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

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Acknowledgement:
Oleg Dubovik (NASA/GSFC)
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 \( \mu \text{m} \))

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

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

Terra/MODIS
1150-1200 UTC

MSG/SEVIRI
1200 UTC

Aqua/MODIS
1450-1500 UTC

MSG/SEVIRI
1500 UTC
4 March 2004: Focus on dust retrievals
3 dust microphysics models proposed in literature
Tested with SEVIRI along with AVHRR 3rd generation model

<table>
<thead>
<tr>
<th>LUT</th>
<th>Aerosol model</th>
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<tbody>
<tr>
<td>AVHRR 3gen</td>
<td>Mono-modal, log-normal size distribution, purely scattering aerosol. Used as standard in 3rd generation AVHRR aerosol retrievals</td>
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<tr>
<td>Opac0</td>
<td>OPAC desert model at RH=0% (Hess, Köpke &amp; Schultz 1998)</td>
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<tr>
<td>Opac99</td>
<td>OPAC desert model at RH=99% (Hess, Köpke &amp; Schultz 1998)</td>
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<tr>
<td>Des</td>
<td>Desert-like aerosol model (Shettle 1984)</td>
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<tr>
<td>Dubovik (AERONET)</td>
<td>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)</td>
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</tbody>
</table>
SEVIRI vs. AERONET

Extinction

SSA

Phase Function

5 March 2004 Capo-Verde site

Wavelength

Wavelength

Scattering Angle

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