Tropospheric ozone in Ireland, current status and impact on vegetation

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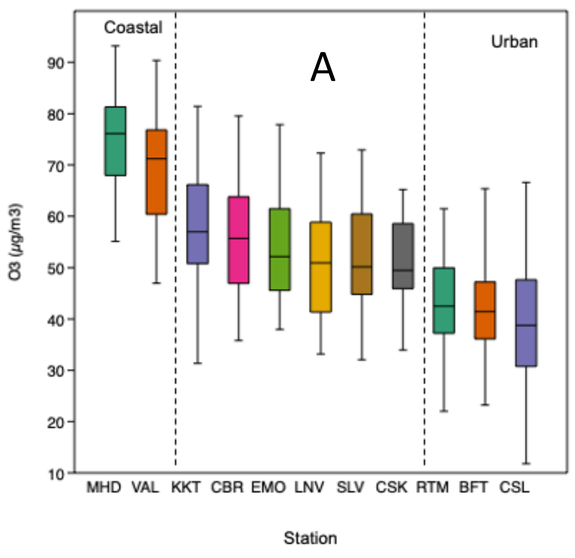
Introduction

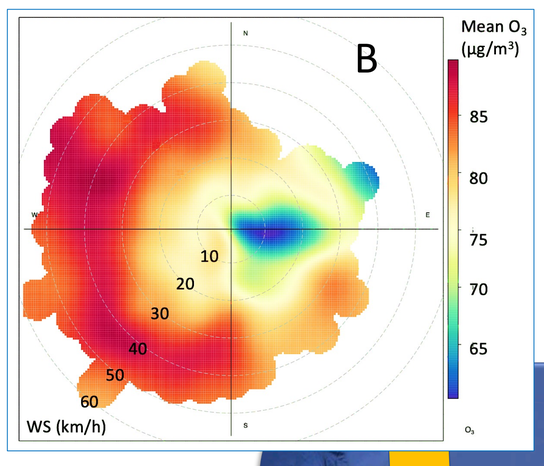
- It is well established that ground-level ozone can damage vegetation and impact ecosystem health. Nonetheless, there have been relatively few studies carried out on tropospheric ozone in Ireland.
- There are 11 monitoring stations in Ireland with tropospheric ozone data for at least 5 years, and 2 stations with exceptionally long data sets of 30+ years.
- This study aims to provide a better understanding of the changing status and potential impact of tropospheric ozone on vegetation in Ireland.

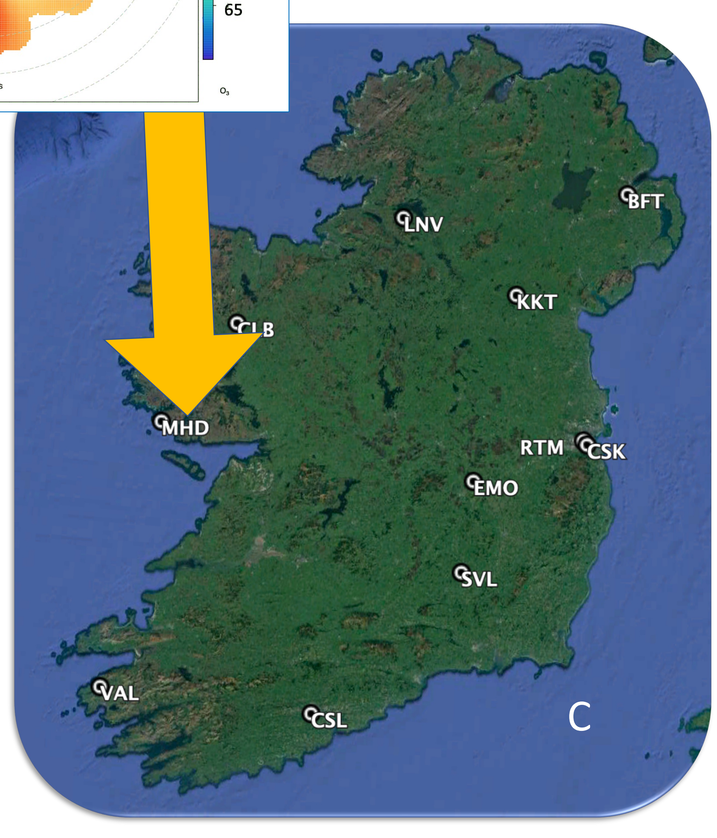
Methods

- Current concentrations were based on the 5-year period 2015–2019 (n=11) and long-term trend detection was carried out on stations with 15 years of data (n=7) for the period 2005–2019.
- The Theil–Sen slope estimator and Mann–Kendall test for significance were used for long-term trend analysis, based on monthly mean ozone concentrations.
- Polar plot were used as a visual tool linking wind speed and direction to ozone concentration.

Results







Currents Concentrations

- Annual mean concentrations ranged between 39 and 75 µg/m^3. The highest concentrations were found at western coastal stations and the lowest concentrations at urban centers (e.g., Dublin (RTM), Cork (CSL) and Belfast (BF), Figure A.)
- Coastal influence: Polar plot for Mace Head (MHD, Figure B) 2015–2019, shows the coastal influence where high ozone concentrations are associated with winds from the Atlantic

Long-term trends

- Increased ozone concentrations were observed at 6 of the 7 stations during 2005–2019 with a significant increase at 2 rural stations (LNV and EMO), and the urban station of Belfast (BFT).
- The largest increases occurred in the winter season concentrations.

Discussion

Concentrations show a similar spatial pattern to previous studies. In a study by de Kluizenaar et al. (2001) for the period 1995–1997 showed highest concentrations at coastal stations, and lowest in urban centres. Tripathi et al. (2010) showed evidence of concentrations rising up to the year 2000, after which a levelling off occurred. This leveling off appears to have stopped, with 3 stations showing significant increases.

References: De Kluizenaar, Y.; J. Aherne and E.P. Farrell (2001). "Concentrations, cumulative exposure and critical levels of ozone in Ireland." Water, Air and Soil Pollution: Focus **1**(1–2): 197–210. https://doi.org/10.1023/A:1011536023187
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