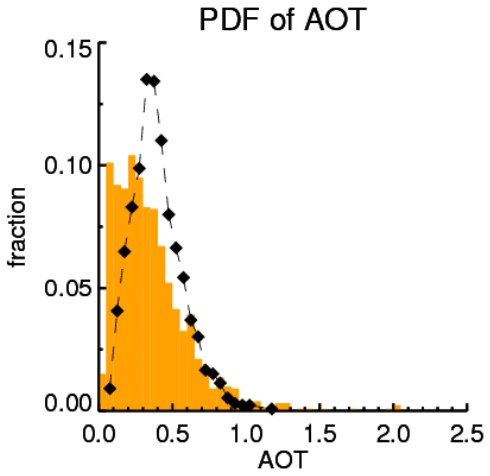
71% of MODIS aerosol retrievals
over land fall within expected uncertainty

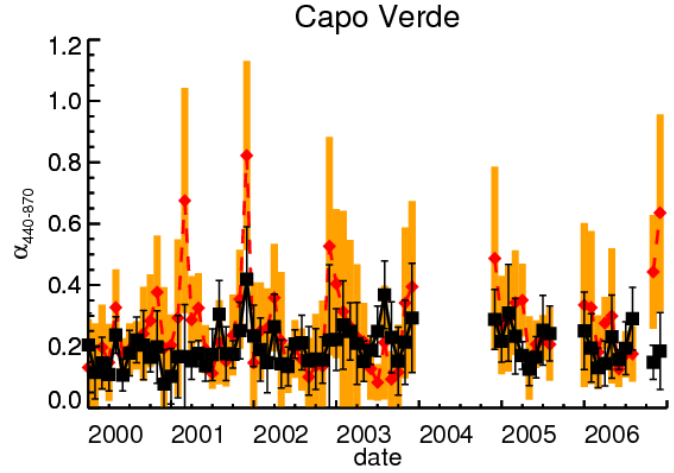


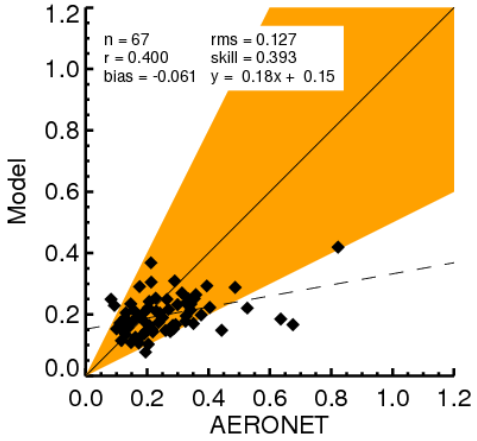
Remer et al. (2005)

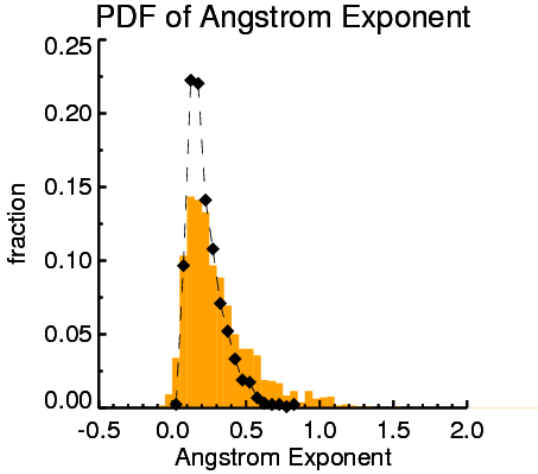












AERONET monthly mean AOT/Angstrom parameter and standard deviation

GEOS-4 monthly mean AOT/Angstrom parameter and standard deviation

Multi-year comparison of AERONET observations at Capo Verde, Sal Island, to results of the GEOS-4 model with online aerosols from the GOCART module.

Colarco et al., "Online simulations of global aerosol distributions in the NASA GEOS-4 model and comparisons to satellite and ground-based aerosol optical depth," in preparation for submission to JGR-Atmospheres

Validation of AERONET Retrievals

Comparisons from 16 years of field Campaigns of Opportunity

B. Holben

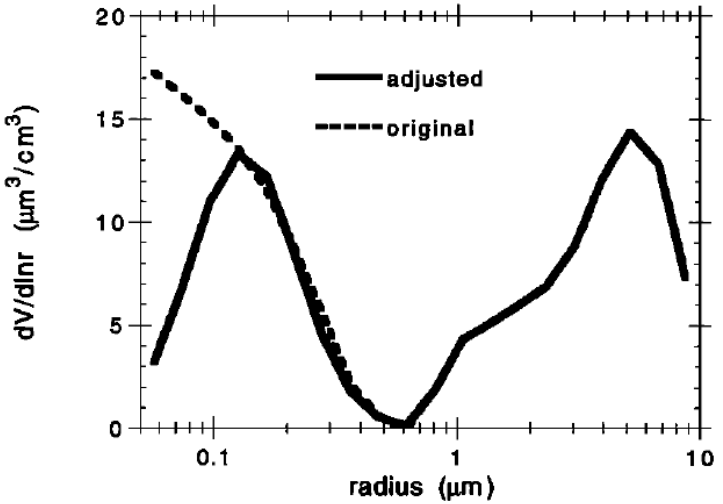
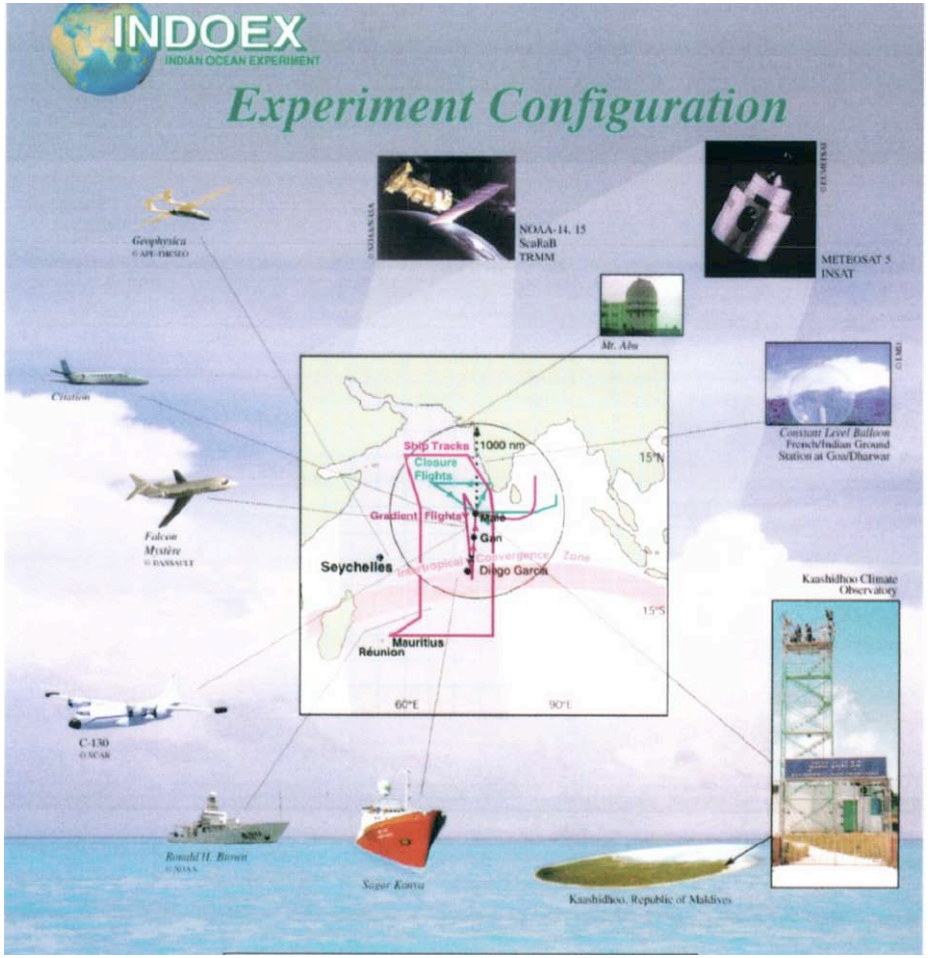


Figure 3. Volume size distribution derived from spectral sky radiance data and inverted using *Nakajima* [1983, 1986] code (dashed curve) and adjusted to better fit the small radius edge (solid curve), using a technique that matches the aerosol single-scattering path radiance of original curve with path radiance of a lognormal size distribution in a look-up table. The lognormal in this case is represented by $r_g = 0.063$ and $\sigma = 0.50$ with a root-mean-square (rms) difference in path radiance of 8%. The data are from an observation on July 28 corresponding to event 6 in Table 2.


INDOEX
INDIAN OCEAN EXPERIMENT
Experiment Configuration
Geophysica
© APL-IMGSO
NOAA-14, 15
ScaRaB
TRMM
METEOSAT 5
INSAT
Mt. Abu
Citation
Constant Level Balloon
French/Indian Ground
Station at Goa/Dharwar
Falcon
Mystère
© DASSAULT
Ship Tracks
1000 nm
Closure
Flights
Gradient Flights
Male
Gan
Seychelles
Diego Garcia
Convergence Zone
15°N
15°S
Mauritius
Réunion
60°E
90°E
Kaashidhoo Climate
Observatory
C-130
© NCAR
Ronald H. Brown
© NOAA
Sagar Kanya
Kaashidhoo, Republic of Maldives

Jim Haywood-SAFARI2000

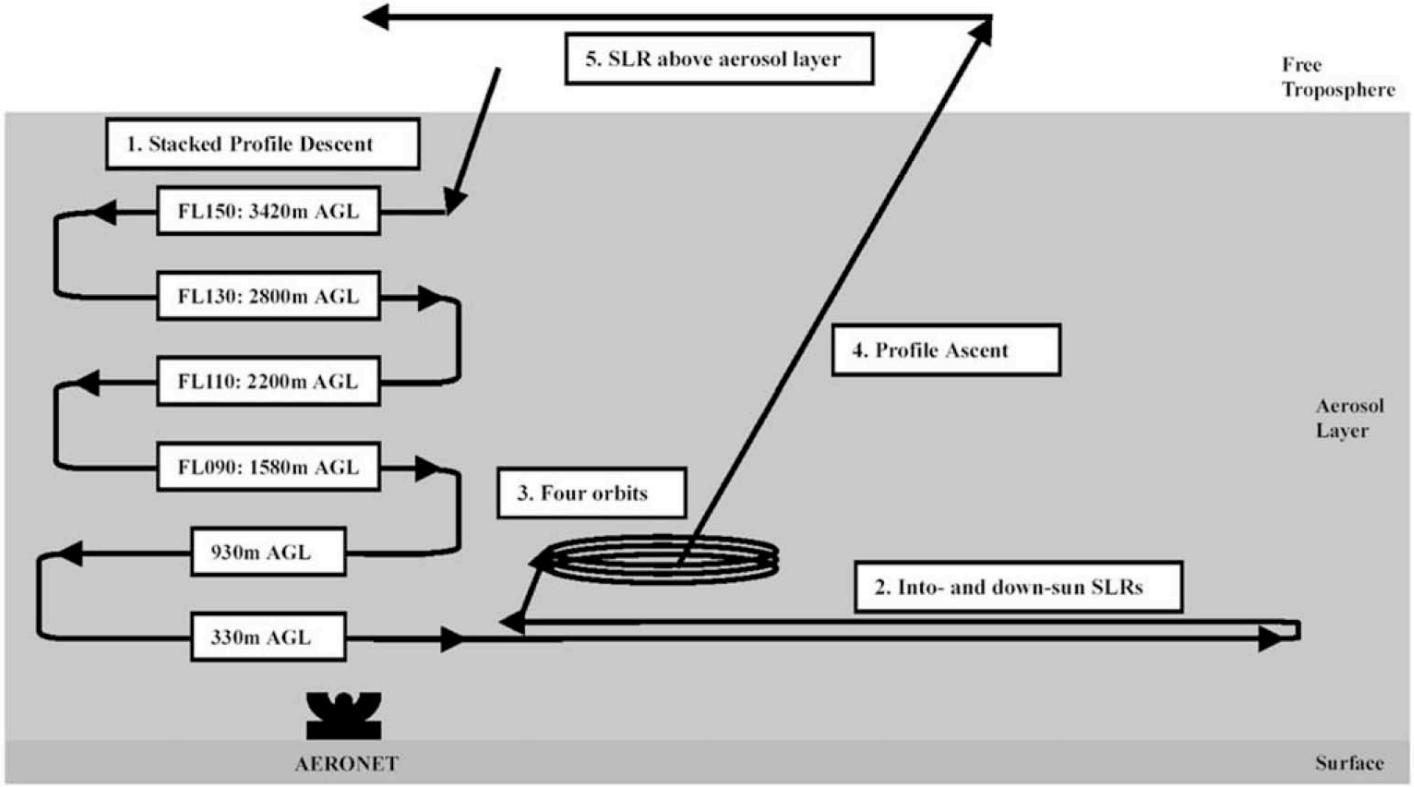


Figure 2. Schematic diagram of the flight pattern performed by the C-130 over the Etosha AERONET site on 13 September 2000. Consisting of (1) stacked profile descent, (2) into-Sun and down-Sun SLRs, (3) a series of four orbits, (4) profile ascent, and (5) SLR above the aerosol layer.

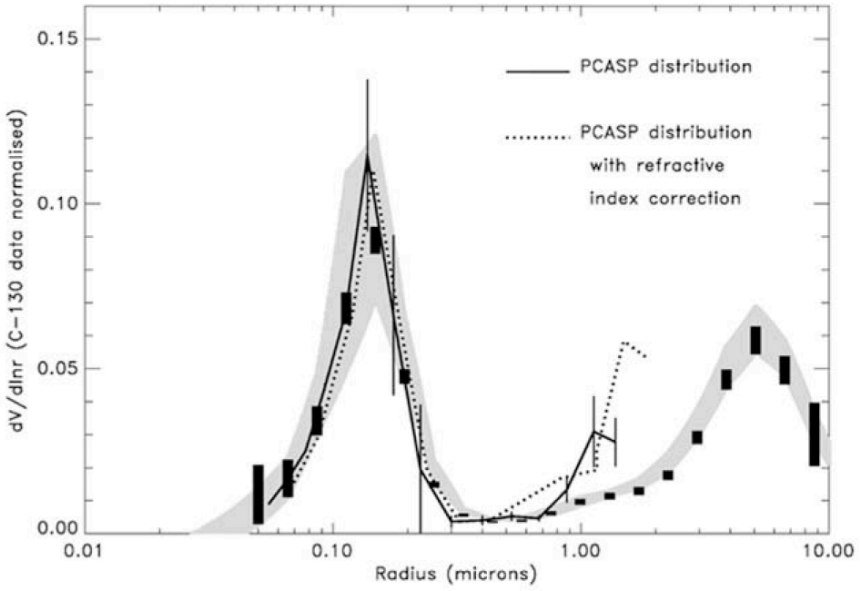


Figure 7. The size distribution derived from the PCASP-100X (black line, with thin vertical lines representing 1 standard deviation in the measurements from the different SLRs). The dotted line represents the PCASP size distribution when differences in the refractive index between the latex calibration spheres and the aerosol are accounted for (see text). The shaded envelope represents the daily mean size distribution ±1 standard deviation derived from the inversion of *Dubovik and King* [2000]. The thick vertical lines represent the size distribution derived at 0709 UTC and include an error estimate for this single size distribution.

Leahy-Safari2000

GEOPHYSICAL RESEARCH LETTERS, VOL. 34, L12814, doi:10.1029/2007GL029697, 2007

A synthesis of single scattering albedo of biomass burning aerosol over southern Africa during SAFARI 2000

L. V. Leahy,[1] T. L. Anderson,[1] T. F. Eck,[2] and R. W. Bergstrom[3]

AERONET/PSAP SSA Comparison-Amazonia

Instrument\Time period	Coincident Comparisons (5)	Sept. 9 – Nov. 14 AERONET (125): 8 YEARS PSAP (24,011): 1 Season
AERONET	0.902 ± 0.042	0.918 ± 0.025
Surface PSAP	0.916 ± 0.027	0.911 ± 0.03

AERONET uncertainty ±0.05

PSAP uncertainty ± 0.05

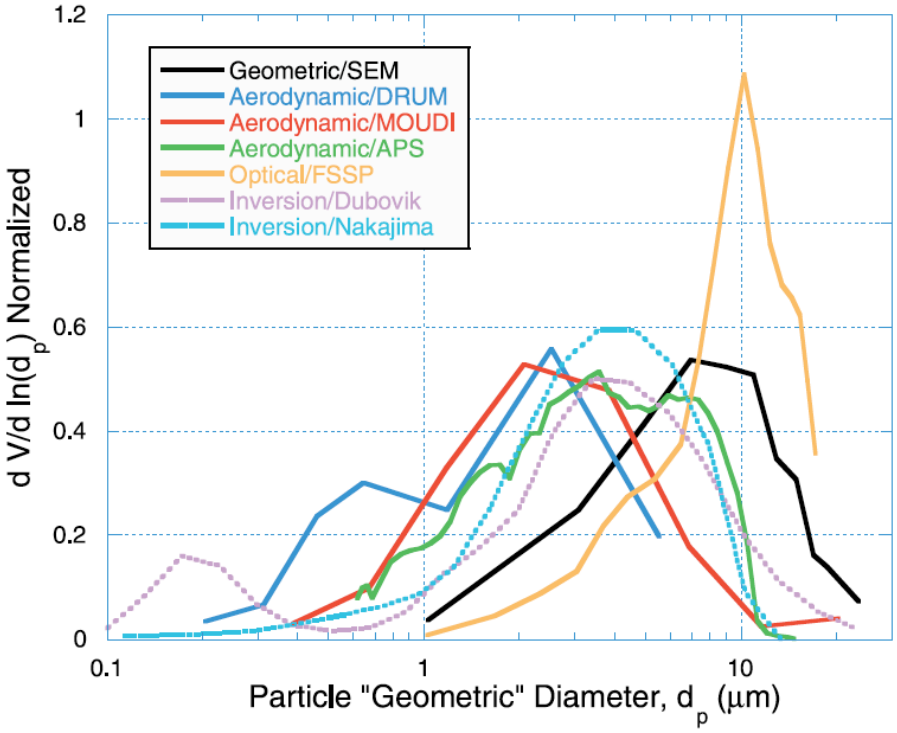


Figure 20. Intercomparison of average dust volume distributions from all of the methods discussed in this study.

Parameter\Type	Urban	Biomass Burning	Dust	Sea Salt Maritime	Mixed
SSA (ω_o)	-Ra$^{\dagger\#}$	-H$^{@\#}$, +L, B, C†, Sc$^{\&}$			+J$^{@}$
Size Distribution dV/dlnr, r_v	-Re*	+H$^{@\#}$	+Rp$^{\#}$, +Ru	-S$^{\dagger\#}$	+J$^{@}$
Real Index (n)					
Imaginary (κ)					
Asymmetry (g)					+J$^{@}$
% Sphericity					

†Regional comparisons

*Nakajima retrievals

#Version 1

@ Single point

& surface comparison

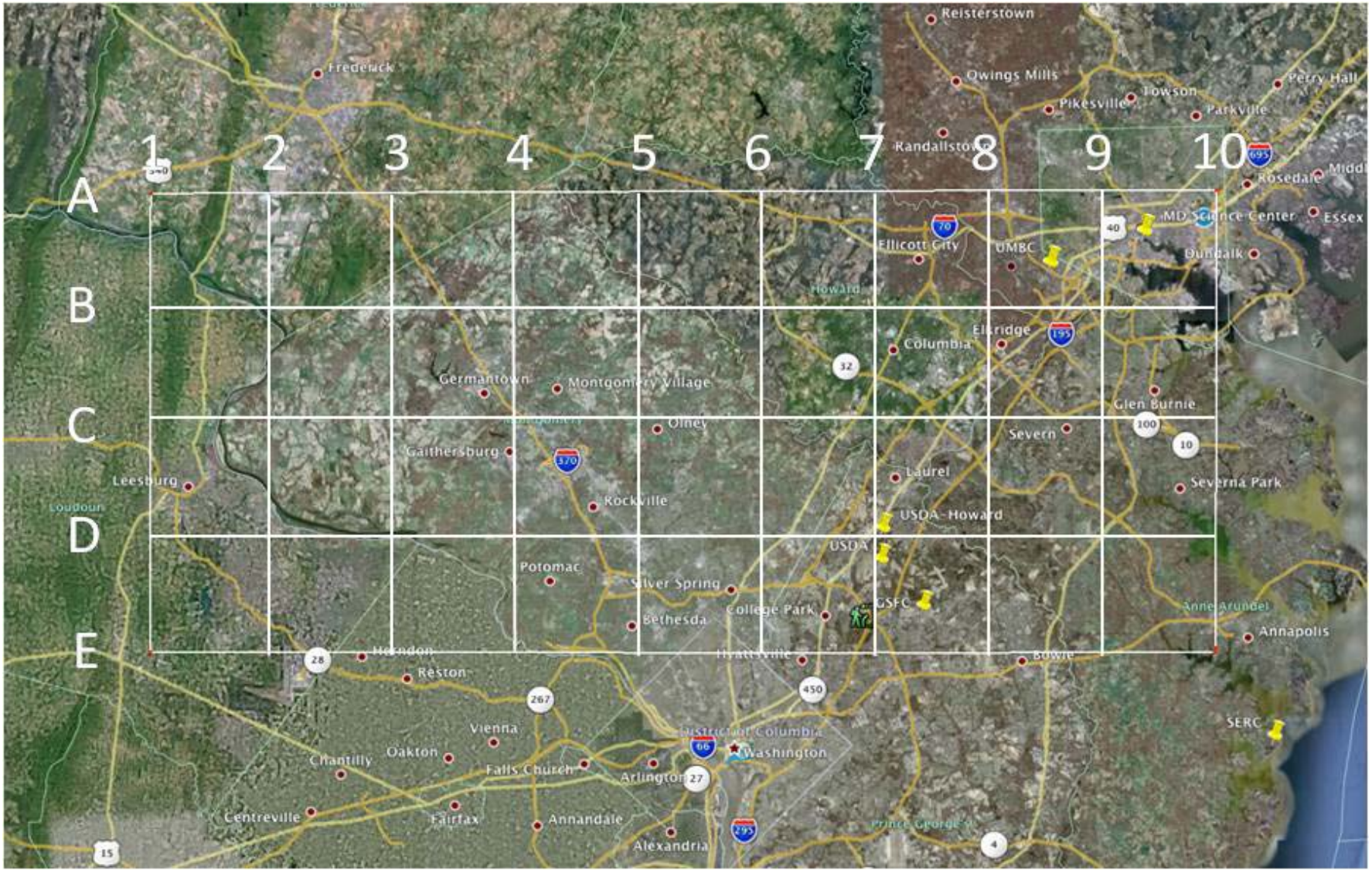
Table 1, shows the principle parameters measured by sun and sky scanning spectral radiometers for the aerosol types likely encountered. Eight published validations/comparisons were made during field campaigns or the last 16 years; these are Ra=Ramanathan et al, 2000, Re=Remer et al., 1998, H=Haywood et al, 2003, L=Leahy et al., 2008, B=Bergstrom et al., 2003, Rp=Reid et al, 2003, Ru=Reid et al., 2008, S=Smirnov et al., 2003, Sc=Schafer et al., 2008 and J=Johnson et al., 2009. Note that most categories are incomplete, not updated and/or lack relevance.

New NASA/CNSA (Chinese) initiative

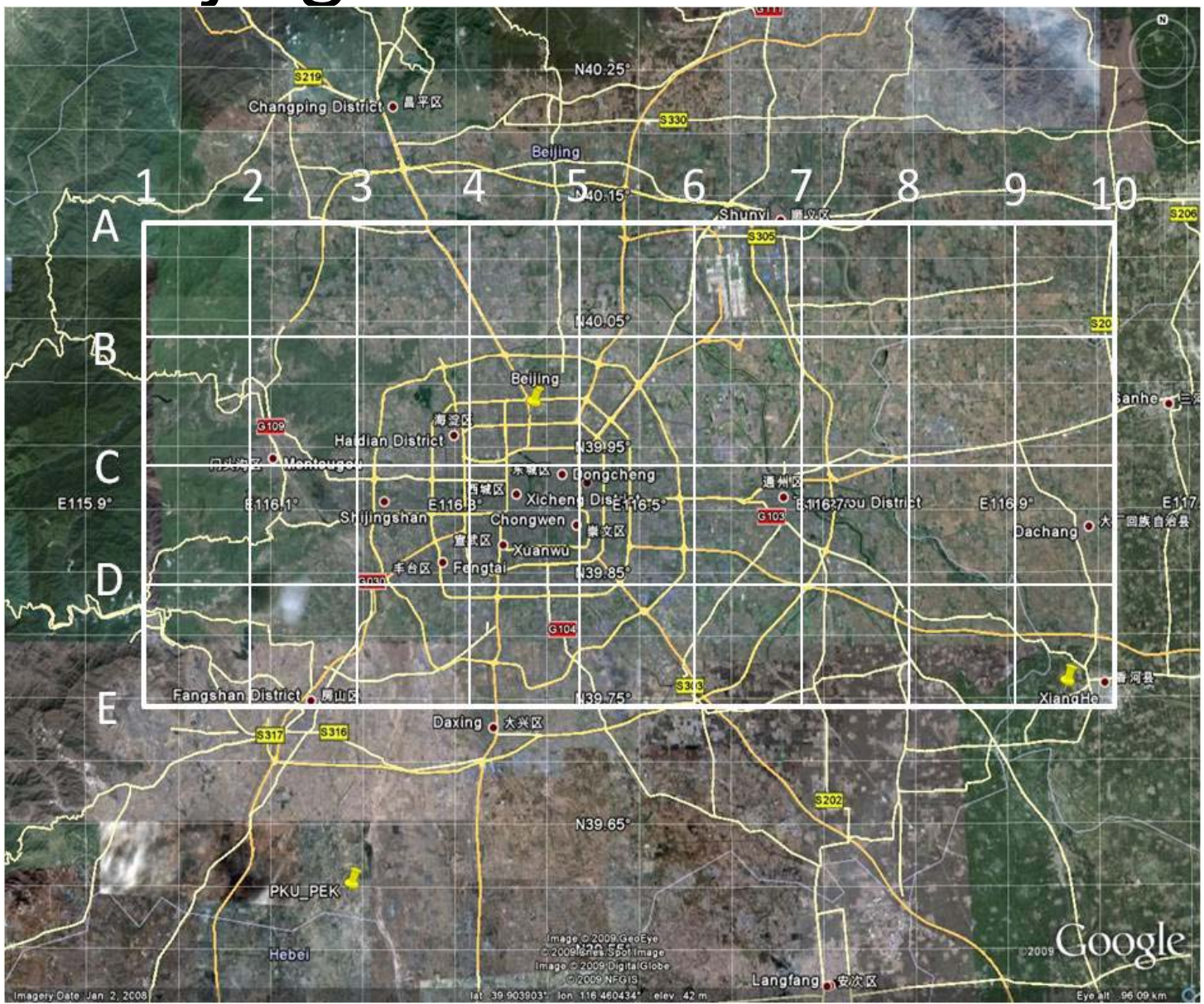
Distributed Regional Aerosol Gridded Observation Networks (DRAGON)

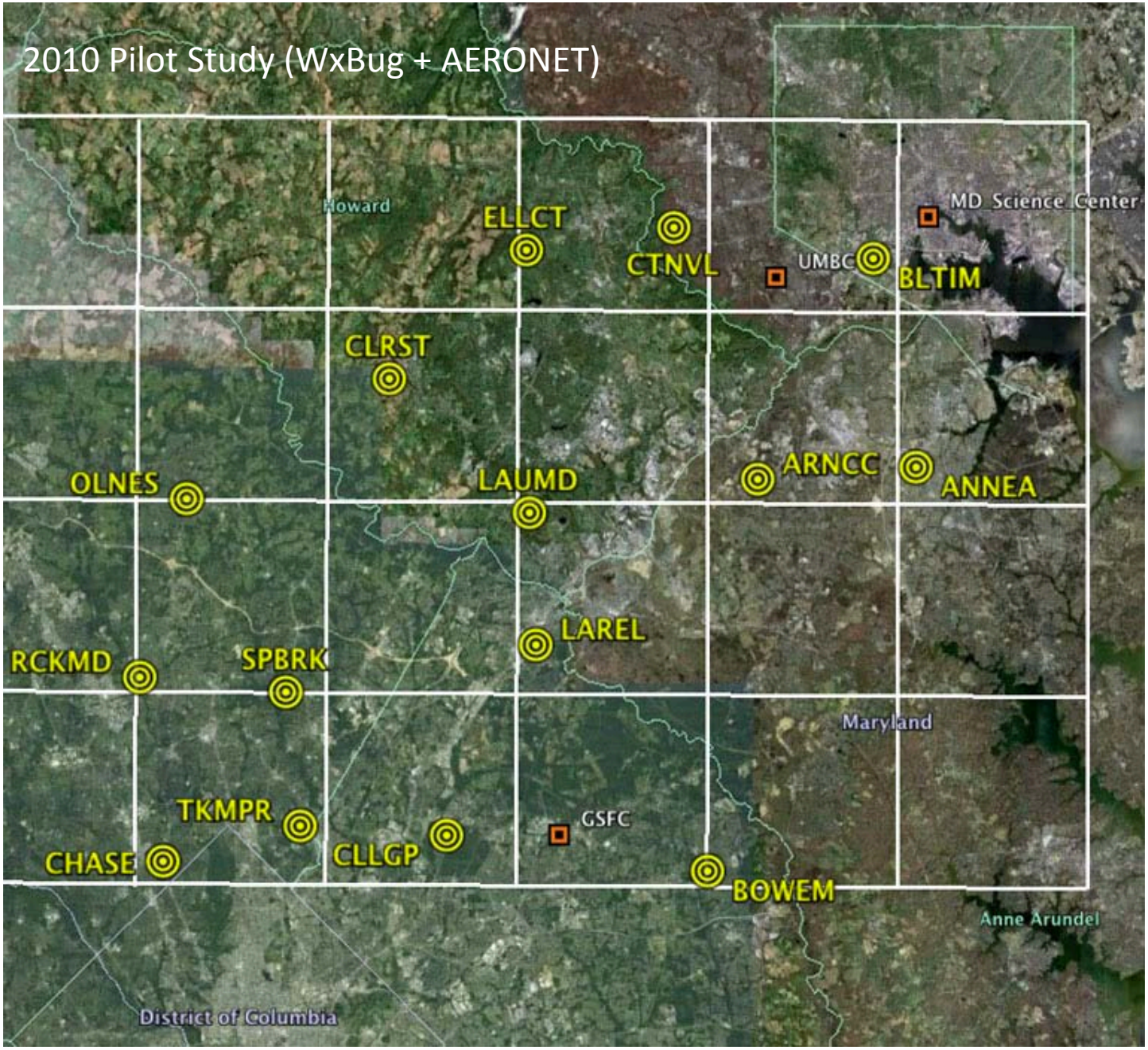
Distributed Regional Aerosol Gridded Observation Networks with Logical Airborne, In situ and Remote-sensing Systems (DRAGON LAIRS)

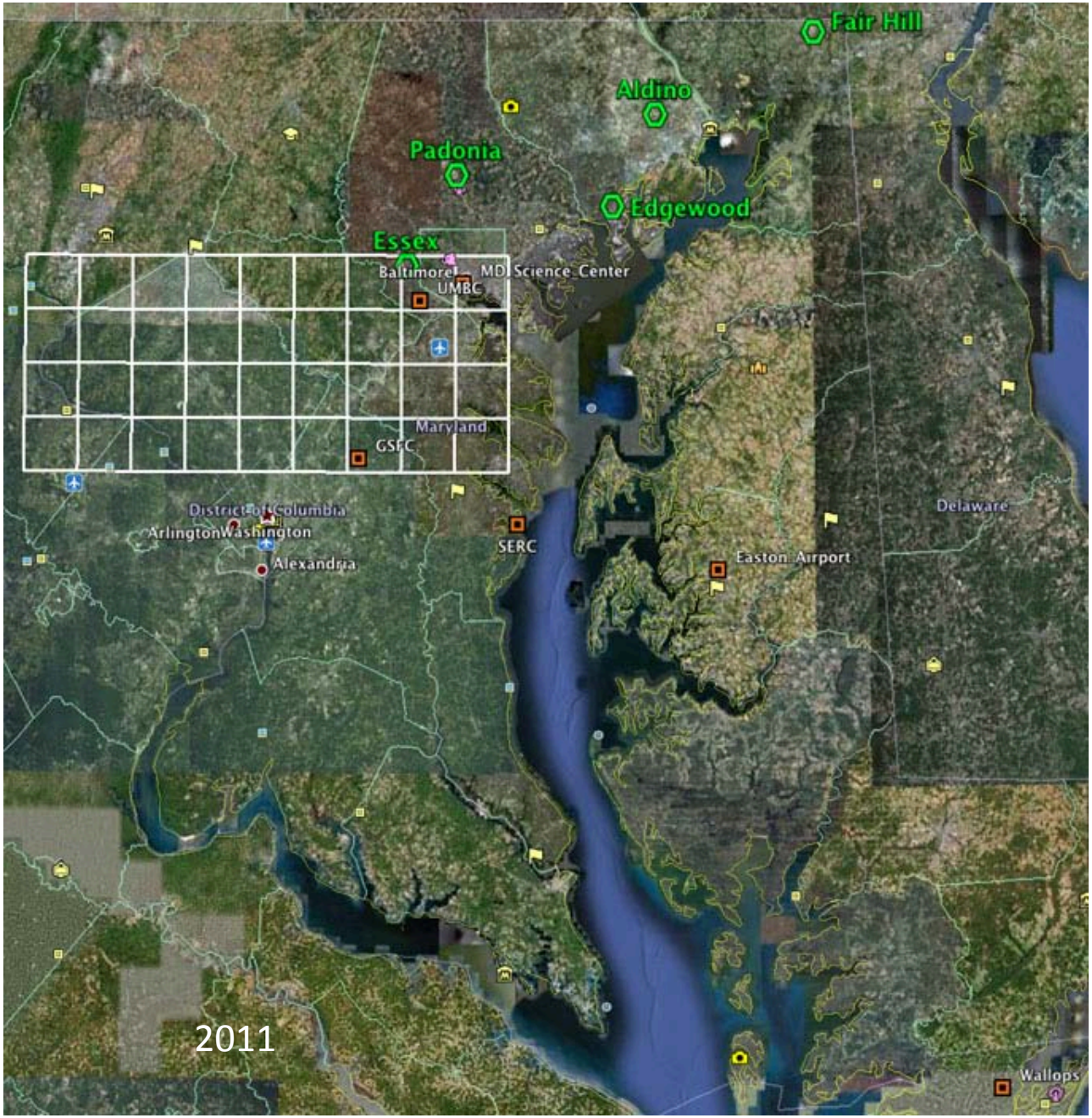
Washington DC Gridded Network

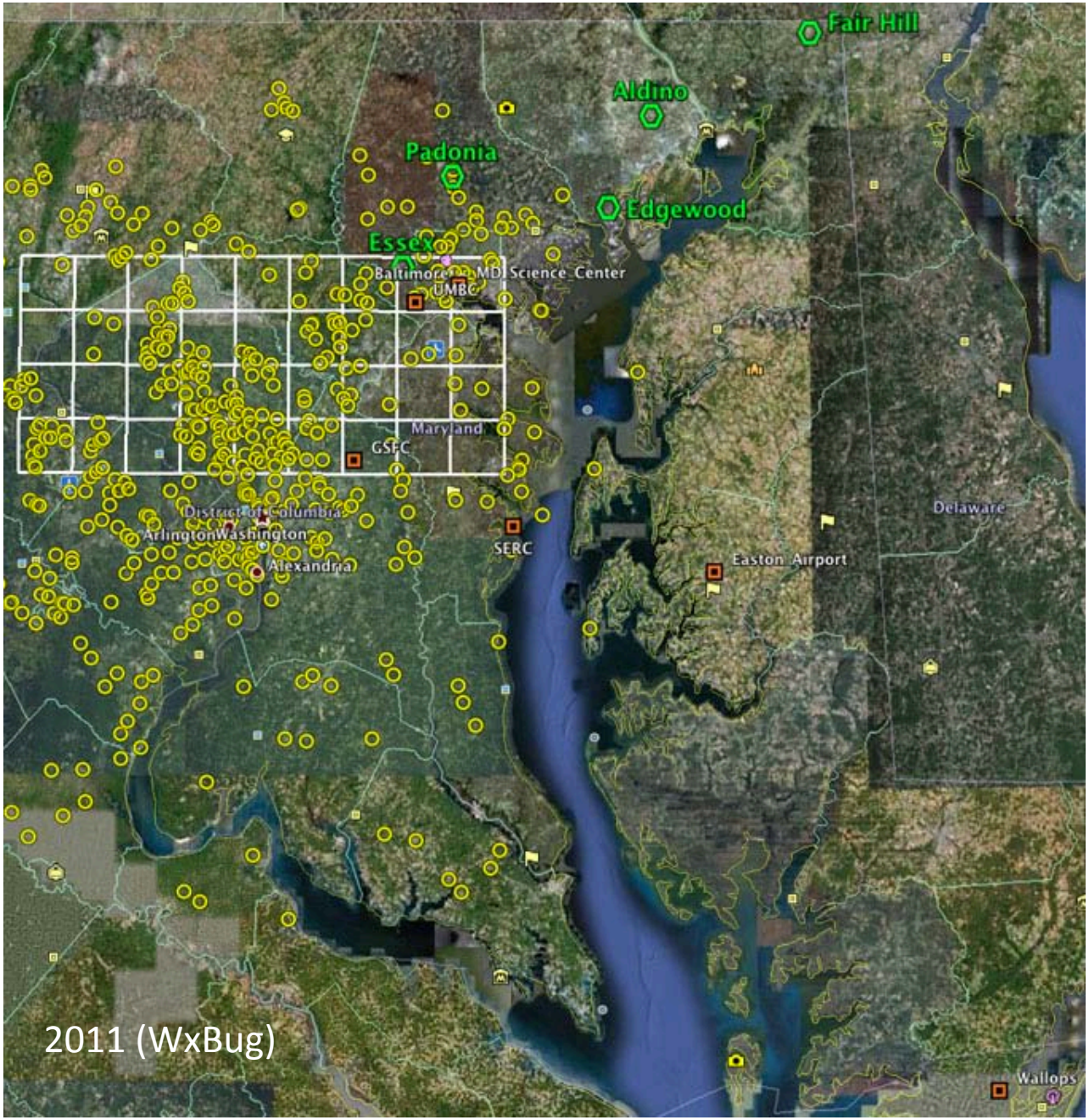


Beijing Gridded Network

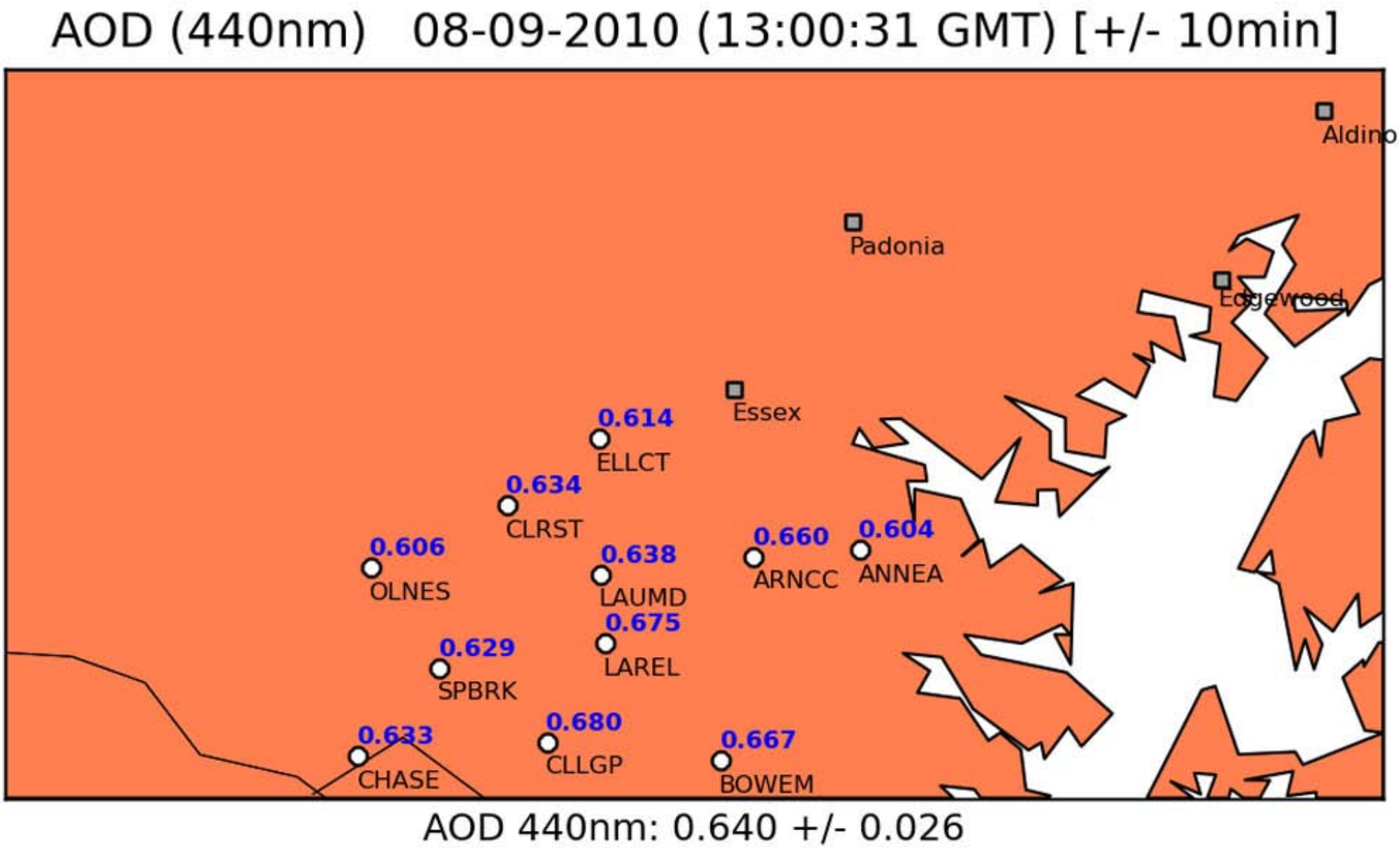


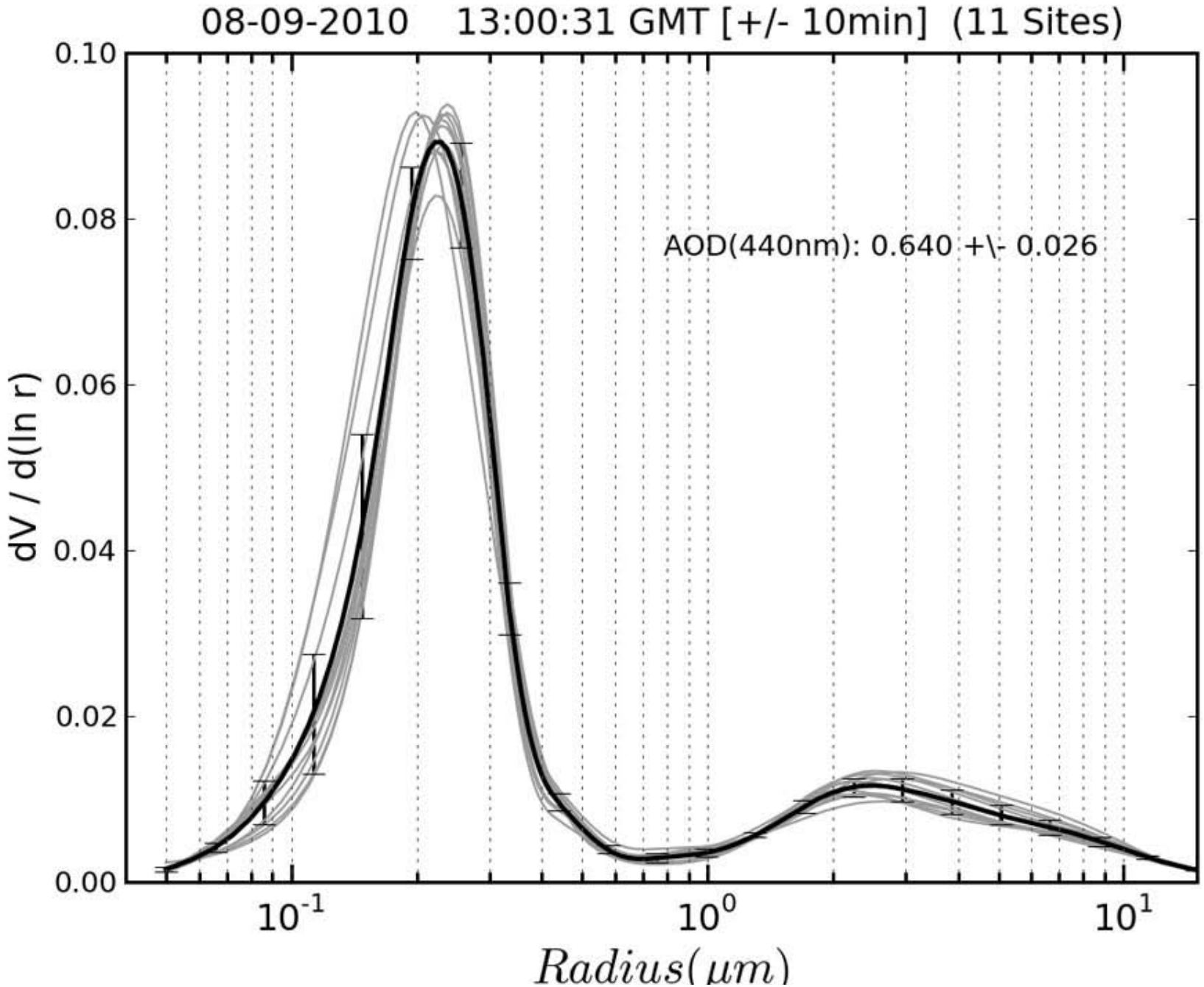

2010 Pilot Study (WxBug + AERONET)
Howard
ELLCT
CTNVL
MD Science Center
UMBC
BLTIM
CLRST
OLNES
LAUMD
ARNCC
ANNEA
LAREL
RCKMD
SPBRK
Maryland
TKMPR
GSFC
CHASE
CLLGP
BOWEM
Anne Arundel
District of Columbia


Fair Hill
Aldino
Padonia
Edgewood
Essex
Baltimore
MD Science Center
UMBC
Maryland
GSFC
District of Columbia
Arlington
Washington
Alexandria
SERC
Easton Airport
Delaware
Wallops
2011

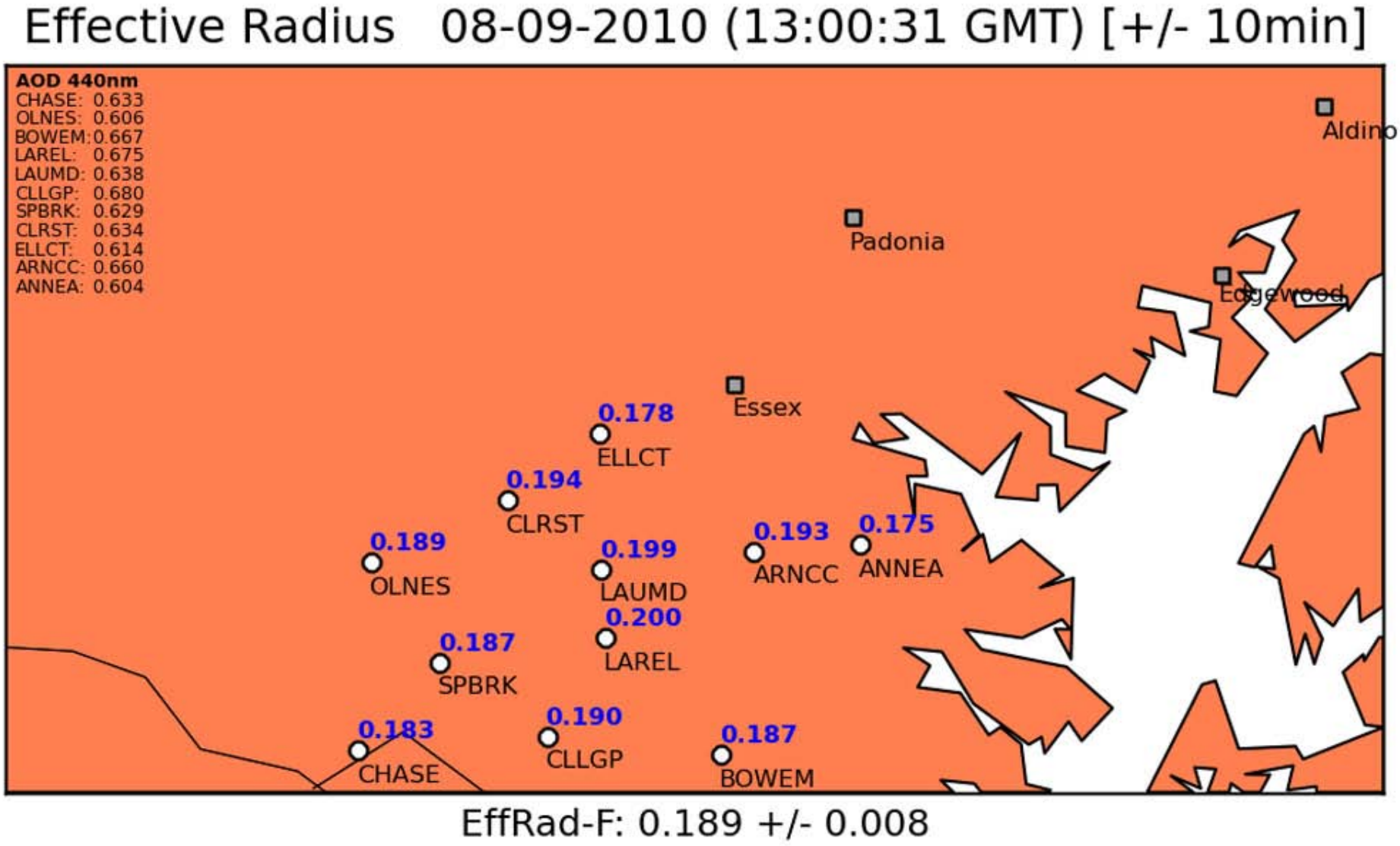

Fair Hill
Aldino
Padonia
Edgewood
Essex
Baltimore
MD Science Center
UMBC
Maryland
GSFC
District of Columbia
Arlington
Washington
Alexandria
SERC
Delaware
Easton Airport
Wallops
2011 (WxBug)

Regional Aerosol Optical Depth

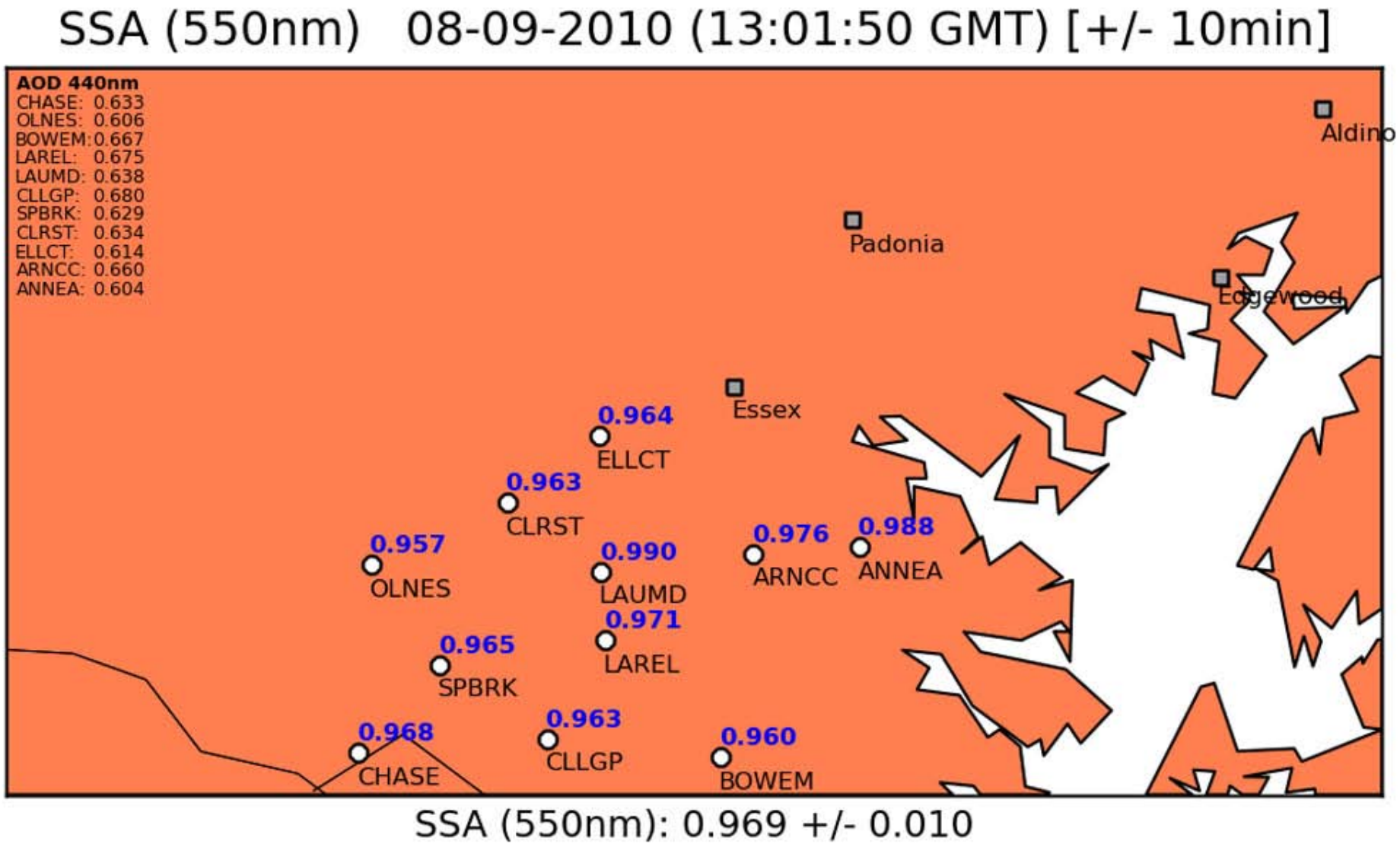



08-09-2010 13:00:31 GMT [+/- 10min] (11 Sites)
AOD(440nm): 0.640 +\- 0.026
dV / d(ln r)
0.10
0.08
0.06
0.04
0.02
0.00
10^{-1}
10^{0}
10^{1}
$Radius(\mu m)$

Cimel Inversion Product Comparison



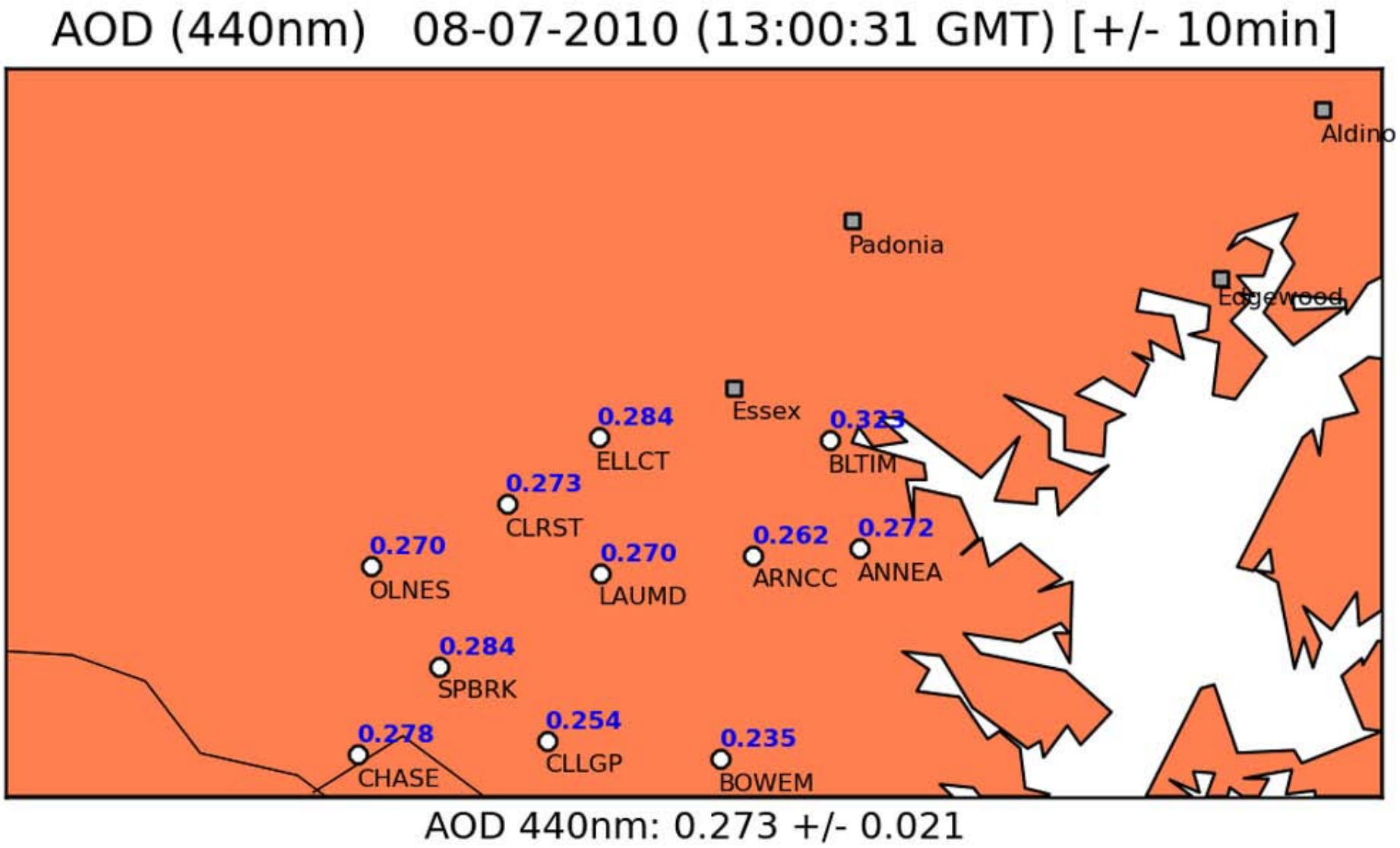
Cimel Inversion Product Comparison

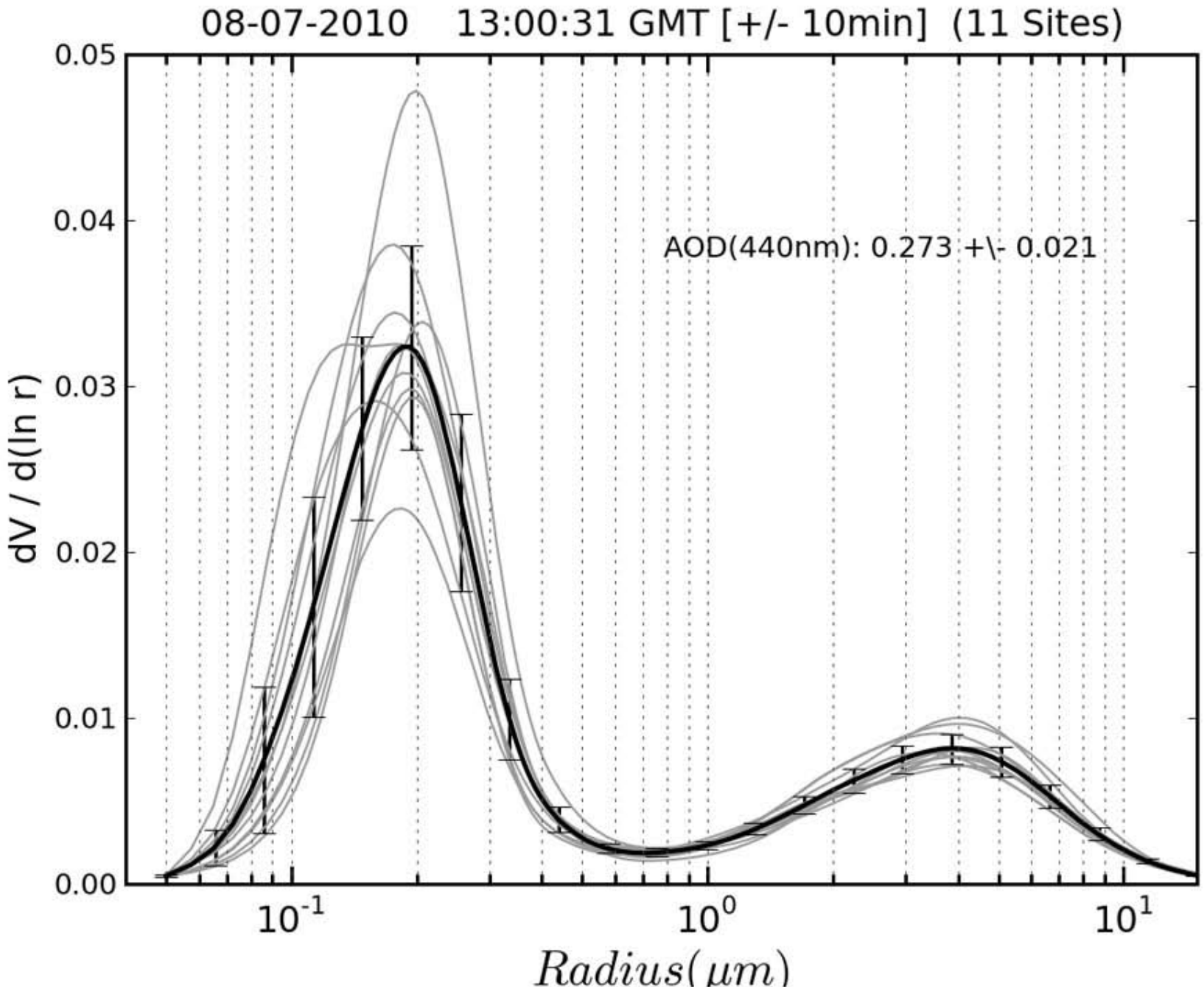
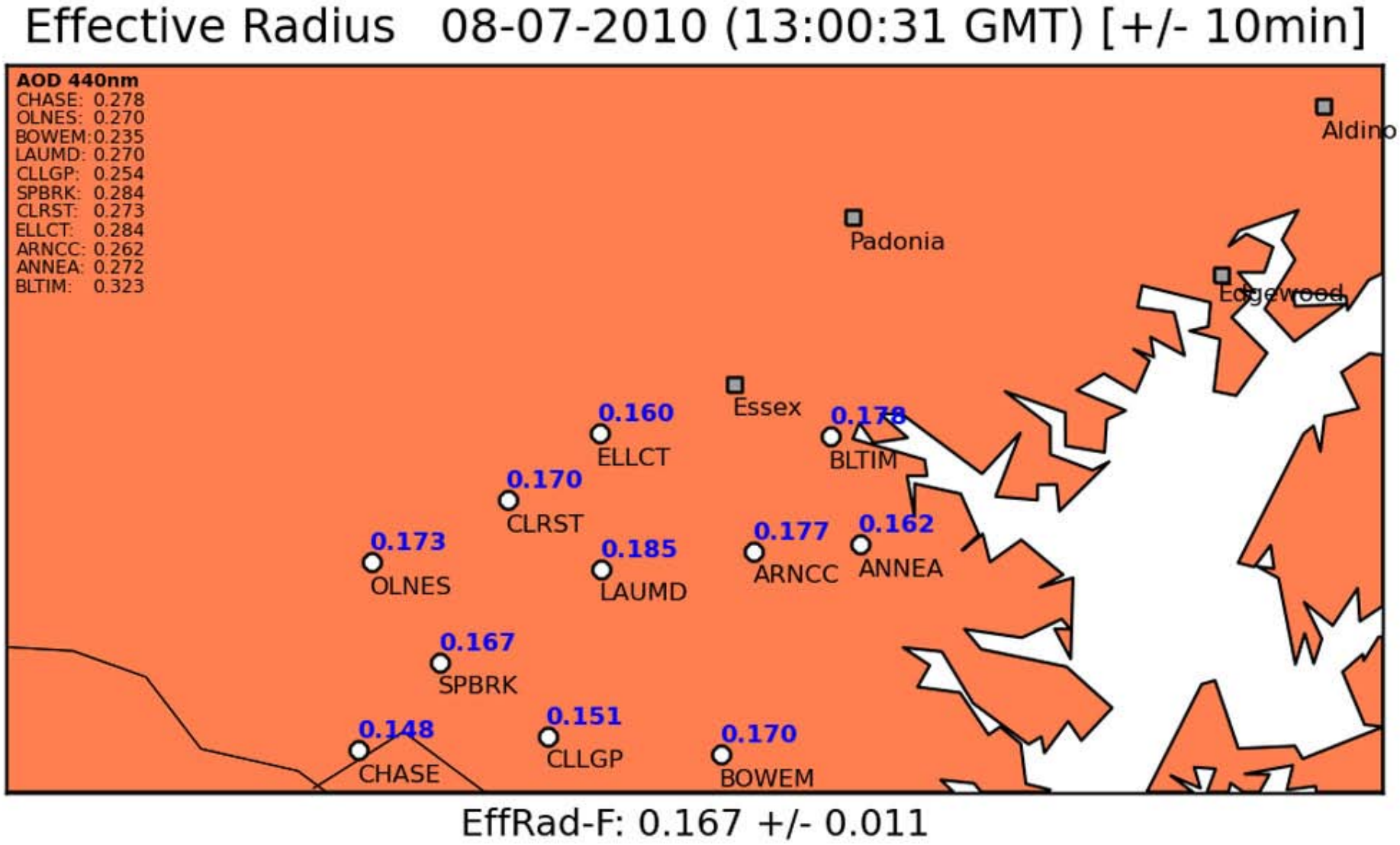


Summary-Issues

- ~10 km Gridded network, June, July, Aug
- ~50 AERONET stations, 5 contributed from DISCOVER AQ
- Column integrated aerosol properties 15/60 min.
- AERONET validation/comparison
- Airborne spirals
- Co-location w/ lidars, in situ observations, Met.
- Support Satellite validation, A-train

Regional Aerosol Optical Depth




08-07-2010 13:00:31 GMT [+/- 10min] (11 Sites)
AOD(440nm): 0.273 +\- 0.021
dV / d(ln r)
0.05
0.04
0.03
0.02
0.01
0.00
10^{-1}
10^{0}
10^{1}
$Radius(\mu m)$

Cimel Inversion Product Comparison