Research brief

Summary of research paper published in Journal of Atmospheric Chemistry titled: Assessment of polar organic aerosols at a regional background site in southern Africa

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A recent paper reported GCxGC-TOFMS analysis used for the first time in southern Africa to tentatively characterise and semi-quantify ~1 000 organic compounds in aerosols at Welgegund – a regional background atmospheric monitoring station (Booyens et al., 2015). This was considered to be the largest number of ambient organic compounds tentatively characterised in atmospheric samples utilising GCxGC-TOFMS. In this new paper, ambient polar organic aerosols characterised are further explored in terms of temporal variations, as well as the influence of meteorology and sources. Organic aerosols in southern Africa are affected by globally important sources, which include (primary and secondary) biomass burning aerosols.

No distinct seasonal pattern was observed for the total number of polar organic compounds tentatively characterised and their corresponding semi-quantified concentrations (sum of the normalised response factors, ∑NRFs). However, the total number of polar organic compounds and ∑NRFs between late spring and early autumn seemed relatively lower compared to the period from mid-autumn to mid-winter, while there was a period during late winter and early spring with significantly lower total number of polar organic compounds and ∑NRFs. Relatively lower total number of polar organic compounds and corresponding ∑NRFs were associated with fresher plumes from a source region relatively close to Welgegund. Meteorological parameters indicated that wet removal during late spring to early autumn also contributed to lower total numbers of polar organics and associated ∑NRFs. Increased anticyclonic recirculation and more pronounced inversion layers contributed to higher total numbers of polar organic species and ∑NRFs from mid-autumn to mid-winter, while the influence of regional biomass burning during this period was also evident. The period with significantly lower total number of polar organic compounds and ∑NRFs was attributed to fresh open biomass burning plumes occurring within proximity of Welgegund, consisting mainly of volatile organic compounds and non-polar hydrocarbons.

Temporal variations observed could not be related to a specific influencing factor, but rather seemed to depend on a combination of the influences of source regions and meteorology. Multiple linear regression analysis substantiated that the total numbers of polar organic compounds and associated semi-quantified concentrations were related to a combination of the influence of these factors and the occurrence of wild fires within close proximity of Welgegund.

References

Booyens, W., Van Zyl, P.G., Beukes, J.P., Ruiz-Jimenez, J., Kopperi, M., Riekkola, M.-L., Josipovic, M., Venter, A.D., et al., Jaars, K., Laakso, L., Vakkari, V., Kulmala, M., Pienaar, J.J.: Size-resolved characterisation of organic compounds in atmospheric aerosols collected at Welgegund, South Africa. J. Atmos. Chem. 72, 43-64 (2015)