AERONET-From project to program

A few moments in history and thoughts of invincibility, mortality, and inevitability

Brent Holben

Sept 17, 2024

1980-2015
Apex of Human Civilization-

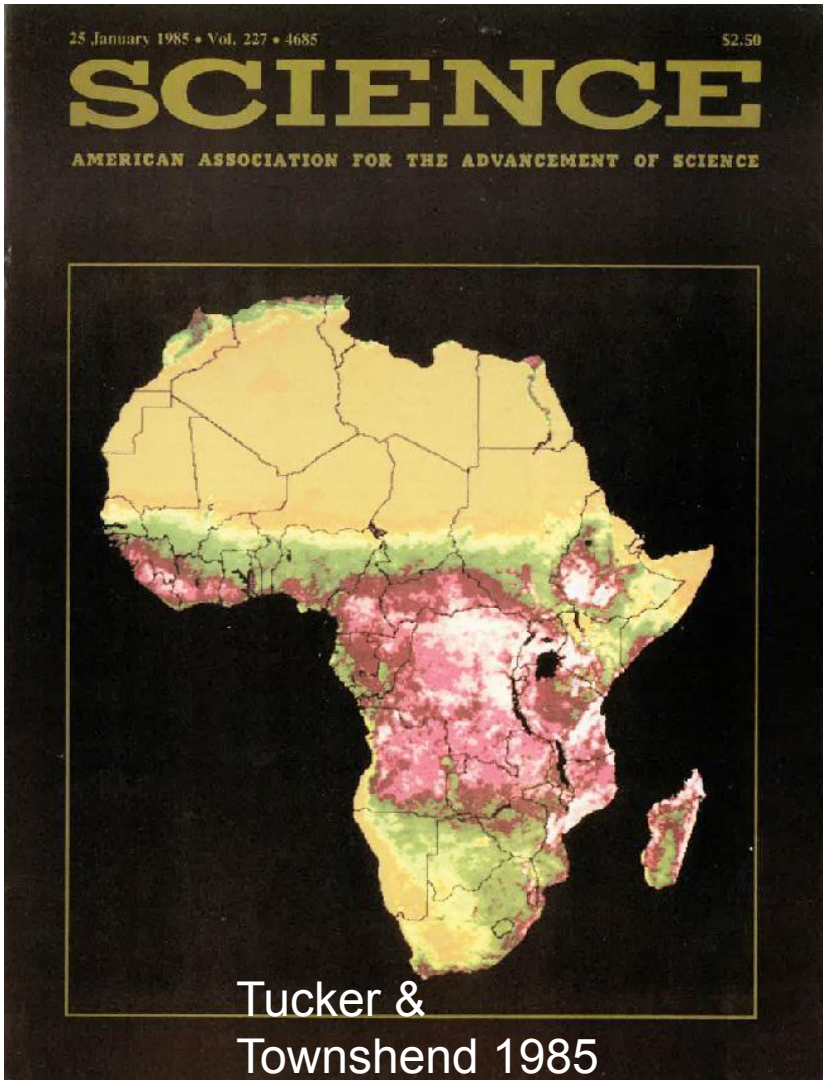
Peter Zeihan: The End of the World is…

- Energy
- Few wars
- Food Security
- Transportation/Globalization
- Rise of mega cities and global wealth
- Instantaneous Communication/email
- International Collaboration
- Maturing of Baby Boomers
- Closely tracks the evolution of AERONET-We're very lucky

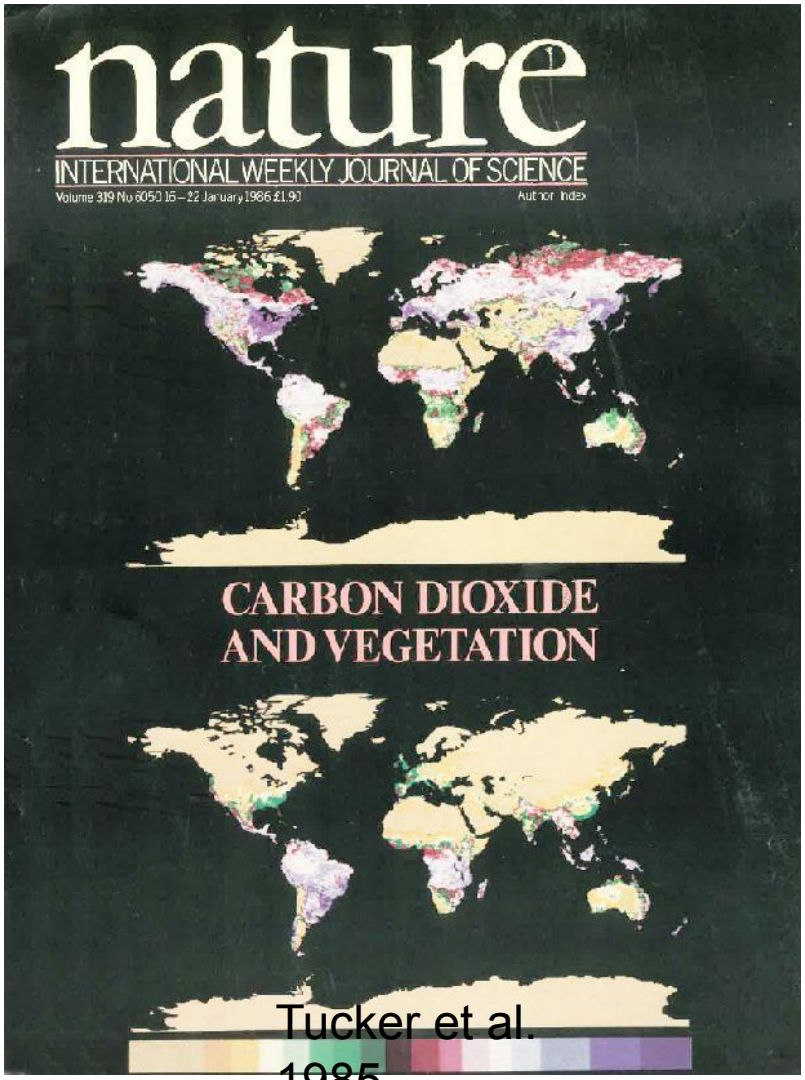
First, the primordial swirl 1978-85

- NASA early days of Earth science focused on Earth's surface: Landsat
- Ground based observations—Tucker NDVI
- First Modis Science Team (AOD afterthought)
- Multi year Drought in Sahel
- Amazon burning
- AVHRR

The Beginning-GIMMS Tucker/Justice/Holben (‘75 to ‘82)



Tucker & Townshend 1985



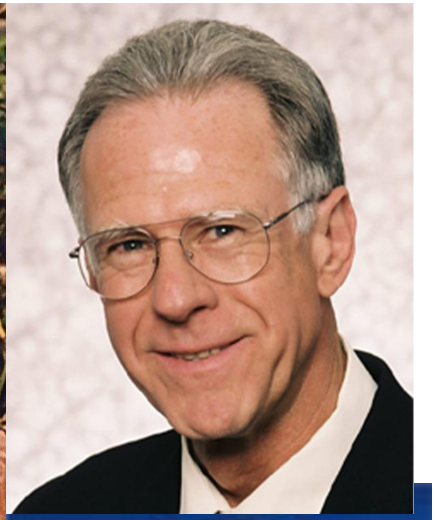
Tucker et al. 1985

Reaching Out

Bob Frasier

Yoram Kaufman

John Reagan
Joe Prospero



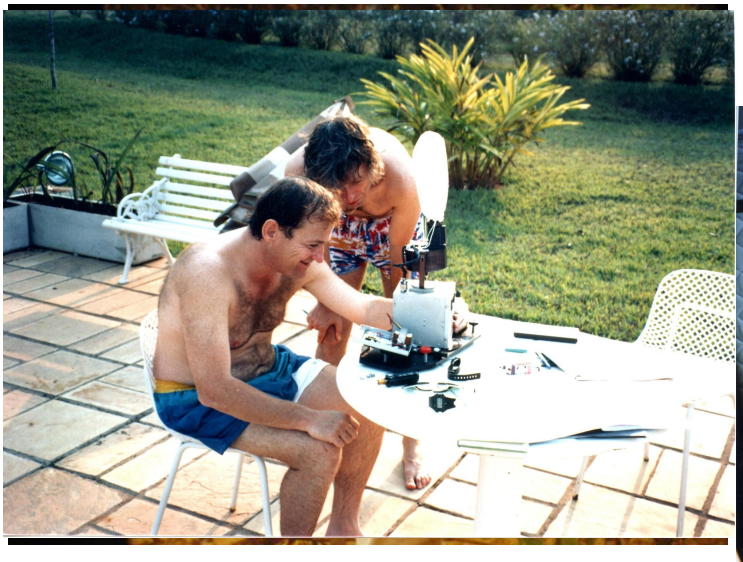
Coalescing to AERONET 1986-1993

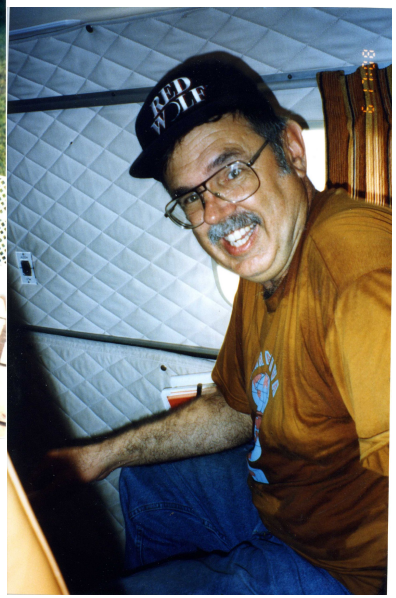
- Didier Tanre-aerosol LOA
- Terry Nakajima-U. Tokyo
- Darold Ward-USFS
- Alberto Setzer-Amazon Biomass Burning
- Diane Wickland-NASA HQ
- M Buis
- Michael King-EOS

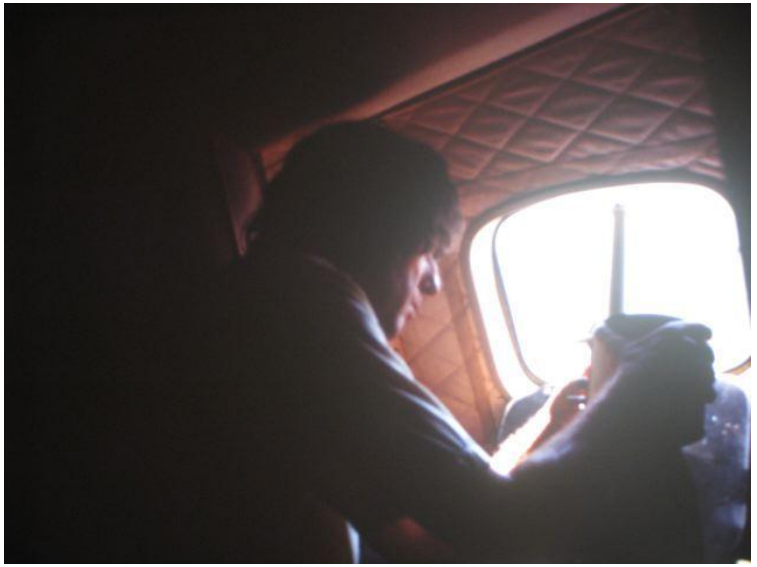
Alberto's
Big Fly
About

Tanre/Ward/Nakajima/ Kaufman/Holben/Smoke

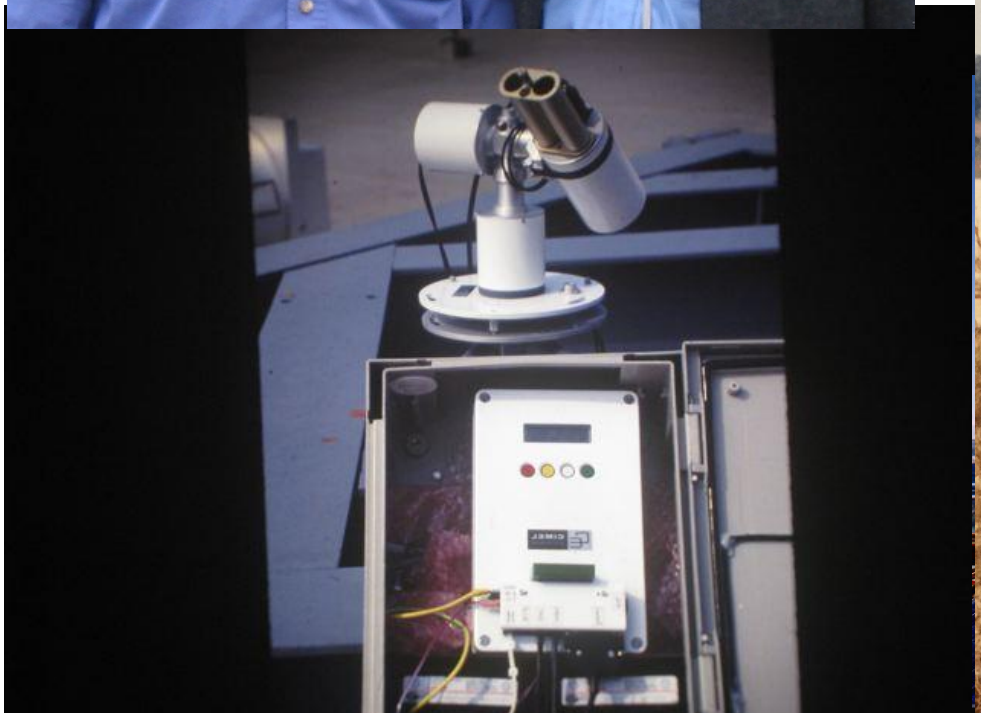
1988 - 1991





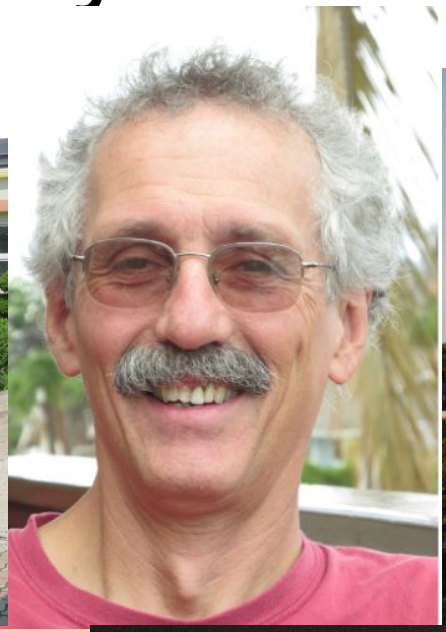


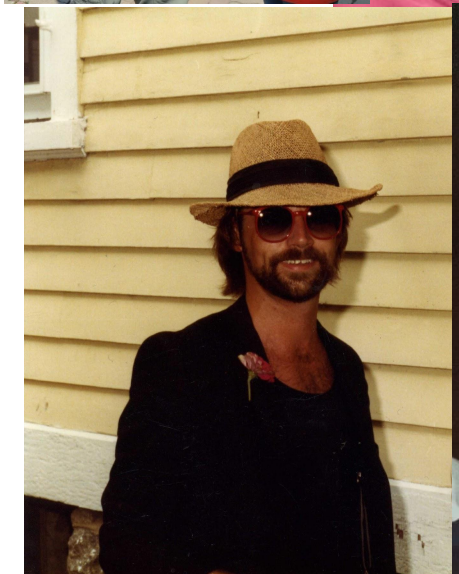
Mother
Diane




TOYOTA

Early Hero's of AERONET





MODIS Science team
Kaufman, Justice, Esaias
EOS Project Scientist
M. King

$ $ $

People and Campaigns and Instruments

- Nadir Abuhassen-Engineer
- Alexander Smirnov-Sun Photometry
- Oleg Dubovik-RT Inversion
- Boreas-Markham
- LBA-Schafer
- TARFOX, INDOEX, Zibbie, Safari, BASE-B
- 100 instruments by 1998

Holben et al., 1998

- Imposed Network Standardization
  - Calibration
  - Measurements
  - Processing
  - Distribution
- Near real time Acquisition-transparency of data (the good and bad)
- Federated with global partners
- AOT→Size Distribution,ref Index
- Citations (GS): 8270

Globalizing AERONET 1997-2004

- Formation of an External Steering/Advisory Committee
- AERONET-OC
- Safari2000 field Campaign/Terra Modis
- Validation Campaigns

1997 AERONET Steering Committee formed

- Didier Tanre, LOA (President)
- John Reagan, UA
- Els Dutton, NOAA ESRL
- Phil Teillet, CCRS
- Joe Prospero, U Miami
- Bruce Forgan, BM
- Howard Gordan, U Miami
- Inez Fung, UC Berkeley
- Terry Nakajima, U Tokyo
- Larry Stowe, NOAA NESDIS
- John Ogren, NOAA ESRL
- Chuck McClain, NASA/GSFC
- Michael King (Ex oficio)
- Bob Curran (NASA HQ)

Steering Committee to Advisory Committee, April 2000 Meeting: The full-court press

- Michael King (AERONET and EOS perspective)
- Bob Curran (GACP and global contributions)
- Norm O'Neil (SDA/AERPCAN)
- Yoram Kaufman (AERONET and Global science)
- Lorraine Remer (Model validation)
- Eric Vermote (MODLAND modland)
- Omar Torres (TOMS aerosol index Validation
- Brent Holben
- Tom Eck
- Ilya Slutsker
- Alexander Smirnov
- Joel Schafer
- Oleg Dubovik
- Mikhail Sorokin
- Wayne Newcomb
- Stefan Kinne
- Christoph Peitras
- Ann Vermuelen

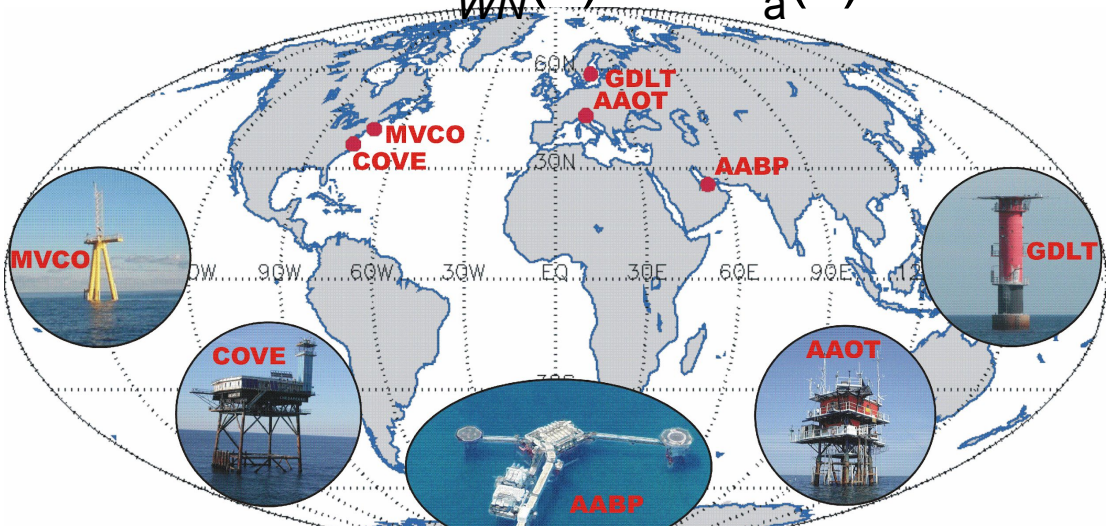
Customer # 1

MODIS Science Team January 2001

AERONET-OC

Joint Research Centre

AERONET – Ocean Color is a sub-network of the Aerosol Robotic Network (AERONET), relying on modified sun-photometers to support ocean color validation activities with highly consistent time-series of $L_{WN}(\lambda)$ and $\tau_a(\lambda)$.



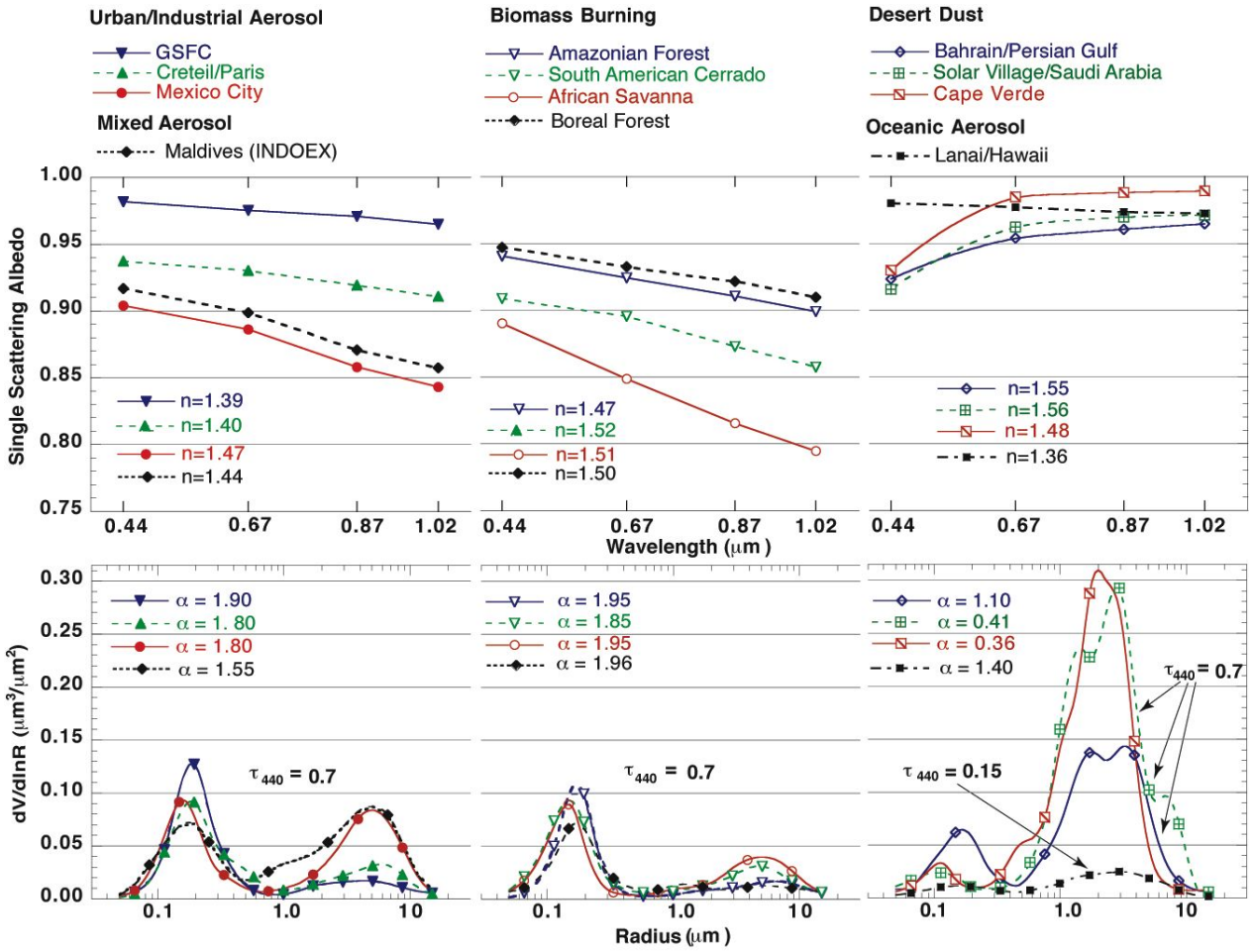
Rationale:

- Autonomous radiometers operated on fixed platforms in coastal regions;
- Identical measuring systems and protocols, sensors calibrated using a single reference source and method, and data processed with the same code;
- Standardized products of normalized water-leaving radiance and aerosol optical thickness.

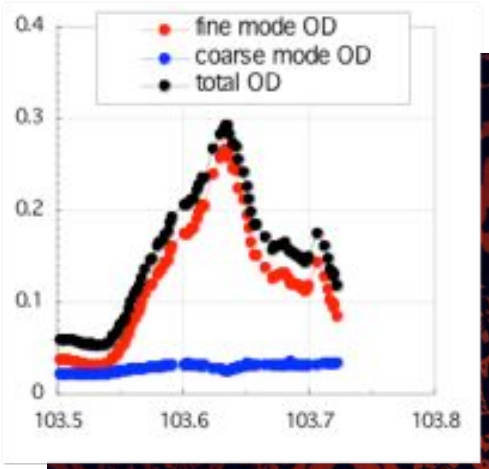
G.Zibordi et al. A Network for Standardized Ocean Color Validation Measurements. Eos Transactions, 87: 293, 297, 2006.

G.Zibordi et al. Advances on the Ocean Color component of the Aerosol Robotic Network 1 (AERONET-OC), Submitted to the Journal of Atmospheric and Oceanic Technology June 2020 and revised October 2020.

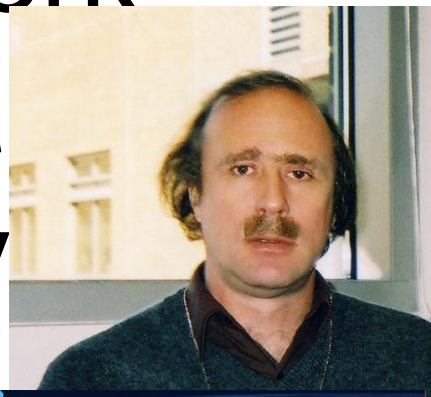
AERONET Milestones: Dubovik & King 2000; Dubovik et al., 2002

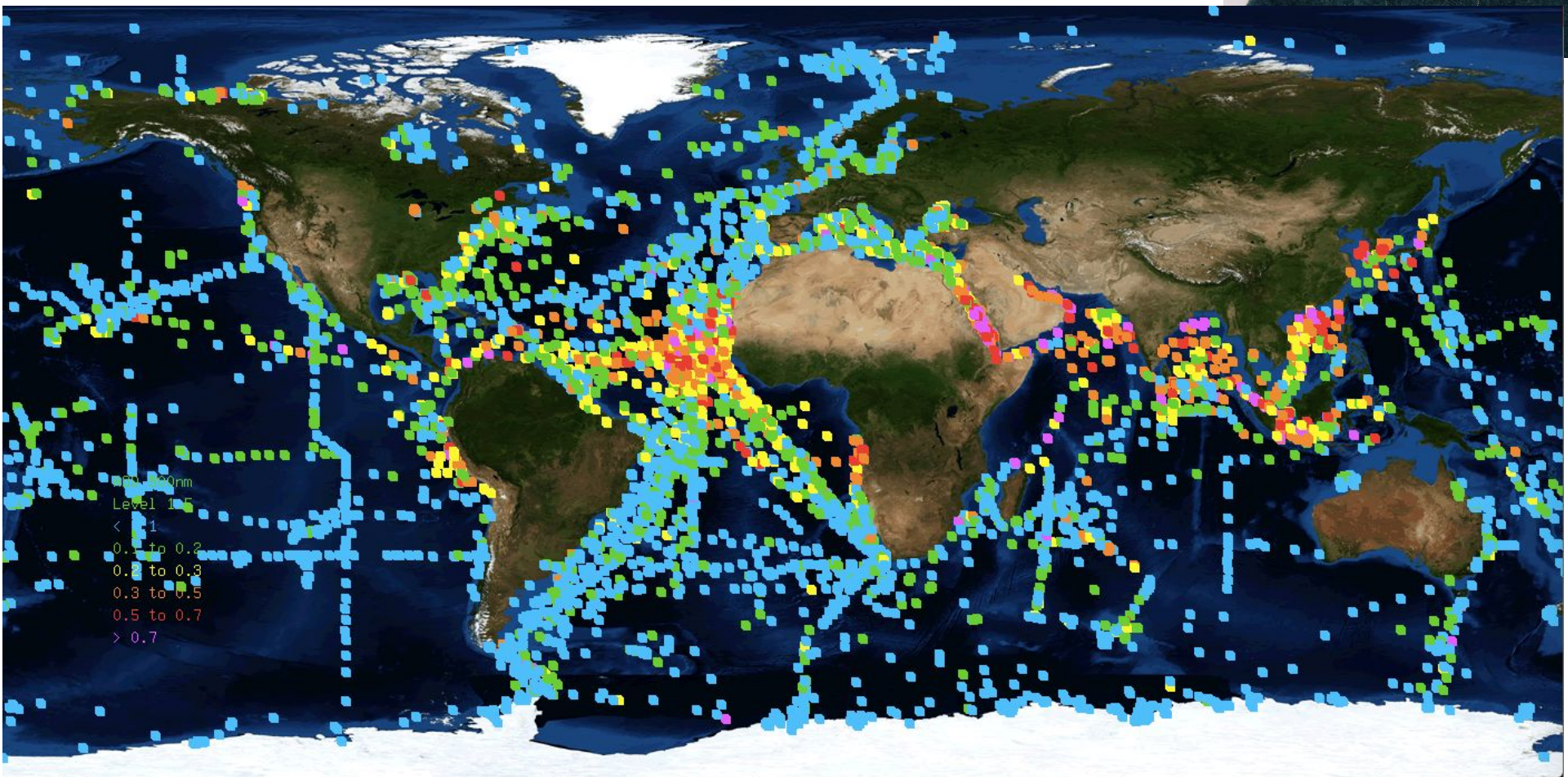


Norm, Sasha & Tom. San Fran AGU, Dec. 07 AGU. Discussing SDA



Maritime Aerosol Network (MAN) 2004-present SIMBIOS to Smirnov



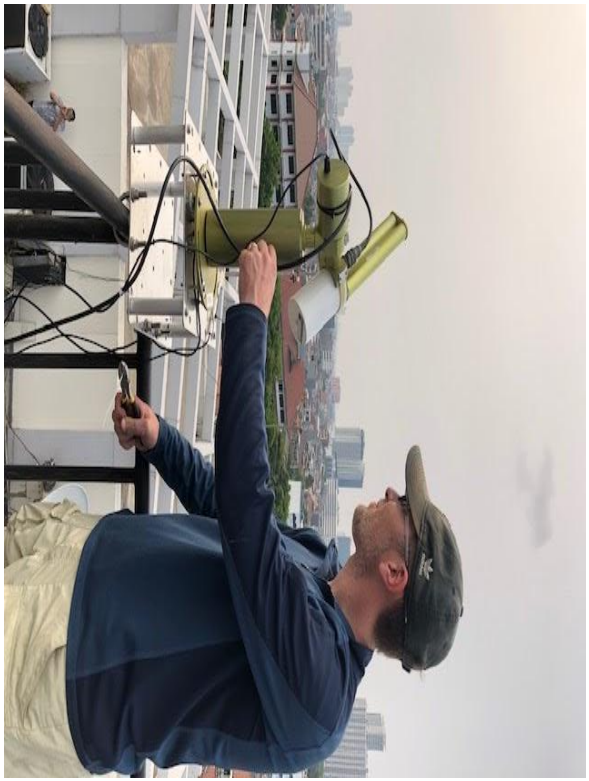


Comrade Hero's of AERONET

Version 3—2018

Near the end of the Boomer era

David Giles **https://aeronet.gsfc.nasa.gov**



- Data Display
- Download Tool
- Download All Sites
- Climatology Tables
- Web Services
- Synergy Tool

Giles, D. M., Sinyuk, A., Sorokin, M. S., Schafer, J. S., Smirnov, A., Slutsker, I., Eck, T. F., Holben, B. N., Lewis, J., Campbell, J., Welton, E. J., Korkin, S., and Lyapustin, A.: Advancements in the Aerosol Robotic Network (AERONET) Version 3 Database – Automated Near Real-Time Quality Control Algorithm with Improved Cloud Screening for Sun Photometer Aerosol Optical Depth (AOD) Measurements, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2018-272, 201

The Calibration teams Transition

- PHOTONS—Tanre to Goloub 2001
- Cimel—Buis to Crozel 2006
- RIMA—Cachorro to Toladano 2018+?
- NEON—Locher to Csavina
- CARSNET— Che to Zheng 2022
- APAC—Lin to Wang 2023

The next generation

Pawan Gupta

Elena Lind

The Glimpse ahead

- Short term
- Vicarious/intercomparisons calibrations
- Solar spectrum, BRDF, V. 4
- Multi-channel inversions
- Lunar level 2
- Ship based sun photometry
- AI: Uncertainty
- Expansion & Collaboration
- Minimize bureaucracy
- Politics & funding
- ‘Just do something’

- Long term
- What will AERONET be in 30 years?
- Value of long term records
- Global Warming
- Changing sources/strengths
- Validation: Sats, GCM, AQ
- Sea level rise coastal assessments
- International federation in a deglobalizing world-strength of scientific collaboration
- Synergism with other networks
- Ground system are inexpensive/costs sharing
- Keep it simple

My deepest gratitude to the all for their vision and collaboration and the many many people inside and on the periphery of AERONET who are fundamentally the source of the AERONET's 30-year success...

My apologies that I've been able to highlight only a fraction of those that have enabled AERONET to serve the community.