Maritime Aerosol Network (MAN) as a component of AERONET – current status

8th AeroCom Meeting, Geophysical Fluid Dynamics Laboratory, Princeton, New Jersey, October 5-7, 2009

Maritime Aerosol Network (MAN) - as spatial extension to AERONET

Alexander (Sasha) Smirnov - presenter

Brent Holben, David Giles, Norm O'Neill, Ilya Slutsker, Tom Eck, Peter Croot, Andreas Macke, Sergey Sakerin, Tim Smyth, Mike Harvey, Giuseppe Zibordi, Tymon Zielinski, Patricia Quinn, K. Krishna Moorthy, Vladimir Radionov, Joaquim Goes, Remi Losno, Jean Sciare, Yann Courcoux, Kenneth Voss, Carlos Duarte, Norm Nelson, Nicholas Nalli, Simon Belanger

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List of collaborators

- USA – Woods Hole Oceanographic Institution; Bigelow Laboratory for Ocean Sciences; University of California at Santa Barbara; NOAA Pacific Marine Environmental Laboratory; University of Hawaii; University of Miami; University of Washington; Howard University
- Canada – Institut Maurice-Lamontagne (Québec); Université du Québec à Rimouski (Québec); Université de Sherbrooke (Québec)
- UK – Plymouth Marine Lab; University of East Anglia; University of Edinburgh
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- Russia - Institute of Atmospheric Optics (Tomsk); Arctic and Antarctic Institute (St. Petersburg); Institute of Oceanology (Moscow)
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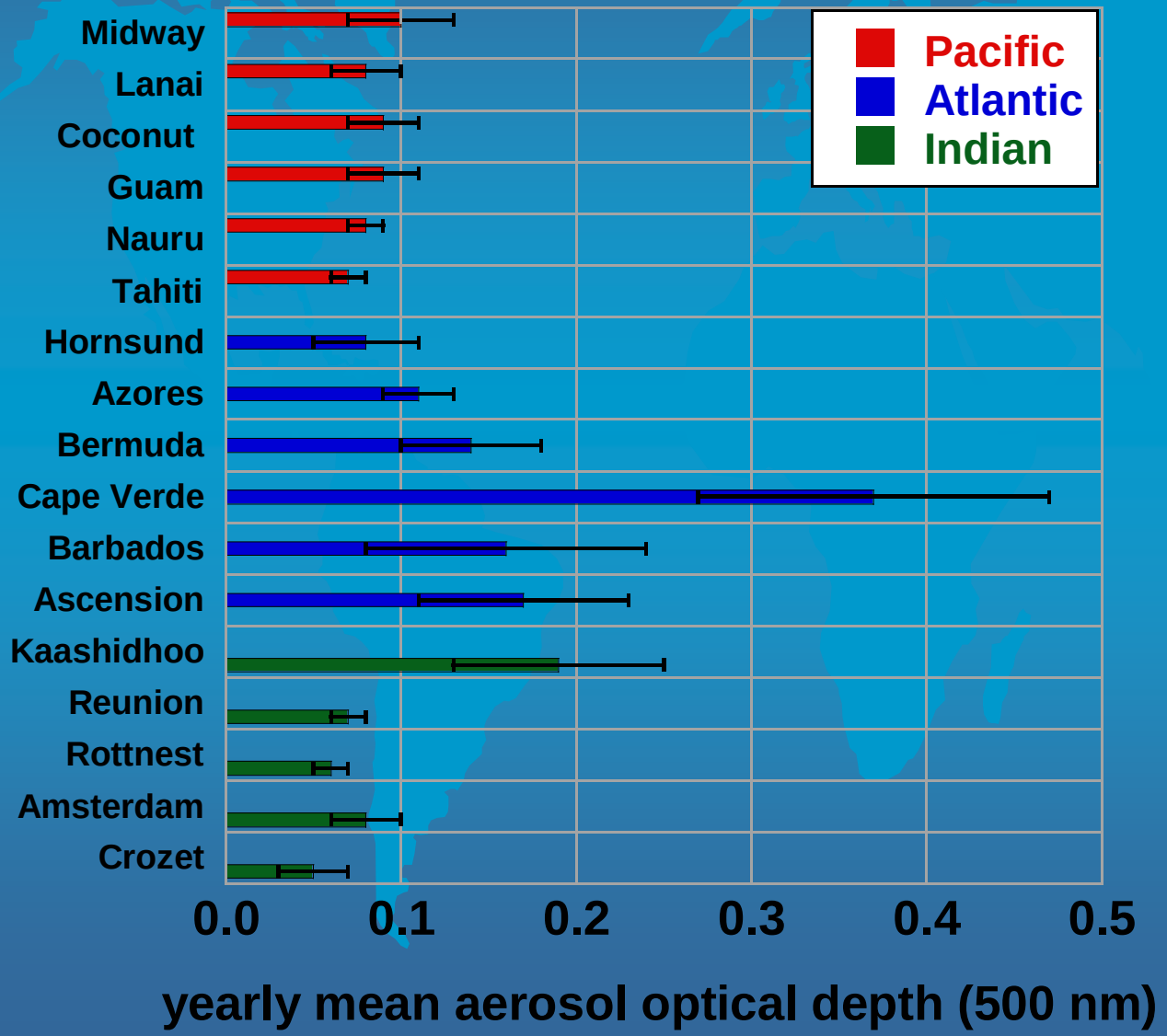
- New Zealand – National Institute of Water and Atmospheric Research (Wellington)
- Australia – The Commonwealth Scientific and Industrial Research Organisation (Canberra)
- Spain- Mediterranean Institute for Advanced Studies (Mallorca)
- South Africa – University of the Witwatersrand
- Indonesia - Agency for the Assessment and Application of Technology (Jakarta)
- Italy – Joint Research Center (Ispra)
- Poland – Sopot Institute of Oceanology
- India - Space Physics Laboratory (Trivandrum)

Many thanks to

- W.W.Newcomb, M.Sorokin, A.Scully, A.Tran, D.A.Siegel, P.K.Quinn, D.Covert, L.Logan, M.Reynolds, D.Hamilton, L.Rainville, A.Jayakumar, S.Schick, D.Menzies, P. Schoessow, E.Emry, M.Conley, A.Proshutinsky, E.Joseph, A.Flores (USA); V.Radionov, M.Panchenko, O.Kopelevich, S.Gulev, A.Sinitsyn, D.Kabanov, S.Terpugova, V.Polkin (Sr), A.Tikhomirov, Yu.Turchinovich, N.Vlasov, A.Gubin, V.Polkin (Jr), A.Kalsin (Russia); S.Kinne, Y.Zoll, A.Wassmann, M.Heller, A.Tessendorf, M.Schlundt, , C.Schlosser, T.Hanschmann, B.Pospichal (Germany); P.Goloub, F.Jourdin, L.Blarel, C.Petus, S.Triquet, J.Nicolas, S.Devidal, L.Martinon, M.Faillot, P.Hernandez (France); A.Baker, C.Powell, C.Gallienne (UK); P.Larouche, C.Bourgeault-Brunelle, M.Palmer (Canada); H.Power, T.Bromley, R.Martin (New Zealand); J.Piskozub, J.Kowalczyk, A.Ponczkowska, B.Lednicka, K.Zielinski, P.Makuch (Poland); S.Piketh, D.Williams, B.Kuyper (South Africa); K.Niranjan, S.Babu, V.S.Nair, S.N.Beegum (India); R.M.Castillo (Spain)

Distribution of island-based AERONET sites

Aerosol optical depth over the oceans (AERONET island-based measurements)



Globally averaged

τ_a (500 nm) = 0.11

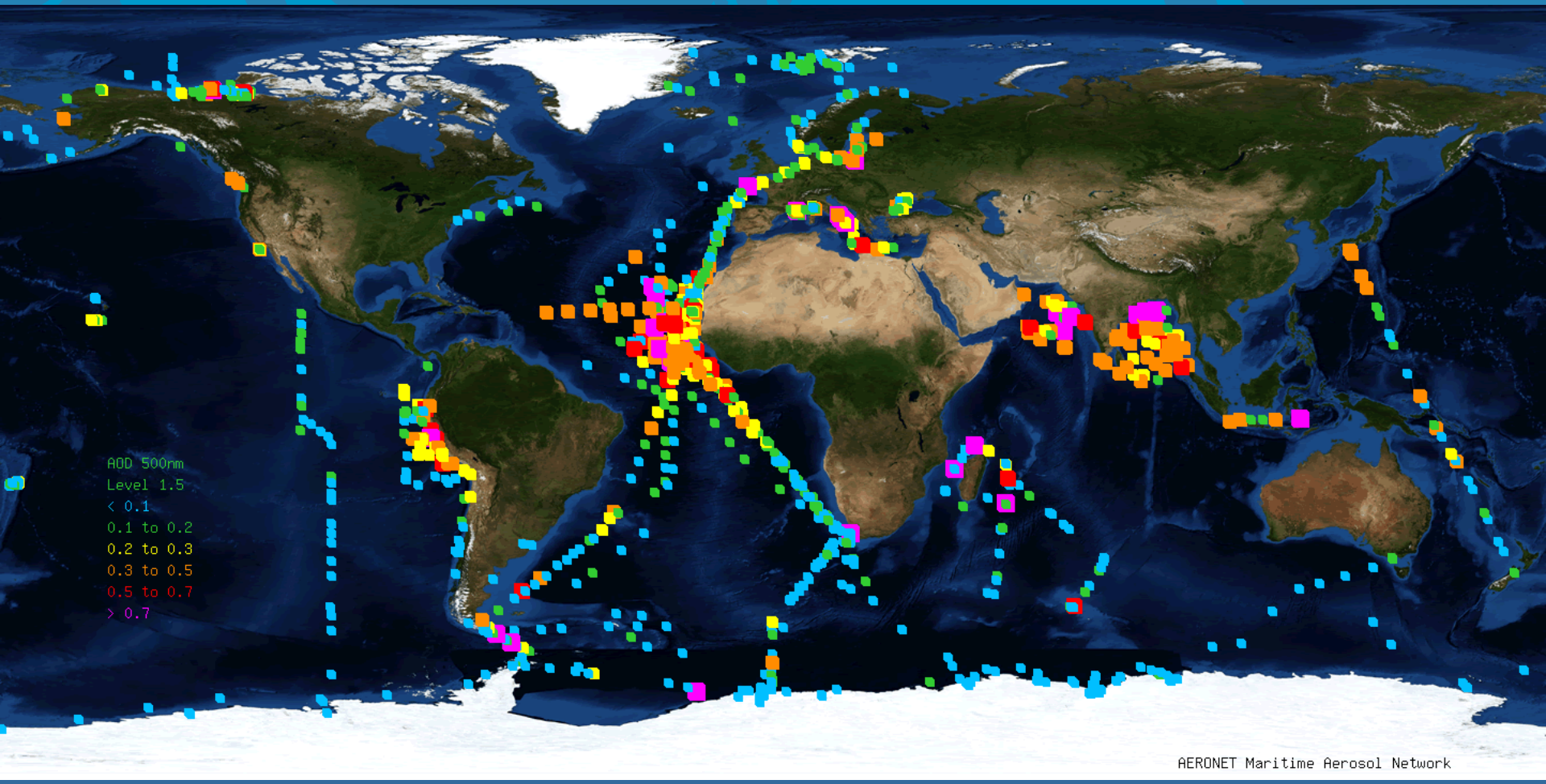
σ = 0.04

α (440-870 nm) = 0.60

σ = 0.16


GPS
GPSmap 60CSx
GARMIN
SOLAR LIGHT CO.
NASA
MICROTOPS II
Ozone Monitor - Sunphotometer
Sun target
PROPERTY NASA U.S. GOVERNMENT
Incr.
Decr.
On/Off
Scan Escape
Menu Enter
Made In USA
05/14/2007

Maritime Aerosol Network global coverage

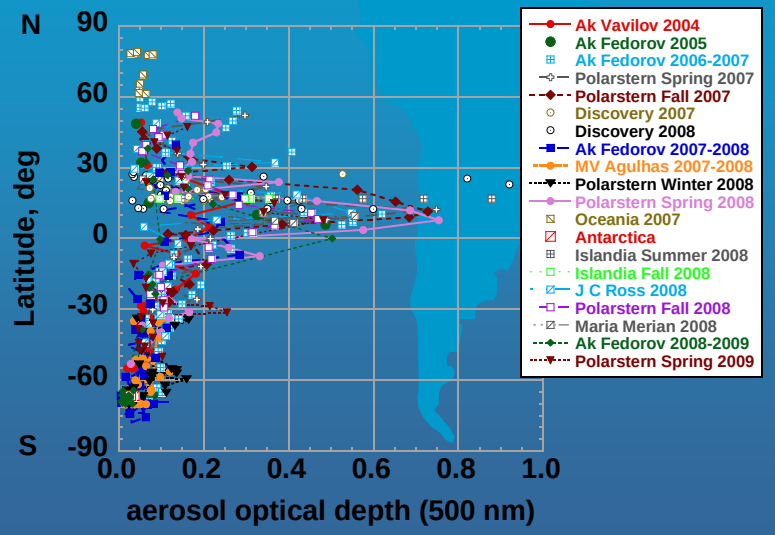


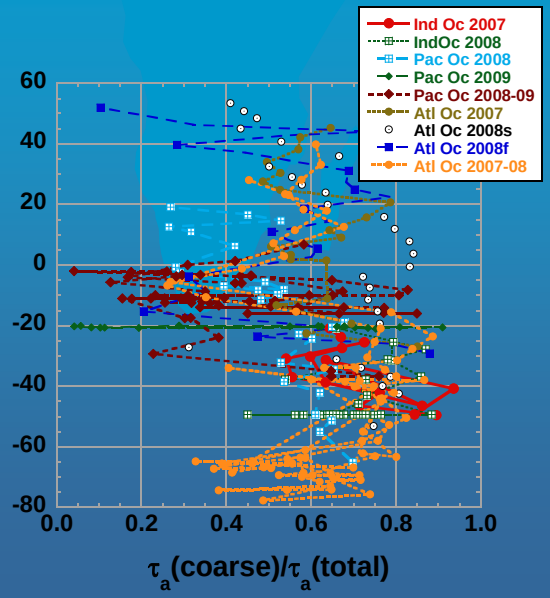
Scientific Objectives

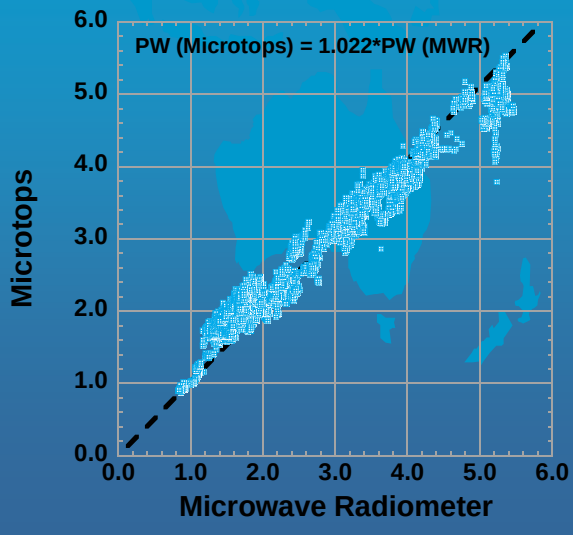
- Climate change studies (direct and indirect forcing)
- Satellite retrieval validation
- Ocean color studies (atmospheric correction)
- Validation of global aerosol transport model simulations
- Global aerosol distribution

MAN products:

- Aerosol optical depth (Level 1; Level 1.5; Level 2)
- Water vapor content (Level 1; Level 1.5; Level 2)
- Aerosol optical depths: fine (sub-micron) and coarse (super-micron) at 500 nm (the spectral de-convolution algorithm by O'Neill et al. 2004)







AERONET
MARITIME AEROSOL NETWORK

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MARITIME AEROSOL NETWORK (MAN)

The Maritime Aerosol Network (MAN) component of AERONET provides ship-borne aerosol optical depth measurements from the Microtops II sun photometers. These data provide an alternative to observations from islands as well as establish validation points for satellite and aerosol transport models. Since 2004, these instruments have been deployed periodically on ships of opportunity and research vessels to monitor aerosol properties over the World Oceans.

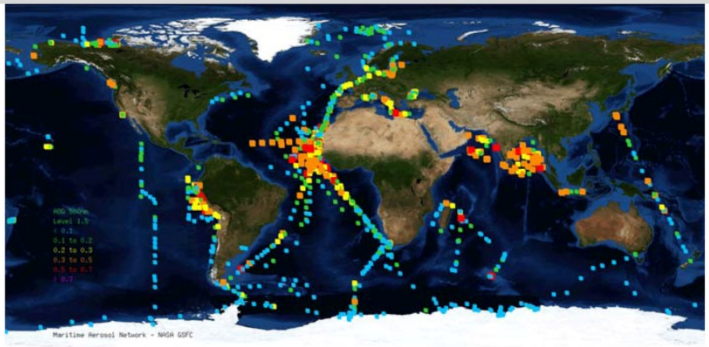
Microtops instruments currently in the network have five channels but they may have one of two configurations: 340, 440, 675, 870, 936nm or 440, 500, 675, 870, and 936nm. In addition, the instrument has built-in temperature and pressure sensors as well as the ability to log accurate time and geographical position using a GPS. The Microtops instruments are calibrated at the NASA Goddard Space Flight Center (GSFC) calibration facility via a transfer calibration procedure between the Microtops and the master Cimel sun photometer at GSFC, which has a calibration traceable to a Langley calibration of a Cimel sun photometer on Mauna Loa, Hawaii. In general, the estimated uncertainty of the aerosol optical depth in each channel does not exceed plus or minus 0.02, which is slightly higher than the uncertainty of AERONET field (not master) instruments.

Additional information on data processing and quality may be found by choosing the "Data" link in the left column.

MAN Publication Reference:

Smirnov, A., B. N. Holben, I. Slutsker, D. M. Giles, C. R. McClain, T. F. Eck, S. M. Sakerin, A. Macke, P. Croot, G. Zibordi, P. K. Quinn, J. Sciare, S. Kinne, M. Harvey, T. J. Smyth, S. Piketh, T. Zielinski, A. Proshutinsky, J. I. Goes, N. B. Nelson, P. Larouche, V. F. Radionov, P. Goloub, K. Krishna Moorthy, R. Matarrese, E. J. Robertson, and F. Jourdin (2009),
Maritime Aerosol Network as a component of Aerosol Robotic Network,
J. Geophys. Res., 114, D06204, doi:10.1029/2008JD011257.

CRUISES



Level 1.5 | Level 2.0

The table below provides information for past, ongoing and planned cruises. The Ship column provides links to the information and data for each cruise. The Region column provides a KML file to view the cruise in Google Earth.

Year	Ship	Region	Status
2004	RV Akademik Sergey Vavilov	Atlantic Ocean Transect, Southern Ocean	Completed
2005-2006	RV Akademik Fedorov	Atlantic Ocean Transect, Antarctica	Completed
2006-2007	RV Akademik Fedorov	Atlantic Ocean Transect, Antarctica	Completed
2007	Ecklonia	Atlantic Ocean near South African Coast	Completed
2007	RV Polarstern	Atlantic Ocean Transect	Completed
2007	RV Urania	Mediterranean Sea	Completed
2007	Trans Future 5	Pacific Ocean Transect	Completed
2007	RV Oceania	Baltic, Norwegian, Greenland Seas	Completed
2007	RV Aranda	Gulf of Bothnia	Completed
2007	CCGS Louis St. Laurent	Beaufort Sea	Completed
2007	Roger Revelle	Arabian Sea	Completed
2007	RV Oceania	Baltic Sea	Completed
2007	Roger Revelle	Arabian Sea	Completed
2007	University of Bari	Adriatic Sea	Completed
2007	RV Polarstern	Atlantic Ocean Transect	Completed
2007	RRS Discovery	Canary-Cape Verde	Completed
2007	RV Marion-Dufresne	South Indian Ocean	Completed
2007-2008	NOAA Ronald H. Brown	Pacific Ocean Transect	Completed
2007-2008	MV SA Agulhas	Southern Ocean	Completed
2007-2008	RV Akademik Fedorov	Atlantic Ocean Transect, Antarctica	Completed
2008	RRS Discovery	Canary-Cape Verde	Completed
2008	RV Polarstern	Southern Atlantic	Completed
2008	RV Knorr 2008	North Atlantic Ocean	Completed
2008	Trans Future 5	Pacific Ocean Transect	Completed
2008	RV L'Atalante	Gulf of Lion	Completed
2008	RV Polarstern	Atlantic Ocean Transect	Completed
2008	MV Akbar 2008	Bay of Bengal	Completed
2008	RV Islandia	Cape Verde	Completed
2008	USCGC Healy	Bering Sea	Completed
2008	CCGS Amundsen	Beaufort Sea	Completed
2008	Trans Future 5	Pacific Ocean Transect	Completed
2008	RP FLIP	Santa Barbara Basin	Completed
2008	NRV Alliance	Ligurian Sea	Completed
2008	RRS James Clark Ross	Atlantic Ocean Transect	Completed
2008	RV Islandia	Cape Verde	Completed
2008	NOAA Ronald H. Brown	Carribean Sea, Pacific Ocean	Completed
2008	RV Polarstern	Atlantic Ocean transect	Completed
2008	RV Maria S. Merian	Central and Tropical Atlantic	Completed
2008	RV Marion-Dufresne	South Indian Ocean	Completed
2008	RV Meteor	Pacific Ocean	Completed
2008-2009	RV Sagar Kanya	Bay of Bengal	Completed
2008-2009	RV Akademik Fedorov	Atlantic Ocean transect	Completed
2009	RV Polarstern	Northern Greenland Sea	Completed
2009	RV Marion Dufresne	Beaufort Sea	Completed
2009	Norwegian Sun	Tropical Pacific	Completed
2009	R/V Marcus G. Langseth	Around the Americas	Ongoing
2009	FORV Sagar Sampada	South China Sea	Ongoing
2009	RV Hesperides	South Pacific Ocean	Planned
2009	NRV Alliance	Atlantic Ocean transect	Planned
2009	RV Oceania	Tropical Atlantic	Planned
2009	RV Baruna Jaya IV	South Indian Ocean	Planned
2009	RV Marion Dufresne	South Indian Ocean	Planned
2009	RV Polarstern	South Pacific Ocean	Planned
2009	RV Akademik	Pacific Ocean	Planned
2009	RV Islandia	Atlantic Ocean transect	Planned
2009	RRS Discovery	Baltic Sea	Planned
2009	RV Jan Mayen	Atlantic Ocean transect, South Ocean	Planned
2009	RV Kilo Moana		
2009	NOAA Ronald H. Brown		
2009	RV Oceania		

y and Important Notices

Curator: David M. Giles
NASA Official: Brent N. Holben
Last Updated: July 16, 2009

R/V Polarstern 2007 (fall) cruise

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+ AEROSOL OPTICAL DEPTH | + AEROSOL INVERSIONS | + SOLAR FLUX | + OCEAN COLOR | + MARITIME AEROSOL

Web Site Feature: AERONET Data Synergy Tool - Access Earth Science data sets for AERONET sites
Announcement: + 2008 AERONET Review - 6 November 2008

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MARITIME AEROSOL NETWORK (MAN)

2007 RV Polarstern Cruise

R/V Polarstern belongs to the Alfred Wegener Institute for Polar and Marine Research (Bremerhaven, Germany). The cruise took place from October to November 2007. The cruise area included an Atlantic transect from Bremerhaven to Cape Town. One-hundred and ninety-three (193) measurement series spanning 20 days were acquired during the cruise.

Dr. Prof. Andreas Macke was a Principal Investigator for optical depth measurements. Mr. Yann Zoll and Mr. Andreas Wassmann from the same institution operated sun photometer onboard.

DATA

+Download Data and Track

Measurements onboard: Mr. Yann Zoll

Measurements onboard: Mr. Adreas Wassmann

PUBLICATIONS

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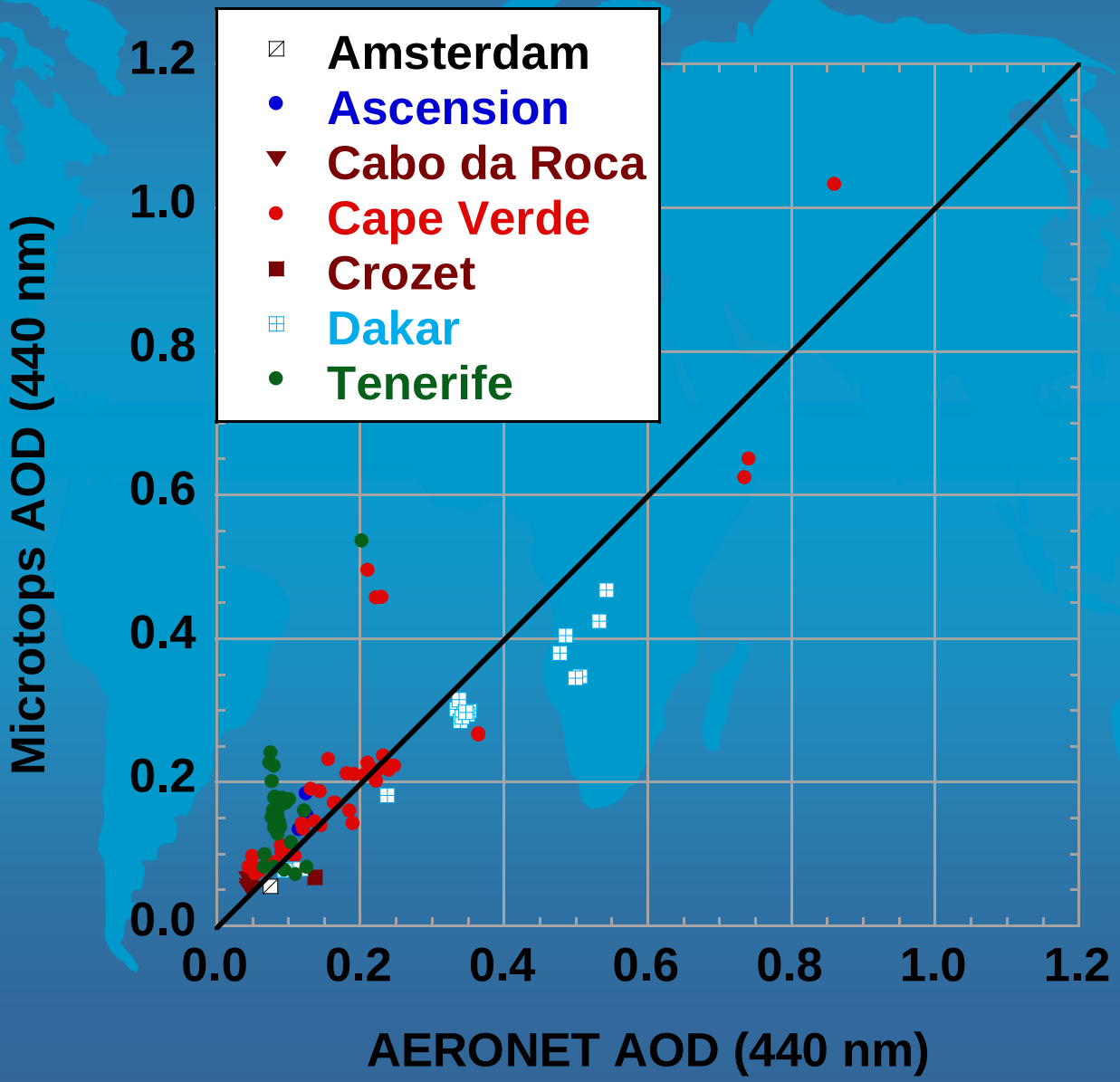
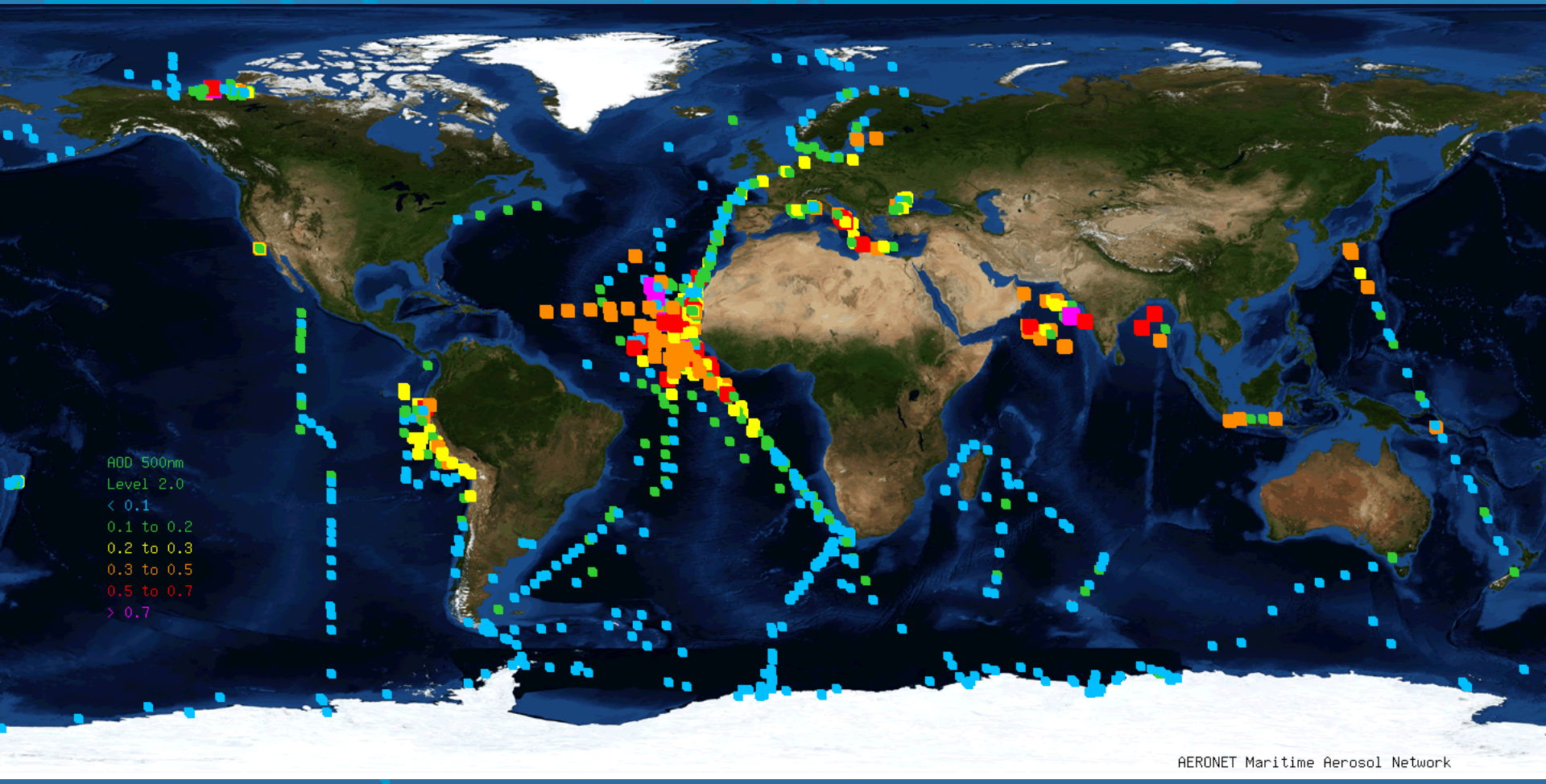
Curator: David M. Giles
NASA Official: Brent N. Holben
Generated: 24/11/2008

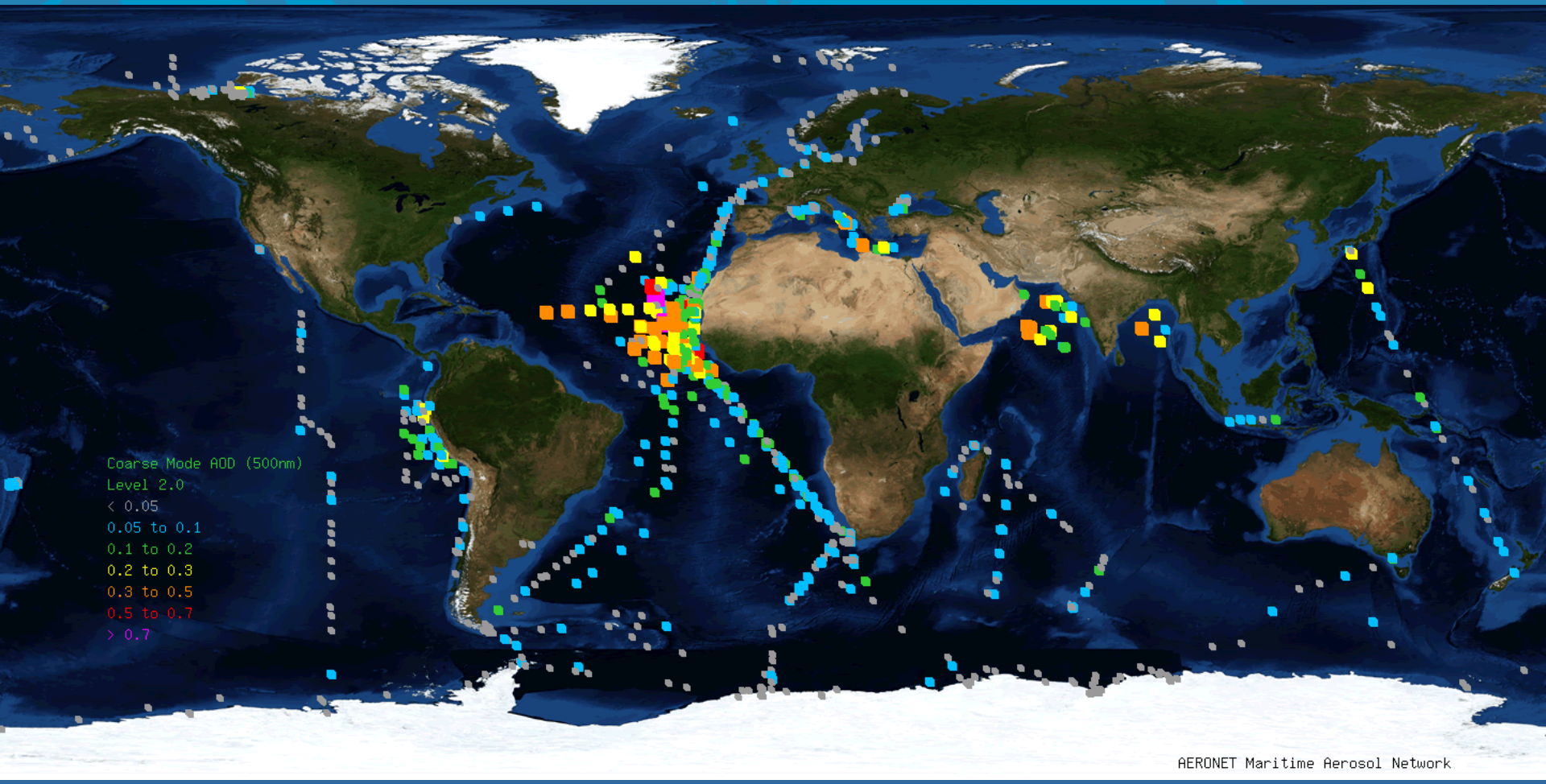
Ship-based and AERONET τ_a comparison



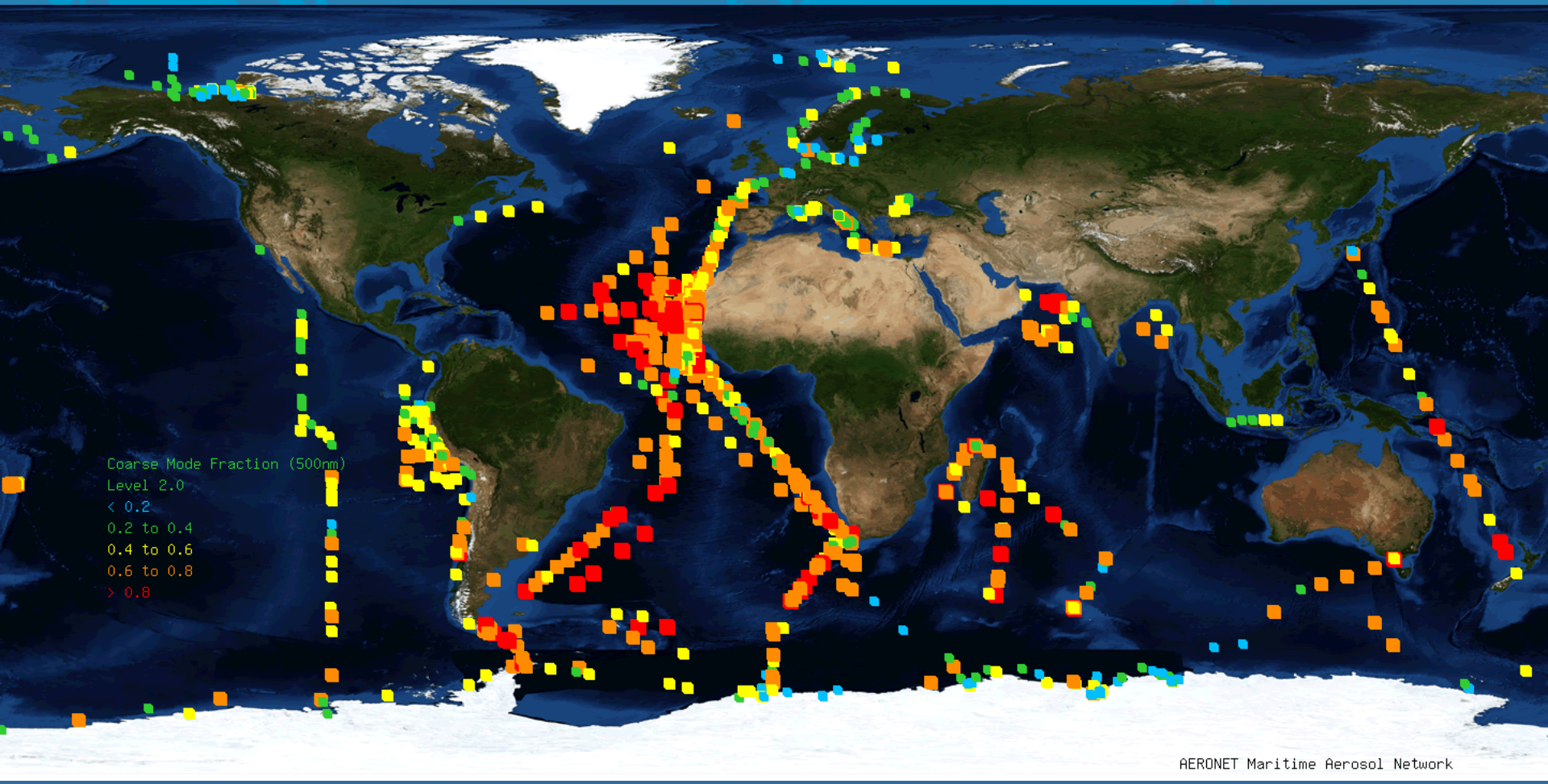
Maritime Aerosol Network aerosol optical depth (Level 2)



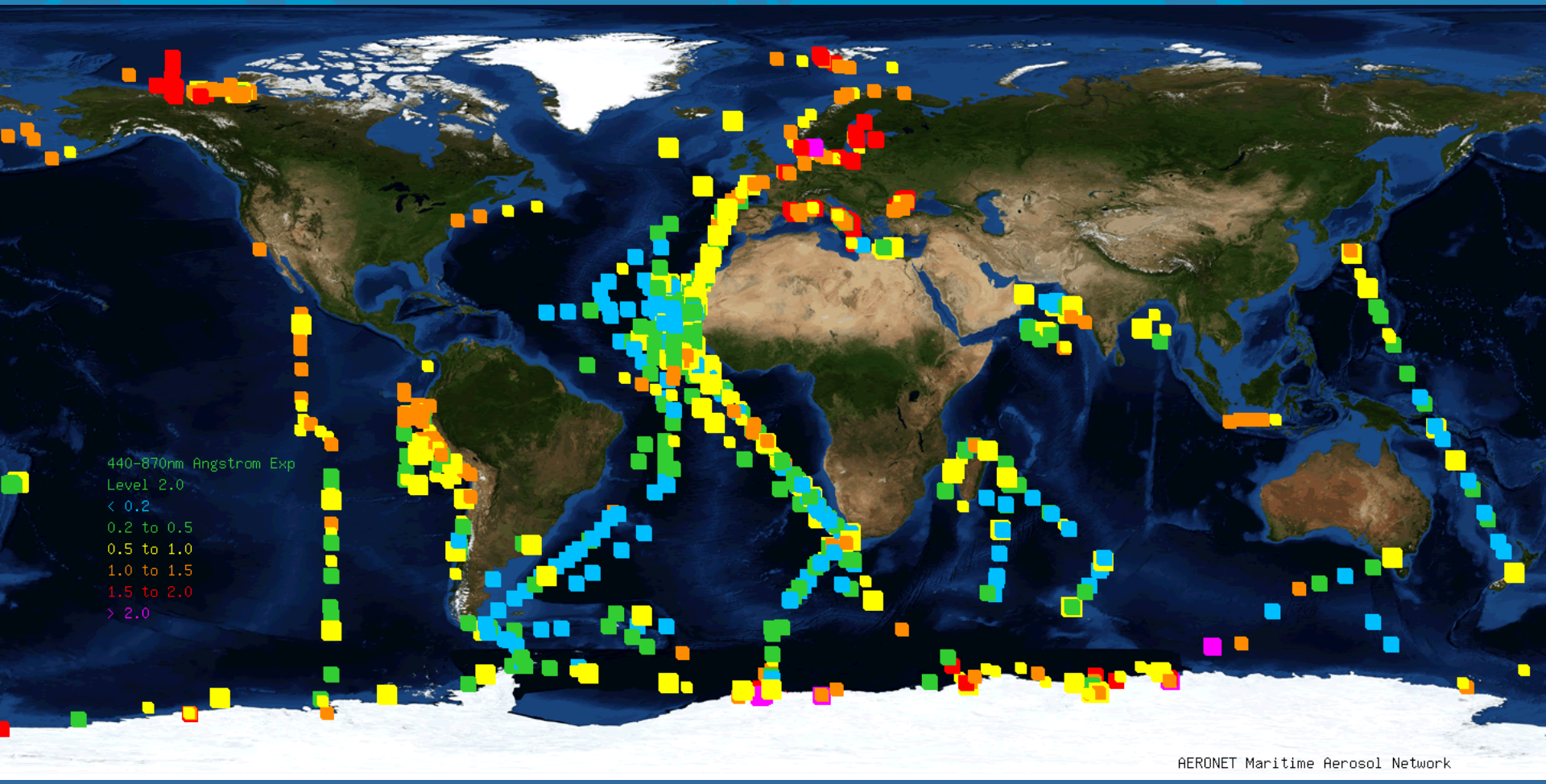
Maritime Aerosol Network aerosol optical depth (coarse)



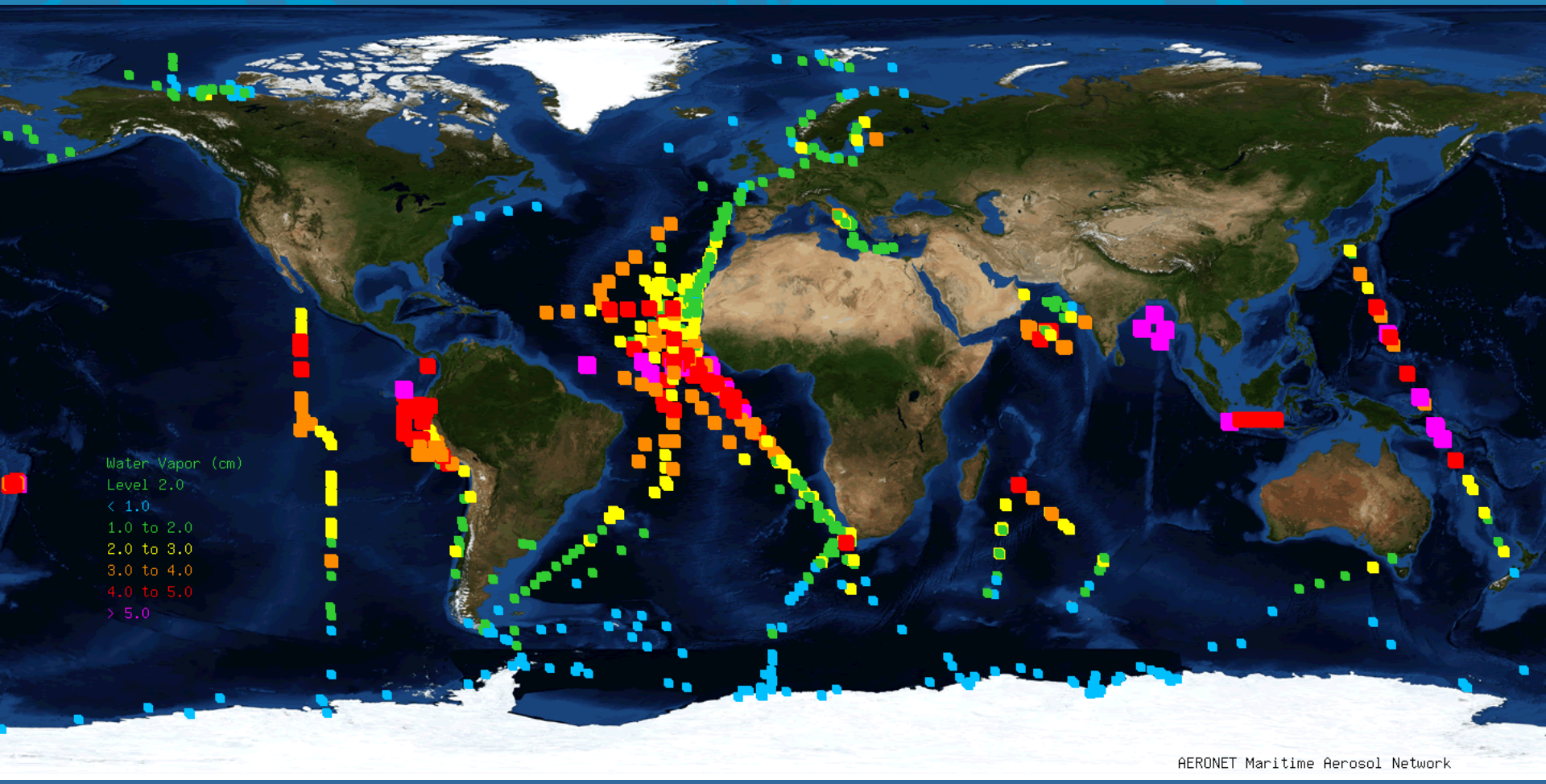
Maritime Aerosol Network aerosol optical depth (coarse fraction)



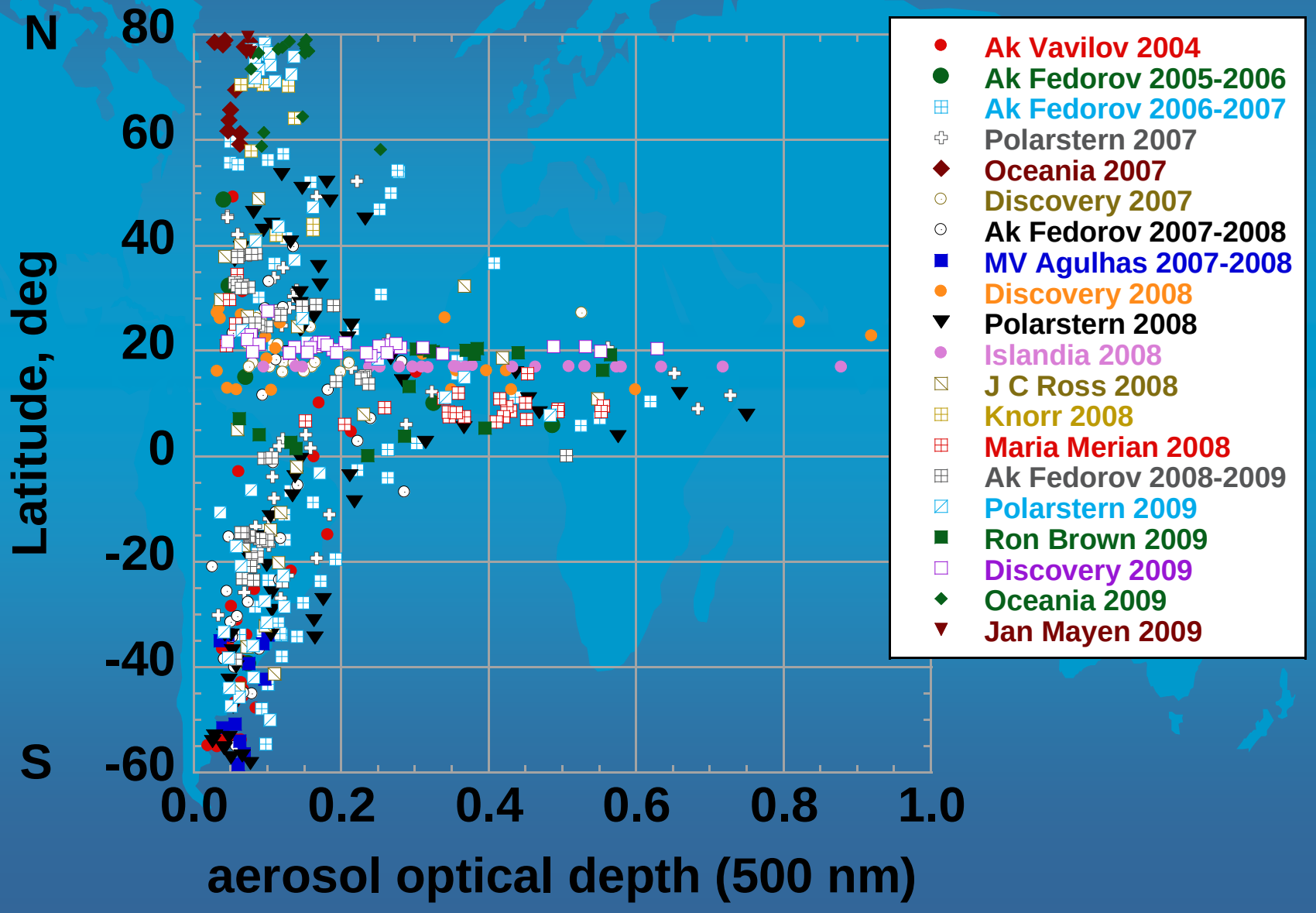
Maritime Aerosol Network Angstrom parameter (Level 2)



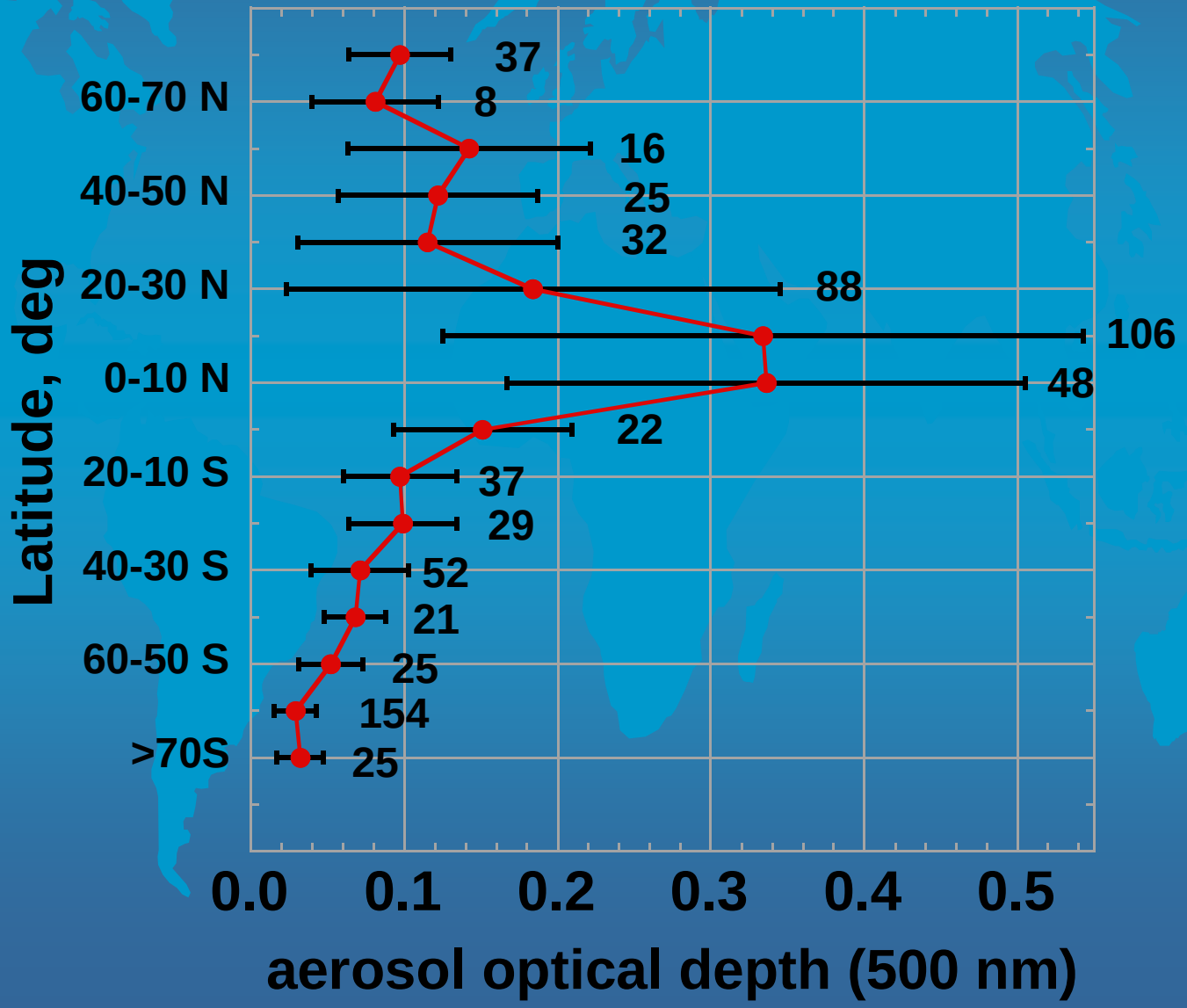
Maritime Aerosol Network water vapor content (Level 2)



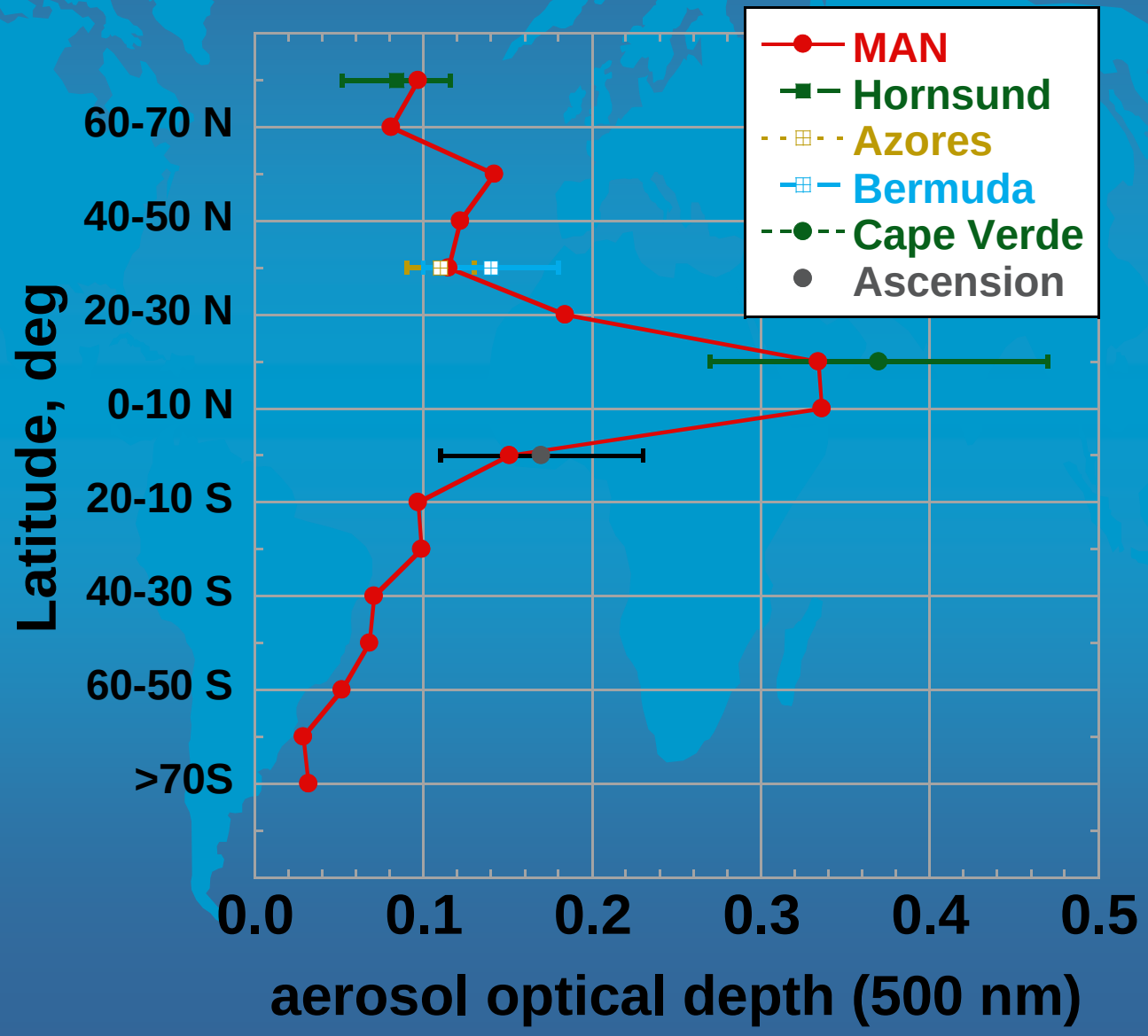
Latitudinal dependence of aerosol optical depth in the Atlantic Ocean



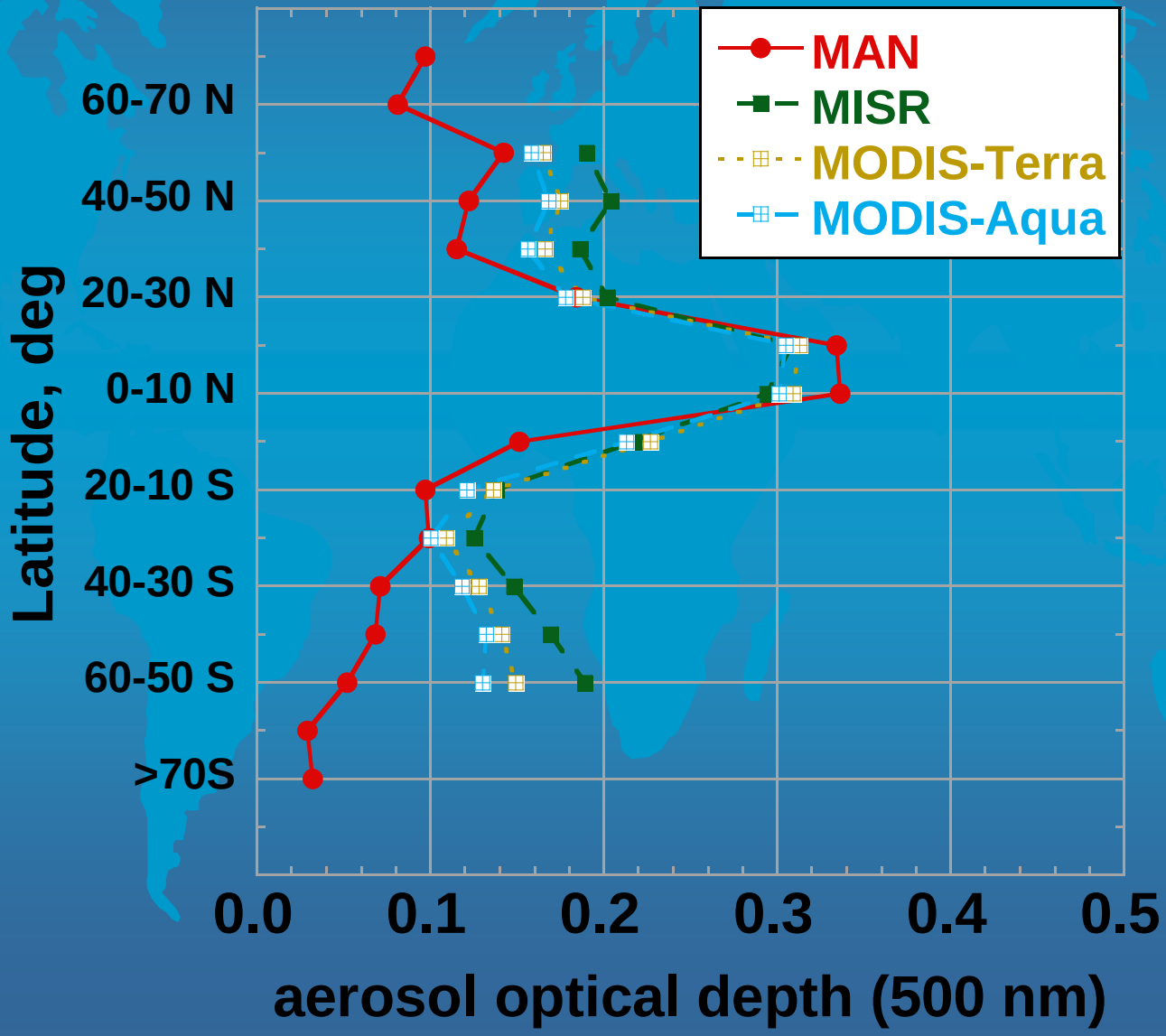
Aerosol optical depth by latitudinal belts (Atlantic Ocean)

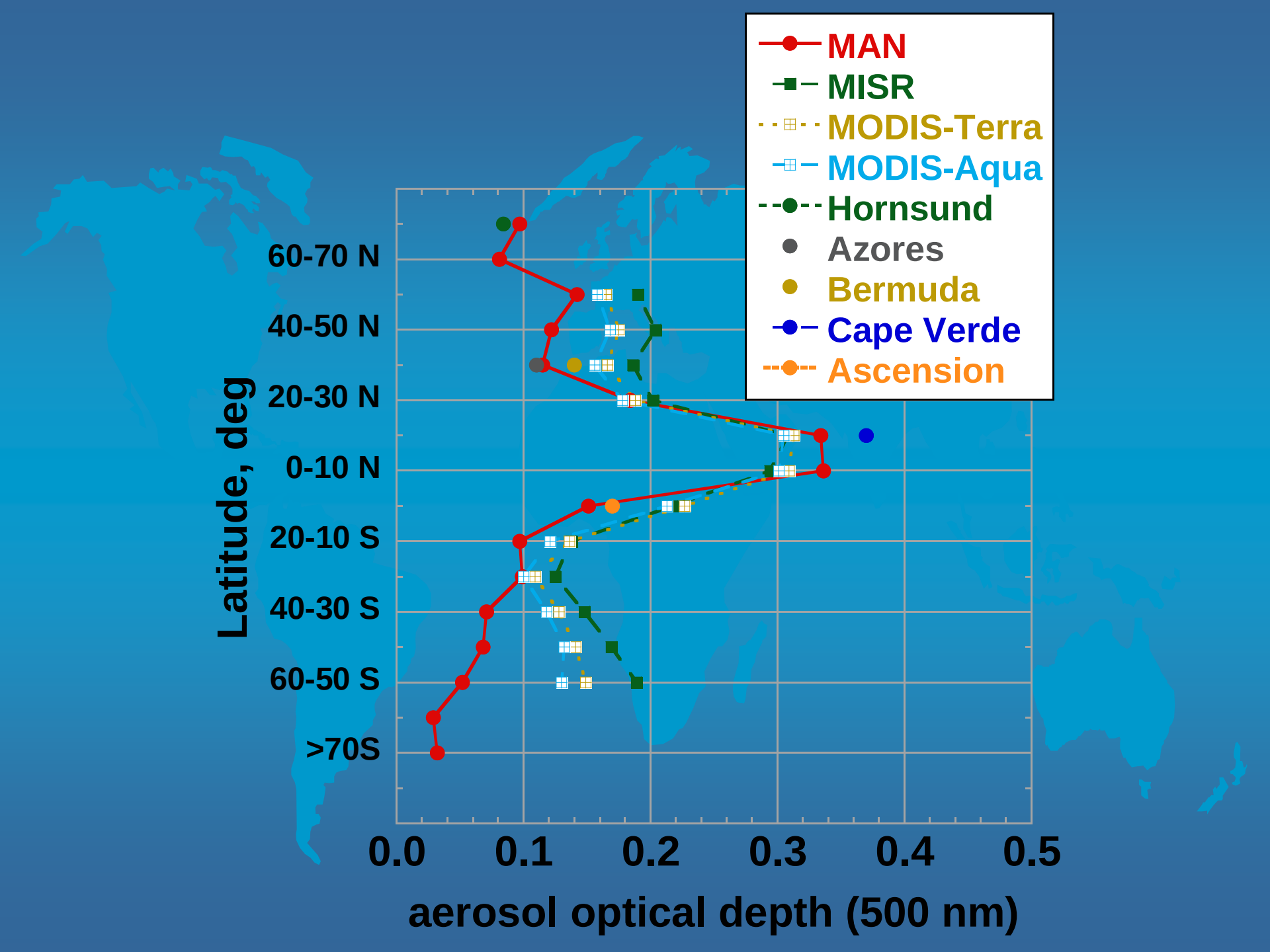


Aerosol optical depth by latitudinal belts (Atlantic Ocean)

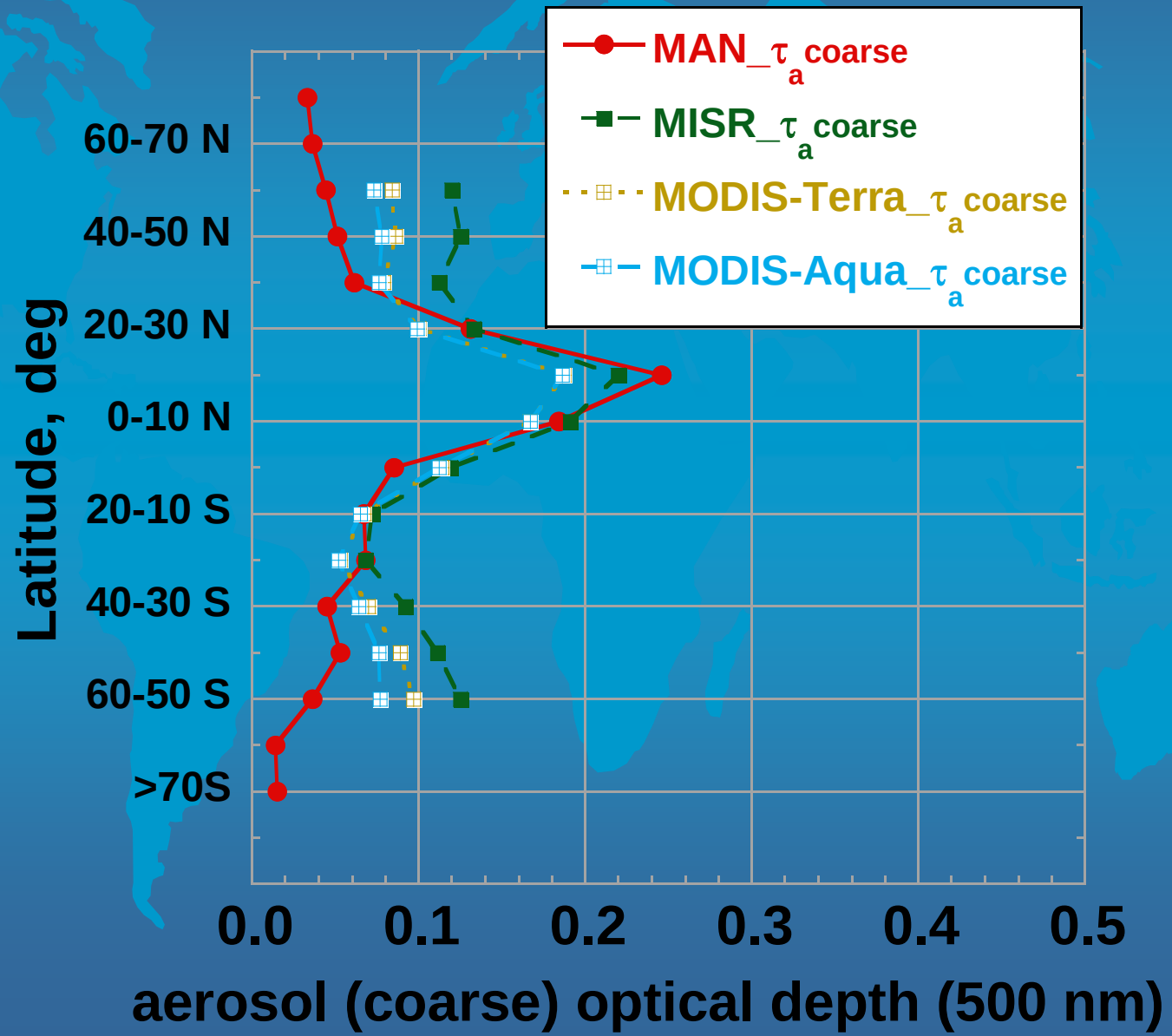


Aerosol optical depth by latitudinal belts (Atlantic Ocean)

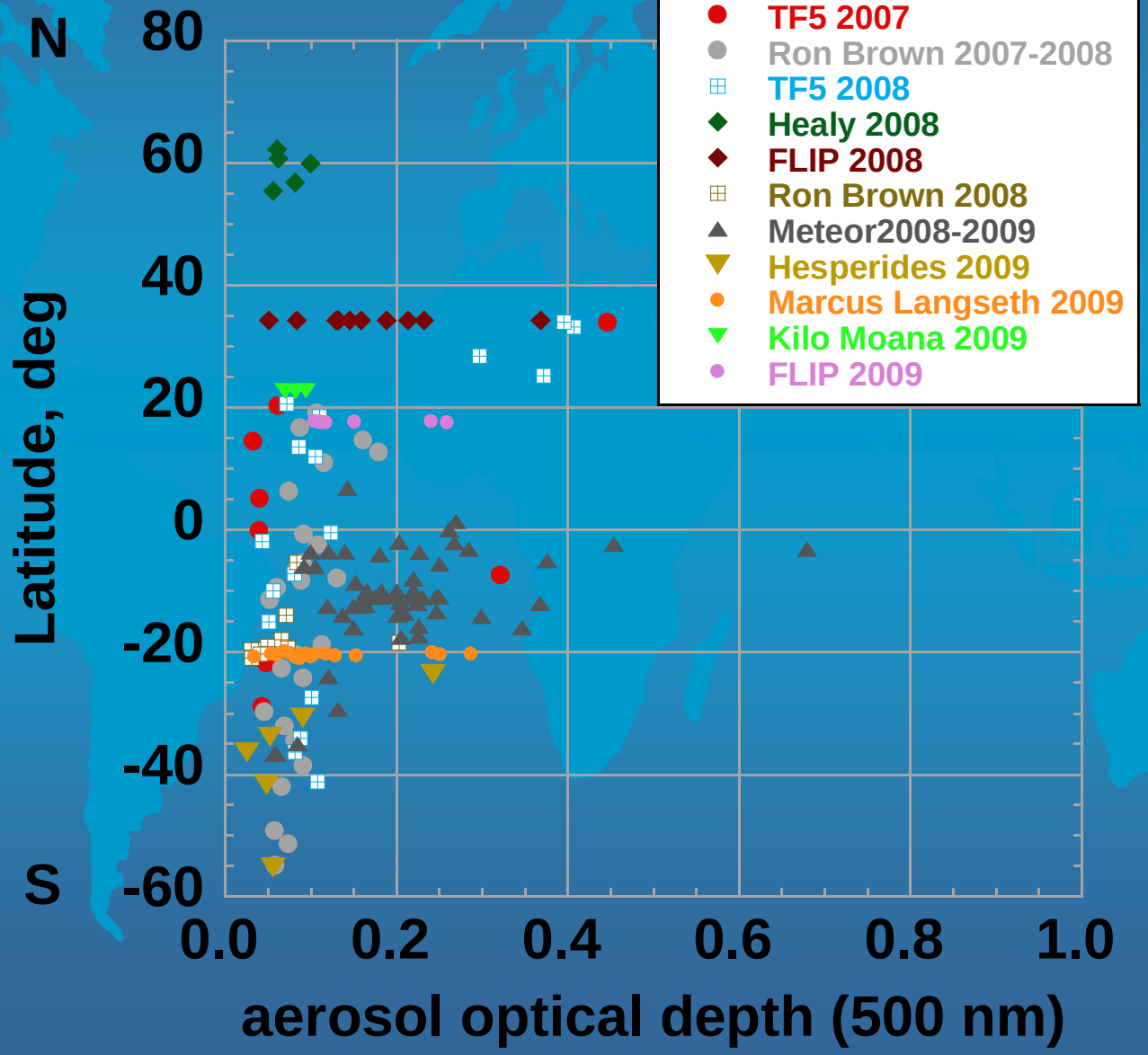



MAN
MISR
MODIS-Terra
MODIS-Aqua
Hornsund
Azores
Bermuda
Cape Verde
Ascension
60-70 N
40-50 N
20-30 N
0-10 N
20-10 S
40-30 S
60-50 S
>70S
Latitude, deg
0.0
0.1
0.2
0.3
0.4
0.5
aerosol optical depth (500 nm)

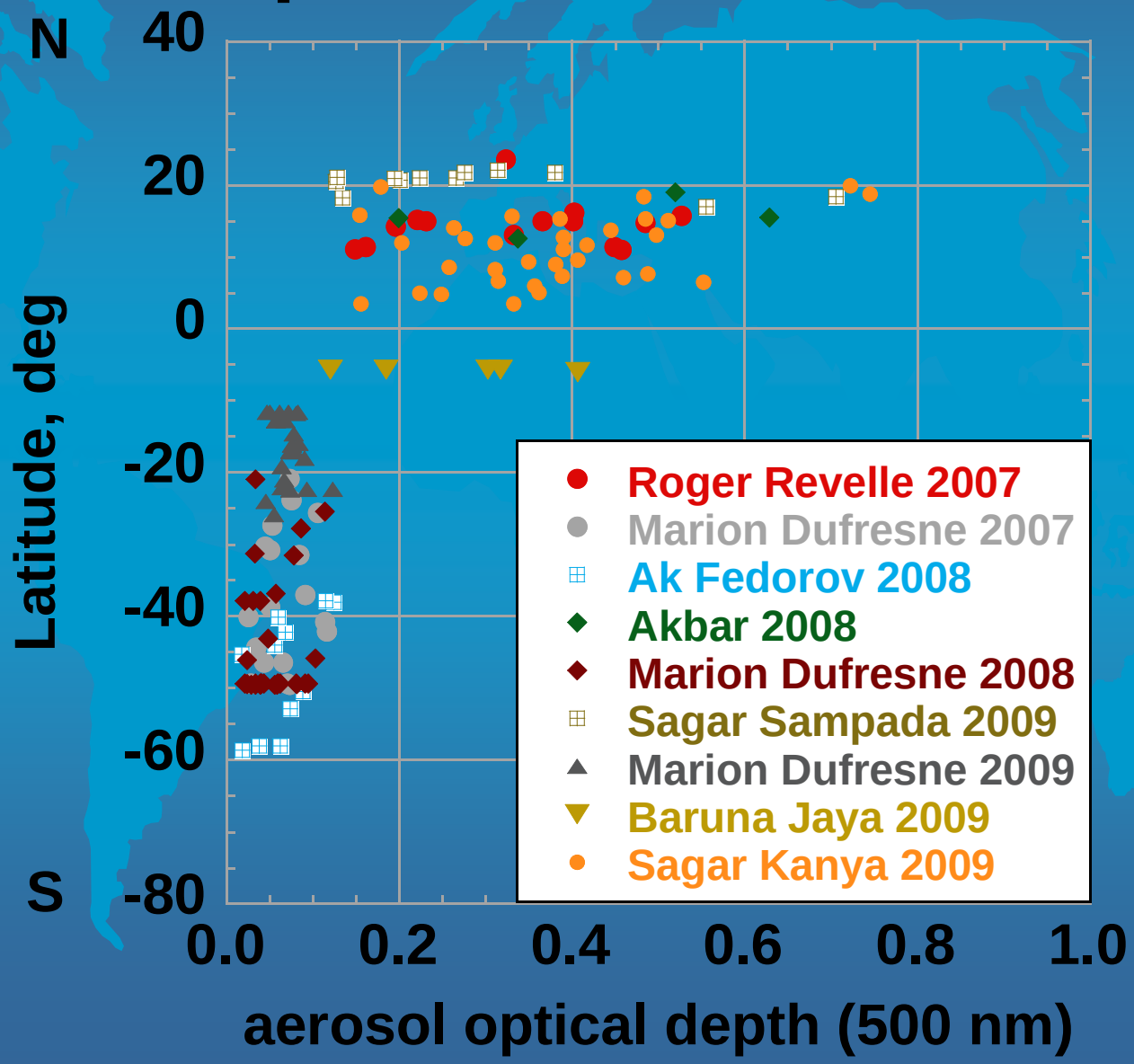
Aerosol optical depth by latitudinal belts (Atlantic Ocean)



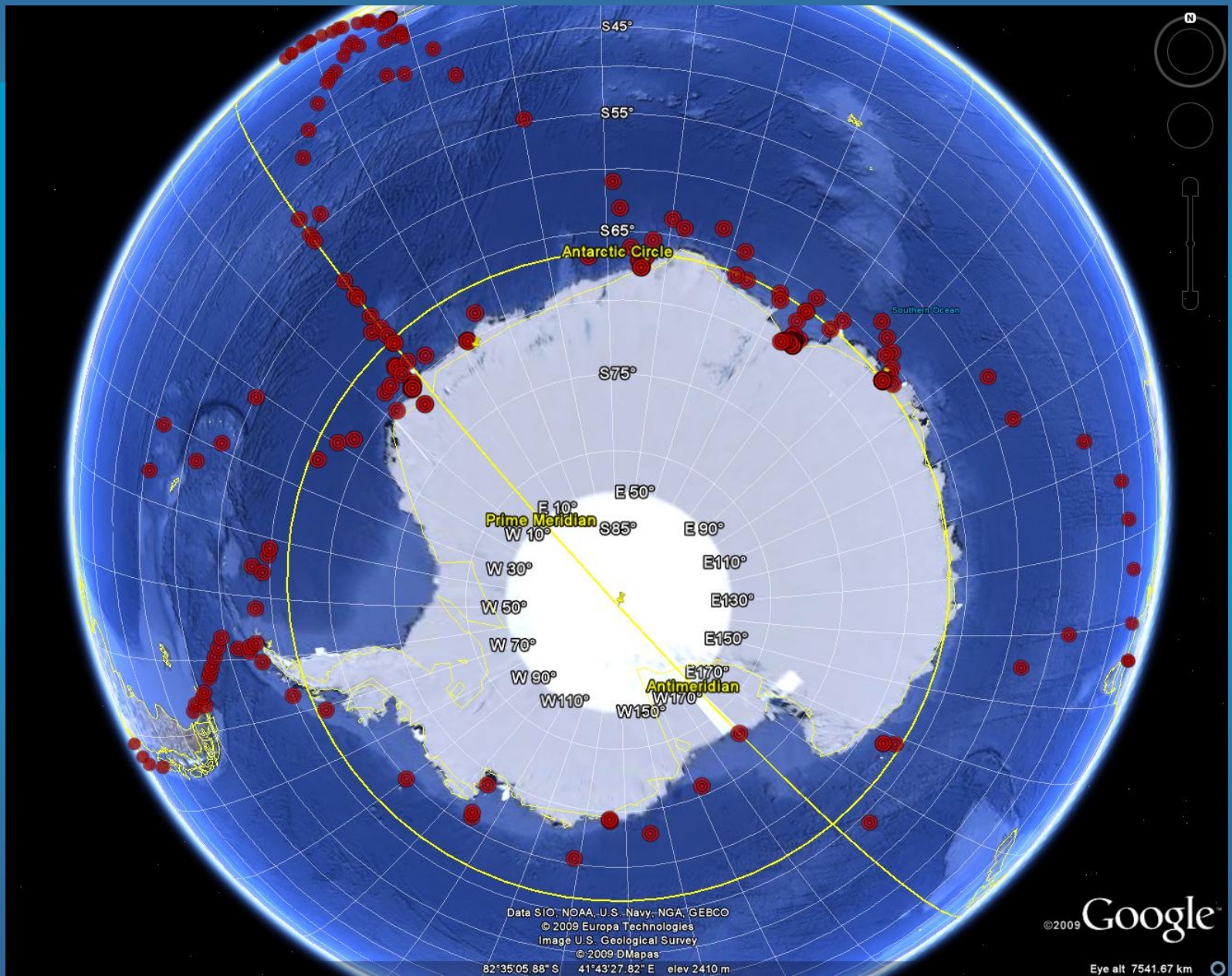
Latitudinal dependence of aerosol optical depth in the Pacific Ocean



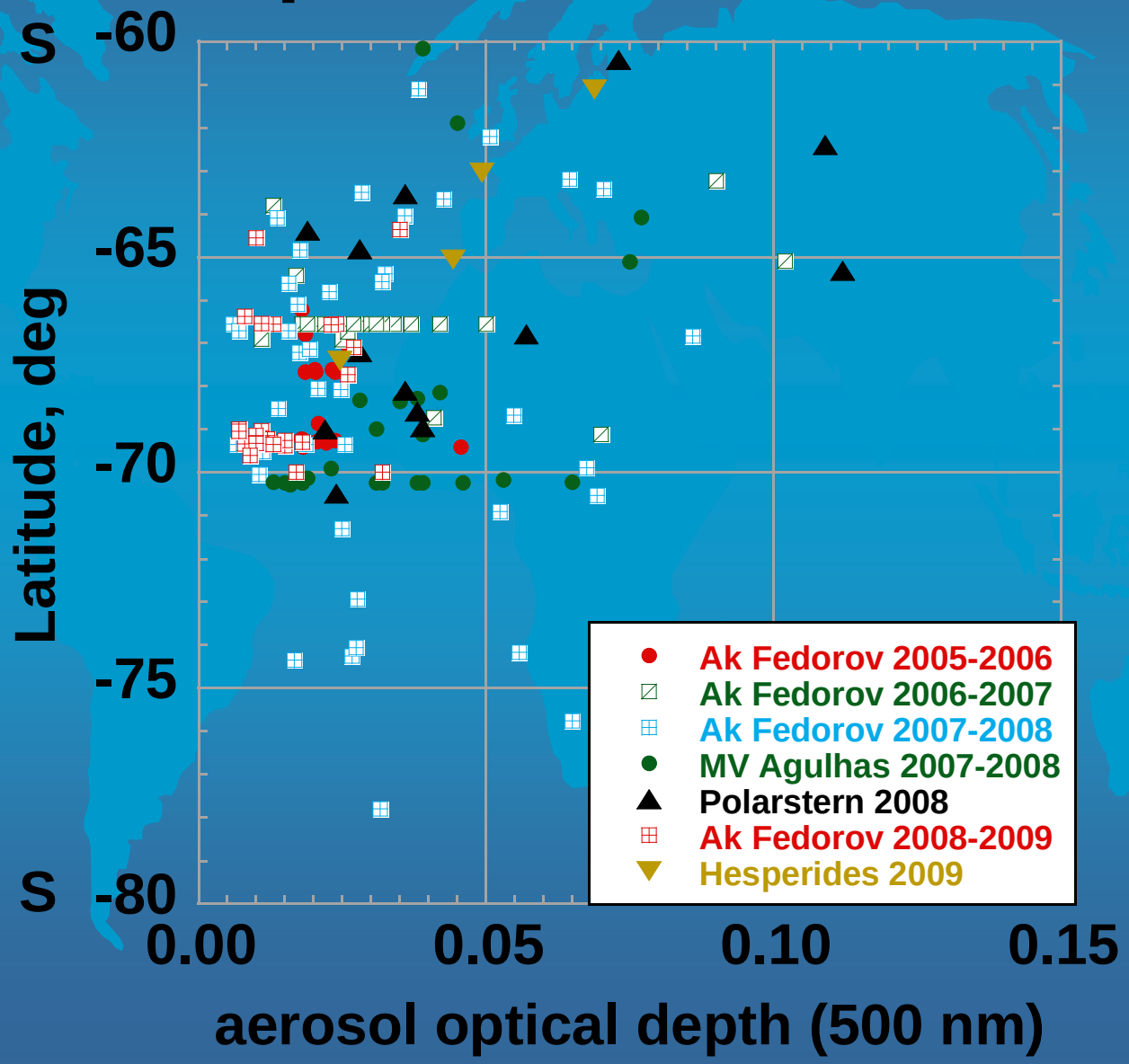
Latitudinal dependence of aerosol optical depth in the Indian Ocean



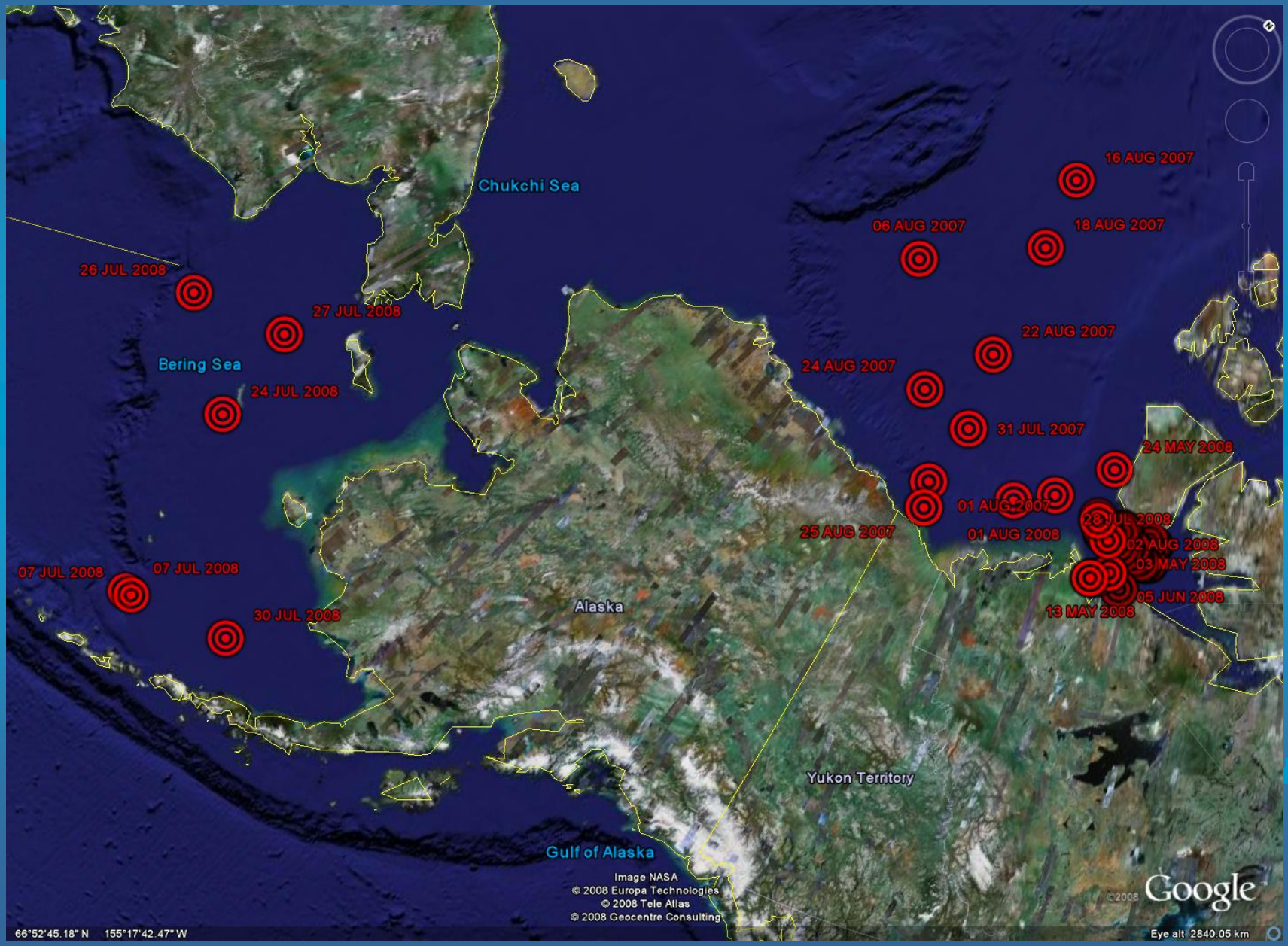
Measurements in the South Ocean



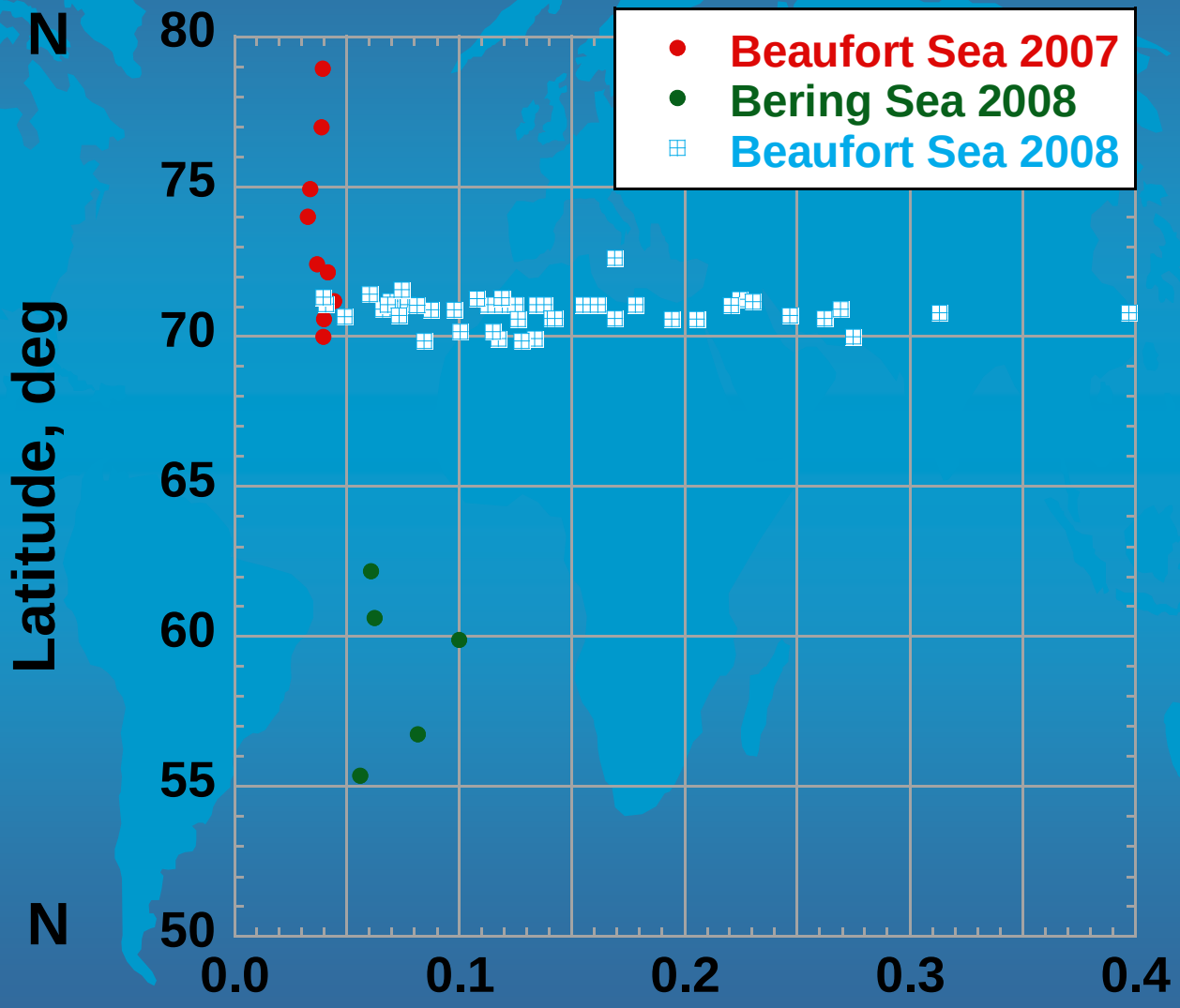
Latitudinal dependence of aerosol optical depth in the South Ocean



Bering Sea and Beaufort Sea

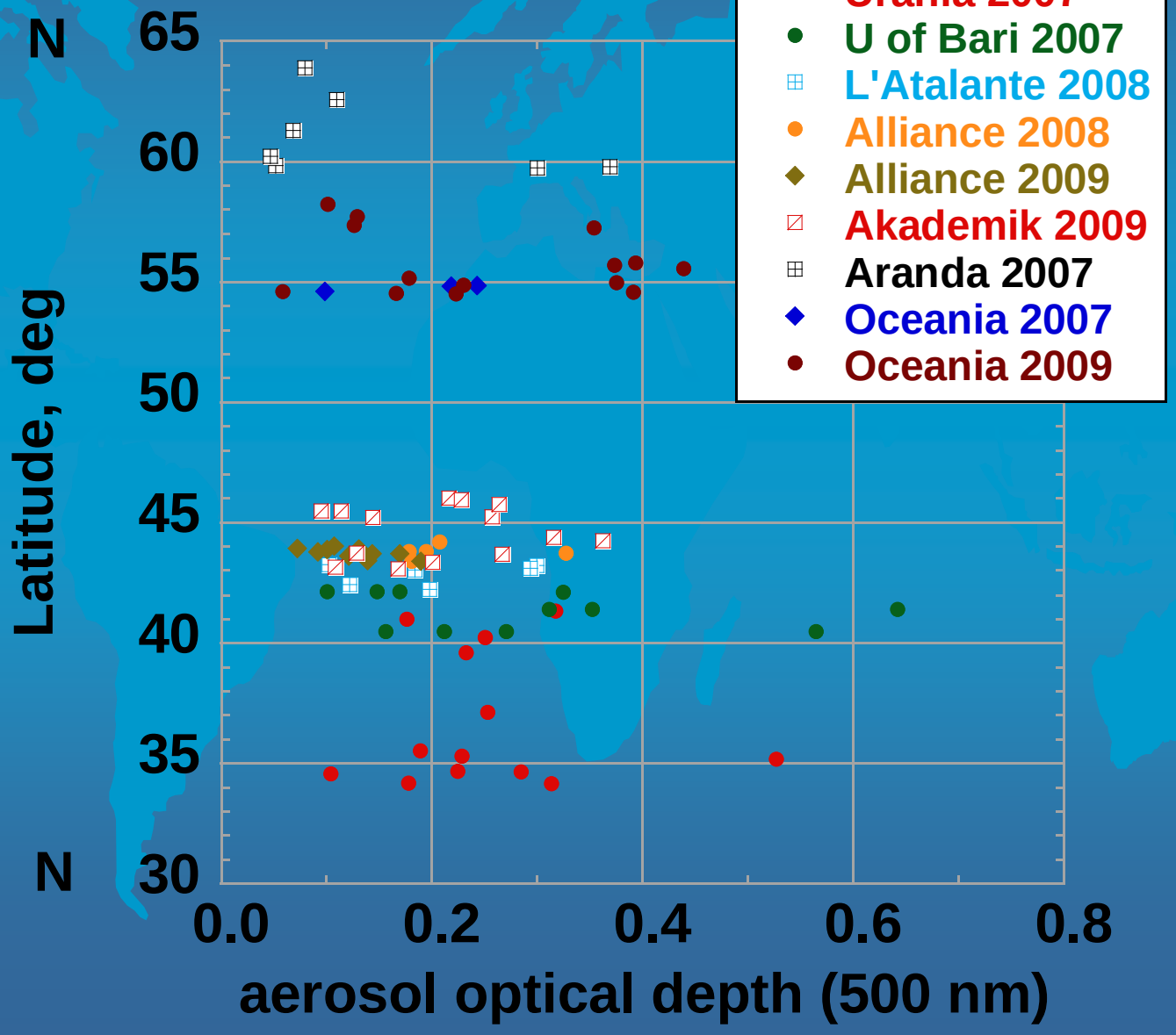


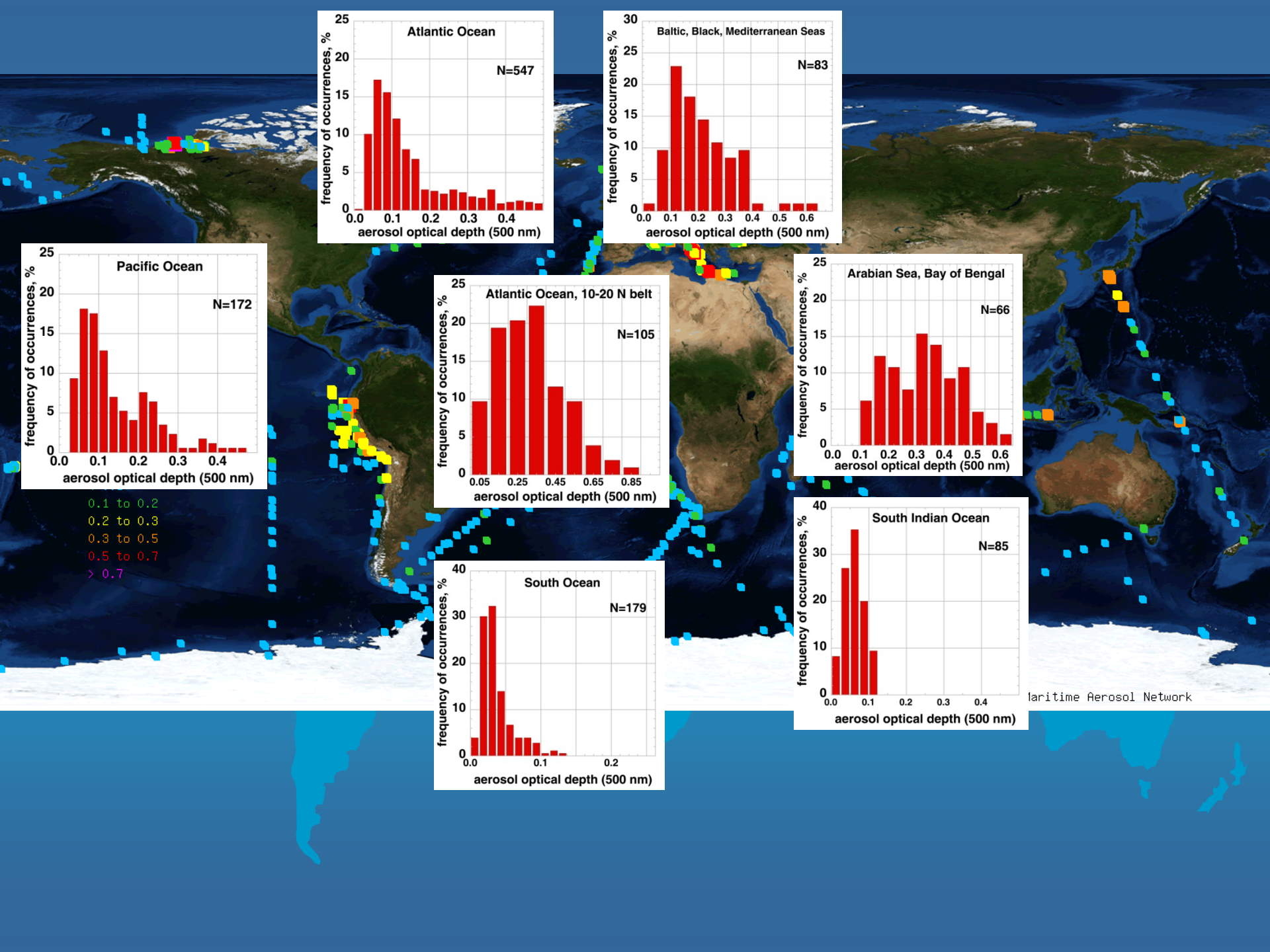
Bering Sea and Beaufort Sea



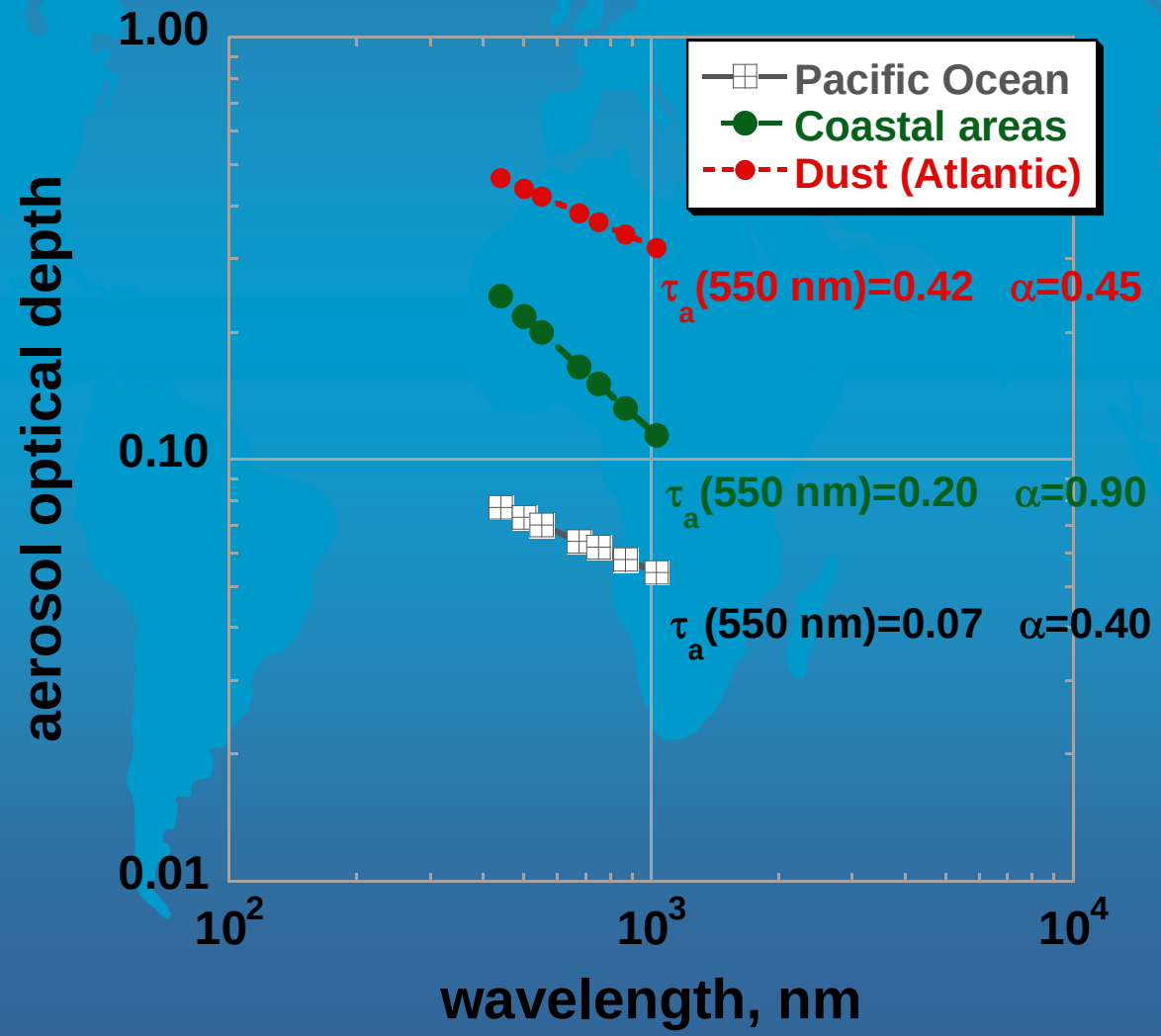
Baltic, Black, Mediterranean Seas

Baltic, Black, Mediterranean Seas

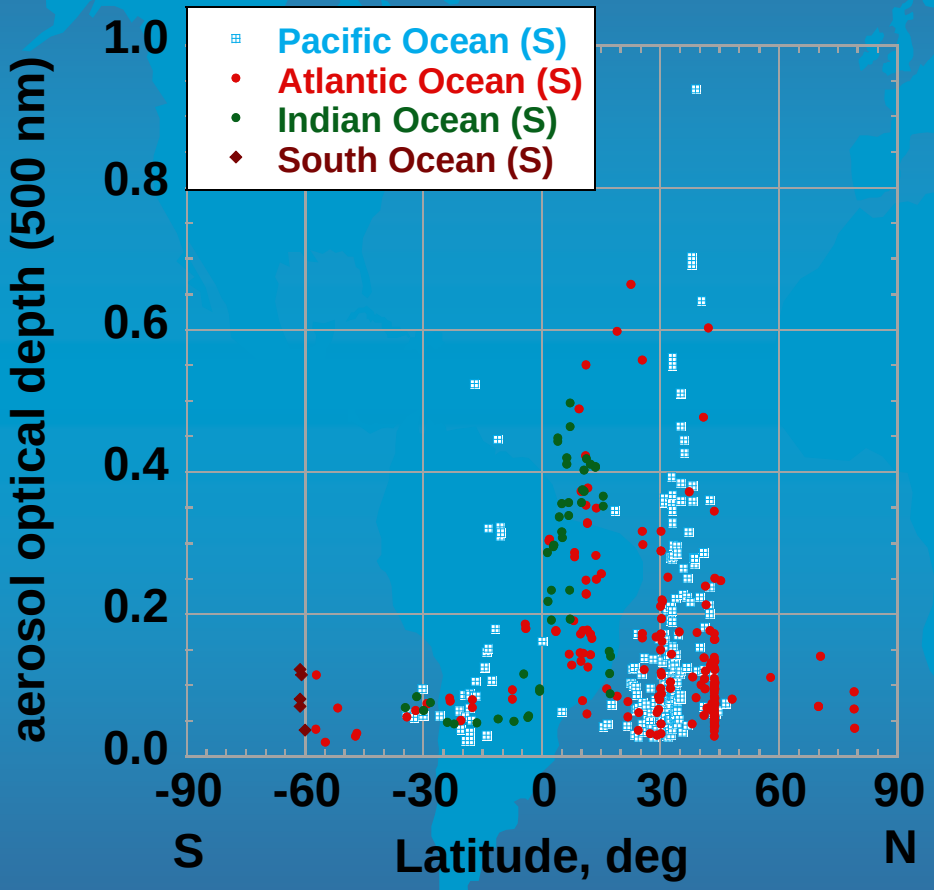


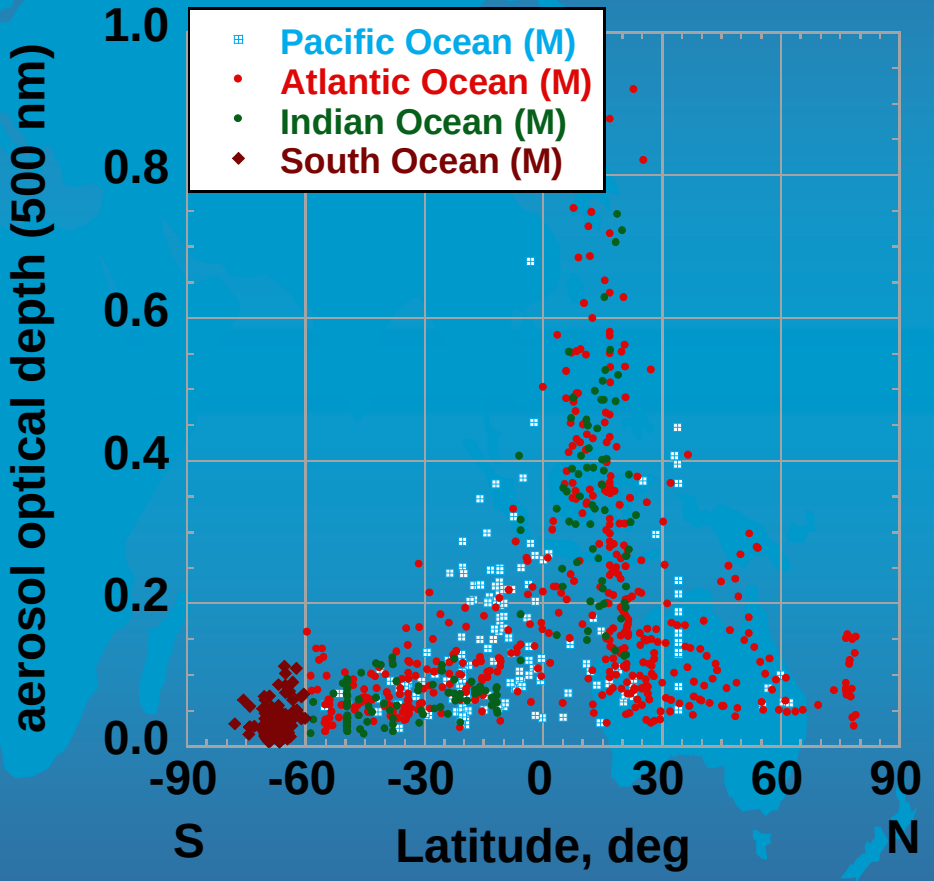

Atlantic Ocean
N=547
frequency of occurrences, %
aerosol optical depth (500 nm)
Baltic, Black, Mediterranean Seas
N=83
frequency of occurrences, %
aerosol optical depth (500 nm)
Pacific Ocean
N=172
frequency of occurrences, %
aerosol optical depth (500 nm)
Atlantic Ocean, 10-20 N belt
N=105
frequency of occurrences, %
aerosol optical depth (500 nm)
Arabian Sea, Bay of Bengal
N=66
frequency of occurrences, %
aerosol optical depth (500 nm)
South Ocean
N=179
frequency of occurrences, %
aerosol optical depth (500 nm)
South Indian Ocean
N=85
frequency of occurrences, %
aerosol optical depth (500 nm)
0.1 to 0.2
0.2 to 0.3
0.3 to 0.5
0.5 to 0.7
> 0.7
laritime Aerosol Network

Typical sea areas (as of 1988)



The SIMBIOS and MAN datasets





Summary

- Number of cruises completed – 62
- Number of measurement days – 1157
- Number of measurement series – 7641
- Number of ongoing cruises – 2
- Number of planned cruises - 11

Summary

- In the last several years data acquisition was extended to the areas that previously had very little or no record at all (South Ocean)
- Data are easily accesible in the web-based public data archive and will stimulate research and international collaboration in various scientific areas

Acknowledgments

- We thank Dr. Hal Maring of the NASA Headquarters for his support of AERONET

Long live the Sun,
Let darkness dissapear!

Alexander Pushkin (1825)

Thank you for your attention