Aerosol satellite product inter-comparisons (WG 3)
(introduction / seed questions)
Inter-comparison questions

- Review of existing inter-comparisons
  - can we identify gaps?
    - What to compare / which focus
    - Which reference datasets
    - Which metrics
    - Which approach (experiments, statistics, sensitivities, information content, synthetic simulations, …)

- Can we define additional meaningful exercise(s)?
  - seek funding
Inter-comparison potential gaps

- aerosol properties: fine mode AOD, …
- geostationary (several SEVIRI algorithms; GEO - LEO)
- Climatologies of AOD (and aerosol properties)
- (regional) trends and anomalies (using same time windows, same background period)
- …?
## Inter-comparison table (ocean and dust)

<table>
<thead>
<tr>
<th>publication</th>
<th>variables</th>
<th>method(s)</th>
<th>sensors</th>
<th>period</th>
<th>regions</th>
<th>references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinne, S. (2009), edited by A. Kokhanovsky and G. de Leeuw, Springer ISBN: 978-3-540-69396-3</td>
<td>AOD, L3 scoring</td>
<td>x x x x x</td>
<td>various algorithms for one sensor</td>
<td>Various multi-annual</td>
<td>Global ocean; regions</td>
<td>AERONET, SKYNET</td>
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<td>Myhre, et al., (2005), ACP, 5, 1697-1719, doi:10.5194/acp-5-1697-2005</td>
<td>AOD, Monthly means</td>
<td>x x x x x x</td>
<td>various algorithms for one sensor</td>
<td>Various, 1997-2000 / 8M of 2000</td>
<td>Global oceans; regions</td>
<td>AERONET, campaigns</td>
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<td>Sayer, et al., (2012), JGR, 117, D03206, doi:10.1029/2011JD016599</td>
<td>AOD, L3</td>
<td>x x x x x x</td>
<td>various algorithms for one sensor</td>
<td>Multi-year</td>
<td>Global ocean</td>
<td>AERONET</td>
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<td>Publication</td>
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<td>Kahn et al. (2011), JQSRT, 112:901–909, doi:10.1016/j.jqsrt.2009.11.003</td>
<td>AOD</td>
<td>L2 statistics</td>
<td>x x</td>
<td>3 months 2006</td>
<td>Global</td>
<td>-</td>
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<tr>
<td>Kittaka et al. (2011), AMT, 4, 131–141, doi:10.5194/amt-4-131-2011</td>
<td>AOD</td>
<td>Collocated pairs, 5 deg</td>
<td>x x</td>
<td>2006-2008</td>
<td>global</td>
<td>-</td>
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<tr>
<td>Sayer, et al. (2012), AMT, 5, 1761, doi:10.5194/amt-5-1761-2012</td>
<td>AOD</td>
<td>Lv3</td>
<td>x x x</td>
<td>Multi-year</td>
<td>global</td>
<td>AERONET</td>
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<tr>
<td>Redemann, et al. (2012), ACP 12, 3025-3043, doi:10.5194/acp-12-3025-2012, 2012</td>
<td>AOD</td>
<td>L2</td>
<td>x</td>
<td>4M 2007 &amp; 2009</td>
<td>Global CALIOP tracks</td>
<td>-</td>
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<tr>
<td>Carlson and Lacis (2013), JGR, 118, 8640–8648, doi:10.1002/jgrd.50686</td>
<td>AOD</td>
<td>PCA analysis</td>
<td>x x x</td>
<td>2002-2010</td>
<td>Global ocean</td>
<td>-</td>
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<tr>
<td>Kahn, et al. (2009), TGARS 47, 4095-4111, doi:10.1109/TGRS.2009.2023115</td>
<td>AOD, ANG</td>
<td>L2 statistics</td>
<td>x x</td>
<td>2M of 2006</td>
<td>Global</td>
<td>-</td>
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<tr>
<td>Bréon, et al., (2011), RSE 115, 3102</td>
<td>AOD, ANG</td>
<td>L2 statistics</td>
<td>x x x</td>
<td>various</td>
<td>global; sea/land</td>
<td>AERONET</td>
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<tr>
<td>Kokhanovsky, et al. (2010), AMT, 3, 909-932, doi:10.5194/amt-3-909-2010</td>
<td>AOD, optical properties</td>
<td>Single cases</td>
<td>various algorithms for one sensor</td>
<td>Single cases</td>
<td>Single cases</td>
<td>Simulations</td>
</tr>
</tbody>
</table>
Inter-comparison potential gaps

- aerosol properties: fine mode AOD, AAOD, ...
- geostationary (several SEVIRI algorithms; GEO - LEO)
- Climatologies of AOD (and aerosol properties)
- (regional) trends and anomalies (using same time windows, same background period)
- Spatial variability – Dragon campaigns / plume detection frequency/high AOD episodes, pdfs
Aerosol_cci comparisons

Lessons learned and plans
ACCI comparisons

- **Improve**: Workshops + algorithm experiments (1 month)
  - Optical models, cloud masks, (surface)
  - Post-processing (cloud contamination, bright surface)

- **Select**: Round robin exercise (4 months)
  - Best versions for all algorithms

- **Validate**: Full ECV products (entire 2008)

- At all steps application of the same validation tools and statistics
  - Level 2 and level 3
  - Global + regional statistics
  - Scoring (spatial / temporal correlation)
  - Against AERONET / MAN + MODIS / MISR / CALIPSO

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Holzer-Popp, et al., AMT 2013

de Leeuw et al., RSE 2013, in press

Kinne, et al., in preparation
ACCI experiences

- Improvement achieved by
  - working groups, algorithm experiments, iterated validation

- Level / amount of analysis needed
  - 4 months (all seasons) global analysis sufficient (equals 12 months)
  - Lv3 (AEROCOM grid) results overall similar to lv2

- Limited coverage of reference data
  - Oceans, Southern hemisphere, near clouds
  - Aerosol properties for low AOD (all inversions)

- Filters matter
  - Common points - “fair” comparison
  - All points – deserves separate focus (coverage, difficult cases)
  - Land / ocean / coast / regions / seasons
    - needed for problem identification
ACCI plans (- 2017)

- Round robin comparison 4 IASI “dust AOD” algorithms
  - “Greater Sahara” region / 1 year
- Fine mode AOD, dust AOD from AATSR, …
- Use POLDER / GRASP as “quasi-reference”
  - 4 diagnostic sites (1200 x 1200 km²) with few AERONET land regimes (biomass burning, dust, pollution), oceans
- Suggested optional round robin exercises of pathfinder algorithms responding to user needs
  - AAOD (glint, mixing fractions, AAI)
  - Layer height (O2A, IASI spectra)
  - MERIS algorithms
## GCOS requirements

<table>
<thead>
<tr>
<th>variable</th>
<th>resolution</th>
<th>accuracy</th>
<th>Stability [/ decade]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol optical depth (column)</td>
<td>5-10 km</td>
<td>N / A</td>
<td>4 h</td>
</tr>
<tr>
<td>Single scattering albedo (column)</td>
<td>5-10 km</td>
<td>N / A</td>
<td>4 h</td>
</tr>
<tr>
<td>Aerosol layer height</td>
<td>5-10 km</td>
<td>N / A</td>
<td>4 h</td>
</tr>
<tr>
<td>Aerosol extinction coefficient (profile)</td>
<td>200-500 km</td>
<td>1k (~10km)</td>
<td>1 week</td>
</tr>
</tbody>
</table>