CURRENT CONCENTRATIONS AND LONG-TERM TRENDS OF TROPOSPHERIC OZONE IN IRELAND

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Introduction

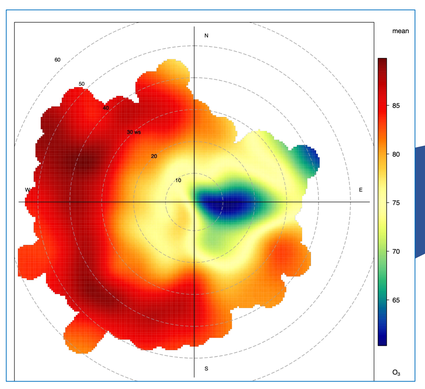
It is well established that ground-level ozone can damage vegetation and impact ecosystem health. Nonetheless, there have been relatively few studies carried out on tropospheric ozone in Ireland. There are 11 monitoring stations in Ireland with tropospheric ozone data for at least 5 years, and 2 stations 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, comparing to previous studies.

Methods

Current concentrations were based on the 5-year period 2015–2019 (n=11) and long-term trend analysis was carried out on stations with at least 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 concentrations.

Current Concentrations

- Annual mean concentrations ranged between 39 and 75 µg/m^3 (see map), which is lower than the EU average. The highest concentrations were found at western coastal stations and the lowest concentrations at urban stations (e.g., Dublin and Belfast).
- There is a yearly pattern of spring maximum for all the stations.



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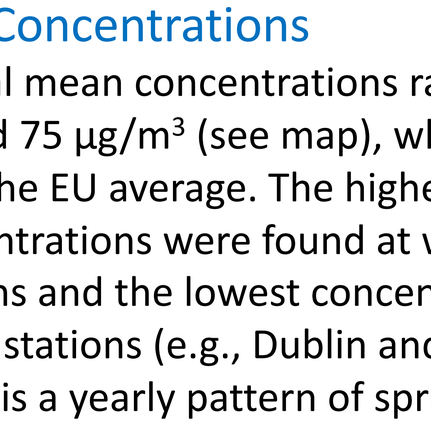

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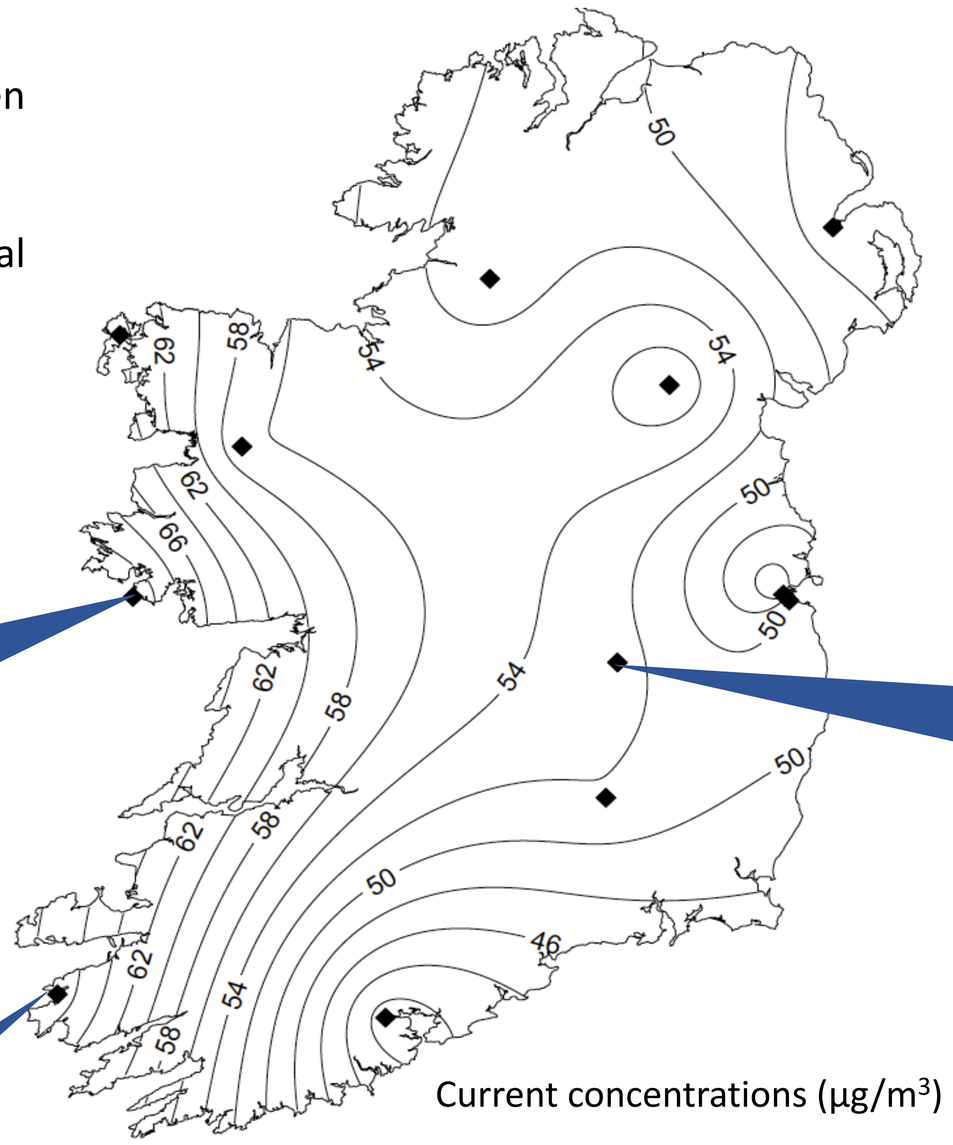
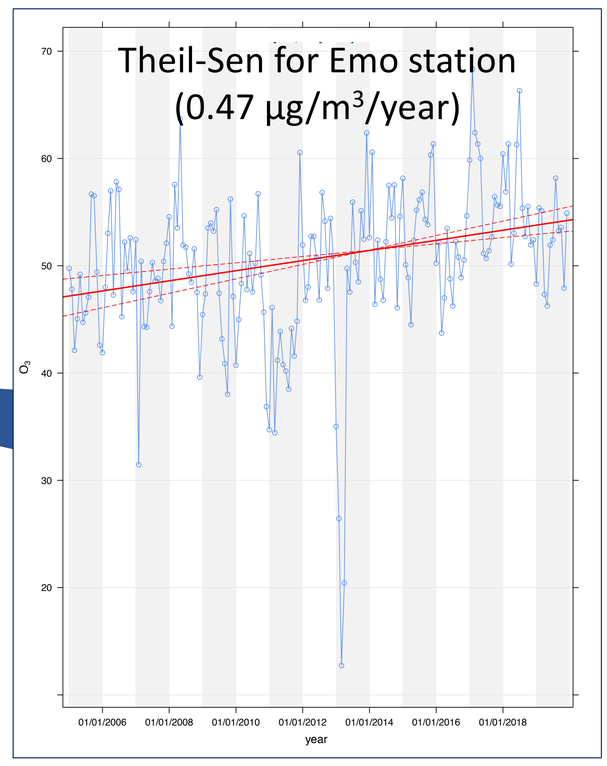


Current concentrations (µg/m^3)

Polar plots based on 5 years (2015–2019), demonstrate the coastal Influence. In general, wind originating from the direction of the ocean coincides with higher ozone concentrations.

Long-term Trends

Slight increases observed at 6 of the 7 stations over the period with a significant increase at two stations in Emo, county Laois, and Lough Navar, county Fermanagh



Discussion

Concentrations show a similar spatial pattern to previous studies. 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 in recent years, with stations showing slight increases. Coastal areas experience higher concentrations dur to lower levels of deposition velocity and higher levels of insolation. Increased titration from freshly emitted NO_x leads to lower concentrations in urban centers, especially during rush hour traffic.

Acknowledgements
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References:
de Kluizenaar, Y.; J. Aherne and E. Farrell (2001). "Concentrations, cumulative exposure and critical levels of ozone in Ireland." Water, Air and Soil Pollution: Focus **1**(1–2): 197–210.
Tripathi, O.;S. Jennings; C. O'Dowd; L. Coleman; S. Leinert; B. O'Leary; E. Moran; S. O'Doherty and T. Spain (2010). "Statistical analysis of eight surface ozone measurement series for various sites in Ireland." Journal of Geophysical Research: Atmospheres **115**(D19).