Satellite derived total column ozone climatology over West and East Bulgaria (a contribution to the GMES initiative)

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Introduction

The atmosphere ozone is the most important absorber of UV-B radiation and especially in the shorter wavelengths. Many applications need information on the ozone distribution. For example, TV-media, environmental and public health authorities need this up-to-date information to early warn people against health risks since low total column ozone implies increased ground-level UV-B radiation, as it could be biologically harmful one.

The total ozone maps by satellite data reflect the extremely high variability of the ozone content in time and space. For instance, Fig. 1 impressively demonstrates that there are strong gradients in total ozone on horizontal scales of only a few hundred kilometers.

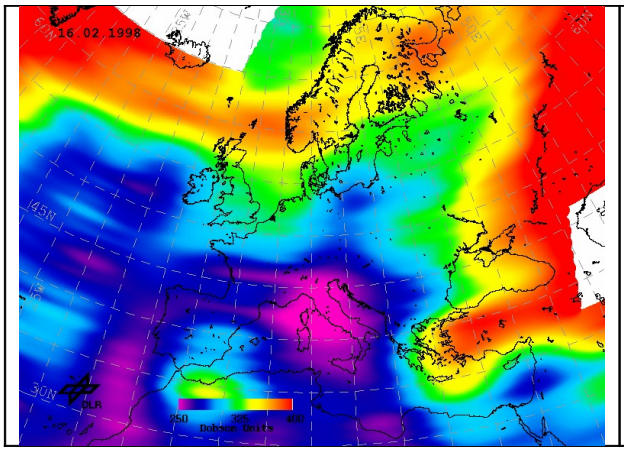

Fig. 1.

Fig. 2.

Objectives

The present paper concentrates on the study of satellite total ozone data over Sofia and Varna that can be considered representative of West and East Bulgaria and to present their climate characteristics. The ozone data over Bulgaria, derived by the satellite total ozone column measurements from 1979 through 2009 show that behavior of total ozone changes during the studied period is enough complicated.

Satellite's sensors data.

A big amount of the data comes by the ESA's Global Ozone Monitoring Experiment (GOME/GOME2), launched on the ERS-2 satellite and by the SCanning Imaging Absorption Spectrometer for Atmospheric Cartography (SCIAMACHY) sensor, at the European platform ENVISAT (Fig.2), providing global coverage. These instruments have been joined by the Ozone Monitoring Instrument (OMI). The SCIAMACHY is a spectrometer that maps the air over a very wide wavelength range which allows detection of trace gases, ozone and related gases, clouds and dust particles throughout the atmosphere. It works by measuring sunlight, transmitted, reflected and scattered by the Earth's atmosphere or surface in the ultraviolet, visible and near infrared wavelength region.

Thanks to the Holland colleagues courtesy we were supplied with 30 years period satellite ozone data about Sofia and Varna.

Results

In Fig. 3 and 4 calculated annual average total ozone column magnitude runs about Sofia and Varna for the period of 1979-2009 and derived corresponding moving averages trend-lines are shown.

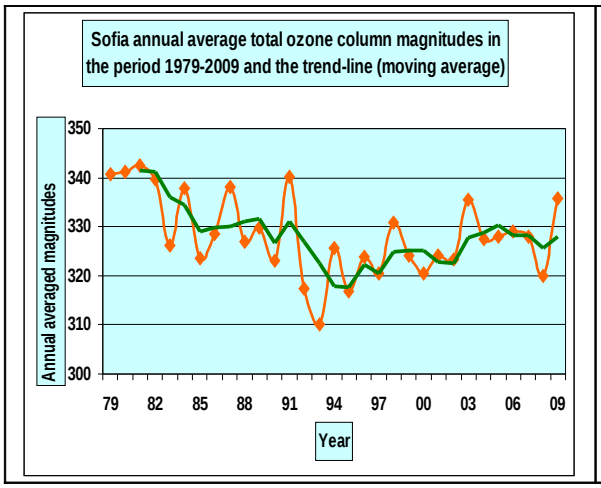

Fig. 3.

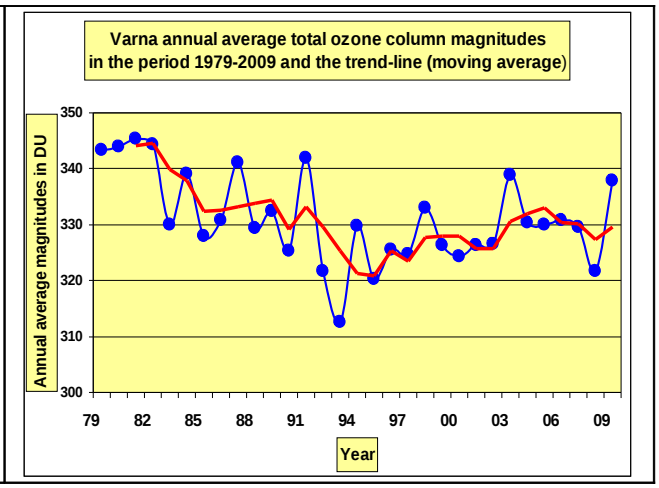

Fig. 4.

Compared annual average total ozone column magnitude runs about Sofia and Varna for the same period are exhibited at the Fig. 5. The seasonal averaged total ozone column runs about West and East Bulgarian sides are demonstrated in Fig. 6.

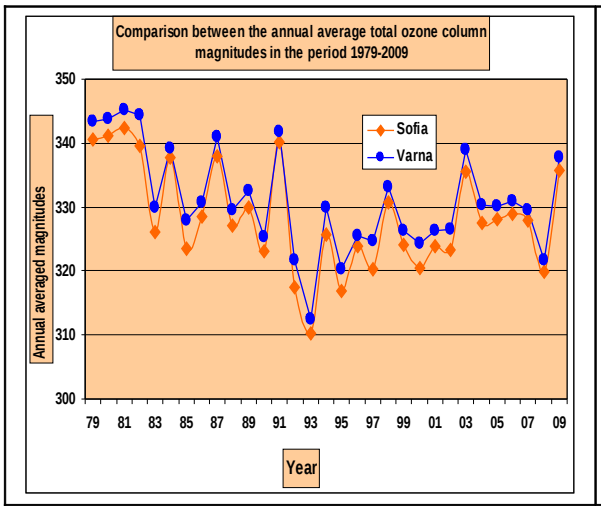

Fig. 5.

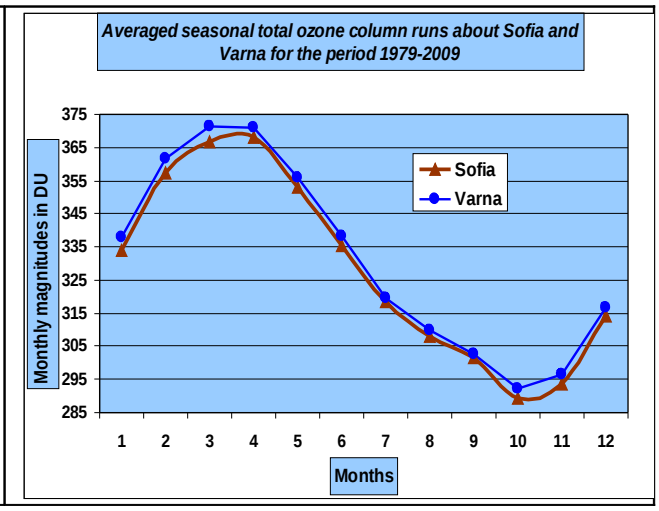

Fig. 6.

Conclusions

It has been derived the climatic characteristics of the total ozone column (TOC) over Bulgaria. It is seen (Fig.3 ÷ 6), that the annual averaged TOC magnitudes about Sofia and Varna, for the period 1979-2009, are inside the limits 310-345 DU. The behaviour of the trend-lines shows that till 1995 there are a stable decreasing tendencies for West and East Bulgaria and the slight stable increasing tendencies are noted since 1996 for both. The seasonal runs are similar for West and East Bulgarian sides. In all cases the Varna magnitudes exceed the Sofia ones with 1 %.

References

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2. G. Kiesewetter, B.M. Sinnhuber, M. Weber and J. P. Burrows; Attribution of stratospheric ozone trends to chemistry and transport: a modeling study; Institute of Environmental Physics, University of Bremen, Otto-Hahn-Allee 1, 28359 Bremen, Germany

Acknowledgments

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