

TOTAL OZONE OVER STARA ZAGORA, BULGARIA (2005-2013)

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Abstract: An analysis of the total ozone content (TOC) over Stara Zagora, (42°25' N, 25° 37' E), Bulgaria in the period 2005-2013 is presented. For this purpose data from the Ozone Monitoring Instrument (OMI) on board the NASA EOS-Aura satellite are used.

The annual TOC variations in this period are shown. These variations are expressed by an abrupt maximum in the spring and a gently sloping decrease in the autumn. The total ozone behaviour by its monthly mean values is presented. From 2005 to 2013 a slight decrease in total ozone over Stara Zagora is observed. The monthly TOC variations for this period are presented too. April is the month of highest ozone content : 362 DU (Dobson Unit). The lowest TOC value is in November : 286 DU. The investigation of the seasonal TOC variations show that the highest ozone content is in the spring (March-April-May) : 354 DU. The lowest ozone value is in the autumn (September-October-November) : 293 DU.

ОБЩО СЪДЪРЖАНИЕ НА ОЗОНА НАД СТАРА ЗАГОРА, БЪЛГАРИЯ (2005-2013)

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Ключови думи: Общо съдържание на озона (ОСО), годишен ход на ОСО, спътникови измервания.

Резюме: Представен е анализ на общото съдържание на озона (ОСО) над Стара Загора, (42°25' N, 25° 37' E), България в периода 2005-2013 г. За тази цел са използвани данни от Ozone Monitoring Instrument (OMI) на борда на спътника NASA EOS-Aura.

Показани са годишните вариации на ОСО в този период. Тези вариации се изразяват със стръмен максимум през пролетта и плавно намаление през есента. Представено е поведението на озона чрез неговите средномесечни стойности. От 2005 до 2013 г. се наблюдава леко намаление в общото съдържание на озона над Стара Загора. Представени са също месечните вариации в ОСО за този период. Април е месецът с най-високо съдържание на озона: 362 DU (Добсънова единица). Най-ниската стойност на ОСО е през ноември: 286 DU. Изследването на сезонните ОСО вариации показва, че най-високо озонно съдържание има през пролетта (март-април-май): 354 DU. Най-ниската стойност на озона е през есента (септември-октомври-ноември) : 293 DU.

Introduction

Ozone is an important atmospheric constituent, which is formed from the photodissociation of molecular oxygen mainly in the stratosphere. It absorbs the part of solar radiation that is deleterious to biological life on the Earth. The ozone in the stratosphere acts a protective layer to prevent UV radiation reaching the Earth's surface [1]. The role of the ozone for the thermal balance and the temperature structure of the atmosphere is important because it is a heater of the stratosphere, absorbing the UV radiation, a trace species and a major participant in the photochemical processes. Therefore, the monitoring of the ozone amount in global scale is considered nowadays a task of primary significance for the life of our planet.

For this purpose the Global Atmosphere Watch (GAW) network has been created to monitor the total ozone by a set of ground-based instruments. Simultaneously, several projects such as Total Ozone Mapping Spectrometer (TOMS), Global Ozone Monitoring Experiment (GOME), SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY (SCIAMACHY), Ozone Monitoring Instrument (OMI) etc. investigate the ozone from space.

Instruments and methods

This paper presents the total ozone column (TOC) behaviour over Stara Zagora, (42°25' N, 25° 37' E), Bulgaria in the period 2005-2013. The ozone dynamics is investigated by using data from the Ozone Monitoring Instrument (OMI) on board the NASA EOS Aura spacecraft.

Ozone Monitoring Instrument flies on the Aura satellite since July 2004. OMI is a nadir-viewing wide-field-imaging spectrometer, that measures the solar radiation backscattered by the Earth's atmosphere and surface. It employs hyperspectral imaging in a push-broom mode to observe solar backscatter radiation in the visible (350-500 nm) and ultraviolet (270-380 nm) with a spectral resolution of about 0.5 nm. The 114° viewing angle of the telescope corresponds to a 2600 km wide swath on the surface, which enables measurements with a daily global coverage.

Two algorithms, OMI-TOMS and OMI-DOAS (Differential Optical Absorption Spectroscopy), are used to produce OMI daily total ozone datasets. OMI is continuing the TOMS record for total ozone and other atmospheric parameters related to ozone chemistry and climate [2,3].

Data analysis and results

Fig.1 shows the annual TOC variations in the period 2005-2013 by data of OMI. These variations are expressed by an abrupt maximum in the spring and a gently sloping decrease in the autumn. This ozone seasonal course doesn't correspond to the solar radiation energy distribution throughout the year. It is also different from the course of other parameters, such as temperature, humidity, air pressure, which follow the course of the solar radiation with a certain delay at all latitudes.

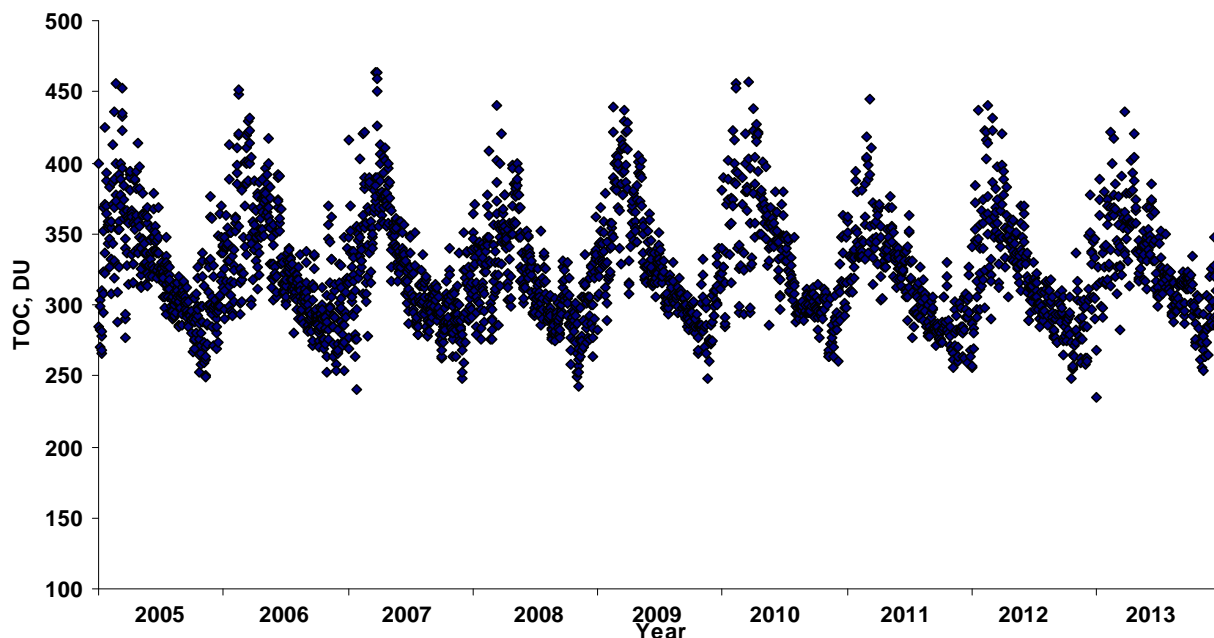


Fig. 1. Day to day variation in TOC, measured by OMI during 2005-2013 period over Stara Zagora

The total ozone behaviour by its monthly mean values is presented in Fig.2. The highest TOC maximum : 390 DU (Dobson Unit), is registered in March 2009, while the lowest one (350 DU) – in May 2008.

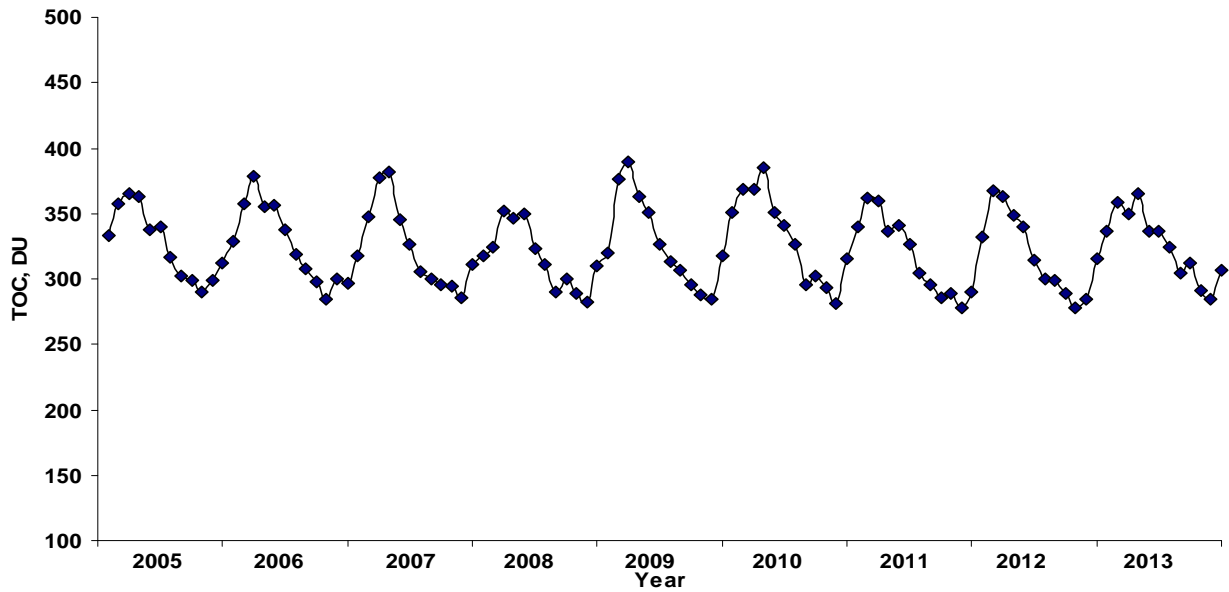


Fig. 2. Total ozone behaviour (monthly mean values) in the period 2005-2013 over Stara Zagora

Fig. 3 presents the monthly TOC variations over Stara Zagora for the considered period. From 2005 to 2013 a slight decrease in total ozone over Stara Zagora is observed. The linear trend is negative: (- 3.6%).

- April is the month of highest ozone concentration : 362 DU.
- The lowest TOC value is in November : 286 DU.

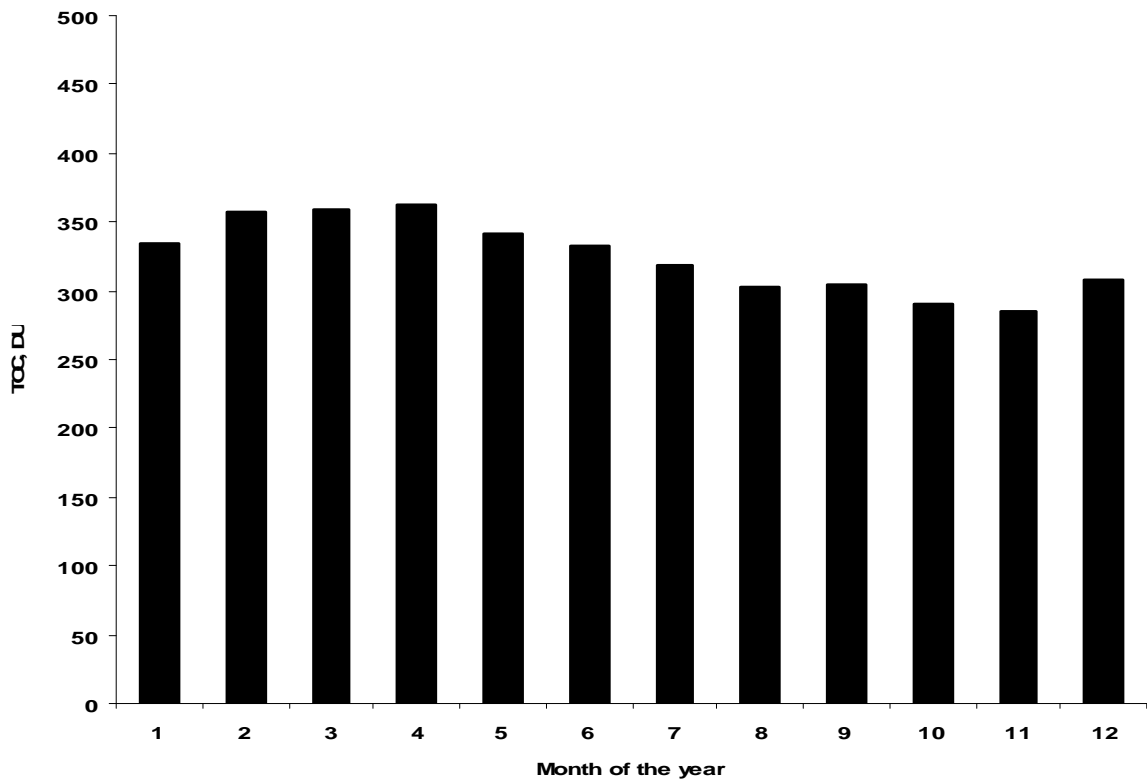


Fig. 3. Monthly mean ozone values for the period 2005-2013 over Stara Zagora

An attempt is made to find the seasonal variations of ozone concentration over Stara Zagora using the OMI data from 2005 to 2013. (Fig.4) .

- It is found that the highest ozone content is in the spring (March-April-May) : 354 DU.
- The lowest ozone value is in the autumn (September-October-November) : 293 DU.

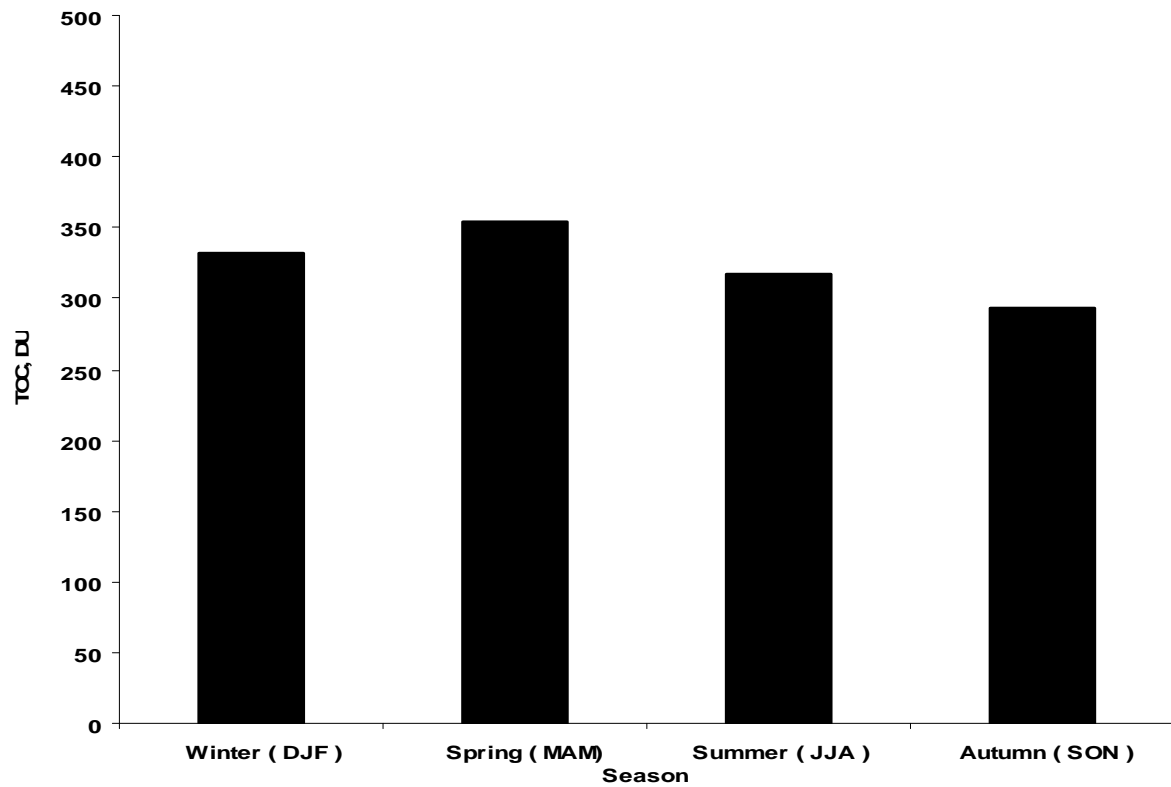


Fig. 4. Seasonal ozone variations for the period 2005-2013 over Stara Zagora

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