AVHRR-like aerosol retrievals from MSG/SEVIRI for the GERB processing

Helen Brindley (GERB & Imperial College)

Alexander Ignatov (CERES & NOAA/NESDIS)

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Oleg Dubovik (NASA/GSFC)

Aerosol from SEVIRI

Meteosat Second Generation (Meteosat-8; launched 28 Aug 2002)

- GERB (sister-instrument to CERES)
- SEVIRI (sister-instrument to AVHRR; Aerosol bands 0.63, 0.83, 1.6 μm)

AVHRR-like algorithm for SEVIRI delivered to

1) Helen Brindley (GERB / IC)

- Updated MPEF cloud mask to restore "dusty" pixels from "cloudy"

- Implemented with SEVIRI/Tested vs. AERONET & MODIS

- 2 case studies: 3-5 Mar 2004 & 12-13 Oct 2004

- Submitted a 2-part paper to Rem. Sens. Env. (2005)

2) Steve DeWitte/Bart DePaepe (GERB / RMIB)

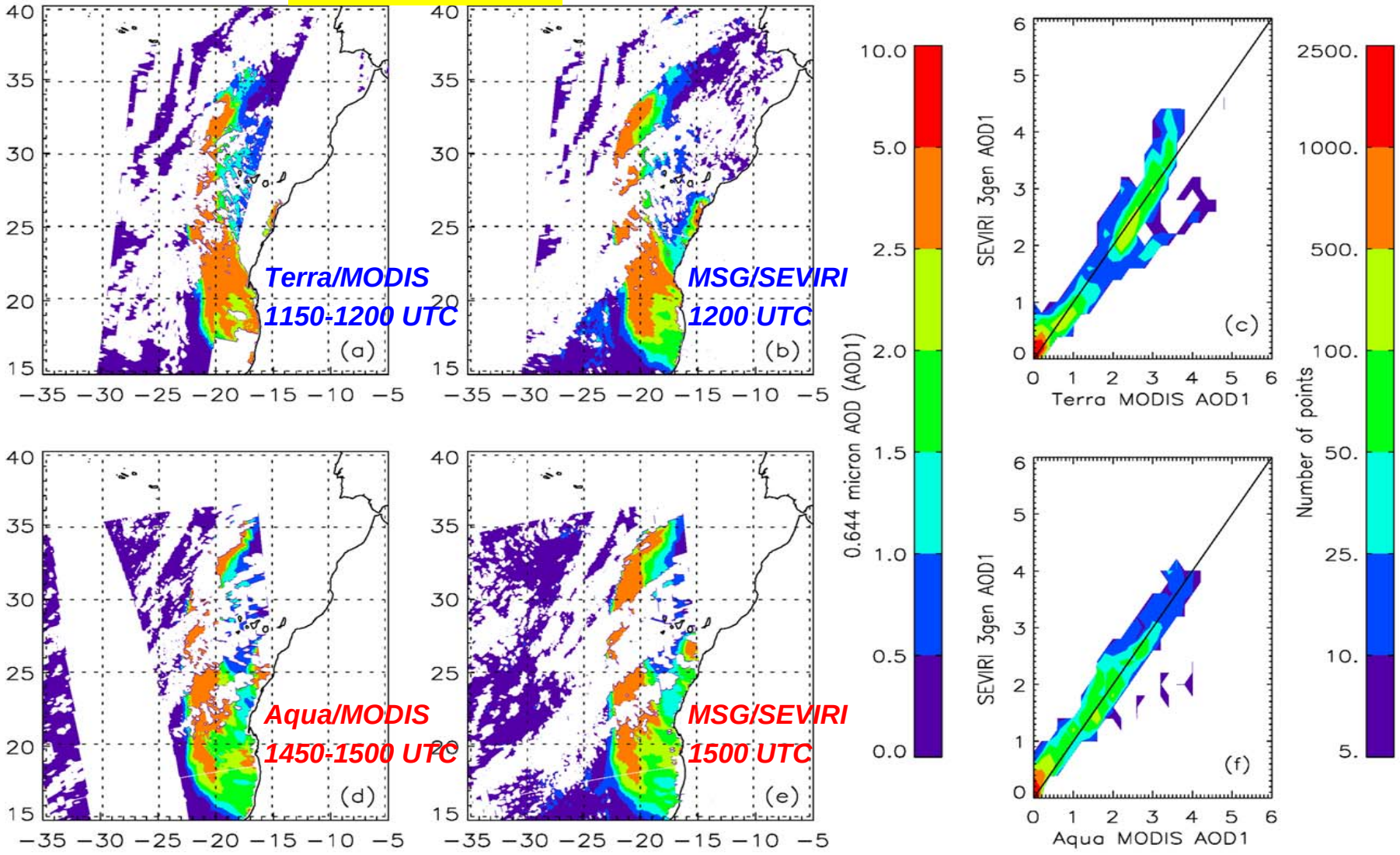
- Self- and cross-consistency checks w/MODIS (4 weeks of global data)

3) Marianne König (EUMETSAT; Real time applications)

- Test the MPEF cloud/glint mask using Aerosol/SST products
- Cross-compare with RAL Aerosol product (Watts/Allen/Mutlow)
- RAL/NESDIS algorithms: candidate for MPEF processing

SEVIRI vs. MODIS

4 March 2004



Sensitivity to Aerosol Microphysics

4 March 2004: Focus on dust retrievals

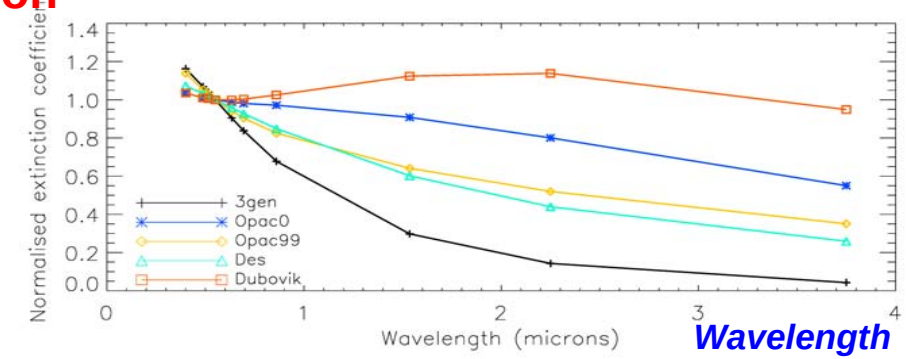
3 dust microphysics models proposed in literature

Tested with SEVIRI along with AVHRR 3rd generation model

LUT	Aerosol model (**blue – spherical**; **red – non-spherical**)
AVHRR 3gen	Mono-modal, log-normal size distribution, purely scattering aerosol. Used as standard in 3rd generation AVHRR aerosol retrievals
Opac0	OPAC desert model at RH=0% (Hess, Köpke & Schultz 1998)
Opac99	OPAC desert model at RH=99% (Hess, Köpke & Schultz 1998)
Des	Desert-like aerosol model (Shettle 1984)
Dubovik (AERONET)	Optical properties derived using AERONET retrieval of desert dust size distribution and refractive indices and assuming particles to be randomly orientated spheroids (Dubovik et al. 2002ab)

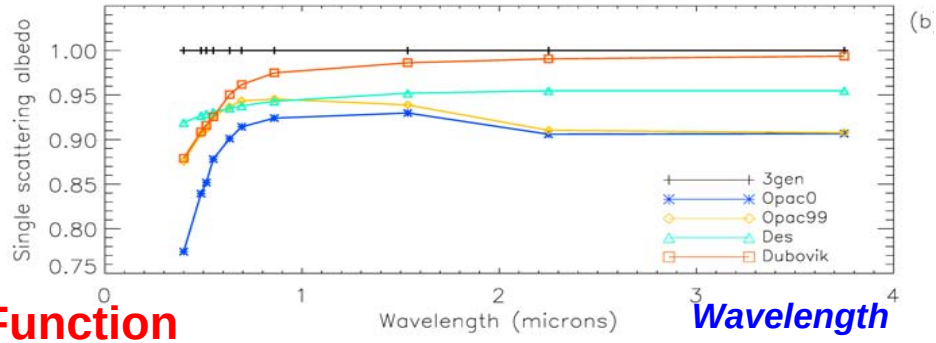
SEVIRI vs. AERONET

Extinction



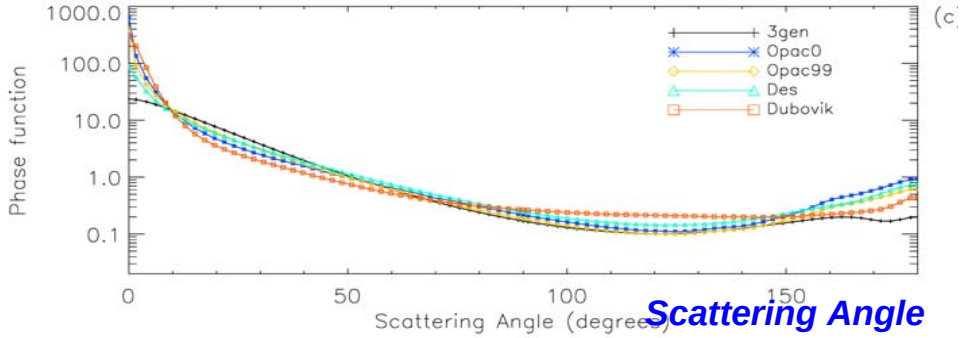
Wavelength

SSA



Wavelength

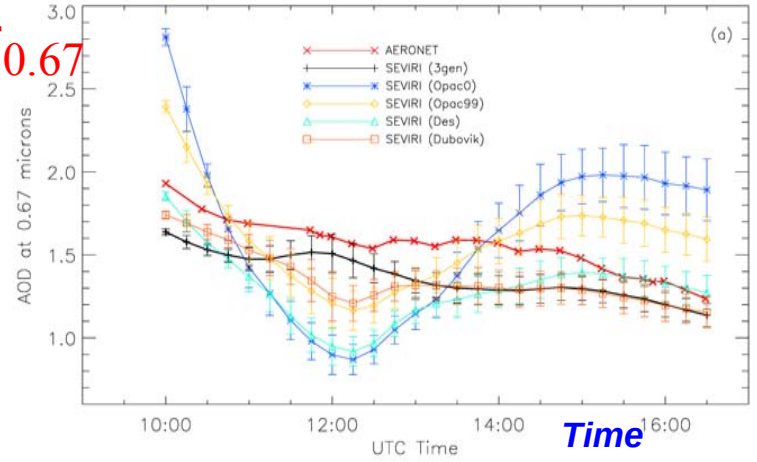
Phase Function



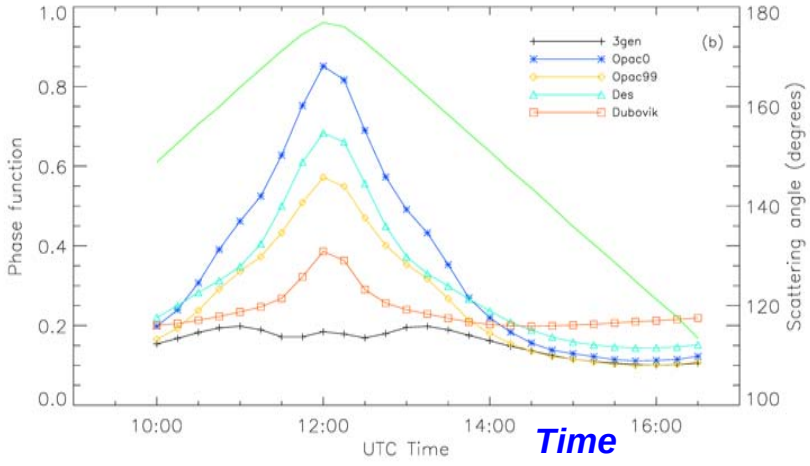
Scattering Angle

5 March 2004 Capo-Verde site

$\tau_{0.67}$



Time



Time

Conclusion

- AVHRR-like aerosol algorithm is ready for routine use with SEVIRI
- Tests on specific dust case studies: Aerosol model affects the retrieval quality. Of the 5 models considered here, the NESDIS aerosol representation provides the best match to AERONET AOD so far.
- Snapshot comparisons with MODIS: a mean AOD agreement of ~ 0.1 @ 0.644 μm. The spatially resolved differences can be > |2.0| for optically thick AOD > 4.0.
- Time evolution of SEVIRI AOD over coastal AERONET sites: Close agreement. Absolute values of AODs also in reasonable agreement but SEVIRI AOD biased low relative to the AERONET. The bias could be adjusted through the incorporation of a small absorption in the aerosol model (consistent with suggestions in the literature).
- The dedicated desert-like dust models tested here do not capture the temporal behavior of the AOD, principally due to the strong dependence of their Mie-calculated phase functions on scattering angle in the back-scatter region.
- A similar, albeit reduced effect is seen when a non-spherical model is used.

Future work

- Assist RMIB and IC: Implement aerosol algorithm (GERB/climate)
- Assist EUMETSAT: Implement aerosol algorithm (real-time)
- Ensure consistency of cloud/glint screening across groups
- Extend Helen's analyses to include
  - statistics: global self-/cross-consistency (now, only 2 case studies)
  - clean ocean cases: SEVIRI calibration (L1.5)
  - "global" analyses: cloud/glint screening
- Geostationary/Feedback: Check/Improve AVHRR-like algorithm