An improved PSI index for assessing air quality

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ABSTRACT

The Pollutant Standards Index (PSI) has been developed by the EPA to provide accurate, timely and easily understandable information about daily levels of air pollution. The EPA uses for the PSI the measurements of five major pollutants for which it has established National Ambient Air Quality standards: PM_{10}, SO_2, CO, NO_2 and O_3.

A software tool has been developed in order to calculate the PSI for the city of Athens for all five pollutants. Daily concentration data cover a period of 15 years and a space of 10 stations all around the city. These concentrations are expressed as a number on a scale of 0 to 500, according to the methodology of EPA. The PSI scale has been altered in order to depict the European standards, which are stricter than the US' similar index.

The results have been analyzed per year, per station and per pollutant. Besides, an average pollutant PSI has been calculated for the whole city as the median value of the indices of all stations.

However, the PSI doesn't take into account the adverse effects associated with combinations of pollutants -it is determined entirely by the pollutant with the highest relative concentration. For this reason, an aggregation function has been used in order to provide an overall pollution index, a more representative picture of air quality. The function has been built according to the concept of iso-pollution surfaces, in a way not to overestimate or underestimate the quality of the air.

The intervals on the scale relate to potential health effects of the daily concentration of each of these five pollutants. Thus, the PSI of each pollutant can be considered as a "welfare loss function", a common metric that can be aggregated. The calculated index remains a PSI number that can be corresponded to one of the standard air quality categories. Moreover, the overall index can be used to compare air quality over time and space.

The results of the above analysis in Athens, showed that PM_{10}, followed by ozone, is the most dangerous pollutant. Furthermore, the overall aggregated index is significantly higher than the one resulted by the EPA's method as the maximum of the five pollutants' PSI.
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