



The impact of Circulation Weather Types in Urban Air Quality in Portugal

Ana Russo and Ricardo Trigo

Universidade de Lisboa, IDL, Lisbon, Portugal (acrusso@fc.ul.pt)

It is now clear that emissions of the main air pollutants in Europe have declined significantly in recent decades (EEA, 2011). Nevertheless, many European countries (including Portugal) do not expect to comply with one (or more) pollutant emission ceilings and to air quality limit values, especially for particulate matter (PM), ground level ozone (O₃) and nitrogen dioxide (NO₂) (EEA, 2011). Consequently, and considering that air pollution (AP) plays a role as a major cause of human mortality and morbidity, exposure to pollutants remains a key environment-related health concern (EEA 2010). Thus, and to comply with the new limits, new strategies must be applied for air quality management.

The main objective of this work is to present an objective classification of pre-defined and widely used CWTs affecting Portugal and, based on the most relevant patterns, provide a framework that is useful to characterise the occurrence of pollution episodes, namely its inter-annual and intra-annual variability, as well as the occurrence of extreme events.

CWTs were determined using the simple Geostrophic approximation according to the methodology proposed by Trigo and DaCamara (2000). The interannual variability of the resulting CWTs was determined for the period with AP data (2002–2010) and the number of days for each CWT and season for the same period was accounted for. During this period, the most frequent CWTs were found to be the anticyclonic (A), the north (N) and the northeast (NE) types, accounting respectively for 34.7%, 10.9% and 14% of the days. However, higher-than average episodes tend to occur associated predominantly with situations characterized by a few less frequent CWTs, namely easterly (E), northeasterly (NE) and southeasterly (SE) types (that together contributed to less than one fourth of all observed days), are the ones which are associated to higher median and maximum concentrations of the three pollutants. Results obtained highlight the existence of strong links between the interannual variability of daily air quality and interannual variability of CWTs. Additionally, three specific extreme episodes were assessed in more detail including a comparison with results obtained with the HYSPLIT system model. In general, all the pollutants' extreme events occur associated predominantly with situations characterized by an Eastern component and advection of dry air masses.