Geophysical Research Abstracts
Vol. 13, EGU2011-1328, 2011
EGU General Assembly 2011

Extensive aerosol retrieval algorithm evaluation within the ESA aerosol_cci project

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In mid-2010 the ESA Climate Change Initiative project aerosol_cci started. The project aims at preparing consistent prototype algorithms for the production of long-term aerosol datasets from European Earth Observation sensors. The overall concept of the project rests on four pillars:
- understand the differences of various products
- integrate major European aerosol EO teams
- focus on ENVISAT first and extend to European sensors
- work with AEROCOM model user community

The project builds on 9 existing algorithms:
- 3 for ATSR-2/AATSR multi-spectral aerosol optical depth (ORAC by RAL / Oxford university, dual view by FMI and by Swansea university)
- 2 for MERIS multi-spectral aerosol optical depth (BAER by Bremen university and the ESA standard)
- the LOA PARASOL algorithm for POLDER multi-spectral aerosol optical depth
- the absorbing aerosol index together with averaging kernel information by KNMI for OMI, SCIAMACHY, GOME and GOME-2
- the SYNAER synergetic multi-spectral aerosol optical depth retrieval by DLR for AATSR / SCIAMACHY, AVHRR / GOME-2 and ATSR-2 / GOME
- the BIRA stratospheric extinction profile retrieval for GOMOS and SCIAMACHY.

In its first phase an in depth analysis and comparison of the retrieval results for a selected dataset and specific case studies is conducted in order to understand the strengths and weaknesses of each algorithm. Through inter-comparison and validation of 4 months global datasets (1 month per season) of each algorithm within a round robin exercise against other satellite (MODIS, SEVIRI) and ground-based reference datasets (AERONET, WMO-GAW) differences between the algorithms are explored in detail and their errors are characterized in detail. By means of error propagation algorithm uncertainty will be calculated for each retrieval pixel. At the same time elements of community algorithms and harmonized retrieval are worked out. This analysis covers the different assumptions and algorithms which are needed in aerosol retrieval algorithms due to the ill-posed nature of the underlying inversion problem:
- optical aerosol properties, where a harmonized choice of aerosol types will be used
- surface reflectance / bi-directionality treatment, where sensor-specific harmonization of estimation approaches will be explored
- cloud masking, where best suited sensors with full visible to thermal spectral range and highest spatial resolution will be the starting point for weaker sensors
- auxiliary datasets with an attempt to agree on common use of e.g. digital elevation model, land cover, humidity treatment, ocean white caps to constrain the retrieval

Based on the round robin analysis and a critical review of GCOS requirements for satellite aerosol products by the AEROCOM model user community the best modules or combinations of modules will be identified for each sensor and prototype algorithms will be integrated by consolidating the pre-cursor algorithms. Then annual global datasets will be produced and validated in depth. One major outcome of the project will thus be a sophisticated error characterization of each dataset.

The paper will provide an overview of the project work plan and summarize first results of the ongoing

inter-comparison and evaluation work.