5. D2.3: Database of ground-based observations of stratospheric smoke layers.

5.1. Overview

StratoFIRE WP2 aims to (a) detect major events of stratospheric aerosol transport and identify the cases related to pyroCb injections and (b) to provide to WP3, WP4, and WP5 the necessary ground-based and satellite observations for the stratospheric aerosol layers, with focus on the specific extreme smoke events (e.g., Canadian 2017, Australian 2019-2020) as well as any future event within the project period.

StratoFIRE will make use of two sites of ground-based lidar observations to probe the upper troposphere - lower stratosphere, during individual intense pyroconvective events. It must be mentioned that the number of sites and the spatial and temporal coverage of the ground-based data are significantly lower compared to D2.2 satellite products.

The present section provides an overview of satellite-based observations used in the StratoFIRE, namely:

- Leipzig EARLINET
- PANGEA EARLINET

In the following we provide a short introduction to each dataset and describe the files which are distributed by the project.

5.2. Leipzig EARLINET

The highest smoke load over EARLINET stations has been reported at Leipzig, Germany for the Pacific- Northwest event (Ansmann et al., 2018). Measurements at the Leibniz Institute of Tropospheric Research (TROPOS) were conducted with the BERTHA (Backscatter Extinction lidar-Ratio Temperature Humidity profiling Apparatus) multi-wavelength polarization Raman lidar system. The system measures the total and cross-polarized component of the elastic backscattered light at 355, 532 and 1064 nm, which are used to derive the PLDR at these wavelengths. It is also able to perform independent measurements of the aerosol extinction coefficient at 387, 607 nm and (after optics re-arrangement) at 1058 nm, and thus has a capability to provide 10 the LR profiles at 355, 532 and 1064 nm. On August 22, the profiles of the stratospheric smoke backscatter and extinction coefficients at 355, 532 and 1064 nm and the smoke PLDR at 355 and 532 nm were derived from two-and-a- half-hour averaging of the lidar signals between 20:45 and 23:17 UTC. The PLDR value at 1064 nm was calculated using a forty-minute averaging between 23:50 and 00:30 UTC. The gap between the end of the first measurement and the beginning of the second, corresponds to the necessary time for the rearrangement of BERTHA optics.
Layer-integrated values of PLDR and LR for the stratospheric smoke layer are derived, which show values typical for aged Canadian smoke at 355 nm (40 ± 16 sr) and 532nm (66 ± 12 sr). Low signal-to-noise ratio at the plume height prevented detailed retrievals of particle extinction coefficient at 1058 nm. Thus, for the LR values at 1064 nm only few measurement points could be derived. This yields a LR value of 92 ± 27 sr at 1064 nm.

Description of the dataset

File name: collection of dat files.

Time Period: 22-Aug-2017

Domain: Leipzig

Variables: backscatter coefficients, extinction coefficients and depolarization ratio

5.3. PANGEA EARLINET

The PANGEA observatory of NOA in the remote island of Antikythera, is located across the travel path of different air masses, providing continuous monitoring of essential climate variables in the Eastern Mediterranean. The Aerosol Remote Sensing facility of ACTRIS (Aerosol, Clouds, and Trace Gases Research Infrastructure; actris.eu) is collecting continuous observations of aerosols and clouds since 2018.

The parameters used are collected from the Polly^{XT}-NOA lidar (part of EARLINET). The Polly^{XT}-NOA lidar is a multi-wavelength Raman-polarization system with 24/7 operational capabilities, providing vertical distributions of the particle backscatter coefficient (β) at 355, 532, and 1064 nm, the extinction coefficient (α) at 355 and 532 nm and the particle depolarization ratio (δp) at 355 and 532 nm.

With the observations, and using well known methodologies, we can separate spherical and non-spherical particles in mixed aerosol layers, towards aerosol characterization. In addition, using parameterizations based on AERONET retrievals we can estimate vertical distributions of aerosol concentrations for different aerosol species (e.g., dust, smoke, and marine) from 200 m above the ground up to ~16 km .

Description of the dataset

File name: collection of dat files.

Time Period and resolution: 2020-present,

Domain: Antikythera

Variables: backscatter coefficients, extinction coefficients and depolarization ratio

5.4. Database access

Access to the HFRI- StratoFIRE D2.3 dataset is provided via the project's Webpage. The user should go to Results tab and the select the deliverables of each work package, as demonstrated in Picture 3.