PM$_{2.5}$ Characterization in Pretoria, South Africa

M. Naveed Anwar
Ph.D. student at Atmospheric Sciences Grad. Group.
Ann M. Dillner
Associate Director of Analytical Research
Air Quality Research Center (AQRC)
University of California, Davis
05/18/2023
PM$_{2.5}$ Pollution at Pretoria

- Pretoria, South Africa, SPARTAN site
- Research Goals
  - Organic and inorganic composition’s variation
  - Source apportionment of PM$_{2.5}$
  - Exploration of possible policy-based solutions
OM Quantification – Approach 1

- Baseline correction
- Multi-peak fitting
- Functional groups
  - aliphatic C-H, carbonyl (C=O), carboxylic acid O-H, and alcoholic O-H, and aNH2
- OM Quantification
OM Quantification – Approach 2

- FGs prediction: multivariate PLS calibration
- Laboratory standards: atmospherically relevant compounds containing
  - Alkane CH, alcohol OH, carboxylic acid OH, and carbonyl C=O.
- Regression coefficients for different FGs and future FGs’ prediction
- OM/OC Quantification
- Elemental carbon (EC) quantification
Multi-peak fitting results – AIRSpec
Dust = [1.89Al × (1 + MAL) + 2.14Si + 1.40Ca + 1.36Fe +] 1.67Ti
MAL = (1.20K/Al + 1.66 Mg/Al + 1.35 Na/Al)/1.89
$PM_{2.5}$ components’ stacked bar plots for monthly averages (April 2021 - April 2022)
OM components’ stacked bar plots for monthly averages (April 2021 - April 2022)
Next Steps

- Reduction of the OM over-prediction
  - OM Quantification through PLS Calibration approach
  - Improving the multi-peak fitting approach
- Source apportionment of PM$_{2.5}$ at Pretoria through
  - Positive Matrix Factorization (PMF) Model
    - Using organic and inorganic speciation
    - Using FT-IR Spectra
  - Back trajectories analysis