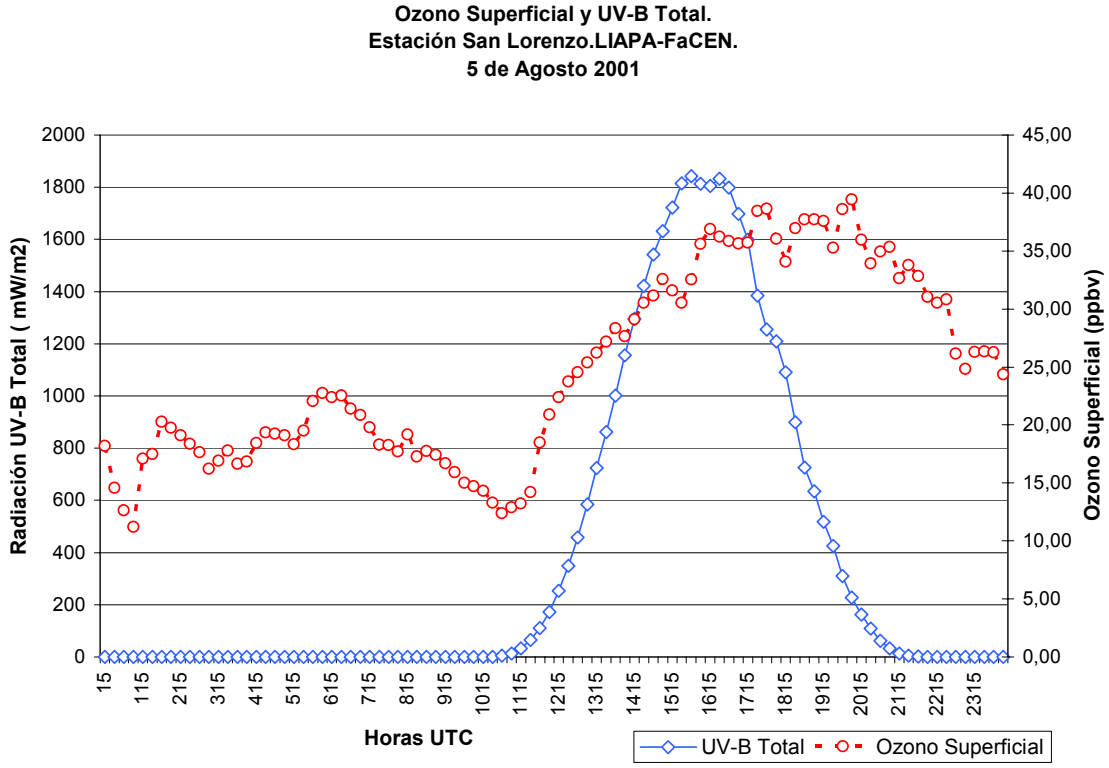
PARAGUAY



UV-B, radiation

In the Figure of above appears the daily behaviour of total UV-B measured in day of clear sky in the station that has the Faculty of Exact and Natural Sciences in the University Campus of San Lorenzo.

The maximum value is of the order of 1800 mW/m^2, and is had around the 12:00 hs local.

The instrument is a Piranómetro UV, YES Model UV-B 1, which also measures the biological effectiveness of solar radiation UVB. First calibration was made in the Meteorological Service of Canada (1996). One second calibration in situ was made by investigators of the Meteorological Service of Spain in 1997.

The Solar Radiation (average every 15 minutes) measured with a LiCor, for the month of January of the year 1999 was between 1,185 and 43 W/m2, that the values of the radiation are high.

Surface Ozone

The Surface Ozone is measurement with a TECO, Model 49/49-PS, for the same period the maximum value is almost 40 ppbv. In the same one it is observed that also superficial ozone is had at night. This can be due to enriched movement shift of air with ozone that lowers from superior levels of the atmosphere due to the thermal contraction of the air.
In the table are the values average of superficial ozone, and the dates in which were surpassed the norms.

Days	Average value in 8 hs (ppbv)	Average value in 10 hs (ppbv)
31-ago	89	85
01-sep	78	73
02-sep	86	81
03-sep	74	69

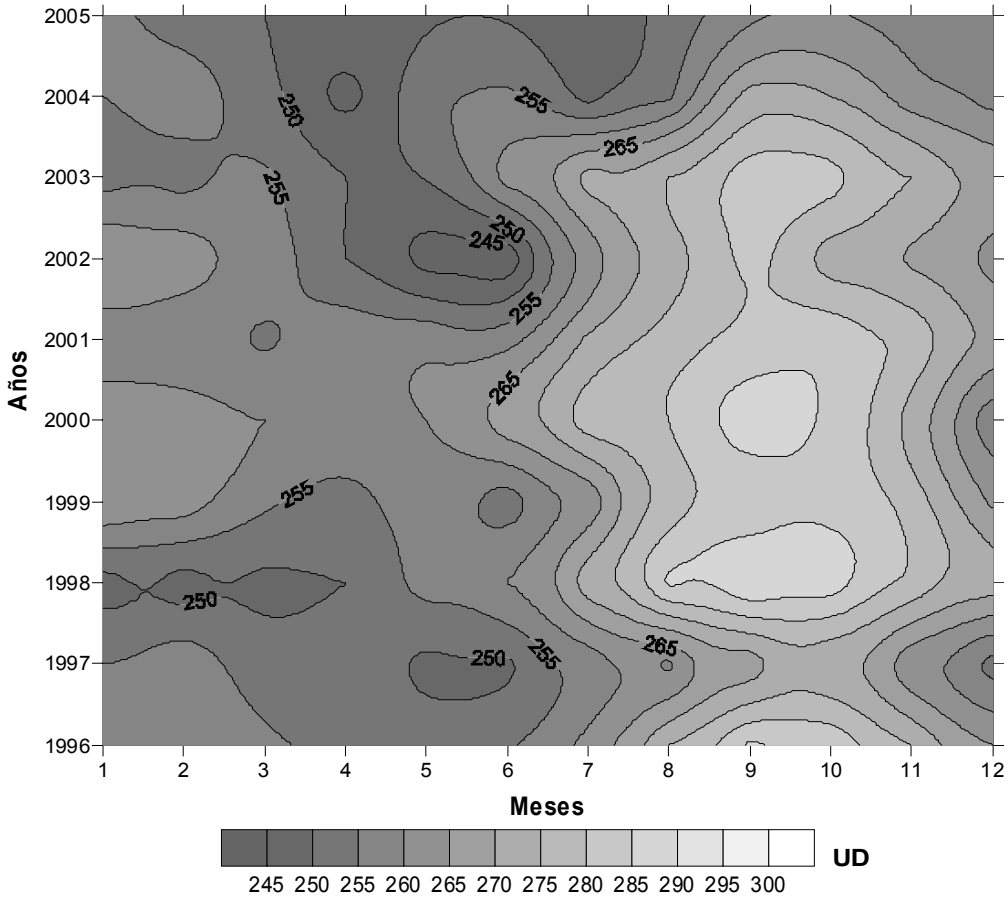
Episode of the year 1999.
Measured in station FaCEN - LIAPA.

Stratospheric Ozone

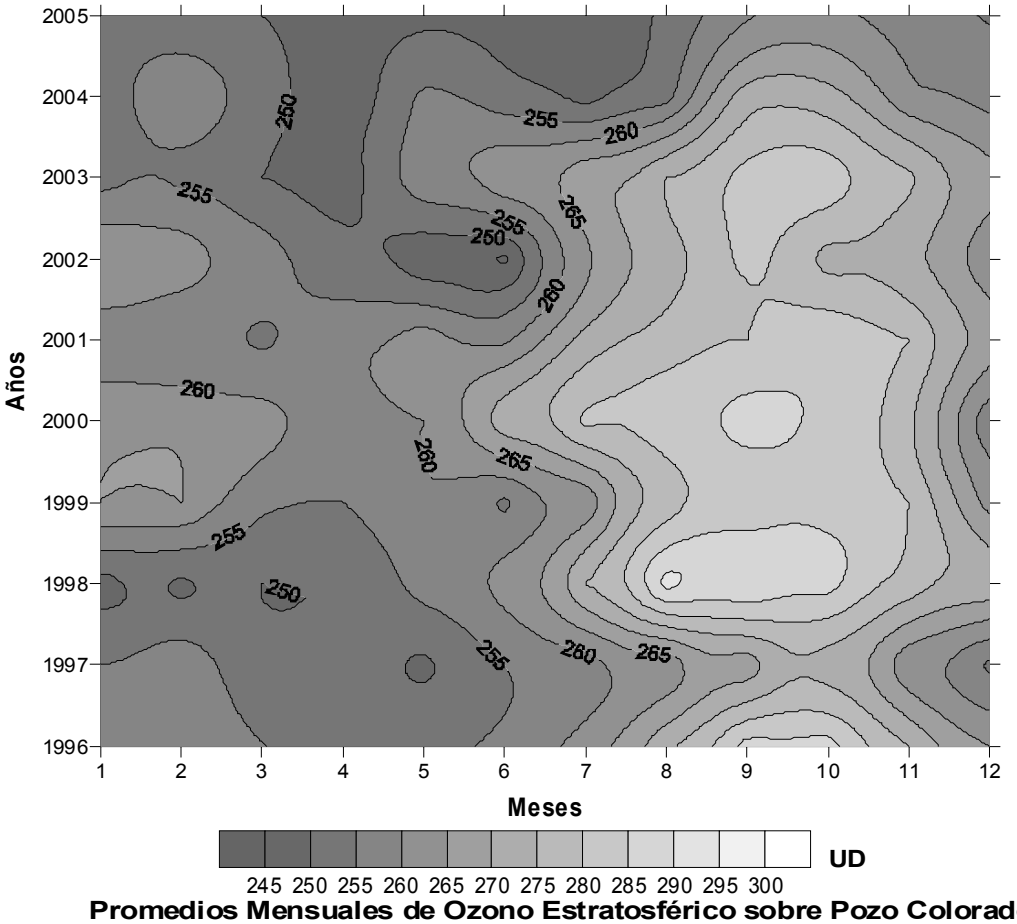
Stratospheric ozone on Paraguay is controlled from the data of the TOMS, down are the means values on Filadelfia, Pedro Juan Caballero, Pozo Colorado, San Pedro, Asunción, Pilar, Encarnacion, important localities by its geographic position and greater human population.

Filadelfia is to the west of Loma Plata, 25 km. San Pedro this to 100 km to the northwest of San Estanislao.

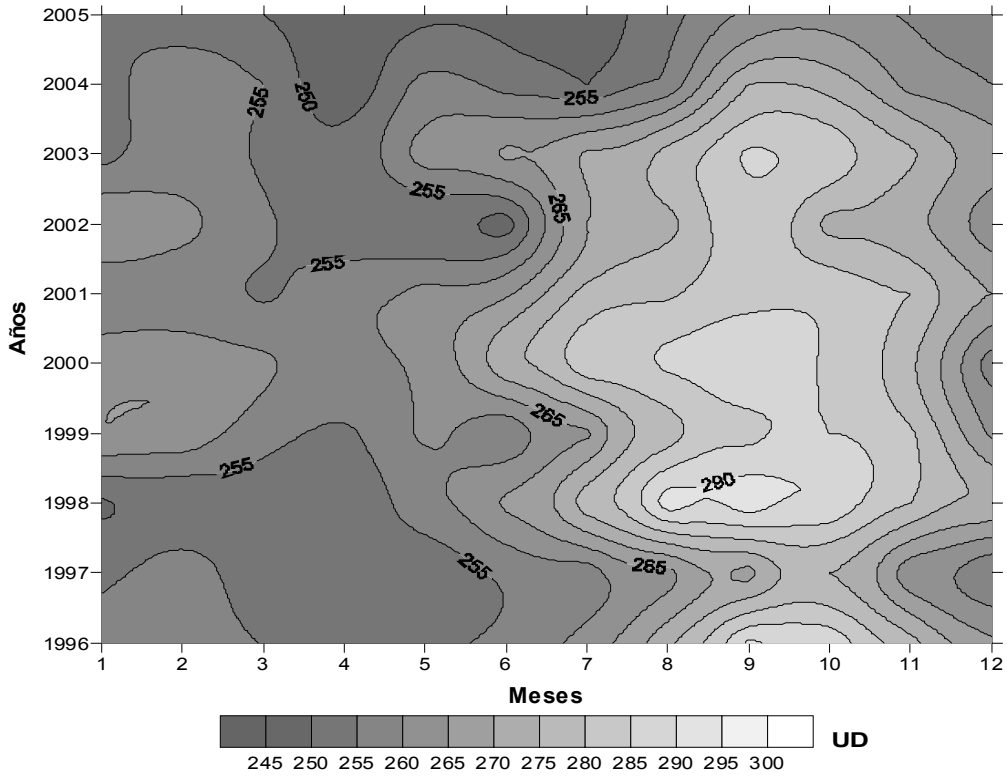
Promedios Mensuales de Ozono Estratosférico sobre Filadelfia.
Datos del TOMS. Periodo 1996 - 2005



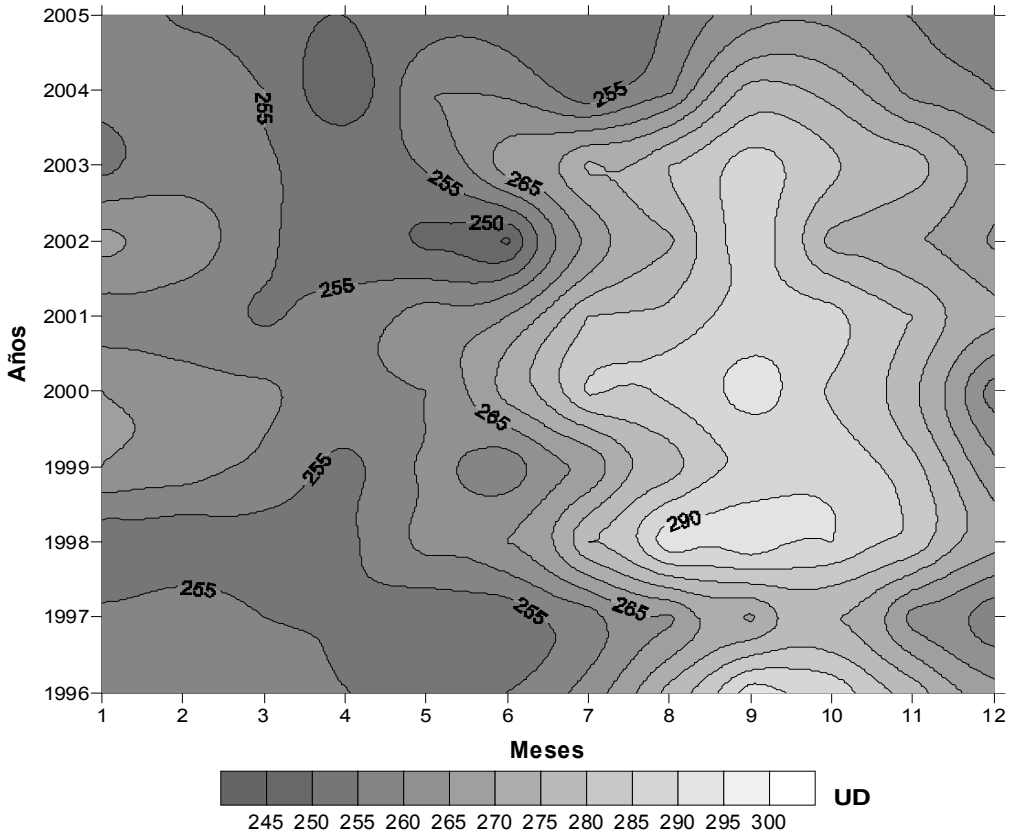
Promedios Mensuales de Ozono Estratosférico sobre Pedro Juan Caballero.
Datos del TOMS. Periodo 1996 - 2005



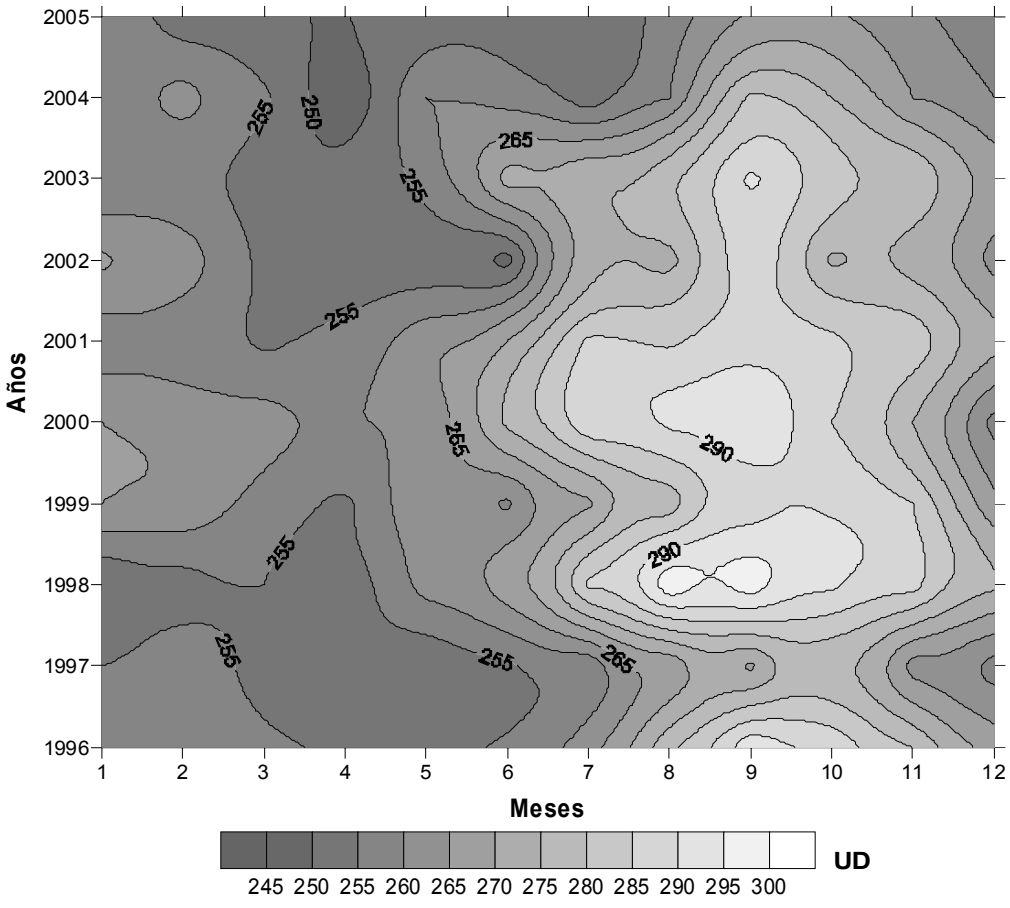
Promedios Mensuales de Ozono Estratosférico sobre Pozo Colorado.
Datos del TOMS. Periodo 1996 - 2005



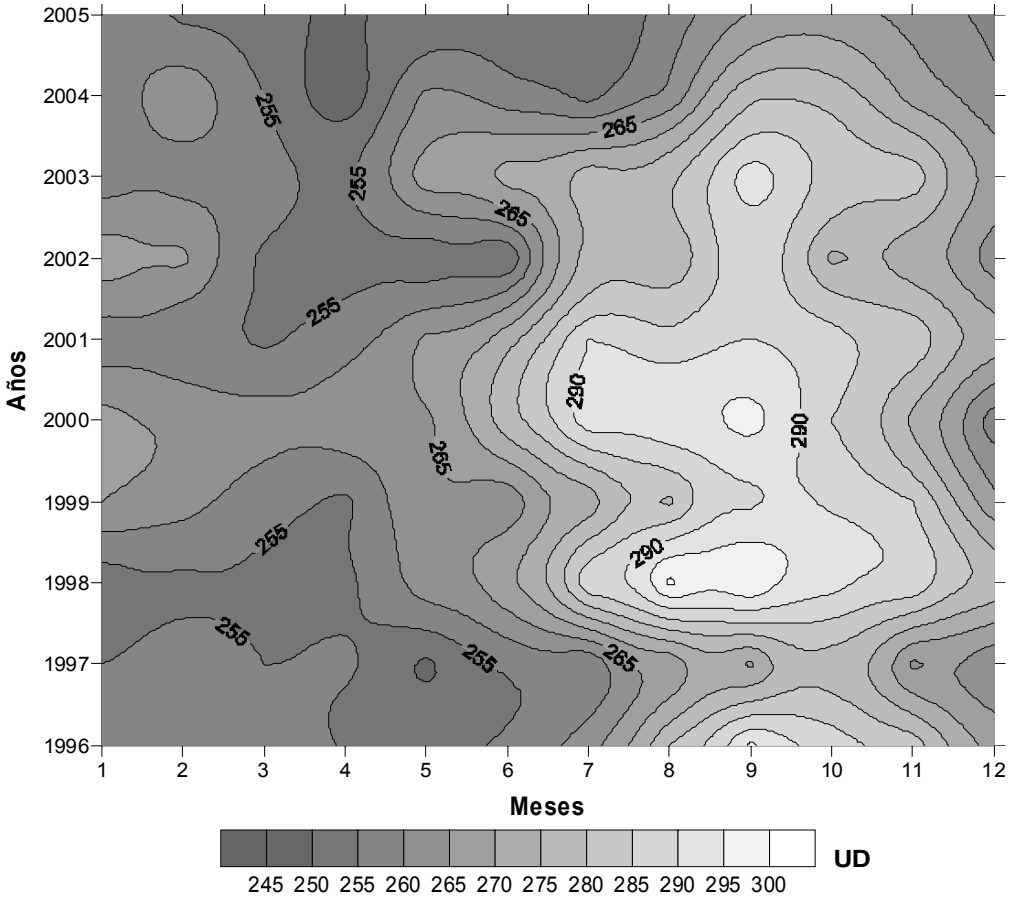
Promedios Mensuales de Ozono Estratosférico sobre San Pedro.
Datos del TOMS. Periodo 1996 - 2005



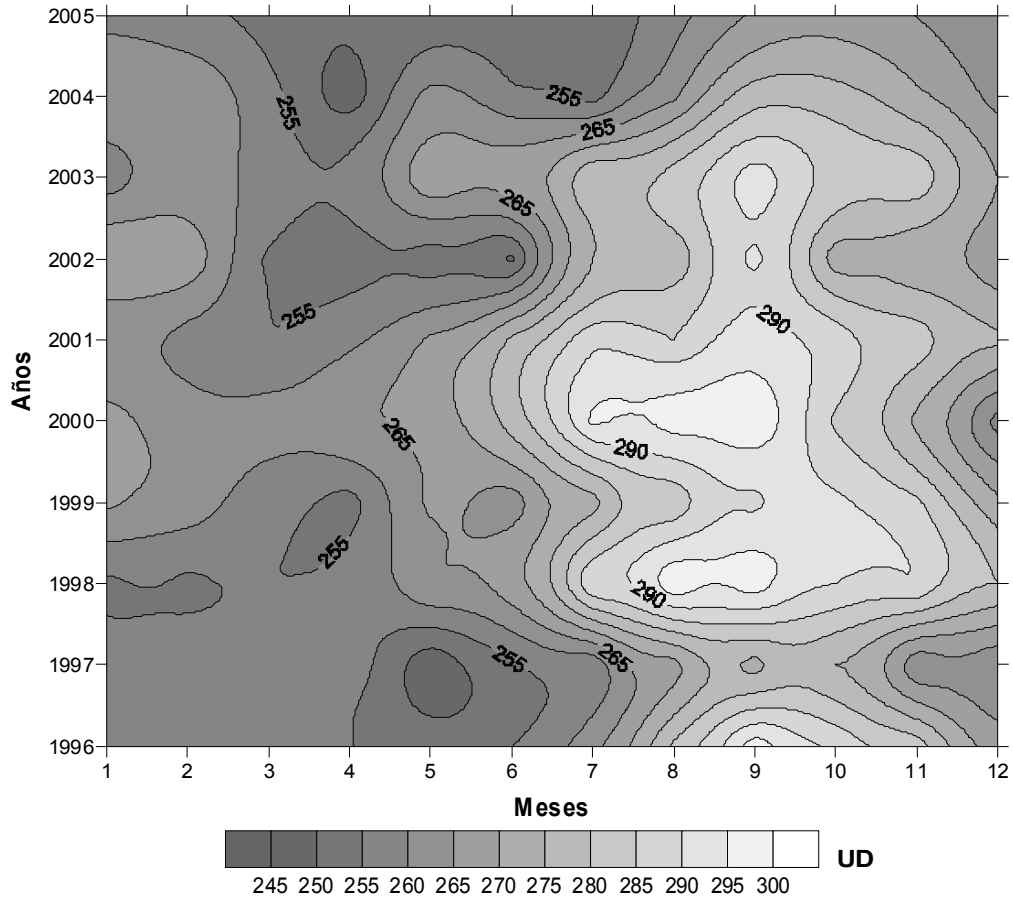
Promedios Mensuales de Ozono Estratosférico sobre Asunción.
Datos del TOMS. Periodo 1996 - 2005



Promedios Mensuales de Ozono Estratosférico sobre Pilar.
Datos del TOMS. Periodo 1996 - 2005



Promedios Mensuales de Ozono Estratosférico sobre Encarnación.
Datos del TOMS. Periodo 1996 - 2005



In all the analyzed stations they are almost observed the same behaviour of monthly distribution during the period from study 1996 - 2005.

	Encarnacion	Pilar	Asunción	San Pedro	Pozo Colorado	Pedro J. Caballero	Filadelfia	Max Maximorum
Max	299	301	299	294	293	292	290	**301**
Min	246	246	246	244	245	244	241	**241**
Promedio	270	269	268	267	266	265	264	**267**

In the period of study, the values of ozone never were below the 240 UD, which is that never was reached the condition of "ozone hole".

In the Chaco region (Pozo Colorado and Filadelfia) is observed that the variability is small, however in Pedro Juan Caballero is observed greater variability of ozone, is necessary to remember that in Pedro Juan Caballero region the florets is much more exuberant that in the Chaco.

Some works

1) ***IRRADIANCIA ERITEMICA E INDICE DE RIESGO SOLAR EN ASUNCION, PARAGUAY EN EL PERIODO 1997-1999***

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Instituto de Física Rosario (CONICET-UNRosario), 27 de Febrero 210 bis, 2000 Rosario, Argentina

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2 Facultad de Ciencias Bioquímicas y Farmacéuticas, UNRosario
3 Facultad de Ciencias, Universidad Nacional de Asunción, San Lorenzo, Paraguay

Resume:

We analyze solar irradiance in the UV range (290 nm-400 nm) registered with a biómetro having a filter that reproduce the erythemal (alarm of the skin) action spectral. Data were obtained in Asunción, Paraguay between 1997 and 1999, in the months with large aerosols content due to biomass burning. We compare the solar erythemal irradiance, transformed in the solar risk UV index, with results of the solution of the atmospheric radiativa transfer equation, employing the Madronich code. The most important geophysical variable, ozone, is obtained through measurements made with the instrument TOMS (Total Ozone Mapping Spectrometer)/NASA on board of Earth Probe satellite. We employed the method of variable identification in order to determine the aerosol optical depth. In this way we calculate the time variation of UV index, in particular during the biomass burning event that is particularly important in the Chaco and Amazonia regions during August-September of each year. We compare this index with the corresponding one forecasted by CONAE (Comisión Nacional de Actividades Espaciales/Argentina) for the region, giving in general a rather good agreement, except for the days of high aerosol optical depth due to the intense biomass burning.

INTERNATIONAL RADIATION SYMPOSIUM 2004 – Current Problems in Atmospheric Radiation
August 23-28, 2004, Busan, South Korea

COMPARATIVE STUDY OF UVB ATTENUATION OBSERVED DURING DRY AND WET SEASONS IN A SOUTH AMERICAN REGION

Marcelo de Paula Corrêa[1], Juan C. Ceballos[1], Genaro Coronel[2], Marcus J. Bottino[1]

[1] Division of Satellites and Environmental Systems – CPTEC/INPE – BRAZIL
[2] LIAPA – Universidad Nacional de Asunción - PARAGUAY

Summary

Some cases showing the relationship between UVB and solar global radiation under cloudless, cloudy and forest fires conditions are presented. The analysis is focused on data collected since 1996 in Asunción City (Paraguay – 25.33S, 57.52W; altitude 130m) during wet (with low aerosol loads and cloudy days) and dry seasons (with biomass burning aerosol predominance in clear-sky days). For the wet season – February/April – a clustering method applied to GOES-8 imagery allows identification of different types of clouds. Aerosol content during the dry season – August/September – was assessed using TOMS Aerosol Index. The goals of this preliminary study are: a.) illustrate characteristics of UVB attenuation in both seasons; b.) evaluate empirical patterns relating UVB fluxes, cloudiness and aerosol presence in the region; and c.) determine possible relationships between solar and UVB measurements under clear-sky or cloudy conditions.

Instrumentation and Methods

Radiative transfer models used in clear-sky calculations
UVB radiation: Ultraviolet Global Atmospheric Model (UVGAME)[1]
Solar radiation: A simplified model for assessment of clear-sky solar irradiance at ground level[2]

Measurement instruments
UVB radiation: YESDAS UVB-1 measures global (direct + diffuse) irradiances between 280 and 320nm, received by a horizontal surface.
Solar irradiance: LiCor LI-200SZ pyranometer – measurements of global irradiance in 0 – 1100 nm spectral range.

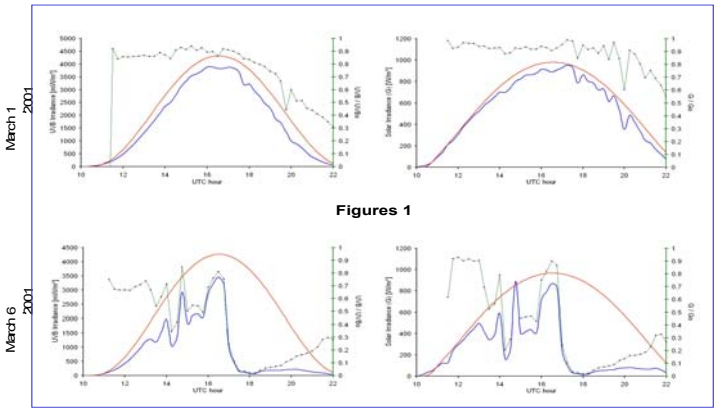
Method for identification of different types of clouds and clear-sky pixels in GOES-8 imagery[3].

Based on full resolution images in VIS and IR channels, four different variables were designed for pixel identification (reflectance and brightness temperature, and their textures). A clustering procedure ("dynamic cloud") was used for determining 30 different classes of pixel environment, defined by respective 4-dimensional centroids. Results are coherent with usual two-dimensional analysis based on reflectance (channel 1) and brightness temperature (channel 4), providing additional information related to the textures. Hierarchical clustering of centroids suggests the existence of five main groups of scenes (surface, cumulus, cirrus, stratus and deep convective multi-layered clouds).

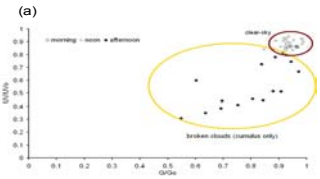
Results

Figures 1 illustrate two daily cycles of ultraviolet [UV] (**left**) and total solar [G] (**right**) irradiances. Measurements are shown in **blue** (UV and G), clear-sky calculations in **red** (UVo and Go) and their quotients in **green** (UV/UVo and G/Go). Figures 2 show the relationship between UV/UVo and G/Go quotients. Figures 3 show cloud classification in GOES-8 imagery for morning and afternoon time. They make an evident clear-sky predominance in the morning with an increasing afternoon cloudiness over Asunción region.

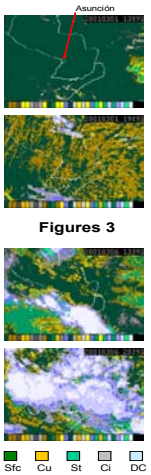
As expected, UV/UVo and G/Go are concentrated in the upper right corner for clear-sky conditions (both figures 2). It is observed a non-linear relationship among the quotients in figure 2a, while figure 2b shows a fairly linear relationship along the day and under different cloud cover situations. For the case of fair weather cumulus (figure 2a) the geometry of interactions between clouds and radiation is a complicated matter; further analysis using separate measurements of ultraviolet, visible and infrared radiation is recommended. The other types of cloud cover (figure 2b) are actually equivalent to overcast situations with different cloud optical thicknesses; this fact could explain a nearly linear relationship.



Figures 1



Figures 2



Figures 3

Can smoke attenuate UV radiation like a cloud ?
Figure 4 shows UVB attenuation during biomass burning [BB] episodes during August/September, 1996 to 2001, occurred in South America (mainly in Brazil and Bolivia). BB particulate is frequently transported over South America attaining Paraguay. Particularly in 1999, a steady smoke cloud provoked almost 90% of UV attenuation. This is about the same attenuation observed in a stratified optically thick clouds.

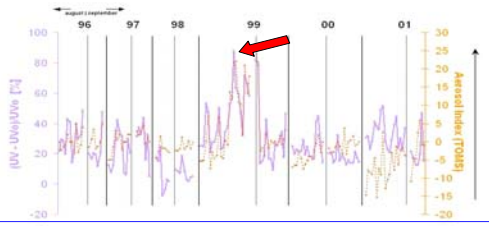


Figure 4

Final considerations

The discussion involving both UV and solar radiation suggests a functional relationship between them, under clear-sky and overcast local conditions. Relationship in fair weather cumulus conditions requires further analysis. Cloud classification in satellite imagery can provides an useful information about the cloud cover and its characteristics.

The influence of pollution on UV fluxes can be equivalent to cloud effects not only by BB episodes, but also by industrial or urban activities. Additional studies related to this influence are being carried out in São Paulo metropolitan area.

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2. Ceballos, J. C., Bottino, M. J., Souza, J. M. A simplified physical model for assessing solar radiation over Brazil using GOES-E imagery. J. Geoph. Res, v. 109, D02211, doi:10.1029/2003JD003531, 2004.
3. Bottino, M.J., Ceballos, J.C., 2003: Classification of scenes in mustispectral GOES-8 IMAGERY. Proceedings of XI Remote Sensing Brazilian Symposium Belo Horizonte, MG, 2003.

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Plans for development

With the instrument AFO (Automatic Filter Ozonometer) never the amount of total ozone could be measured, by this reason is that we needed an instrument of low cost to measure it as Solar Light Microtops II Ozonometer. I am pleased to enclose as attachment the requested Proforma on Solar Light Ozonometer with filters for water vapour measure.