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The influence of scales of atmospheric motion on air pollution over Portugal

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Air pollution is determined by the combination of different factors, namely, emissions, physical constrains, meteorology and chemical processes [1,2,3]. The relative importance of such factors is influenced by their interaction on diverse scales of atmospheric motion. Each scale depicts different meteorological conditions, which, when combined with the different air pollution sources and photochemistry, result in varying ambient concentrations [2]. Identifying the dominant scales of atmospheric motion over a given airshed can be of great importance for many applications such as air pollution and pollen dispersion or wind energy management [2].
Portugal has been affected by numerous air pollution episodes during the last decade. These episodes are often related to peak emissions from local industry or transport, but can also be associated to regional transport from other urban areas or to exceptional emission events, such as forest fires.
This research aims to identify the scales of atmospheric motion which contribute to an increase of air pollution. A method is proposed for differentiating between the scales of atmospheric motion that can be applied on a daily basis from data collected at several wind-measuring sites in a given airshed and to reanalysis datasets. The method is based on the daily mean wind recirculation and the mean and standard deviation between sites. The determination of the thresholds between scales is performed empirically following the approach of Levy et al. [2] and also through a automatic statistical approach computed taking into account the tails of the distributions (e.g. 95% and 99% percentile) of the different wind samples. A comparison is made with two objective approaches: 1) daily synoptic classification for the same period over the region [4] and 2) a 3-D backward trajectory approach [5,6] for specific episodes.
Furthermore, the outcomes are expected to support the Portuguese authorities on the implementation of strategies for a sustainable management of environmental risks.

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