**Project: Aerosol Contributions in Biogenic & Anthropogenic Environments**

This study examines primary and secondary aerosol contributions at Hyytiälä Forest Station (2017-2022) using DMPS, Aethalometer (AE31 & AE33), and Time Over Land (TOL) data. It analyzes particle growth, primary emissions, and black carbon (BC) influence on aerosol properties.

Findings indicate secondary aerosols dominate, but primary emissions may be underestimated, particularly in urban areas. Seasonal trends show higher BC in autumn and winter due to heating emissions and limited dispersion. This research enhances understanding of aerosol behavior under biogenic and anthropogenic influences, aiding air quality assessment.

## Data Collection & Preprocessing

- The DMPS, BC, TOL data was retrieved from the University of Helsinki Data Cloud.

(<https://datacloud.helsinki.fi/index.php/s/anfjq4A7WJ9Wt3c?path=%2FData>)

- The relevant dataset was located in `/Data/Hyytiala/.

**Aethalometer (AE-31 and AE-33)**

<https://datacloud.helsinki.fi/index.php/s/anfjq4A7WJ9Wt3c?path=%2FData%2FHyytiala%2FAerosol%20optics>

**DMPS**

<https://datacloud.helsinki.fi/index.php/s/anfjq4A7WJ9Wt3c?path=%2FData%2FHyytiala%2FAerosol%20optics>

**APS**

<https://datacloud.helsinki.fi/index.php/s/anfjq4A7WJ9Wt3c?path=%2FData%2FHyytiala%2FAPS%20data>

**TOL**

<https://datacloud.helsinki.fi/index.php/s/anfjq4A7WJ9Wt3c?path=%2FData%2FHyytiala%2FAirmass_sources_ToL>

- Data was downloaded for each individual year (e.g., 2017-2022).

**Analysis hierarchy**

1. PSD diurnal trend plot (Hourly average) (Heat Map)
2. PSD VS TOL 4 sectors (Hourly Average) (log) (Heat Map)
3. PSD VS TOL 4 sectors/4 seasons (log) (Heat Map)
4. PSD VS BC 4 sectors (Hourly Average) log (Heat Map)
5. PSD VS BC 4 sectors (log) (Heat Map)
6. PSD VS BC 4 sectors/4 seasons (log) (Heat Map)
7. BC VS TOL sector 1 (4 seasons) (Scattered Plot)
8. BC VS TOL sector 1 (4 seasons) (log) (Scattered Plot)
9. Probability distribution Function (PSD vs TOL)
10. Particle size distribution VS TOL (Mode Fitting)
11. Particle size distribution PSD / TOL
12. Particle size distribution PSD / BC
13. Particle size distribution PSD / TOL
14. Particle size distribution PSD / BC

**Conclusion from analysis**

1. PSD diurnal trend analysis show

* Particle concentrations, higher during late afternoon in all seasons.

2. PSD with TOL analysis indicates

* Sector1 = Lowest particle concentration, than 2,3 and 4 which was expected.
* Smaller particles, 10 to 30 nm dominate across all sectors.

3. PSD with BC analysis indicates

* Sector 1 experiences lower pollution levels, Sectors 2, 3, and 4 are more affected, likely due to differing local activities.
* Pollution level is higher during autumn and winter due to heating season.

4. BC vs TOL

* Sector 1, BC concentrations rise with time over land during colder months (autumn and winter) due to increased emissions and poor dispersal.

5. PSD with TOL (Mode Fitting)

* Tareq’s code was working well as compare to Gabi's code for this mode fitting.

6. Particle size distribution PSD / TOL

* TOL (0-30 h), Small size particle (High concentration)
* TOL (30-60 h), Medium size particles (medium concentration)
* TOL (60-90 h), Big size particle (low concentration)