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Ozone Column Retrieval from Solar UV Irradiance Measurements in Bulgaria

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Recently, the local and regional changes of the total column ozone have been some of the popular

research topics in the atmosphere. The ozone is one of the most important constituents in the atmosphere

and it is the only gas that strongly absorbs the solar radiation at the ultraviolet end of the spectrum. The

stratospheric ozone protects the Earth's surface from the harmful solar ultraviolet radiation (especially

UV-B) and plays an important role in controlling the temperature structure of the stratosphere. For analysis of the atmospheric ozone dynamics we have used measurements and data for the total ozone content (TOC) over Stara Zagora (42˚ 25' N, 25˚ 37'E) , Bulgaria by the ground-based spectrophotometer Photon.

The instrument sensor is a Seya-Namioka monochromator with concave holographic diffraction

grating. The spectrophotometer measures the direct sun light in the range 290-360 nm, with 1 nm

resolution. The spectral calibration has been performed in laboratory conditions by a mercury lamp with

narrow emission bands. In absolute units the instrument has been calibrated by comparison to the

spectrophotometer Brewer within the terms of the International calibration campaign in Thessaloniki,

Greece (1997) and in Andenes, Norway (2002).

The algorithm, which calculates the total ozone content, involves a combination of measured solar

radiation intensities, attenuating according to the Bouguer - Lambert's law. The irradiances ratio at two

wavelengths, one strongly absorbed by ozone (UV-B), and one outside the ozone absorption range in

UV- A, is most sensitive to the ozone total column amount, and only slightly affected by turbidity and

cloudiness. In order to compute TOC, about 30 wavelengths in the interval 300 – 340 nm were used.

The data of the ozone column, retrieved from the Photon ground-based measurements in the time period 1999 – 2005 are presented and compared with satellite data. The TOC data show seasonal variations – maximum in the spring and minimum in the autumn. There hasn't been a statistically significant long-term trend in the ozone column in the last two years. Similar results are shown by Varotsos for latitude 62.5˚ S and by Semenov for latitude 42.6˚ N. A good agreement between our TOC ground-based data and the Global Ozone Monitoring Experiment (GOME) and TOMS Earth Probe satellite-borne ones is obtained. The comparison of the Photon to GOME total ozone shows a seasonal dependence of the differences between the ground-based and the satellite data.

The ozone changes for different months in this period are examined. The biggest fluctuations of the

TOC monthly average values are in February and the smallest – in July.

The relation between the UV radiation and TOC is investigated. Clear negative relationship is recognized between the total ozone and the irradiance of the 305 nm wavelength. The opposition of the two variables is significant ($r = -0.68 \pm 0.18$) at 98 % confidence level.