Evaluating MAPIR v5 Dust Retrievals Using EARLINET Lidars

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Introduction

The Mineral Aerosol Profiling from Infrared Radiances (**MAPIR**) v5.1 algorithm (Vandenbussche et al., 2026) uses Infrared Atmospheric Sounding Interferometer (**IASI**) satellite observations to retrieve dust concentration profiles, as well as products such as dust optical depth at 10 μm and mean dust altitude.

In this study, these products are evaluated against ground-based Lidar measurements from the European Lidar Network (**EARLINET**), using carefully selected collocations and a dust separation technique.

Data & Methodology

MAPIR v5.1 data are freely available at the Royal Belgian Institute for Space Aeronomy (BIRA-IASB) website (https://iasi.aeronomie.be/index.php/mineral-dust-aerosols).

Lidar data are derived from the **EARLINET** website (https://data.earlinet.org/earlinet/). Backscatter and extinction profiles at 532nm are selected for the evaluation.

In order to calculate the dust number concentration, **AERONET** Lv 2 data are also used (Ansmann et al., 2012).

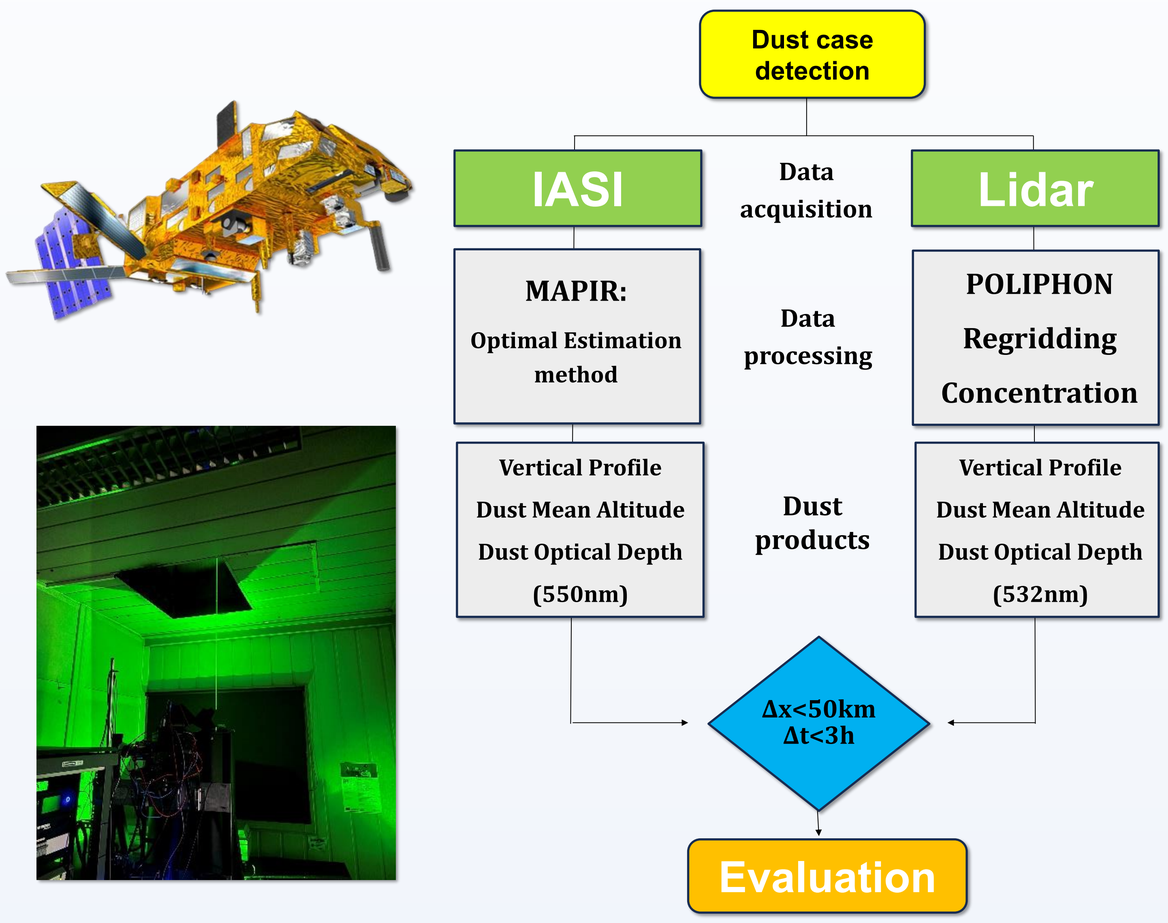

Figure 1: Flowchart of the implemented methodology.

A total of **160 collocations** between lidar and IASI are currently used for the evaluation, derived from 13 EARLINET stations. The number of collocations per station strongly depends on the lidar type and its location.

The mean distance between the instruments is 13km, whereas the mean time difference is less than 15min.

Figure 2: EARLINET stations selected for the evaluation.

Results

In the following, the dust concentration vertical profiles, mean altitude, and optical depth for total and coarse dust, derived using the one-step and two-step POLIPHON methods, are discussed.

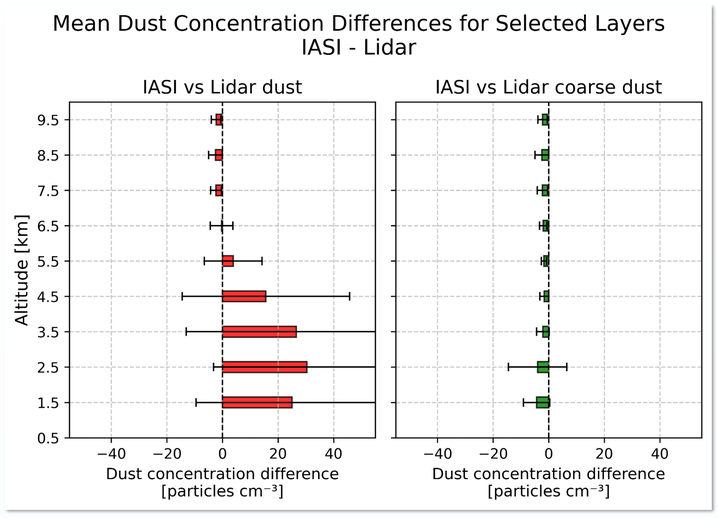

Figure 3: Vertical profile evaluation for total (left) and coarse (right) dust.

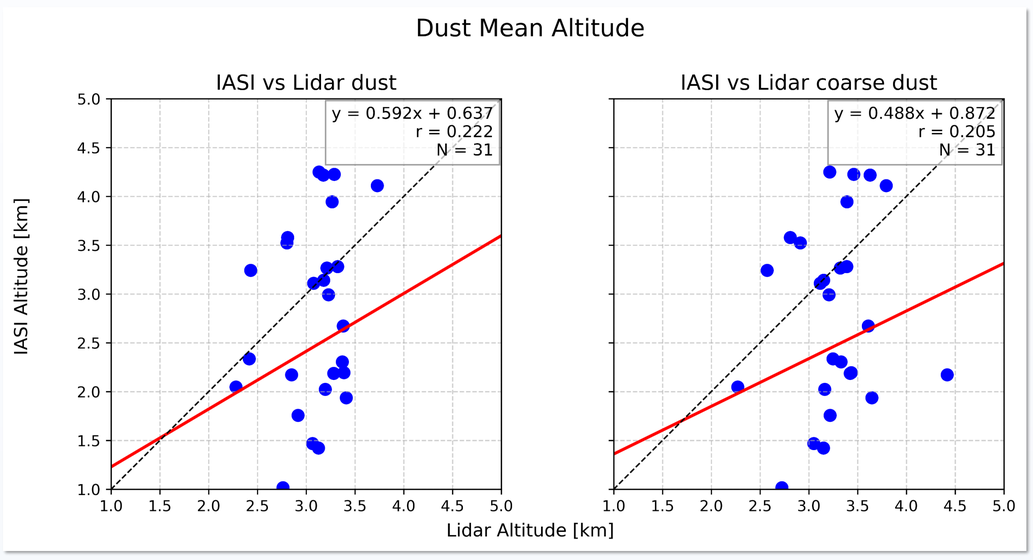

Figure 4: Dust mean altitude comparison for total (left) and coarse (right) dust.

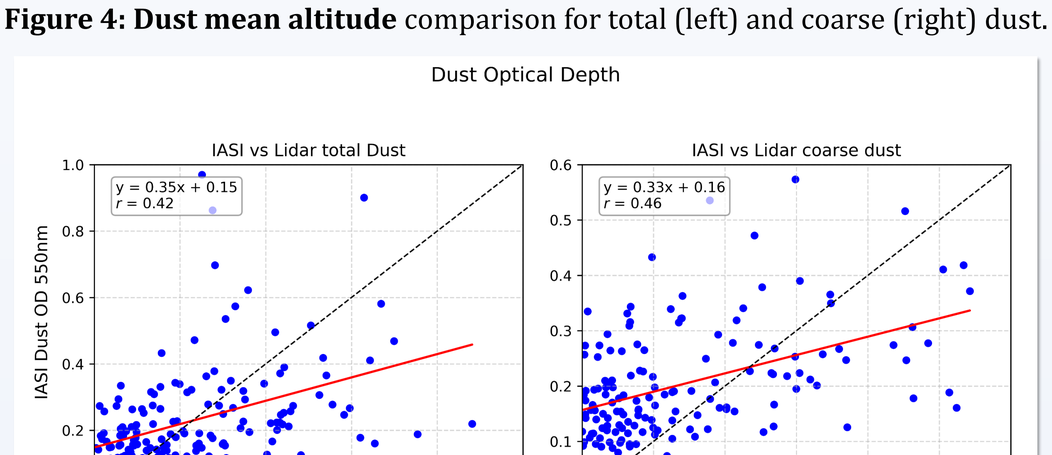

Figure 5: Dust optical depth evaluation for total (left) and coarse (right) dust.

Conclusions:

- The IASI/MAPIR dust concentration profile is much more **sensitive to coarse dust** particles. Lower altitudes show **high variability**.
- The minimum (< 2 km) and maximum (> 4 km) values of the MAPIR dust mean altitude may result from a priori assumptions and cloud pixel contamination. **No apparent differences** are currently observed between total and coarse dust.
- MAPIR tends to **overestimate** the coarse dust optical depth but correlations are satisfying.

Future:

- Identification of **additional cases**.
- **Sensitivity tests** with respect to distance, time difference, station location and various other relevant parameters.
- **Separate analysis** of cases exhibiting the best and worst correlation.

Acknowledgements

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