

ARGENTINA

The Argentine Republic is one of the very few countries whose southern territories come, each spring under the direct influence of the Antarctic Ozone Hole. Furthermore its northwestern territories, at the edge of the Andes Altiplano, register some of the highest levels of UV radiation in the world. Thus ozone and UV monitoring as well as scientific research in the field are very relevant to its society, despite budget limitations. In recent years the developing evidence demonstrating the existence of ozone-climate interactions has become a growing concern. The present report is an update of the previous one and spans the period 2002-2005.

OBSERVATIONAL ACTIVITIES

A number of institutions in Argentina carry out observational activities, measuring stratospheric ozone, ultraviolet radiation as well as other relevant chemistry and dynamics. Primary operational monitoring is carried out by the Servicio Meteorológico Nacional (S.M.N.), Various research institutions (Consejo Nacional de Investigaciones Científicas y Técnicas – CONICET -, Instituto Antártico Argentino – IAA -, Centro de Investigaciones de las Fuerzas Armadas – CITEFA -, Comisión Nacional de Actividades Espaciales – CONAE -, national and private universities) are also involved in monitoring and campaign activities. Furthermore there are other ozone related activities, referred to tropospheric ozone and biomass burning which are also relevant due to possible impact of biomass burning, e.g. methyl bromide production and nitrogen oxides, during severe convection in the subtropics, which can impact ozone in the lower stratosphere.

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

The SMN carries out column ozone operational measurements using Dobson instruments at:

Station	Location	Since	Last calibration
Buenos Aires	34°35'S-58°29'W	Jan. 1966	December 1999
Com. Rivadavia	45°47'S-67°30'W	Sep 1995	December 1999
Ushuaia – GAW	54°49'S-68°19'W	Sep. 1994	December 1999
Base Marambio	64°14'S-56°43'W	Sep. 1987	August 2001

The AFO (Automatic Filter Ozone) network, operated conditionally at the following sites:

Station	Location	Since	Instrument No Last Calibration
La Quiaca	22°06'S 65°06'W	Oct. 1998	
Pilar	31°40'S-63°53'W	Oct. 1998	AFO 7- Sep. 1998
San Julián	49°19'S-67°45'W	Oct 1998	AFO 5 - Set 1998

Due to problems with spare parts and maintenance supplies, which are not attributable to the SMN, these instruments are currently out of operation.

The Instituto Antártico Argentino operates the following instruments, primarily through various international cooperation agreements (Spain, Italy):

Station	Location	Instrument	Since
Belgrano II	77°52'S 34°37'W	Brewer MKIV	1992
		EVA (DOAS)	1996
Marambio	64°14'S 56°37'W	EVA (DOAS)	1994
		NEVA spectrograph	2003
San Martín	68°08'S 67°08'W	Brewer MKIV	2002

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

Ozonesondes

Ozone and temperature profiles are obtained at Marambio, Antarctica, using ECC ozonesondes. This is carried out in cooperation with the Finnish Meteorological Institute since 1988. The original programme which included 40 ozonesonde launches per year has been upgraded this year to more than 50 per year. Ozone and temperature profiles are also obtained at Belgrano II, Antarctica, using ECC ozonesondes, approximately 70 per year, since 1999.

Lidars

Ozone profiles are being obtained at Río Gallegos (Lat: 51° 55' S), using the DIAL technique. This containerized instrument has been recently completed at CEILAP (Centro de Investigaciones Laser Aplicados), CITEFA/CONICET, and transported to its current site with a full complement of instruments (2 lidars for water vapour and stratospheric aerosol) and a set of meteorological instruments with the support of JAICA (Japan). For further information, including the international participants as well as updated results refer to www.division-lidar.com.ar.

A Lidar system operates at CEILAP (Buenos Aires) to monitor atmospheric aerosols. It can simultaneously monitor the whole troposphere (starting from 50 m) into the lower stratosphere (under 30 km). It measures in real time the following atmospheric parameters: the atmospheric boundary layer (ABL), tropospheric aerosols optical parameters (radiative properties), stratospheric aerosols, the tropopause height evolution and cirrus clouds evolution (backscatter coefficient and optical depth statistics)

UV Measurements

Broadband Instruments

The main broadband network is operated by the S.M.N.:
Solar Light at Buenos.Aires, Uhuaia, Marambio and for some years at Pilar.
YANKEE at Pilar and La Quiaca.

All these instruments operate since the setup of the National UV Monitoring Network in 1995.

Regular measurements made are with a YES Biometer (erythemal irradiance meter), also belonging to the network, located and operated by the Observatorio Astronómico and Solar Radiation and Atmospheric Physics Group, Institute of Physics of Rosario - IFIR (Universidad Nacional de Rosario/CONICET, approx. 400km north of Buenos Aires).

Furthermore IFIR also has an EKO Biometer and an EKO UVA solarmeter, presently located in Southern Patagonia, to study the influence of the near vortex (and ozone hole) edge on solar UV irradiances and related biological actions over the Argentine continental territory.

Narrowband filter instruments

The IAA operates the following instruments at the Argentine Antarctic Stations:

UV NILU instruments, at Marambio and Belgrano II, since 1993.

At CEILAP (Buenos Aires) measurements are made with the following instrument array:

UVB – [MS-210D](#), EKO Radiometer (190 nm to 290 nm) with erithemic doses.

UVA – [MS-210A](#), EKO Radiometer (290 nm to 400 nm).

[GUV-541](#) Biospherical Inst. Inc.

CIMEL sun photometer measuring at 1200, 940, 870, 670, 500, 440, 380, 340nm

Spectroradiometers

The IAA operates the following instruments at the Argentine Antarctic Stations:

Brewer instruments, at Belgrano II, since 1993, and San Martin, since 2002.

Periodic measurements are made with a Monospec 27 UV-Vis spectroradiometer with UV CCD detector at specific periods during the year. At present this instrument operates at CEILAP, Buenos Aires.

Calibration Activities

Dobson instruments are calibrated at the S.M.N. Observatorio Central Buenos Aires (Villa Ortuzar) since the Buenos Aires Dobson is the regional reference instrument. WMO Region III TECO as well as those belonging to the national network (Ushuaia, San Julian, Pilar an La Quiaca) are also calibrated at Observatorio Central with the TECO reference instrument.

The Solar Radiation and Atmospheric Physics Group at IFIR (CONICET – National University of Rosario) is responsible for the scientific advice and calibration of the Argentina UV Monitoring Network together with the SMN.

RESULTS FROM OBSERVATIONS AND ANALYSIS

Much work has been done in the analysis of local/regional/hemispheric observations, satellite retrievals (in particular TOMS) and reanalysis products (NCEP and ECMWF). The latest works are listed in section 4.3 below. Combined studies have been carried out relating ozone with UV, and ozone with atmospheric variables on dynamic and climatic scales. Work has been carried out the Departamento de Ciencias de la Atmósfera, University of Buenos Aires (UBA), and at Programa de Estudios de Procesos Atmosféricos en el Cambio Global (PEPACG, Pontificia Universidad Católica Argentina/CONICET) studying the relationship between tropospheric, tropopause and stratospheric dynamics and ozone evolution. Such work includes two PhD Theses, which were successfully defended at UBA, as well as a number of MSc. Thesis in Physics and Atmospheric Sciences.

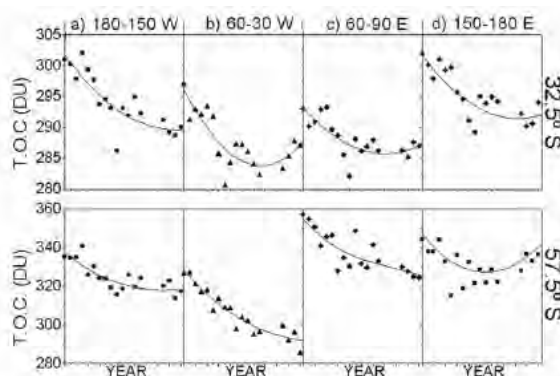


Figure 4. Evolution of annual TOC 1980–2000 for a selection of "bins" at (top) 32.5°S and (bottom) 57.5°S at (a) 180°–150°W, (b) 60°–30°W, (c) 60°–90°E, and (d) 150°–180°E. Symbols (circles, triangles, diamonds, and squares) show the mean of the observations for each bin, and the curves show the result of the cubic polynomial fit of those points.

Figure from Malaca et al. (2005) showing the cubic polynomial fit to 20 years of TOMS total ozone annual mean values (solar cycle and QBO contributions removed) at two southern latitudes for various longitudes.

The IFIR Group, in collaboration with the University of Innsbruck, Austria, the Argentina Skin Cancer Foundation and the Argentina National Weather Service, developed the UV index for clear and cloudy conditions for all the country. A thorough UV climatology, both under clear sky and cloudy conditions, for Argentina was developed as part of a PhD Thesis at Universidad Nacional de Rosario.

THEORY, MODELLING AND OTHER RESEARCH

Theoretical and modeling work has taken place IFIR, UBA and PEPACG. The latter group is cooperating with University of Reading (U.K.) in the development and application of an adaptive grid Chemistry Transport Model, called Adaptive Mesh Refinement or AMR-CTM, which is currently a 2-D model whose resolution adapts locally in order to better solve the evolving stratospheric features. Also included in this work is an interaction with Max-Planck Institut fur Atmospheric Chemie, University of Mainz, in order to install in the AMR-CTM the MECCA-MESSY Chemistry module. Work is under way with the AMR-CTM to understand the evolution of the vortex edge during the 1999 APE-GAIA Campaign, together with Università Degli Studi l'Aquila (Italy) as well as to analyze the behaviour of the 2002 anomalous ozone hole with regards to the tropospheric dynamics of the period. Further work includes the development of a 2-D and 3-D trajectory code.

Work at UBA includes extensive climatology studies of Southern Hemisphere stratospheric and tropospheric variables, in order to understand the mechanisms involved in the dynamic and climate coupling of these two regions and their relation to ozone change. Work at IFIR includes the following topics:

- Radiative transfer model calculation of UV solar radiation and biological actions with the TUV programme (developed by S.O. Madronich at NCAR, www.acd.ncar.edu/TUV)
 - Sensitivity studies of the influence of Biologically Active UV Radiation to Stratospheric Ozone Changes: Effects of Action Spectrum Shape and Wavelength Range.
- At the Facultad de Ciencias Químicas de la Universidad Nacional de Córdoba, lab research is carried out on the chemical behaviour of minor species and species derived from CFC replacements.

DISSEMINATION OF RESULTS

Data Reporting

The SMN sends total ozone measurements from Buenos Aires, Ushuaia, Salto (Uruguay), Comodoro Rivadavia and Marambio routinely to the WOUDC. THE AFO retrievals, when the instruments operated were also submitted there. Ozone sonde data are also submitted to the WOUDC. The database is currently being transformed to the required CSV format. Surface ozone retrievals are submitted to the corresponding centre in Japan.

Information to the public

As mentioned above, the Argentine society is sensitive to ozone and UV related issues. Thus providing information and scientific results is part of the activities of SMN as well as of researchers in the field. Since 2000, the SMN provides a national UV forecast both in its webpage as well as to the national media. Indeed the IFIR Group, in collaboration with the University of Innsbruck, Austria, the Argentina Skin Cancer Foundation and SMN, developed the UV index for clear and cloudy conditions for all the country.

Furthermore, IFIR, UBA and PEPACG provide information to the media. During the ozone hole season PEPACG sends to the media every fortnight a report describing the ozone hole evolution using satellite retrievals and meteorological information. It is interesting to note that the information provided by the Argentine scientists has reached media in the Spanish speaking world. Furthermore primary and high school students, because of these reports contact research groups to get more information for school projects, etc.

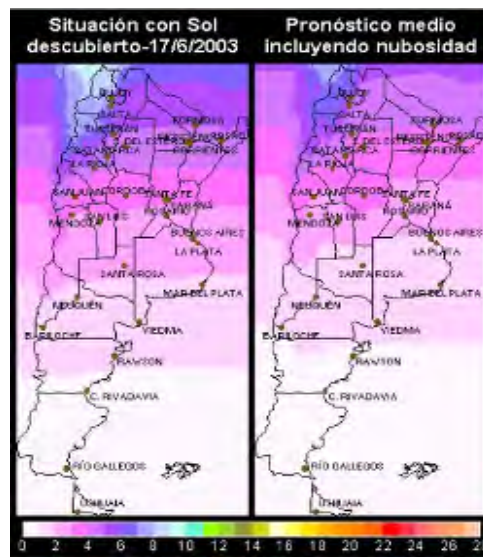


Figure showing the UV forecast products available at the SMN webpage.

Relevant Scientific papers 2002-2005

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PROJECTS and Collaboration

As mentioned above, many of the monitoring and research activities are carried thanks to bilateral and international collaboration. Instruments are being operated thanks to agreements with the Finnish Meteorological Institute as well as with INTA (Spain), CNR/IFA (Italy), JAICA (Japan).

SMN cooperates with the Dirección Nacional del Antártico (DNA) and INTA (Spain) in the training of the ozonesonde operators and scientists bound for Belgrano II Antarctic Station.

Research cooperation takes place in a number of ways, for example through the direct involvement in projects such as EU's SCOUT-O3. Part of the interactions takes place via bilateral agreements between research groups in Argentina and in other countries, such as Italy, France, Chile, etc. These bilateral agreements only fund travel but no research expenditures. The Inter American Institute for Global Change research has proved in the past an interesting tool for funding regional research and cooperation, but again the last calls for research projects were more oriented towards network development and meeting organization than specific research funding. Much of the international and regional cooperation takes place at a scientist to scientist level without formal institutional agreements. Such cooperation includes model and data exchanges. National projects are funded through CONICET and ANPCyT (Agencia Nacional de Investigaciones Científicas y Tecnológicas). While such funding is essential for functioning of research group and basic computational needs, it is very limited by comparison with funds available for research and monitoring in developed countries, and the amounts provided are too limited for experimental/monitoring equipment acquisition.

FUTURE PLANS

The current monitoring networks are to be maintained in operation.

A number of research activities are being considered and proposed for funding at the local level. Part of these will address issues relevant to the upcoming IPY. Some are already planned in regional and international cooperative efforts. Among the main research activities the following should be mentioned:

- Study of the influence of the near vortex and ozone hole regions in Patagonia
- Study the relationship between tropospheric and stratospheric dynamic and climatic behaviour and the links with ozone change.
- Ozone and climate change interactions.
- The chemistry and dynamics of Strat-Trop Exchange
- Cirrus clouds, the tropopause, and ozone.
- UV index development for different regions of South America (Brazil, Ecuador, Venezuela)
- Solar global and its components studies and biological effects in Antarctic Peninsula as part of the International Polar Year 2007-2008.
- Temperature increase as a result of global warming and UV effects on skin cancer development.
- Sustained monitoring with the containerized LIDAR system in Rio Gallegos.

NEEDS AND RECOMMENDATIONS

The Argentine Republic views with concern the international trend towards reducing funding and research on southern hemisphere ozone and stratosphere at mid and high latitudes. Much work needs to be carried out to understand many aspects of the ozone evolution and change, including ozone-climate relationships, particularly under the light of possible impacts of climate change, UV cloud relationships, etc., as well as to monitor ozone recovery.

In order to allow developing countries and countries with economies in transition to meet their commitments under the Vienna Convention and taking into account the lack of funds from other sources, it is crucial and urgent to make operative the Trust Fund established by decision VI/2 for the purpose of financing activities on research and systematic observation and to start providing funds for the activities identified as priorities. This includes, but is not limited to, the maintenance and calibration of the existing WMO Global Atmospheric Watch ground-based stations for monitoring column ozone, ozone profiles and ultra-violet radiation in those countries.

The Ozone Secretariat should be requested to raise awareness in potential donor countries on the importance of the Trust Fund, stressing the necessity of making annual contributions to it on a regular basis.

Specific needs

It would be highly convenient to replace the Marambio Dobson with a Brewer, which is far better suited for high latitude monitoring and can provide information on other variables as well as ozone. Thus an improved quality monitoring would be available there and the current Dobson instrument could be reallocated to a continental site, thus improving the coverage at southern mid latitudes.

International support is need to carry out sustained ozonesonde operation at Comodoro Rivadavia, thus providing very valuable ozone profile information at a southern hemisphere midlatitude site other than Melbourne, particularly under the light of the longitude differences observed in ozone change reported above.

International support is needed to carry out monitoring of tropospheric and stratospheric trace species, for example by providing an FTIR instrument and technical support.

This report was prepared by Dr Pablo O. Canziani, on the basis of the information timely provided by the national institutions and research groups involved in Vienna Convention related monitoring and research activities.

ARMENIA

OBSERVATIONAL ACTIVITIES

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

The measurements of the total ozone are produced on weather station "Arabkir" (40.1N, 44.3E; 1113m above sea level) since 1990 up to present time in city Yerevan by filter ozonemeter M-124.

Since 2000 up to present time the measurements of total ozone (method DS-observations, ADADA wavelengths) are produced also on the south slope of mountain Aragats (40.3N, 44.1E; 2070m a.s.l.) on the regional station #410 of global ozone observation system, created on the weather station "Amberd" (fig.1) and equipped with Dobson-spectrophotometer D-044.

In addition, there is a reserve station for ozone observations on the high-mountain weather station "Aragats" (40.3N, 44.1E; 3227m a.s.l.), equipped with ozonemeter M-124.

There are also short-term experimental synchronous observations on weather stations "Arabkir", "Aragats" and "Sevan" (40.3N, 45.1E; 1927m a.s.l.) in the basin of Sevan Lake.

The measurements of other gases are not produced.



Figure1: Weather Station "Amberd"

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

The regular measurements of the vertical distribution of ozone were not produced. There are several experimental Umkehr-observations on weather station "Amberd", as well as results of data processing the synchronous measurements on different-by-height weather stations "Aragats", "Sevan" and "Arabkir".

UV measurements - not produced.

Calibration activities

At June 2004 the calibration of D-044 at the European Regional Dobson Calibration Center (RDCC/E) at Hohenpeissenberg within the regular calibration schedule was executed.

RESULTS FROM OBSERVATIONS AND ANALYSIS

The results of the observations were submitted for Figure 2.

THEORY, MODELLING, AND OTHER RESEARCH

For study of UV effect, the statistical model, linking the skin cancer morbidity of population with UV irradiation is created in the following regions of Armenia: city Yerevan (altitude 1.1–1.2 km a.s.l., town population), Ararat Valey (altitude 0.9–1.0 km a.s.l, rural population) and basin of Sevan Lake (altitude around 2km a.s.l., rural population). Main results: the dependency of health criticality of the above mentioned groups of the population towards influence UVR depending on lifestyle and heights of terrain is explored.

DISSEMINATION OF RESULTS

Data reporting

The results of the total ozone measurements are monthly sent to the WOUDC.

Information to the public

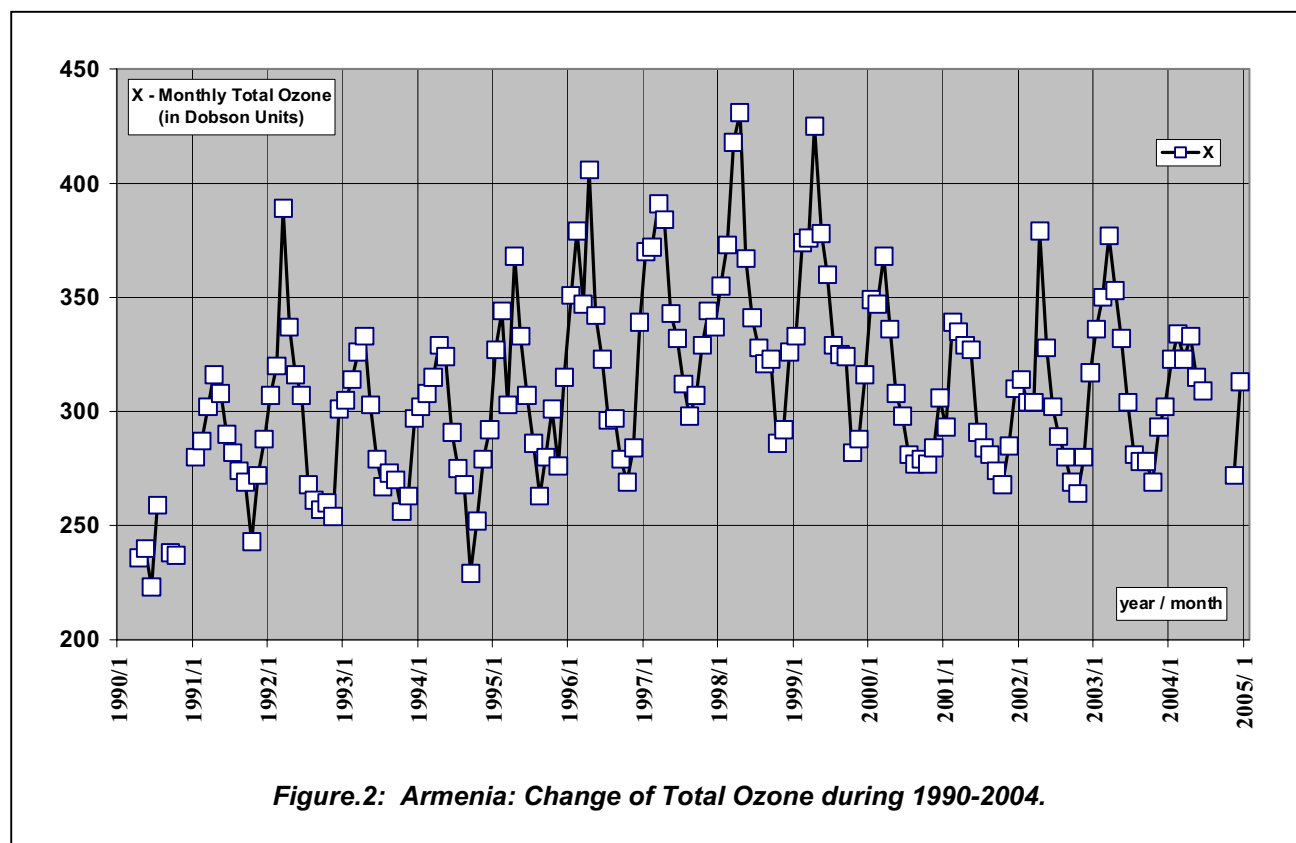
Since 2002 on the basis of the information about UV-indexes provided by the Institute of Biological Physics and Biostatistics, University of Veterinary Medicine Vienna (http://i115srv.vu-wien.ac.at/uv/uv-index/uvi_eue.txt) and according to the recommendations of COST-713 Action "UVB Forecasting" is daily calculated and published through mass media forecasts for UV-indexes for mostly inhabited areas of Armenia.

The meanings of UV-indexes for Armenia are in-group of the highest for Europe.

Relevant scientific papers

In 2001 was issued [1].

Results of the research of effects UV irradiance are published in [2].



PROJECTS AND COLLABORATION

During 1990 - 2002 "The Study on Ozone Layer and Fields of Ultraviolet Radiation on the Territory of Armenia" was executed (Code: 2000-115), financed by state budget of Armenia. Main results: database of the total ozone's dynamics and fields of ultraviolet radiation above the territory of Armenia during 1990-2001.

At present no international and national projects on study of ozone are conducted.

The national project on study of the solar radiation mode for 1980-2004 has just been started.

Execution of Dobson-programme is being implemented with assistance of DWD (Germany) and SOO CHMI (Czech Republic).

FUTURE PLANS

The testing of new instrument - the UV-meter, developed by Institute of the Applied Problems of Physics of Armenia.

NEEDS AND RECOMMENDATIONS

The capacities of weather station "Amberd" allow performing of national and international projects on monitoring of solar radiation, UV climatology, profiling of vertical distribution of ozone with balloon sondes , lidar observations of the composition of atmosphere, transboundary pollution in region of South Caucasus.

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