

TURKEY

Turkish State Meteorological Service is responsible for observing ozone and UV radiation, also research activities have been carried out by Meteorology Service.

OBSERVATIONAL ACTIVITIES

Ozone measurement is made only in Ankara by two kinds of observations. Ozonsonde (ECC - Electrochemical Concentration Cell) and spectrophotometric methods with a Brewer Instrument are used by Turkish State Meteorological Service in Turkey.

Column measurements of ozone and other gases/variables relevant to ozone loss

Brewer Spectrophotometer

MK III instruments has been installed on the roof of main building of Turkish State Meteorological Service (TSMS) since November 2006 In order to measure total column ozone at Ankara Brewer (39° 97' N, -32° 86' E). Beeing the only Brewer in Turkey, it forms an integral part of the WMO ozone monitoring network (WMO, 1994).

Profile measurements of ozone and other gases/variables relevant to ozone loss

Ozonsonde

Ozone measurements have been made by an ozonsonde instrument at Ankara, Turkey since early 1994 by the Turkish State Meteorological Service. Ankara is located at 32° 53' (E) Longitude and 39° 57' (N) Latitude with an altitude of 891 m. Ozone observations have been operated in every one or two weeks or sometimes a month since beginning. Total ozone column is detected with this operation. It is possible to find vertical ozone distribution, vertical ozone profile, in this way. Up to now, total 313 balloon have been launched and 282 daily total ozone column data have been obtained. The 31 observations could not be performed due to the different reasons such early exploding of the balloon.

UV measurements

Broadband measurements

The B band of the ultraviolet radiation has been measured with an UV-B recorder named Model 501 in two one location, Ankara (39° 97' N, -32° 86' E) and Antalya (located on southern coast of Turkey and at 54 m. Altitude, 30° 44' (E) Longitude and 36° 42' (N) Latitude).

The UV-B observations were started on 3 January 1997 at Ankara, and on 21 May 1997 at Antalya. There is any problem on the UV-B time series of Ankara. However, time series of Antalya has some gaps and missing data. UV-Biometer of Antalya was over in 2003.

Additionally, UV-A and UV-B measurements from Brewer Spectrophotometer are observing by the TSMS.

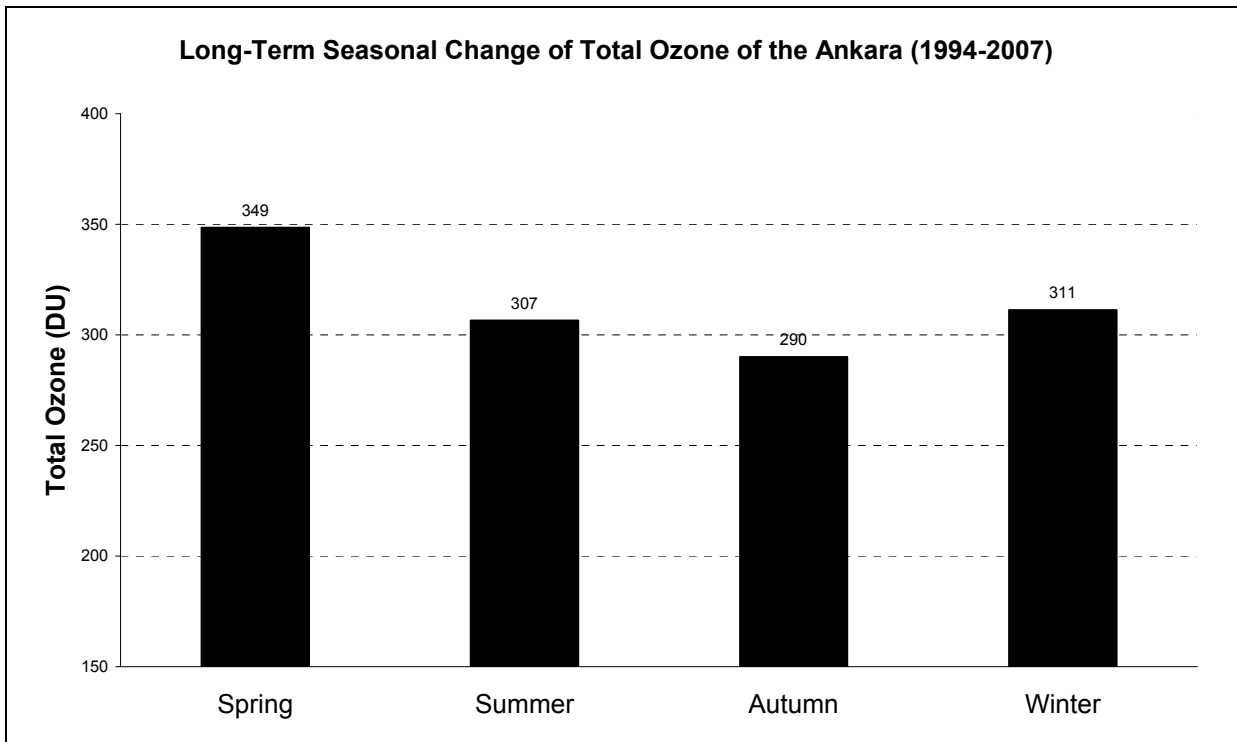
Narrowband filter instruments

Additionally, TSMS going to assemble ten UVR1-B Global Spectral Radiometer to the east and interior of Turkey at the end of the 2008 year. These stations are in Silifke/Mersin, Mardin, Elazığ, Oltu/Erzurum, Aksaray, Kahramanmaras, Merzifon/Amasya, Sivas, Giresun and Van cities.

Calibration activities

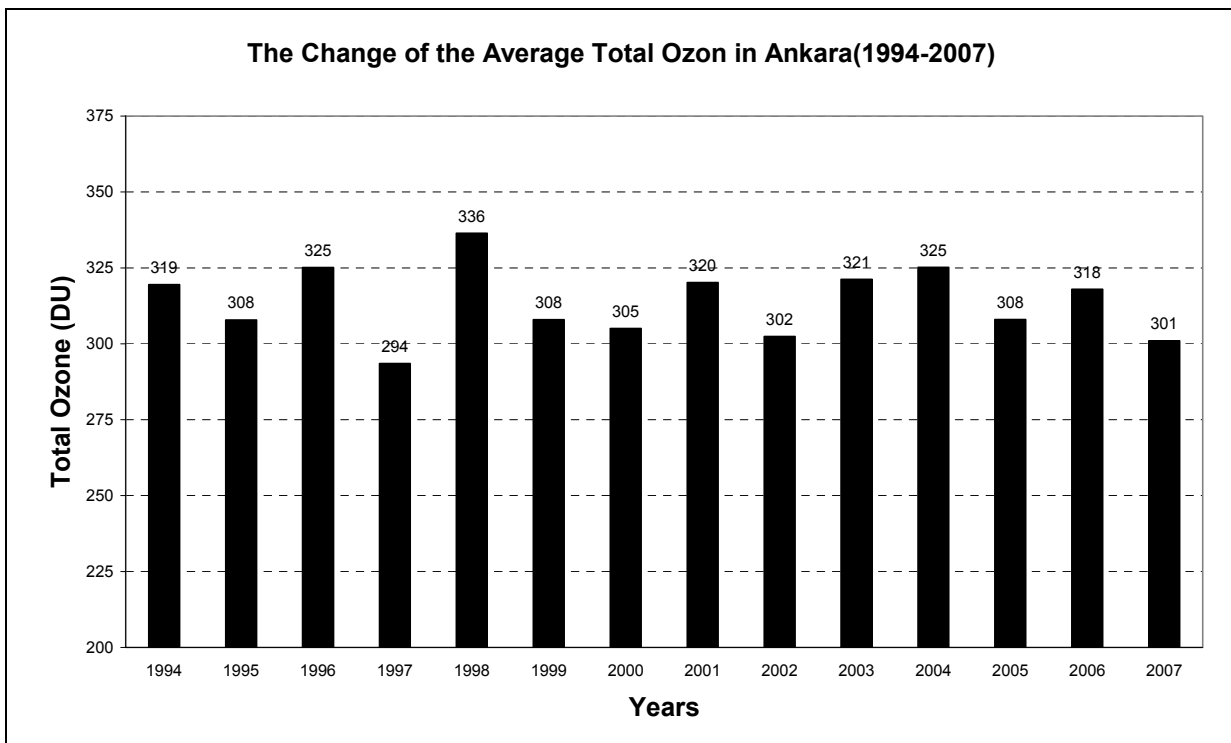
Calibration of our Brewer spectrophotometer have been planned to carried out in this year. TSMS has the capacity about solar radiation but not instruments of ozone and UV radiation

RESULTS FROM OBSERVATIONS AND ANALYSIS

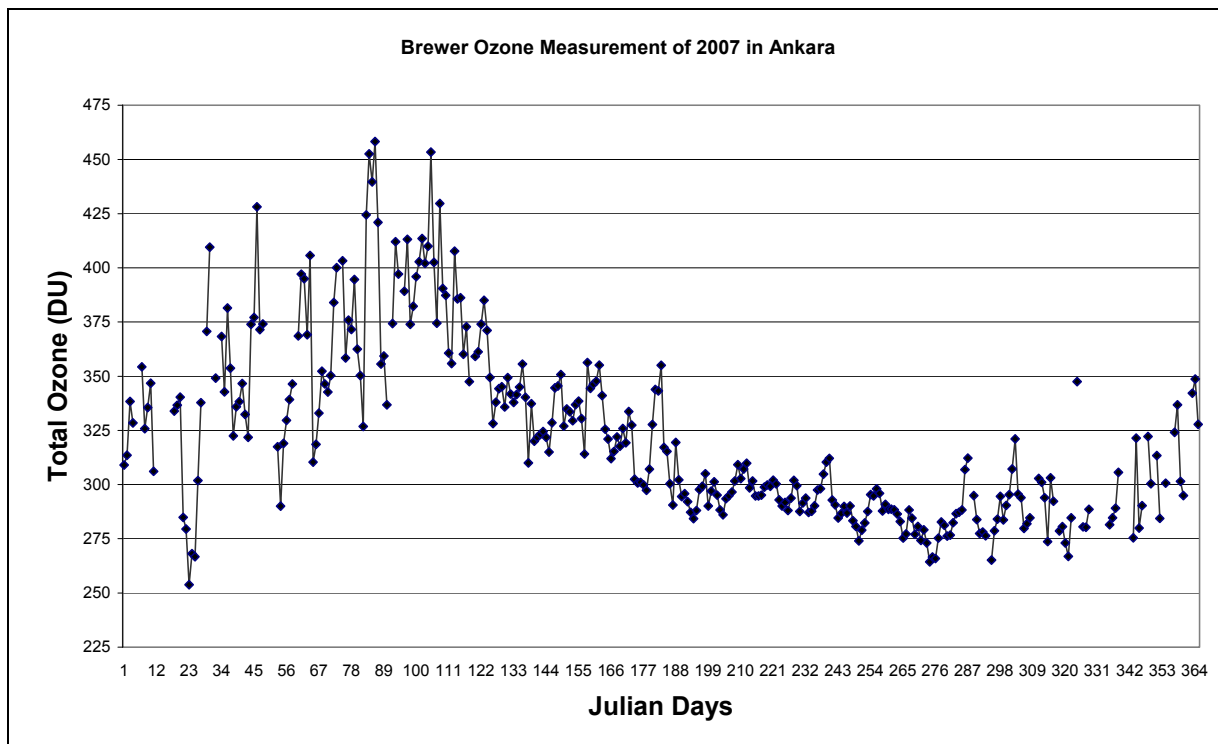


Graphic 1 : Seasonal Ozone Change in Ankara

The seasonal variability of ozone in Ankara, Turkey is characterized by a maximum in spring and a minimum in Autumn. The mean of the spring ozone is 349 DU, the mean of the autumn ozone is 290 DU between 1994 -2007 period.



In 1994-2007 period of ozonsonde measurements, the maximum mean of the period is in 1998 year as 336 DU and minimum mean of the period is in 1997 year as 291 DU.



Maximum brewer ozone data of Ankara is 458 DU in 86th Julian day and minimum of ozone data is 254 DU in 23rd Julian Day.

THEORY, MODELLING, AND OTHER RESEARCH

Turkish State Meteorological Service has been performing on an official project from TUBITAK (Turkish Scientific and Technical Research Council) titled "Observation of the tropospheric and stratospheric ozone/UV-B changings over Turkey and analyses of the results".

A few academic personals from ITU (Istanbul Technical University) also includes in this Ozone Project under contract no: 105G032 .

Multi-Linear regression model was improved for Ankara by the staffs of this official (tubitak) project. This study is the experimental model for Ankara. Multi correlation coefficients of the models differs between 0.775-0.876. It is greater than 0.80 in all months except from January. The standard error of the forecast is calculated between 7.28-23.26 DU. Standard error is smaller than 10 DU in July, August and September. Especially, the results in summer and spring seasons are more successful than winter season result.

Within this year has been started experimental UV-Index forecasting in Ankara by using Canadian Empirical Model. Confidence level of the model is under % 5, multiple-regression coefficient of the model is 0.98 and standard error of the model is 1.57 mW/m².

DISSEMINATION OF RESULTS

Data reporting

The measured ozone data is sent to the 'World Ozone and Ultraviolet Radiation Data Centre' (WOUDC) in order to be archived and published. The station number of Ankara is 348 in WOUDC. Clients could find both of the Ozonsonde and Brewer spectrophotometer data for Ankara in WOUDC.

Information to the public

There is a ozone and UV radiation web pages under the official meteorology web site. Its address is <http://www.meteoroloji.gov.tr/2006/arastirma/arastirma-ozon-ozon.aspx>

This web page includes daily maximum UV Index table for all cities of Turkey (collaborated with DWD).

	26 Mart 2008, Cuma			29 Mart 2008, Cumartesi			30 Mart 2008, Pazar		
	Bulutlu Hava Günlük Maksimum UV İndeks	Açık Hava Günlük Maksimum UV İndeks	Toplam Ozon (DU)	Bulutlu Hava Günlük Maksimum UV İndeks	Açık Hava Günlük Maksimum UV İndeks	Toplam Ozon (DU)	Bulutlu Hava Günlük Maksimum UV İndeks	Açık Hava Günlük Maksimum UV İndeks	Toplam Ozon (DU)
ADANA	5.6	5.6	343	2.7	5.5	351	3.0	5.6	350
İncirlik Hvl.	5.6	5.6	343	2.7	5.5	351	3.0	5.6	350
Sekirpaşa Hvl.	5.6	5.6	343	2.7	5.5	351	3.0	5.6	350
ADIYAMAN	5.8	5.8	342	2.9	5.8	343	4.8	6.1	335
AFYONKARAHİSAR	5.8	6.0	342	3.2	6.1	337	6.2	6.2	337
AĞRI	5.8	6.6	341	3.0	6.0	341	3.1	6.9	308
AKSARAY	5.9	5.9	340	4.3	5.9	345	1.2	6.0	344
AMASYA	3.0	5.5	331	2.7	5.4	337	1.1	5.4	345
Merzifon Hvl.	3.0	5.6	330	2.8	5.5	336	1.1	5.5	344
ANKARA Keçiören	3.2	5.7	331	2.9	5.6	329	1.8	5.7	340
Akinci Hvl.	4.8	5.7	334	4.8	5.9	329	5.8	5.8	339
Esenboğa Hvl.	3.2	5.7	331	2.9	5.9	329	1.8	5.7	340
Güvercinlik Hvl.	1.5	5.6	335	4.1	5.8	331	4.6	5.7	339
Etimesgut Hvl.	4.5	5.6	335	4.1	5.8	331	4.6	5.7	339
ANTALYA Hvl.	3.3	5.8	352	3.1	5.7	361	5.7	6.0	349
Alanya	4.1	5.8	352	2.8	5.6	364	6.0	6.0	349
Finike	3.0	6.0	354	2.7	5.0	367	6.2	6.2	352
ARDAHAN	5.0	6.5	316	3.4	6.0	340	3.4	6.7	314
ARTVİN	2.8	5.6	323	3.4	5.5	340	2.9	5.8	321

Daily Uv Index Forecasts for all cities in Turkey

Relevant scientific papers

C.Kahya, B.Aksoy, D.Demirhan, S.Topçu, S.İncecik, Y.Acar, M.Ekici and M.Özünü 'Ozone Variability over Ankara, Turkey' European Geophysical Union'ın 15-20 April 2007

Deniz D. Bari, Sema Topçu, Bülent Aksoy, Ceyhan Kahya, Selahattin İncecik, Yılmaz Acar, Mustafa Özünü and Mithat Ekici "A Study of Daily Total Column Ozone Forecasting Based on TOMS Data and Meteorology" 'International Union of Geodesy and Geophysics' 02-13 July 2007

B. Aksoy, S. İncecik, S.Topçu, D.D. Bari, C. Kahya, Y.Acar, M.Ozunlu ve M. Ekici 'Total Ozone Over Ankara and Its Forecasting Using Regression Models'

Aksoy, B. ve Acar, Y. 2001. **Ozon (O₃). Technical Report**, Turkish State Meteorological Service, Ankara, Türkiye.

Aksoy, B. ve Ekici, M. 2001. **Ultraviole Radiation, Technical Report**, Turkish State Meteorological Service,, Ankara, Türkiye.

PROJECTS AND COLLABORATION

Turkish State Meteorological Service has been performing on an official project from TUBITAK titled "Observation of the tropospheric and stratospheric ozone/UV-B changings over Turkey and analyses of the results". A few academic persons from ITU (Istanbul Technical University) also includes in this Ozone Project under contract no: 105G032.

In 2007, we have collaborated with the DWD about daily UV Index over Turkey. And now these informations are published to the public from our official web site. Additionally, we use the ozone data for Turkey from Eumetsat satellite and Ecmwf ozone forecast data. These data are used by TSMS Research Department for testing purpose in present. We are planning to apply to all region of Turkey in this year.

FUTURE PLANS

Planned studies for the period of 2008 - 2011 are as follows:

- To have more strong ozone and UV network in Turkey with three Spectrometers and UV network.
- To detect tropospheric ozone profile.
- To detect stratospheric ozone profile.

- To product daily ozone forecast routinely.
- To make UV index forecast routinely.
- To analyse time series of the ozone and the UV-B.
- To evaluate effects of the changes in the ozone and UV time series on the climate.
To join meetings, congress and symposium about ozone and UV radiation.

NEEDS AND RECOMMENDATIONS

It is very important the support for annual calibrations and maintenance of the Brewer and UV sensors.

Educational activities and collaboration between ozone services are enhanced by the WMO, UNEP, WOUDC etc.
