SUMMARY OF FINDINGS

STRIVE Report No. 93

Ozone levels, changes and trends over Ireland – an Integrated Analysis

Authors: Om P. Tripathi, S. Gerard Jennings, Colin O'Dowd, Liz Coleman, Keith Lambkin and Eoin Moran

Lead Organisation: National University of Ireland Galway, Ireland

---

Abstract: The work facilitated for the first time an integrated analysis of ozone concentrations over Ireland, including seasonal variations, trends and changes in ozone levels at 9 stations, over periods varying from 8 up to 20 years – based on the following data sources: the ground based ozone data network in Ireland – from EPA sites, from WMO Global Atmosphere Watch [GAW] sites, and from Lough Navar, Co. Fermanagh. Surface ozone data show a reduction at all sites except at Valentia Observatory and at Mace Head. Ground level ozone target levels and long-term objective ozone exceedences show a downward negative trend in peak values that affect human health and vegetation. Analysis was performed of ozonesonde columnar data from 1994 – 2009 at Valentia Observatory together with Brewer total column ozone and satellite ozone products. A regional climate model is used to assess future changes in ozone for the years 2006, 2030, 2050 and 2100.

Key Words: Air Quality, Surface Ozone, Ozone exposure levels, Stratospheric ozone, Predictions of future ozone levels

Background:

Tropospheric ozone is known to be an important air pollutant mainly because it has a negative impact on human health and vegetation. Although there is a network of stations, run mainly by the Environmental Protection Agency, where ground level ozone has been measured over differing time periods since 1988, there has been no coordinated effort to analyze these data with respect to seasonal variability, trends, or exposure levels. While Met Éireann, at Valentia Observatory, has a long term record of ozone profiling aloft, these data have not been systematically analysed for column ozone variations or trends. Regional influences of climate change and changing emissions on future ozone concentrations and trends over Europe and the North East Atlantic region have not been studied to date, but are assessed in this Project, through use of a regional climate model.

Key points:

- Surface ozone data from 9 stations in Ireland spanning the period from 1987 to 2007 show a reduction (negative trend) at all sites except for the coastal sites at Valentia Observatory and at Mace Head.
- Ozone exceedences set at 60 ppb for a 8 hour running mean, for the protection of human health, have never exceeded the target value of 25 exceedences per calendar year, averaged over 3 years at any of the Irish sites.
- Column ozonesonde data over the period from 1994 – 2009 has shown an increase of ~ +6.6% per decade, in reasonable agreement (~+5%) with Brewer and satellite data.
- A regional air quality – climate model was used to evaluate future ozone concentrations under the RCP6.0 emission storyline. By 2100, European scale ozone is projected to reduce by 2 ppb. Ozone concentration trends over Ireland are influenced by a combination of climate change and emission controls while those over mainland Europe are predominantly influenced by emissions By 2100, predicted ozone exceedences over Ireland are effectively nil.

Recommendations:

- A continuation of the ozone network of stations in Ireland is strongly recommended.
- A continuation of the Brewer Spectrophotometer total column ozone programme at Valentia Observatory is strongly recommended.
- A year round ozonesonde measurement programme at Valentia Observatory is also recommended.
- Regional climate modeling work should be extended to include aerosol driven radiative forcing feedbacks, in order to better predict Air Quality and Climate effects on ozone and other pollutant species.

For Further Information

Contact: Prof. Colin O'Dowd, School of Physics & Centre for Climate and Air Pollution Studies, Ryan Institute, National University of Ireland Galway, University Road, Galway, Ireland, - colin.odowd@nuigalway.ie

This report is published as part of the Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007–2013. The full report is published by the EPA and is available from http://www.epa.ie/downloads/pubs/research/air.

Publications connected to this work:

Tripathi, O. P., Jennings S. G**.,** O'Dowd, C. D., Coleman, L., Leinert, S., O'Leary, B., Moran, E., O'Doherty, S. J., and Spain, T. G., 2010. Statistical Analysis of Eight Surface Ozone Measurement Series for various sites in Ireland. *J. Geophysical Research* **115**, D19302, doi:10.1029/2010JD014040.

Coleman, L., Varghese, S., Tripathi, O.P., Jennings, S.G**.,** and O'Dowd, C.D., 2010. Regional-scale Ozone Deposition to North-East Atlantic Waters. *Advances in Meteorology* 2010, ID 243701, doi:10.1155/2010/243701.