

MOROCCO

Introduction

Casablanca is the biggest city in Morocco. It's located at 7,7° West and 33,6° North. Its climate is soft.

Casablanca is a city which has evolved very quickly, its automobile park represents almost 50% of the national park and its industry represents 60% of the whole national industrial activity. The number of inhabitants in Casablanca is now about 4 millions. But each day, there is many cars and trucks which enter to Casablanca and many individuals who come to the city, from other small cities, for their work. This situation, with others, made of Casablanca a locality very polluted. Obviously, this pollution can affect the measurement accuracy.

Casablanca is also a coastal city and breeze is a mechanism which attenuate the pollution concentration in the city.

In Casablanca, the Ozone measurement began on 1969. Until now, three instruments have been used for that purpose: Dobson (1969-1989); Brewer MKII (1989-1993); Brewer MKIII (2000-...). Unfortunately, all over this period, no calibration test has been done.

Measurements

Dobson period (1969-1989);

With this instrument, measurements have been done during the zenith period, once per day. But, during the week-ends and days off and days with an important cloud cover, measurements didn't have been done.

Brewer MKII period (1989-1993);

During this period, measurements have been performed during two hours (12-14 o'clock), because the instrument is automatic. Probably measurements are more accurate at least if the instrument is well calibrated. The measurements have been performed as above.

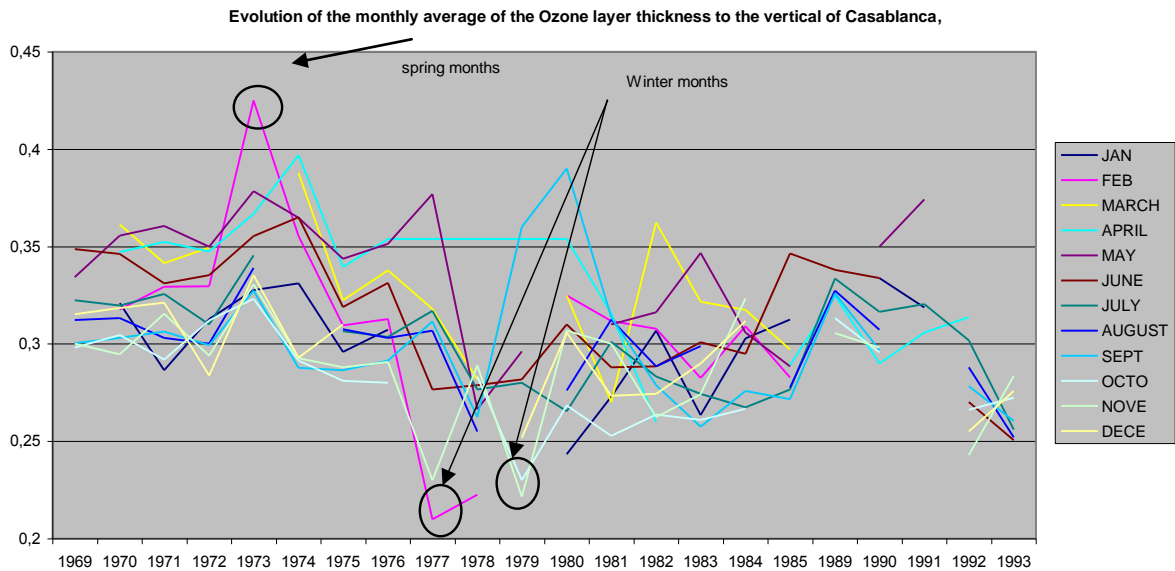
Brewer MKIII period (2001-...);

This period began on late 2000. The instrument measures the SO₂ concentration and the UV radiation also. The measurements are continuous and it's an easy to use instrument. Obviously it keeps the same limitations as its ancestor.

Missing data and data quality

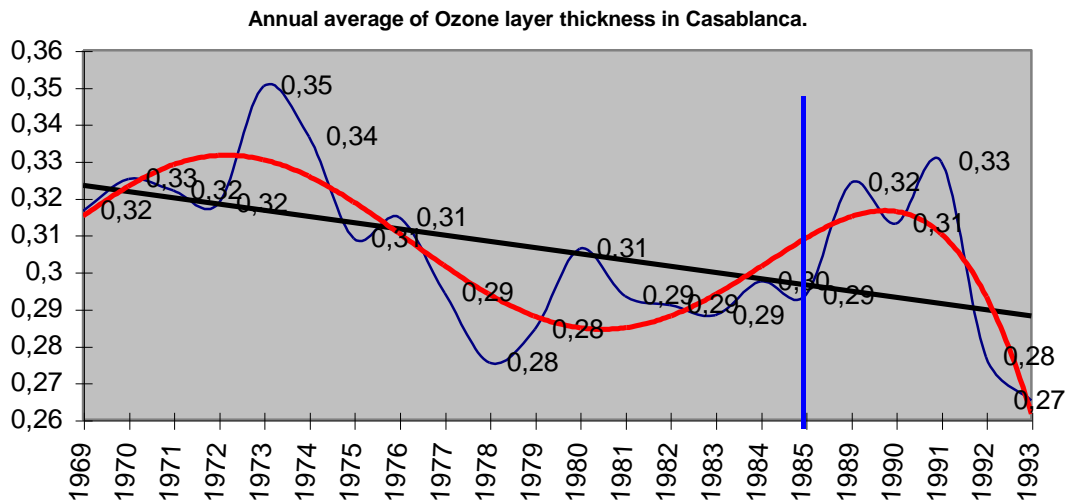
The missing data reflect the instruments availability and, in the sense explained above, the operating mode; These lacks are numerous in Casablanca during the winter season. There is many months indeed where no data has been recorded.

Data quality reflects the instrument calibration. In this respect, some data are abnormally low or abnormally high. As examples, data for February 1977 and October and November 1979 ozone layer thickness reached, respectively, 210, 221 and 230 DU, and during February 1973 it reached 425. Web distributed maps, show that, during these periods, data are almost normal; Thus, unless these data represent a local phenomenon which had not been observed by satellite and other terrestrial observing systems, it can be considered as, at least, suspect.



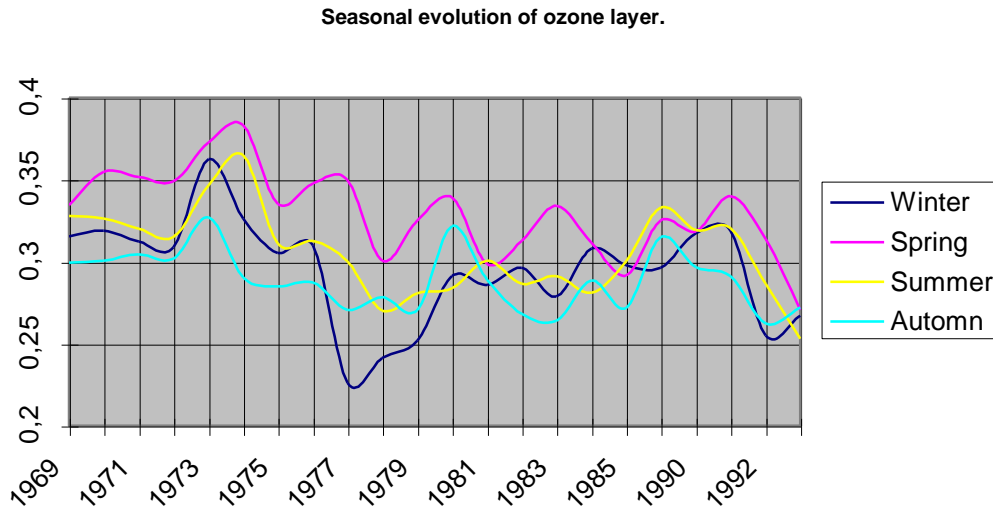
Evolution of the annual ozone layer to the vertical of Casablanca.

Annual Ozone layer thickness to the vertical of Casablanca, has two characteristics; The first is its general decay and the other is its bimodal shape. These two characteristics are made evident by the two trends put in the figure below. The other things that one has to mention are the years with missing data (1986-1988) and years with brewer instrument (1989-1983) which are separated from the other with the blue vertical bar in the figure below.



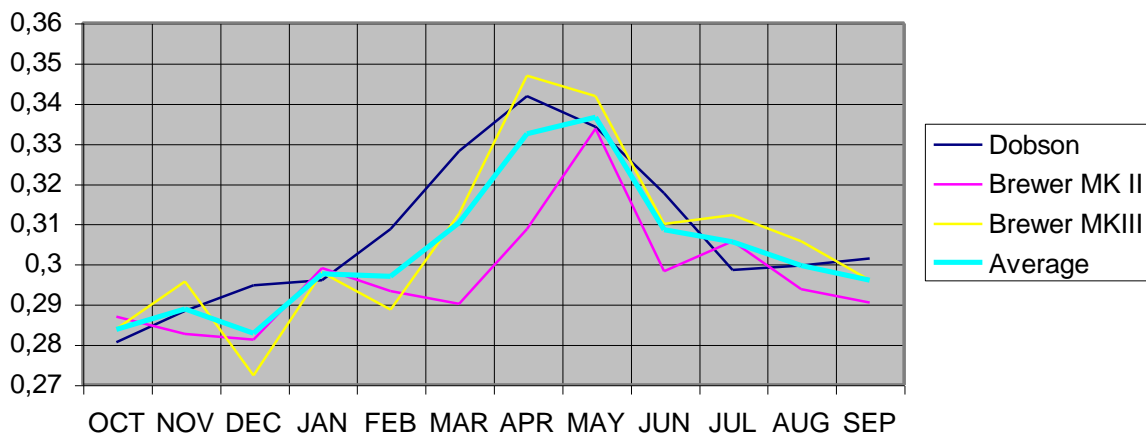
Seasonal evolution of ozone layer to the vertical of Casablanca

In general, Spring is the season where ozone is at the highest level and autumn is the season where it is at its lowest level. There is, however, some years where winter is the lowest level; These years coincide with the years mentioned above as years with some suspect data in winter months. The bimodal shape is visible also in these curves.



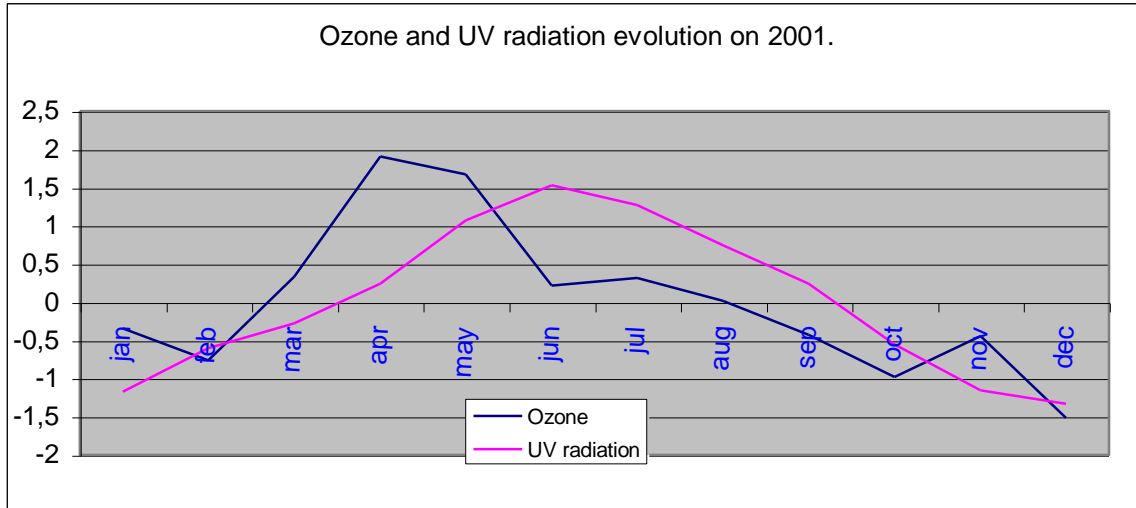
Annual rhythm of the monthly evolution of the ozone layer to the vertical of Casablanca.

The annual rhythm, month by month, shown in the figure below, shows that there is an increase in the ozone layer between October and May and a decrease between May and September.



UV radiations

The Brewer MK III measures also the UV radiations; The figure below, presents the monthly evolution of ozone and the UV radiation during the year 2001. The UV radiation's curve is similar to direct radiation, i.e., it increases during the summer and decreases during the winter. What is curious is the positive correlation between ozone and UV radiation.



Conclusion

As a conclusion, there is a long period of record of ozone in Casablanca. These records have some suspect data, but when monthly or annual averages are considered, the data show some consistent shapes with other localities. The decrease observed is also consistent with decreases observed elsewhere.

In the research center there is many trial-studies to evaluate the impact of weather parameters on health, but we never tried to use ozone layer thickness as a predictor because records aren't continuous or don't coincide with clinical data.

Other activities related to Ozone.

Each year, since the creation of the annual anniversary of the ozone layer, the Moroccan meteorological Service participate to the radio programs in order to promote the public awareness of the environmental effects of the emissions of controlled substances and other substances that deplete the ozone layer.

Other activities related to the industrial sector will be also presented.
