Ozone estimation model in Portugal: urban and rural behaviour

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Assessment of ozone levels is essential especially in urban-industrialized areas (Melkonyan and Kuttler, 2012). For this purpose, an ozoneestimation model was developed using data from the period 2004-2010 for a Lisbon urban site (Entrecampos monitoring station) and a rural site of northeast Portugal (Douro Norte monitoring station), based on a generalized linear model with a log-link function.The independent variables used for studying its contribution to ozone levels were NO, NO_2, NO_X, NO/NO_2, NO_2/NO_X, SO_2, PM_{10}, temperature range(T), pressure (P), relative humidity (RH), wind speed (WS), wind direction (*sin*WD and *cos*WD), solar radiation (SR), dew point temperature (Dew) and precipitation (Precip).

For the rural site, the percentage of variance in ozone concentration explained by other pollutants introduced in a stepwise regression model is relatively low, being the meteorological variables such as wind direction, the factors that explain most of the variance (41.7 %). Therefore, long-range transport, the higher concentration of biogenic volatile organic compounds in this mountainous area and the local geography may play a key role at this site. In the urban site, most of the variance is explained by the NO_2/NO_X ratio (59.5 %), and it can be regarded as the dominant precursor of ozone concentration in this areas.

The ozone concentration values obtained by the estimation equation in the urban station (Fig. 1a) fit satisfactorily with the concentrations measured in the year 2013. Despite the difficulty in predicting extreme values of the regression models, the proposed model appears to be able to estimate the most ozone extreme events in this monitoring station, as well as the ozone minimum values. The average absolute error of the estimation for the year 2013 was 9.0 µg m^{-3} and 83.6 % of the absolute errors were less than 10 µg m^{-3}.

As it can be observed in Fig. 1b, the fit of the ozone estimated concentrations registered during the year 2013 at the rural background monitoring station is not as fine as in the case of the urban site due to the less variance in ozone concentration explained by the independent variables. Even so, the seasonal variation of ozone concentration was captured successfully by the model and the estimated ozone extreme events are seen to agree quite closely with the observed concentrations, but ozone minimum values seem to be a little overestimated. The average absolute error of the estimation for this station was 10.2 µg m^{-3} for the year 2013, whereas 78.4 % of the absolute errors were less than 10 µg m^{-3}.

Melkonyan, A. and Kuttler, W.(2012) *Atmos. Environ.***60**, 316-326.

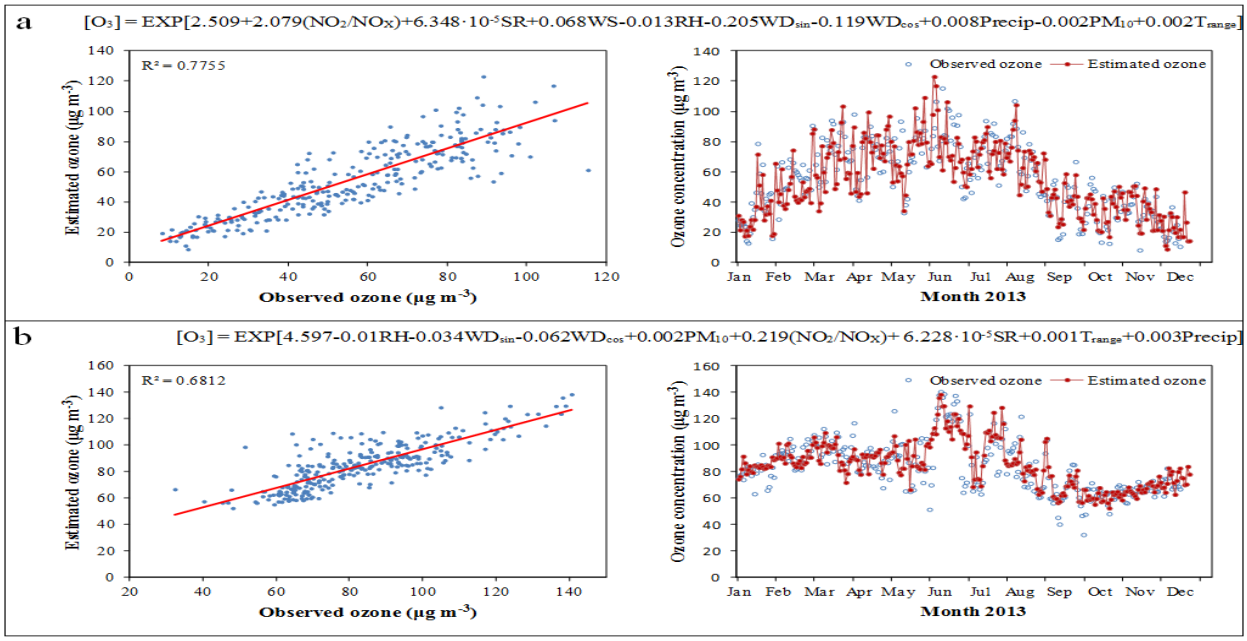

Fig. 1.Observed and estimated values of ozone concentration provided by the generalized linear modelestimation equation for the year 2013 in Entrecampos monitoring station (a) and Douro Norte station (b).