Geophysical Research Abstracts
Vol. 20, EGU2018-5240, 2018
EGU General Assembly 2018

Impact of the extratropical jet on air quality in Europe

Marc Lemus-Cánovas (1,2), Jose M. Garrido-Perez (1,3), Carlos Ordóñez (3), Ricardo García-Herrera (1,3)

(1) Instituto de Geociencias (IGEO, CSIC-UCM), Madrid, Spain, (2) University of Barcelona, Climatology Group, Barcelona, Spain, (3) Universidad Complutense de Madrid, Departamento de Física de la Tierra y Astrofísica, Madrid, Spain

The present study focuses on the relationship between the North Atlantic eddy-driven jet stream and European ground level ozone (O_3) during summer. We have followed a "circulation-to-environment" approach to investigate how the spatial variability of the jet can induce changes in the O_3 concentrations over different regions. We have also used an "environment-to-circulation" approach which first categorises the environmental variable (surface ozone) and then characterises the jet positions prevailing under specific environmental conditions (days with high O_3 concentrations, defined as those above the 95th percentile of the summer distribution).

The daily latitudinal position of the jet has been identified as the latitude where low level wind speeds maximise over the North Atlantic. The jet latitudes are then pooled into three preferred positions: southern (south of 44°N), centre (between 44°N and 53°N) and northern (north of 53°N). The surface O_3 dataset includes 15 summers with daily ozone data over the European continent. These ozone data have been previously regionalised through the application of a k-means algorithm, yielding 9 separate regions: the British Isles, North-Central Europe, Northern Scandinavia, the Baltic countries, the Iberian Peninsula, Western Europe, South-Central Europe, Eastern Europe and the Balkans.

Among these regions, the strongest impact of the jet has been found for Great Britain (BRIT) and the Iberian Peninsula (IBE). The O_3 concentrations in the two regions respond differently to the jet position, with the northern jet position generally favouring elevated ozone in IBE (5 ppb higher than average) and the southern jet position yielding high ozone in BRIT (4 ppb higher than average). In addition, we have characterised the jet positions and synoptic patterns prevailing under days with high O_3 extremes. Ozone extremes in BRIT are often found for the southern and central positions of the jet, and they coincide with high-latitude anticyclones which block the typical westerly circulation. Ozone extremes in IBE are mostly found for the northern and central positions of the jet, and concur with extended ridges and positive anomalies of the Z500 field (geopotential height at 500 hPa).