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Improved global aerosol datasets for 2008 from Aerosol_cci

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Within the ESA Climate Change Initiative (CCI) the Aerosol_cci project has meanwhile produced and validated global datasets from AATSR, PARASOL, MERIS, OMI and GOMOS for the complete year 2008. Whereas OMI and GOMOS were used to derive absorbing aerosol index and stratospheric extinction profiles, respectively, Aerosol Optical Depth (AOD) and Angstrom coefficient were retrieved from the three nadir sensors. For AATSR three algorithms were applied. AOD validation was conducted against AERONET sun photometer observations also in comparison to MODIS and MISR datasets. Validation included level2 (pixel level) and level3 (gridded daily) datasets. Several validation metrices were used and in some cases developed further in order to comprehensively evaluate the capabilities and limitations of the datasets. The metrices include standard statistical quantities (bias, rmse, Pearson correlation, linear regression) as well as scoring approaches to quantitatively assess the spatial and temporal correlations against AERONET. Over open ocean also MAN data were used to better constrain the aerosol background, but in 2008 had limited coverage.

The validation showed that the PARASOL (ocean only) and AATSR (land and ocean) datasets have improved significantly and now reach the quality level and sometimes even go beyond the level of MODIS and MISR. However, the coverage of these European datasets is weaker than the one of the NASA datasets due to smaller instrument swath width. The MERIS dataset provides better coverage but has lower quality then the other datasets. A detailed regional and seasonal analysis revealed the strengths and weaknesses of each algorithm. Also, Angstrom coefficient was validated and showed encouraging results (more detailed aerosol type information provided in particular from PARASOL was not yet evaluated further). Additionally, pixel uncertainties contained in each dataset were statistically assessed which showed some remaining issues but also the added value. Users (MACC/ECMWF, AEROCOM) confirmed the relevance of this additional information and encouraged Aerosol_cci to release the current uncertainties.

A thorough comparison was conducted for the three AATSR algorithms. Care was taken to compare equal data amounts by common point filtering. It was found that in some cases different filtering led to contradicting validation results. This is not yet completely understood and needs further analysis. Obviously one aspect is the anti-correlation between coverage and accuracy and thus the importance of the applied quality control methods (in particular to avoid cloud contamination). Also limitations of the available reference datasets over open ocean and in the Southern hemisphere became obvious. The validation showed that all three AATSR algorithms produce almost equal accuracy, but show differences in the resulting datasets (similar to those between MODIS and MISR). In conclusion the team recommends to use a combination of the three AATSR algorithms, since none of them can be identified which performs best under all conditions. The intensive validation provides a large wealth of information which needs to be fully exploited and can be used to determine future algorithm development priorities.

The paper will summarize and discuss the validation results and conclude with an outline of future steps for validation and algorithm improvement.