Deutsches Zentrum
DLR für Luft- und Raumfahrt

DLR IASI Dust Product

Product Specification Document

Product Coverage

Currently IASI DLR dust product data for the year 2009 are available for Northern Africa, Arabia and Asia (0°-45°N / 20°W-140°E). Data for Asia are not yet processed for all months (see Klüser et al., 2012). IASI data for the French / UK FENNEC campaign in Northern Africa (June 2011) are currently processed and will also be available soon. The IASI DLR dust product covers morning (descending orbits) and evening (ascending orbits) observations.

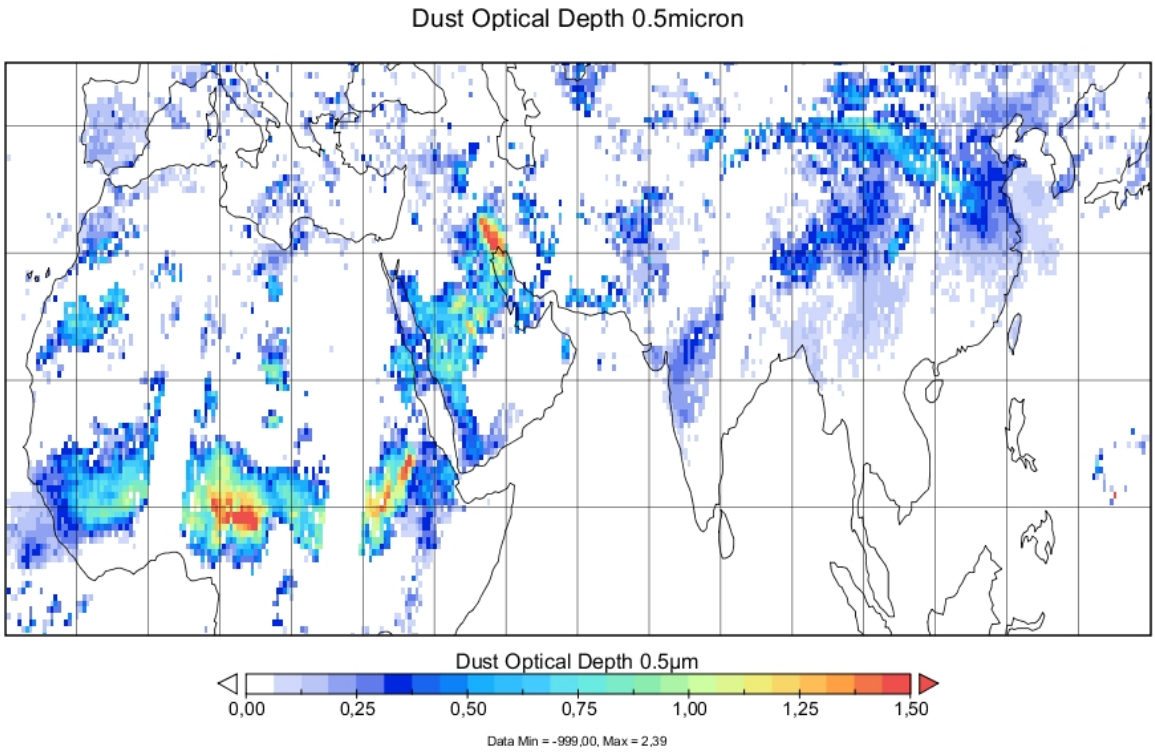

Figure 1: Example of dust optical depth (at 0.5µm) from IASI at 0.5° resolution for descending orbits of February 12, 2009 over the domain covered.

Product Data Format

The data are stored in netCDF format covering the above mentioned region (see Fig. 1). IASI observations are mapped to a 0.5° grid. Data are available subdaily, i.e. gridded products for descending (morning) and ascending (evening) orbits separately.
Filenames contain the satellite ID, date, the orbit ("D": descending; "A": ascending) and the product version (currently v1.91) and are named as following:

IASI_<SatID>_<YYYY><MM><DD><orb>_DLR_Dust_<version>.nc

<SatID>	*satellite ID, currently "M02" for Metop-A*
<YYYY>	*year, e.g. "2009" for Fig.1*
<MM>	*month, e.g. "02" for Fig.1*
<DD>	*day, e.g. "12" for Fig.1*
<orb>	*orbit tag, either „D" or „A"*
<version>	*Version number, e.g. „v191" for Fig.1*

The netCDF files of the IASI dust product contain the following datasets:

short name	**long name**	**description**
LAT	Latitude	*center latitude of the 0.5° gridbox*
LON	Longitude	*center longitude of the 0.5° gridbox*
UTC	UTC Time	*averaged observation time within the gridbox (in UTC)*
Nobs	Number_IASI_Observations	*total number of available IASI observations within the gridbox*
Ndust	Number_Dust_Observations	*number of successful dust retrievals in the gridbox*
AOD_0.5	Dust_Optical_Depth_0.5micron	*dust AOD at 0.5µm*
AOD_10	Dust_Optical_Depth_10micron	*dust AOD at 10µm*
Mass	Dust_Mass	*dust mass column in g/m² (EXPERIMENTAL!)*
DQF	Dust_Quality_Flag	*dust retrieval quality flag covering the range of 1(poor quality) to 6(excellent quality) for successful retrievals. If no dust AOD is retrieved, the QF is 0.*
Error_d	Error_Dust	*Intrinsic retrieval uncertainty in percent.*
Tdust	Tdust	*estimated dust layer emission temperature*

Product Versions

The currently available product version is 1.91 with only slight changes to the version published in Klüser et al. (2012). Instead of using the calcite spectrum (which is hardly represented by the higher order singular vectors) two feldspar components are included separately in this version (see Klüser et al., 2012 for details).
Moreover version 1.91 includes a quality flag and also an experimental retrieval of dust mass column (*which is not yet evaluated!*). The quality flag ranges from 0 (no retrieval) respective 1 (very poor quality) to 6 (excellent quality). It is strongly recommended only to use dust observations with *Quality_Flag ≥ 4* for all applications.

Validation Summary

After the validation efforts presented in Klüser et al. (2011) [with OPAC dust optical properties] and Klüser et al. (2012) [with measured extinction spectra] the introduction of a quality flag and of a revised calculation of the intrinsic uncertainty (now the standard deviation of the retrieved dust emission temperature is also taken into account as well as the standard deviation of the IIS temperatures representing scene homogeneity) allowed for a more stringent validation against AERONET (Holben et al., 1998; O'Neill et al., 2003) by filtering IASI data (only good quality observations with QF≥3 and intrinsic uncertainty ≤40%) and AERONET observations (stations as in Klüser et al., 2012; one hour standard deviation ≤ 40%) of a full year (2009). Comparison is performed for AERONET coarse mode AOD (left plot in Fig. 2, as in Klüser et al., 2012) as well as against a "best fit AOD" (right plot in Fig. 2) which means that either coarse mode or total AOD are selected depending on which one is closer to the IASI observations. The latter approach allows to also accounting for dust particles in the fine mode range. Correlation coefficients are 0.768 (coarse mode AOD) respective 0.838 (best fit AOD).

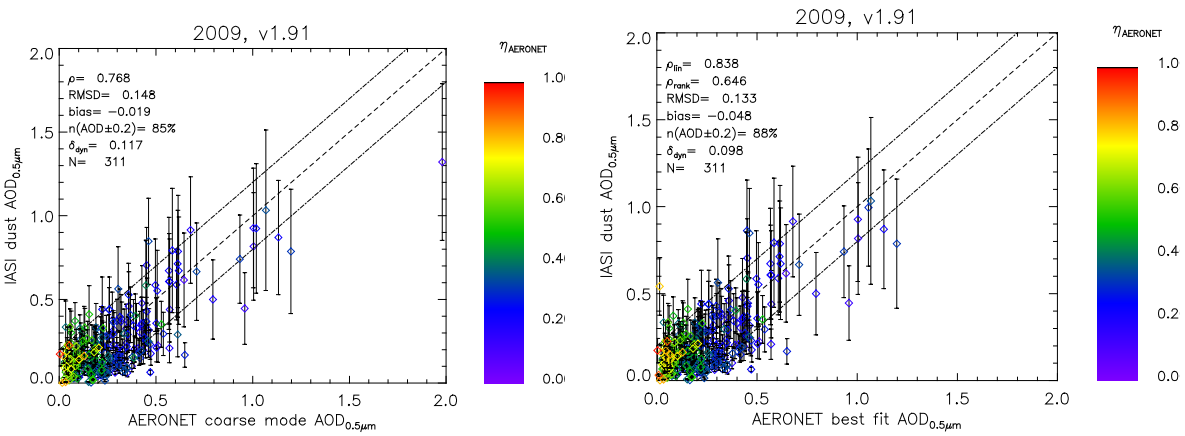

Figure 2: Comparison of IASI derived dust AOD0.5µm with AERONET AOD for 35 AERONET stations in 2009. Left: AERONET coarse mode AOD0.5µm; Right: "best fit" to AERONET AOD0.5µm (total or coarse mode).

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References

Holben, B.N., Eck, T.F., Slutsker, I., Tanré, D., Buis, J.P., Setzer, A., Vermote, E., Reagan, J.A., Kaufman, Y.J., Nakajima, T., Lavenu, F., Jankowiak, I., and Smirnov, A.: AERONET – a federated instrument network and data archive for aerosol characterization, *Remote Sens. Environ.*, 66, 1-16, 1998.

Klüser, L., Martynenko, D., and Holzer-Popp, T.: Thermal infrared remote sensing of mineral dust over land and ocean: a spectral SVD based retrieval approach for IASI, *Atmos. Meas. Tech.*, 4, 757-773, doi: 10.5194/amt-4—757-2011, 2011.

Klüser, L., Kleiber, P., Holzer-Popp, T., and Grassian, V.H.: Desert dust observation from space – application of measured mineral component infrared extinction spectra, *Atmos. Environ.*, 54, 419-427, doi:10.1016/j.atmosenv.2012.02.011, 2012.

O'Neill, N.T., Eck, T.F., Smirnov, A., Holben, B.N., and Thulasiraman, S.: Spectral discrimination of coarse and fine mode optical depth, *J. Geophys. Res.*, 108(D17), 4559-4573, doi:10.1029/2002JD002975, 2003.