

# Fine-mode (sub-micrometer) and Coarse-mode (super-micrometer) pure-dust dataset

## Introduction

A four-dimensional, multiyear, and near-global climate data record of the fine-mode (sub-micrometer in terms of diameter) and coarse-mode (super-micrometer in terms of diameter) components of atmospheric pure-dust, is presented. The separation of the two modes of dust in detected atmospheric dust layers is based on a combination of (1) the total pure-dust product provided by the well-established European Space Agency (ESA) - “Lidar climatology of Vertical Aerosol Structure” (LIVAS) database and (2) the coarse-mode component of pure-dust provided by the first-step of the two-step Polarization Lidar PHOTometer Networking (POLIPHON) technique, developed in the framework of European Aerosol Research Lidar Network (EARLINET). The fine-mode component of pure-dust is extracted as the residual between the total pure-dust and the coarse-mode component of pure-dust. Intermediate steps involve the implementation of regionally-dependent lidar-derived lidar-ratio values and AEROSOL ROBOTIC NETWORK (AERONET) based climatological extinction-to-volume conversion factors, facilitating conversion of dust backscatter into extinction and subsequently extinction into mass concentration. The decoupling scheme is applied to Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) observations at 532 nm. The final products consist of the submicrometer (particles with diameter less than 1  $\mu\text{m}$ ) and supermicrometer (particles with diameter greater than 1  $\mu\text{m}$ ) modes of atmospheric pure-dust, of quality-assured profiles of backscatter coefficient at 532 nm, extinction coefficient at 532 nm, and mass concentration for each of the two components. The datasets are provided primarily with the original L2 horizontal (5 km) and vertical (60 m) resolution of Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) along the CALIPSO orbit-path, and secondly in averaged profiles of seasonal-temporal resolution,  $10\times 10$  spatial resolution, and with the original vertical resolution of CALIPSO, focusing on the latitudinal band extending between 70oS and 70oN and covering more than 15-years of Earth Observation (06/2006-12/2021). The quality of the dust products is justified by using AERONET fine-mode and coarse-mode aerosol optical thickness (AOT) interpolated to 532 nm and AEROSOL properties – Dust (AER-D) campaign airborne in-situ particle size distributions (PSDs) as reference datasets, during atmospheric conditions characterized by dust presence. The near-global fine-mode and coarse-mode pure-dust climate data record is considered unique with respect to a wide range of potential applications, including climatological, time-series, and trend analysis over extensive geographical domains and temporal periods, validation of atmospheric dust models and reanalysis datasets, assimilation activities, investigation of the role of airborne dust on radiation, and air quality.

## Structure of the repository

The files are provided in [netCDF4 format](#). The folders are organized in years. Currently, the CALIPSO-CALIOP L2 5km V4 files have been processed at per-orbit resolution.

## Filename format

**Example file:** Fine-Mode\_Coarse-Mode\_Pure-Dust-V1-CAL\_LID\_L2\_05km-V4-21.2014-01-01T06-27-53ZN.nc

**Full length of the filename: [80]**

- "Fine-Mode\_Coarse-Mode\_Pure-Dust-" → Data set description suffix [0:31].
- "V1" → Release Version of the fine-mode and coarse-mode pure-dust dataset [32:33].
- "CAL" → CALPSO [35:37].
- "LID" → lidar [39:41].
- "L2\_05km" → Level of processing of the CALIPSO CALIOP files used and horizontal resolution [42:49].
- "V4-21" → Version of the CALIPSO CALIOP files used [51:55].
- "2014-01-01" → Date (YYYY-MM-DD) [57:66].
- "06-27-53" → Time (hh-mm-ss) [68:75].
- "ZN" → Day-Night Identifier [76:77].
- ".nc" → File format [79:80].

**Datasets**

Group	Variable	Info
Geolocation	Height	Height (dim: Alt=399) double units = "km" long name = "Height" fill value = NaN
	Latitude	Latitude (dim: Number of L2 5km profiles) double units = "degrees north" long name = "Latitude" fill value = NaN
	Longitude	Longitude (dim: Number of L2 5km profiles) double units = "degrees east" long name = "Longitude" fill value = NaN
	Profile.UTC.Time	Time UTC (dim: Number of L2 5km profiles) uint
Flags_and_Auxiliary	Day_Night_Flag	Day_Night_Flag (dim: Number of L2 5km profiles) float units = "none"; long_name = "Day Night Flag"; fill_value = NaN
	Surface_Elevation	Surface_Elevation (dim: Number of L2 5km profiles) float units = "none"; long_name = "Surface Elevation - mean"; fill_value = NaN
	AVD_Aerosol_Subtype	AVD_Aerosol_Subtype (dim1 = Number of L2 5km profiles / dim2 = Alt)

		float units = "none" long_name = "AVD Aerosol Subtype" fill_value = NaN
	AVD_Feature_Type	AVD_Feature_Type (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = "none" long_name = "AVD Aerosol Subtype" fill_value = NaN
EO4AQ-DustFM_Product		
Backscatter_Coefficient_532	Pure_Dust_Fine_Backscatter_Coefficient_532	Pure_Dust_Fine_Backscatter_Coefficient_532 (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = "km <sup>-1</sup> sr <sup>-1</sup> "; long_name = "Pure Dust Fine-Mode Backscatter Coefficient 532"; fill_value = NaN;
	Pure_Dust_Coarse_Backscatter_Coefficient_532	Pure_Dust_Coarse_Backscatter_Coefficient_532 (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = "km <sup>-1</sup> sr <sup>-1</sup> "; long_name = "Pure Dust Coarse-Mode Backscatter Coefficient 532"; fill_value = NaN;
Extinction_Coefficient_532	Pure_Dust_Fine_Extinction_Coefficient_532	Pure_Dust_Fine_Extinction_Coefficient_532 (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = "km <sup>-1</sup> "; long_name = "Pure Dust Fine-Mode Extinction Coefficient 532"; fill_value = NaN;
	Pure_Dust_Coarse_Extinction_Coefficient_532	Pure_Dust_Coarse_Extinction_Coefficient_532 (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = "km <sup>-1</sup> "; long_name = "Pure Dust Coarse-Mode Extinction Coefficient 532"; fill_value = NaN;
Mass_Concentration	Pure_Dust_Fine_Mass_Concentration	Pure_Dust_Fine_Mass_Concentration (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = " micrograms/m <sup>3</sup> "; long_name = "Pure Dust Fine-Mode Mass Concentration"; fill_value = NaN;
	Pure_Dust_Coarse_Mass_Concentration	Pure_Dust_Coarse_Mass_Concentration (dim1 = Number of L2 5km profiles / dim2 = Alt) float units = " micrograms/m <sup>3</sup> "; long_name = "Pure Dust Coarse-Mode Mass Concentration"; fill_value = NaN;

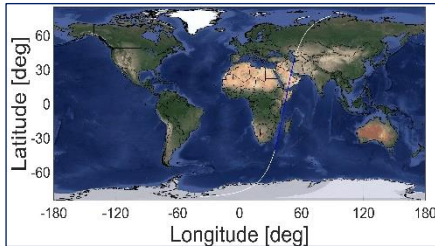
# Basic Products

CALIPSO-CALIOP

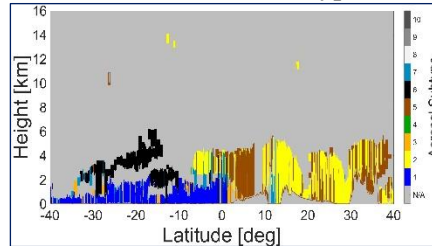
L2 V4.2 A & C Profiles

From: 2015/09/23 22:37:33 UTC To:

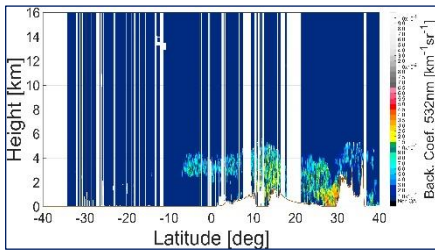
2015/09/23 22:59:41 UTC



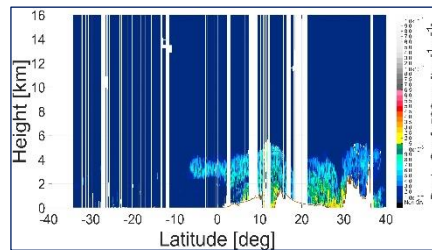
AVD Aerosol Subtype



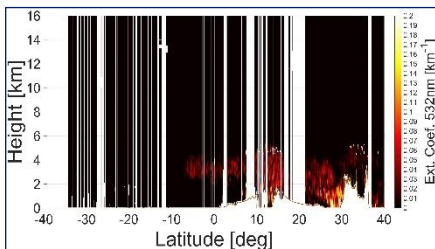
Pure-Dust Coarse-Mode b532nm



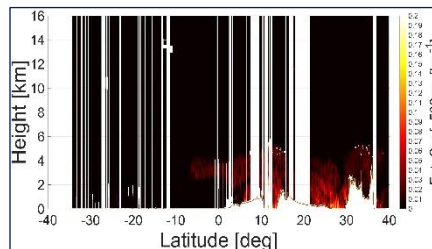
Pure-Dust Fine-Mode b532nm



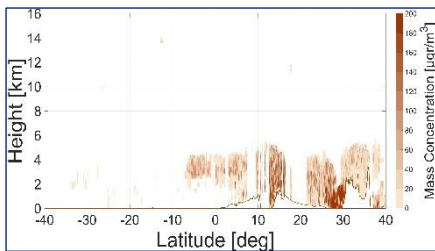
Pure-Dust Coarse-Mode a532nm



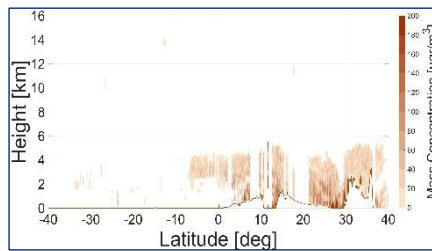
Pure-Dust Fine-Mode a532nm



Pure-Dust Coarse-Mode Mass Concentration



Pure-Dust Fine-Mode Mass Concentration



## Contact

Users can contact with Emmanouil Proestakis ([proestakis@noa.gr](mailto:proestakis@noa.gr)) for any further details and clarifications regarding the atmospheric fine-mode and coarse-mode pure-dust dataset.