



# The HIPERION Report

## October 22, 2008



# The HIPERION Report Backgrounds

- EXA is the Ecuadorian Civilian Space Agency, a civilian, non-governmental and independent institution which objective is the development and implementation of the Ecuadorian Space Program, published on August 29 2007.
- On September 29 2008 by resolution of the plenary of the General Assembly of the International Astronautical Federation (IAF), EXA is accepted as a member of this organism.
- It is the first time in history that one Ecuadorian institution is a full member of the IAF.
- EXA was accepted into the IAF as SPACE AGENCY
- This qualification was possible due achievements like Project DAEDALUS an POSEIDON, showing the level of our science and technology, even in such a short period of time – 1 year

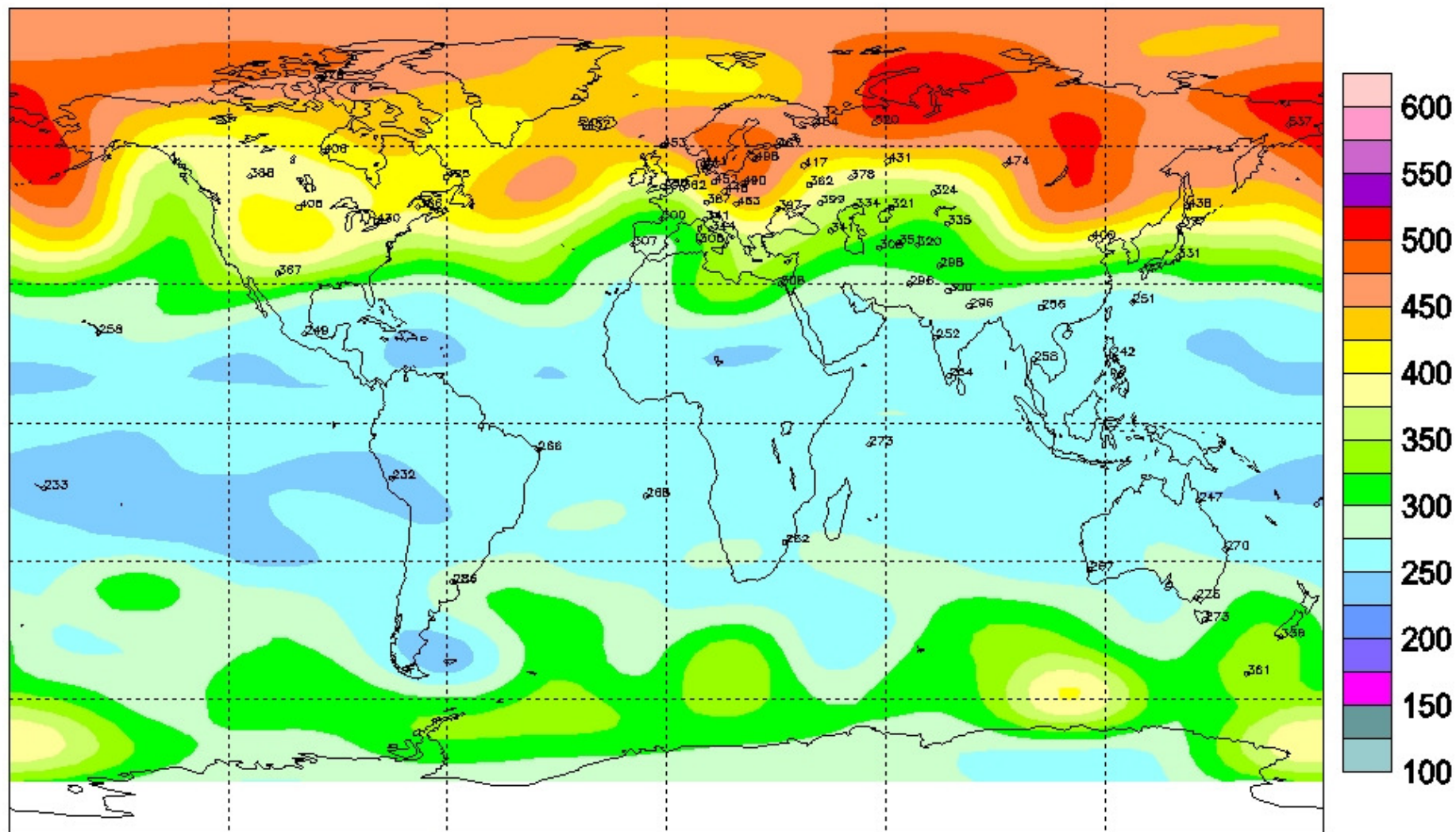


# El Informe HIPERIÓN

## Antecedentes

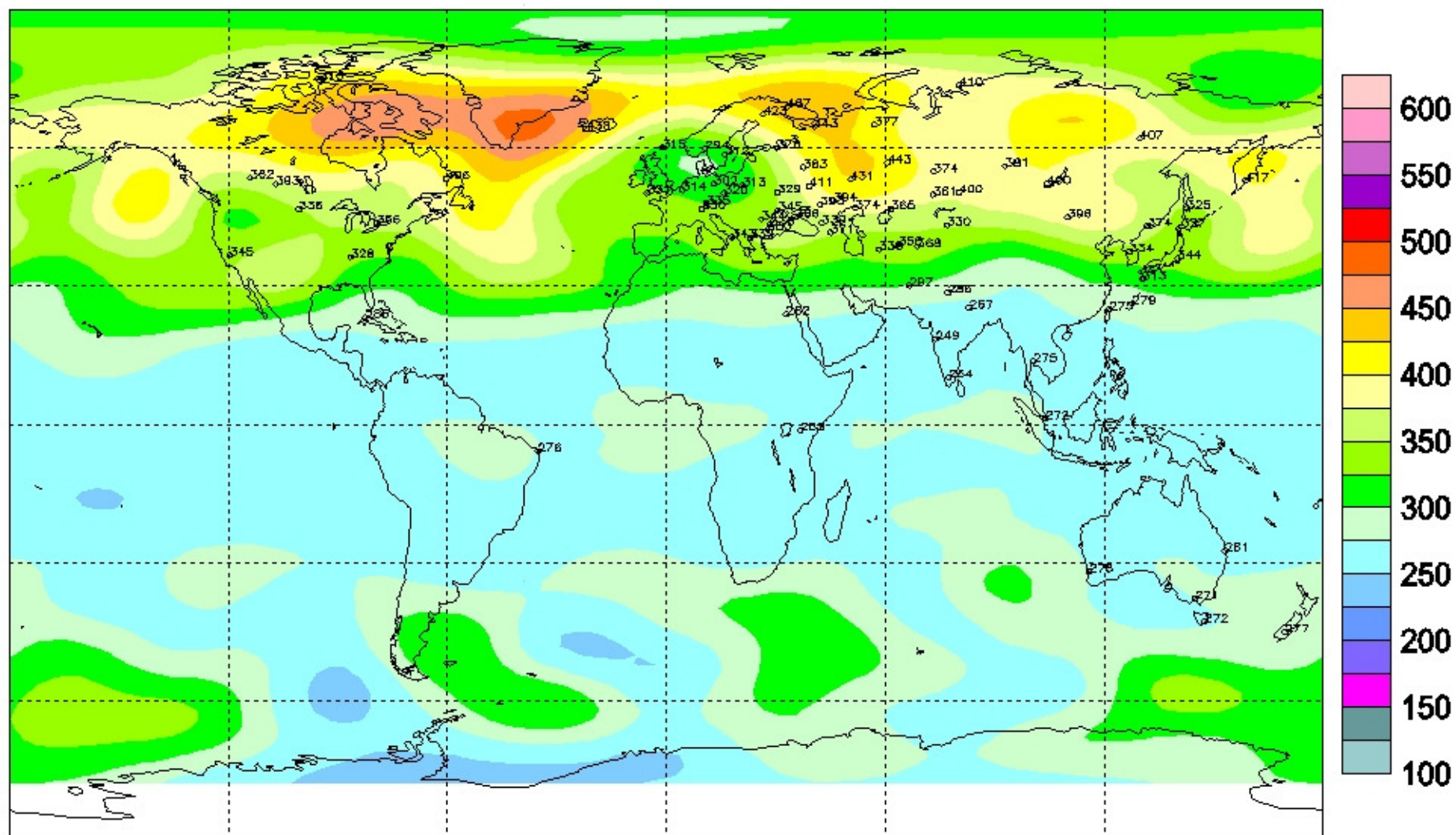
- The Ecuadorian Space Program includes a Planetary Sciences component.
- To fulfill that role, EXA organized the Planetary Sciences Division within the agency, in charge of the study and analysis of active planetary systems.
- EXA's Planetary Sciences has been studying the phenomenon of Ozone layer depletion over the last 12 months. Ozone is the gas that shields our planet from harmful UV radiation from the sun.
- EXA has completed a field study using state of the art technology to find out how much and which types of radiation are reaching the surface of Ecuadorian territory.
- This study has been completed using our own resources and equipment gathering our own data and using data from 12 satellites from NASA, ESA, KNMI, Environmental CANADA and the Meteorology Institute of Russia.
- The name of the project was HIPERION.
- **The results are as follows:**

## Total ozone (DU) / Ozone total (UD), 1980/03/31



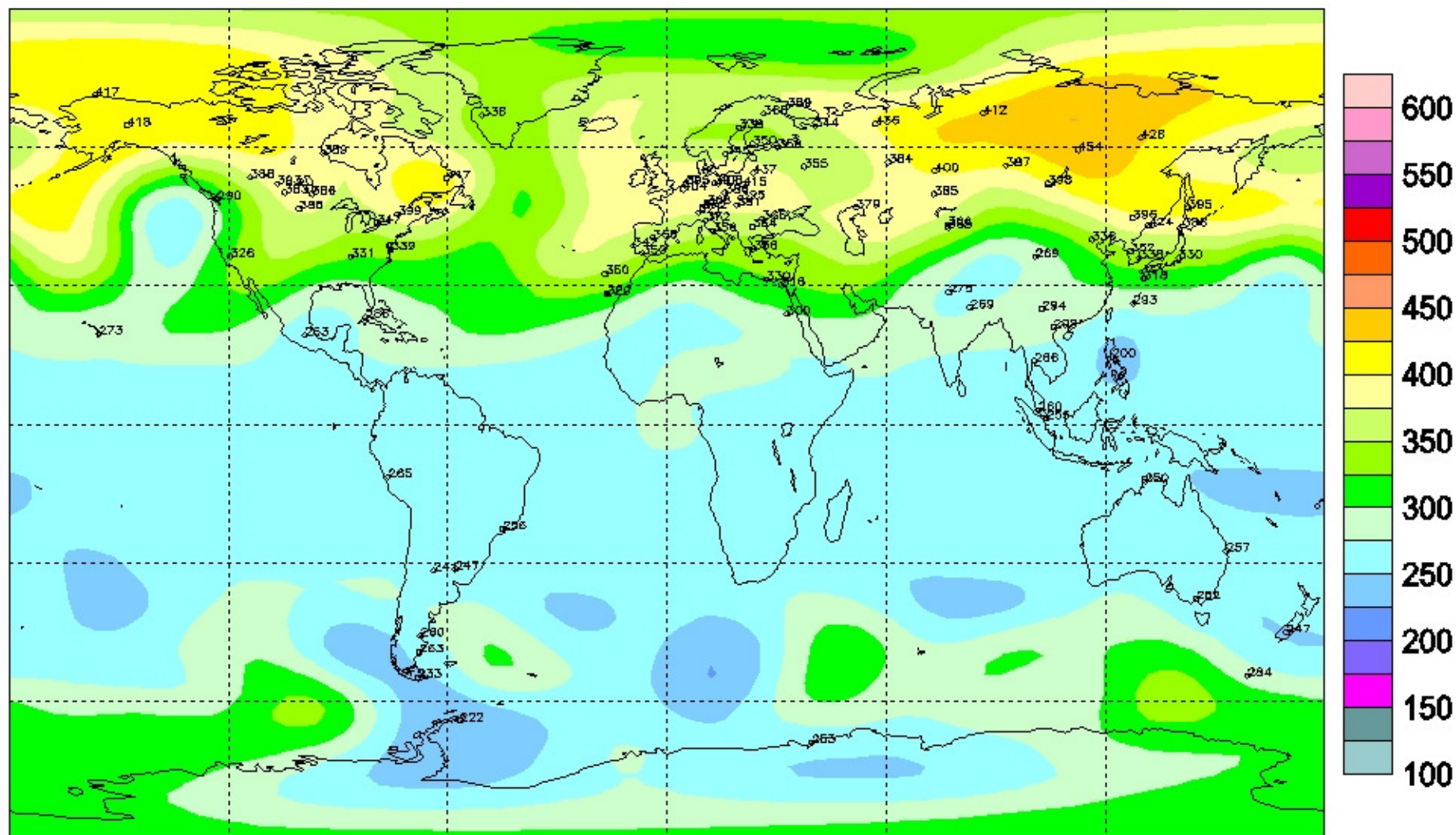
Fuente: Agencia Ambiental Canadiense

## Total ozone (DU) / Ozone total (UD), 1990/03/31



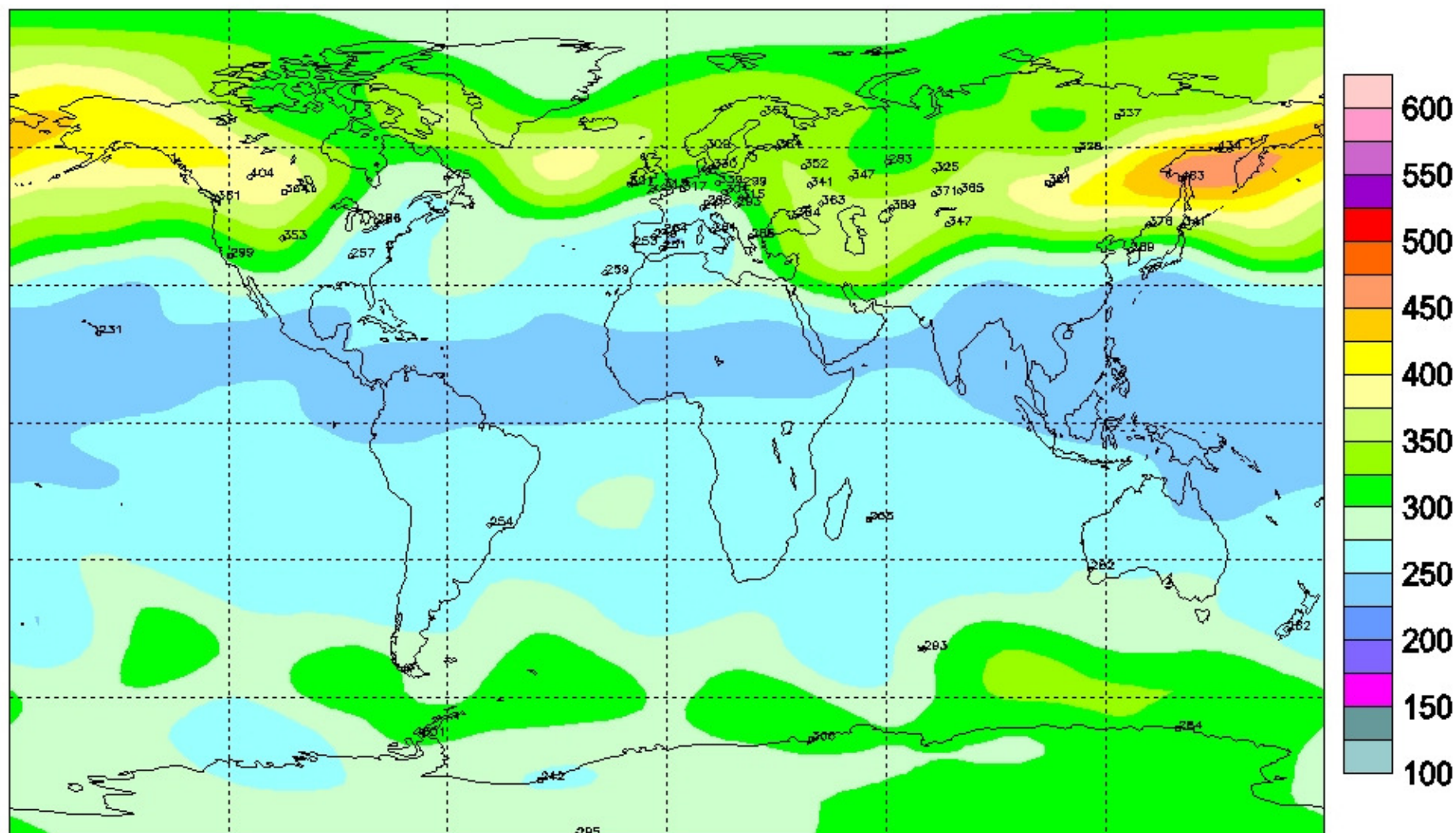
Fuente: Agencia Ambiental Canadiense

## Total ozone (DU) / Ozone total (UD), 2000/03/31



Fuente: Agencia Ambiental Canadiense

## Total ozone (DU) / Ozone total (UD), 2008/01/07

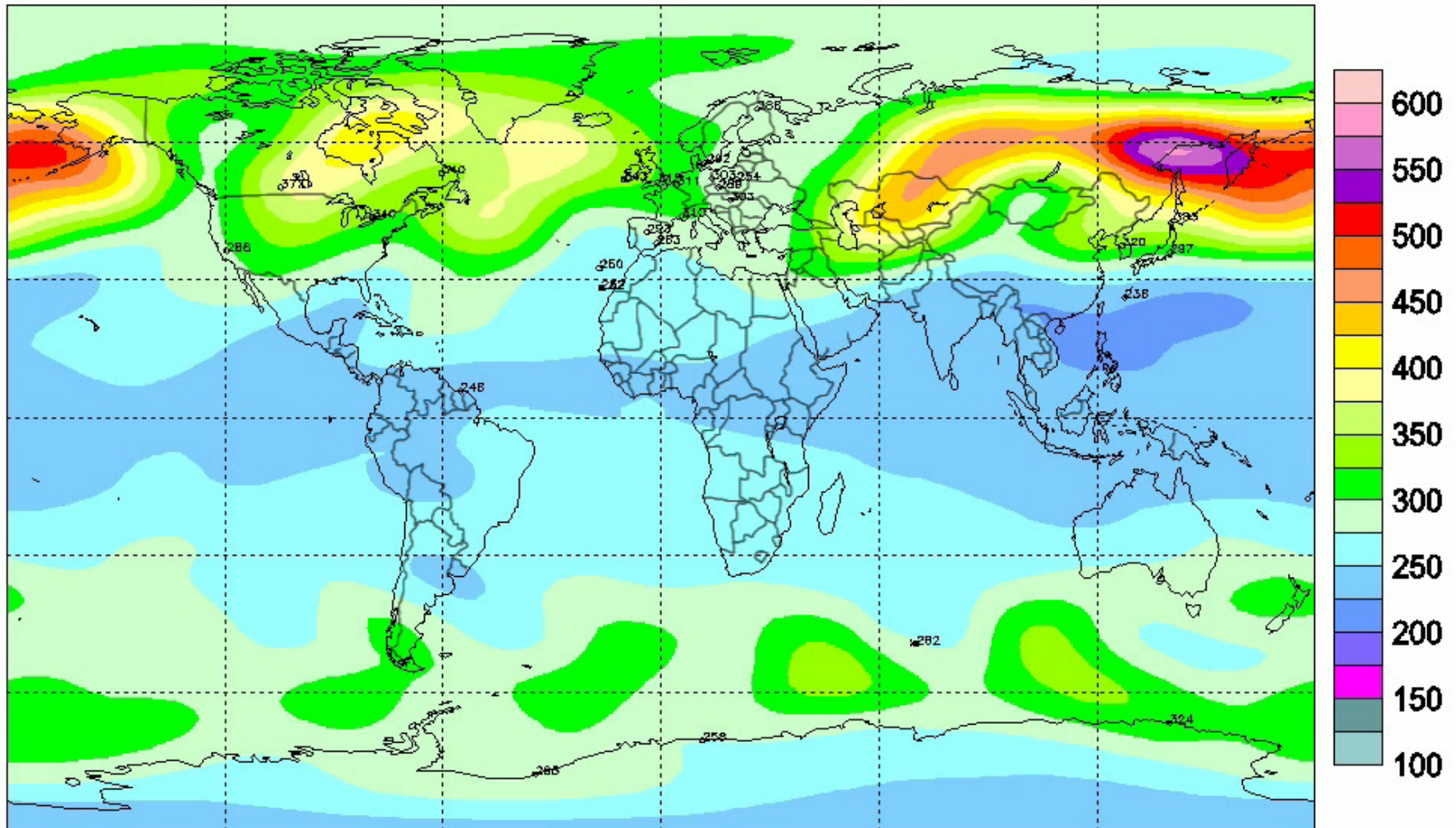


Fuente: Agencia Ambiental Canadiense

# State of the Ozone layer during 2007



## Total ozone (DU) / Ozone total (UD), 2007/01/01



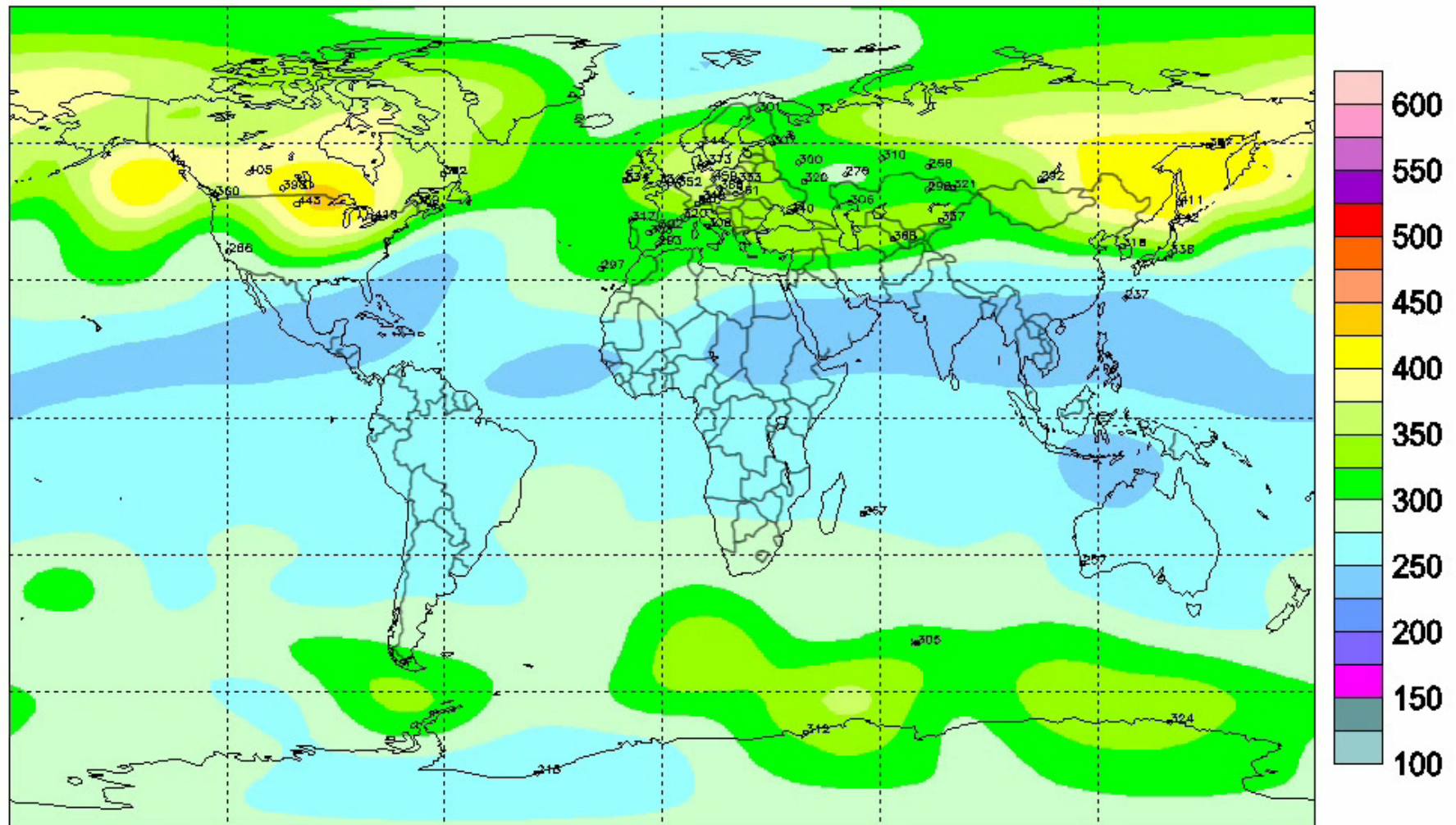
Fuente: Agencia Ambiental Canadiense



# State of the Ozone layer during 2008



## Total ozone (DU) / Ozone total (UD), 2008/01/01



Fuente: Agencia Ambiental Canadiense



# The HIPERION Report

## Key Questions

1. With that density of the ozone layer over the equatorial zone of the planet, how much UV radiation is reaching the surface?
2. What type of UV radiation is reaching surface and in which zones has more impact?

# EXA METEOROLOGICAL STATIONS IN GUAYAQUIL AND QUITO



EXA-ISS-1 GUAYAQUIL  
Latitud: 2° 08' 00" S  
Longitud: 79° 52' 58" W

EXA-ISS-2 QUITO  
Latitud: 0° 08' 18" S  
Longitud: 78° 32' 58" W





# ÍNDICE UV

# SOLAR MUNDIAL

*Guía práctica*

*Recomendación conjunta de:*

Organización Mundial de la Salud



Organización Meteorológica Mundial



Programa de las Naciones Unidas para el Medio Ambiente



UNEP

Comisión Internacional de Protección contra la Radiación no Ionizante



## THE WHO UV INDEX RANGE VALUES



CATEGORÍA DE EXPOSICIÓN

INTERVALO DE VALORES DEL IUUV

**BAJA**

**< 2**

**MODERADA**

**3 A 5**

**ALTA**

**6 A 7**

**MUY ALTA**

**8 A 10**

**EXTREMADAMENTE ALTA**

**11+**

*Tabla 1: Categorías de exposición a la radiación UV*

## THE UV INDEX ACTION RECOMMENDATIONS





# The HIPERION Report

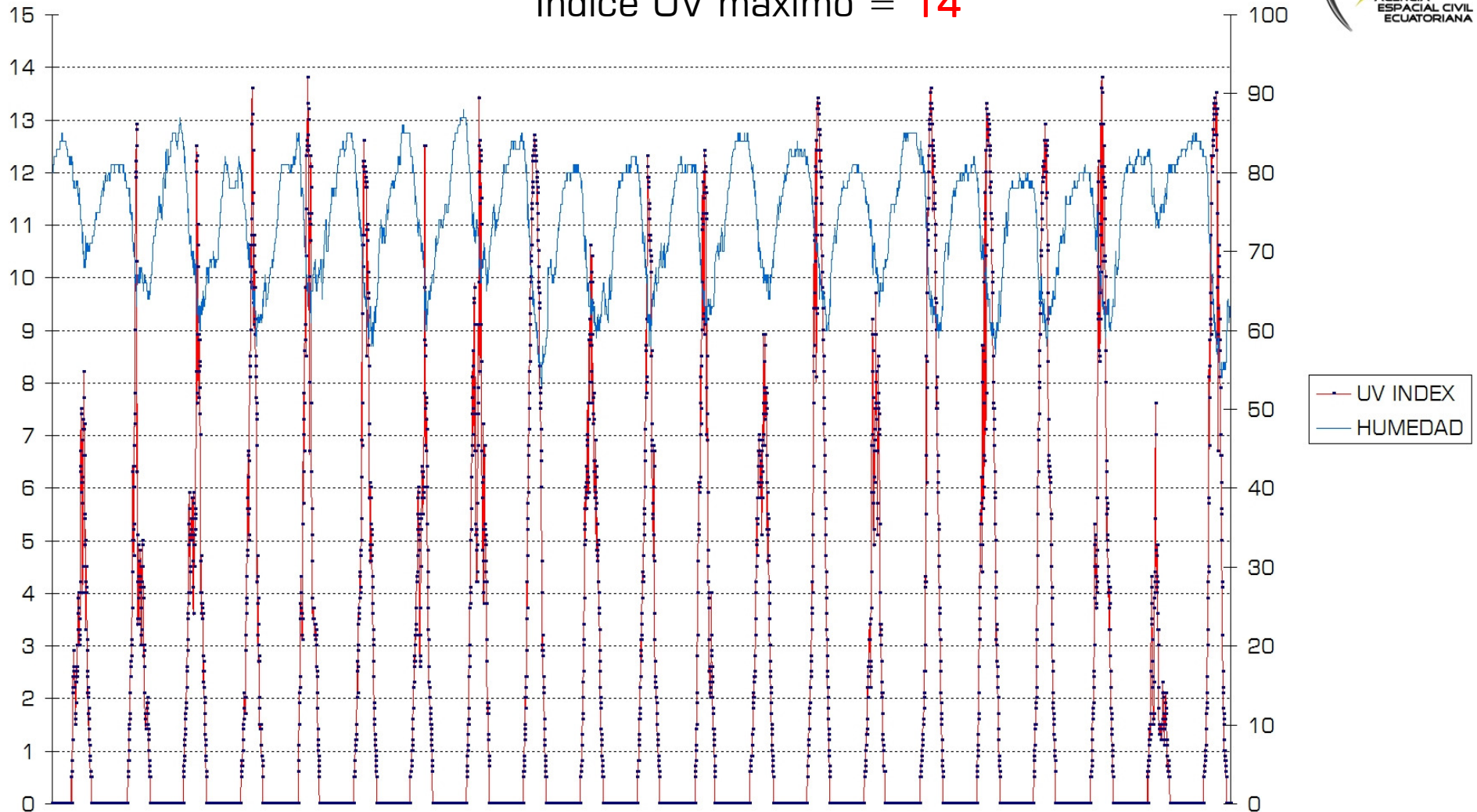
## DIRECT READINGS

1. Using completely automated systems that exclude human intervention we have gathered data about UV radiation on GUAYAQUIL and QUITO since April 2008.
2. The equipment used by EXA use the world wide standard of UV Index.
3. The results are as follows:

PROYECTO HIPERION  
INDICE DE RADIACION UV EN GUAYAQUIL - SEPTIEMBRE 2008

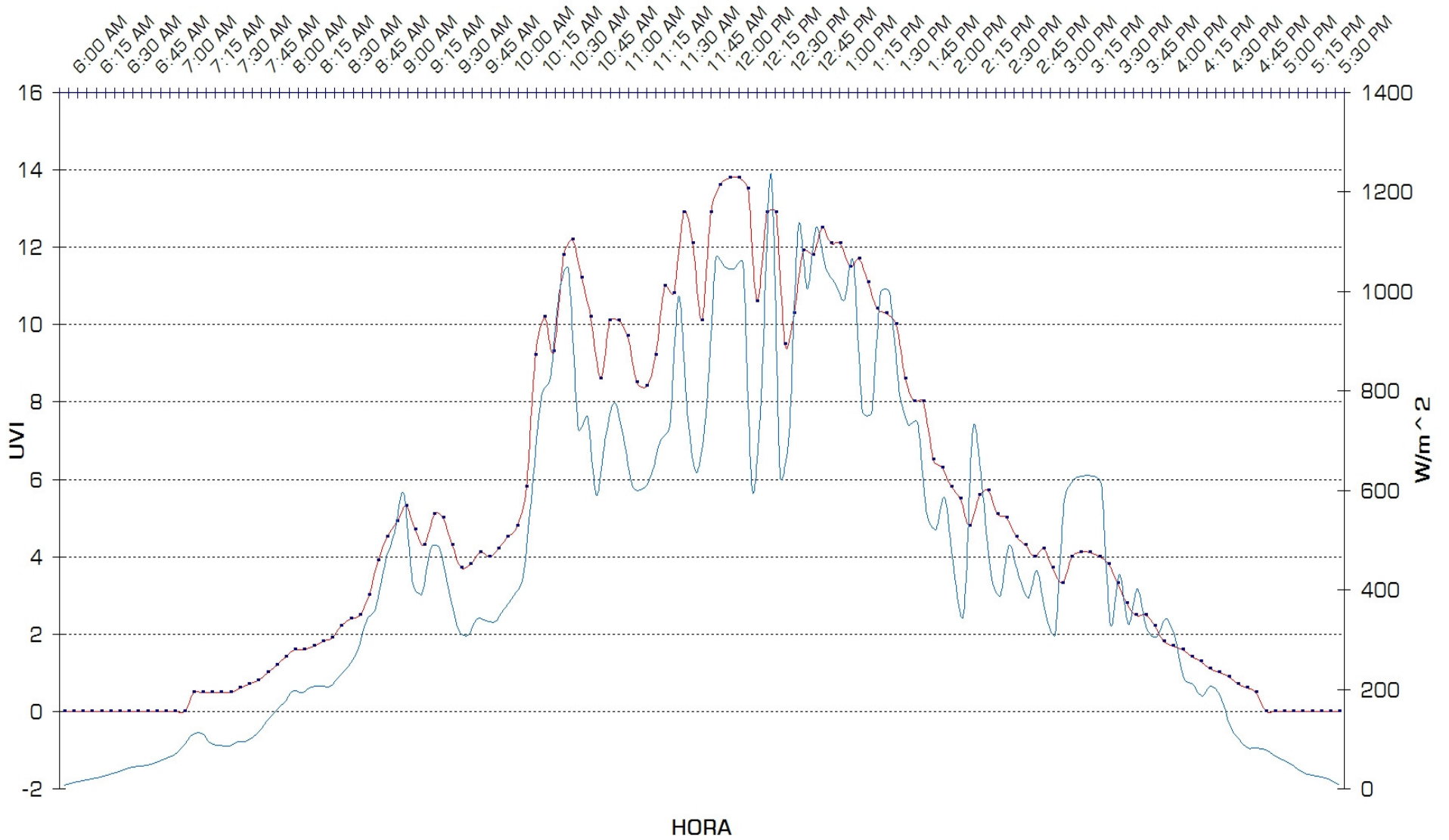


Índice UV máximo = 14





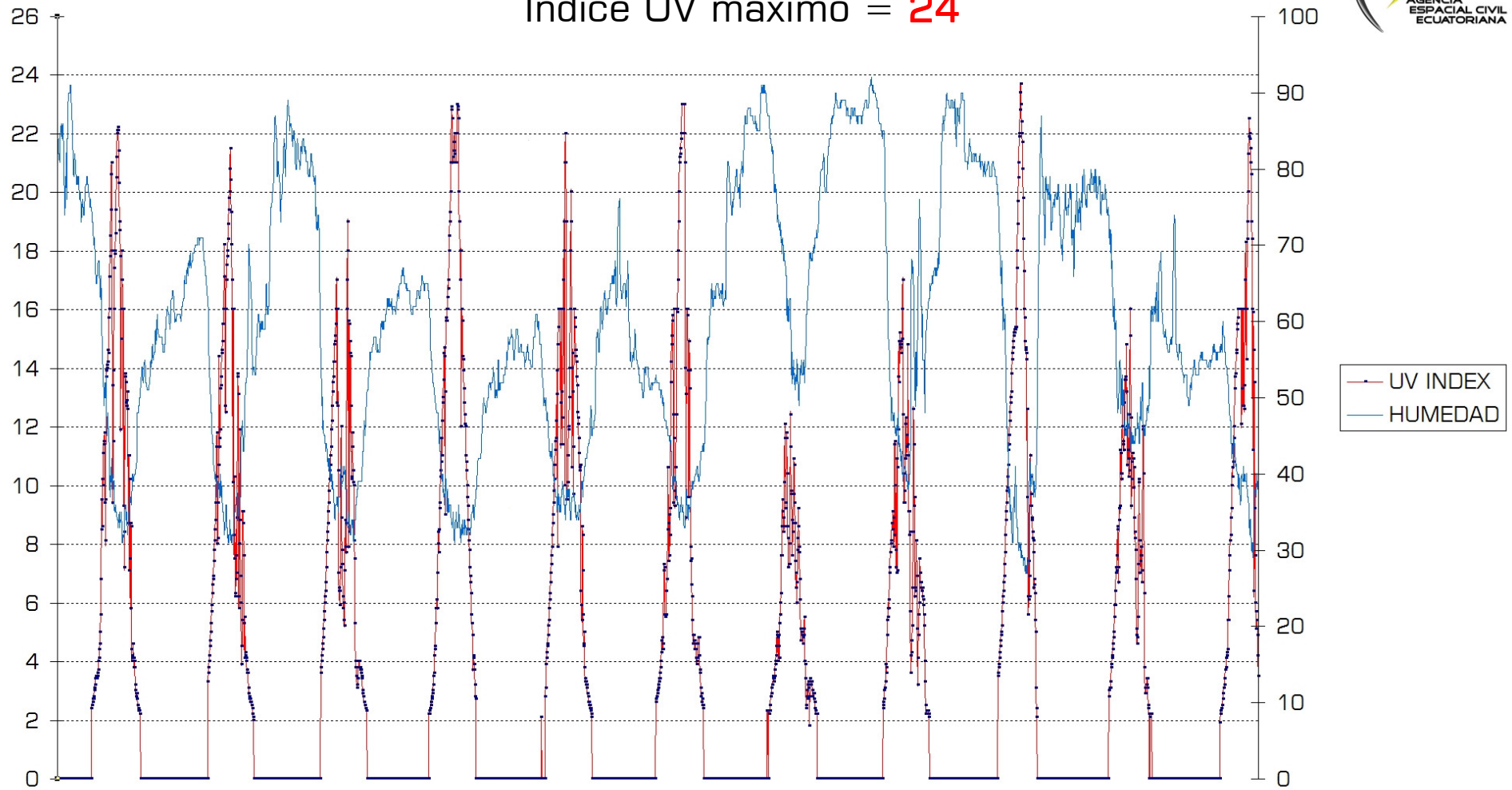
PROYECTO HIPERION  
INDICE DE RADIACION UV EN GUAYAQUIL - SEPTIEMBRE 19 2008



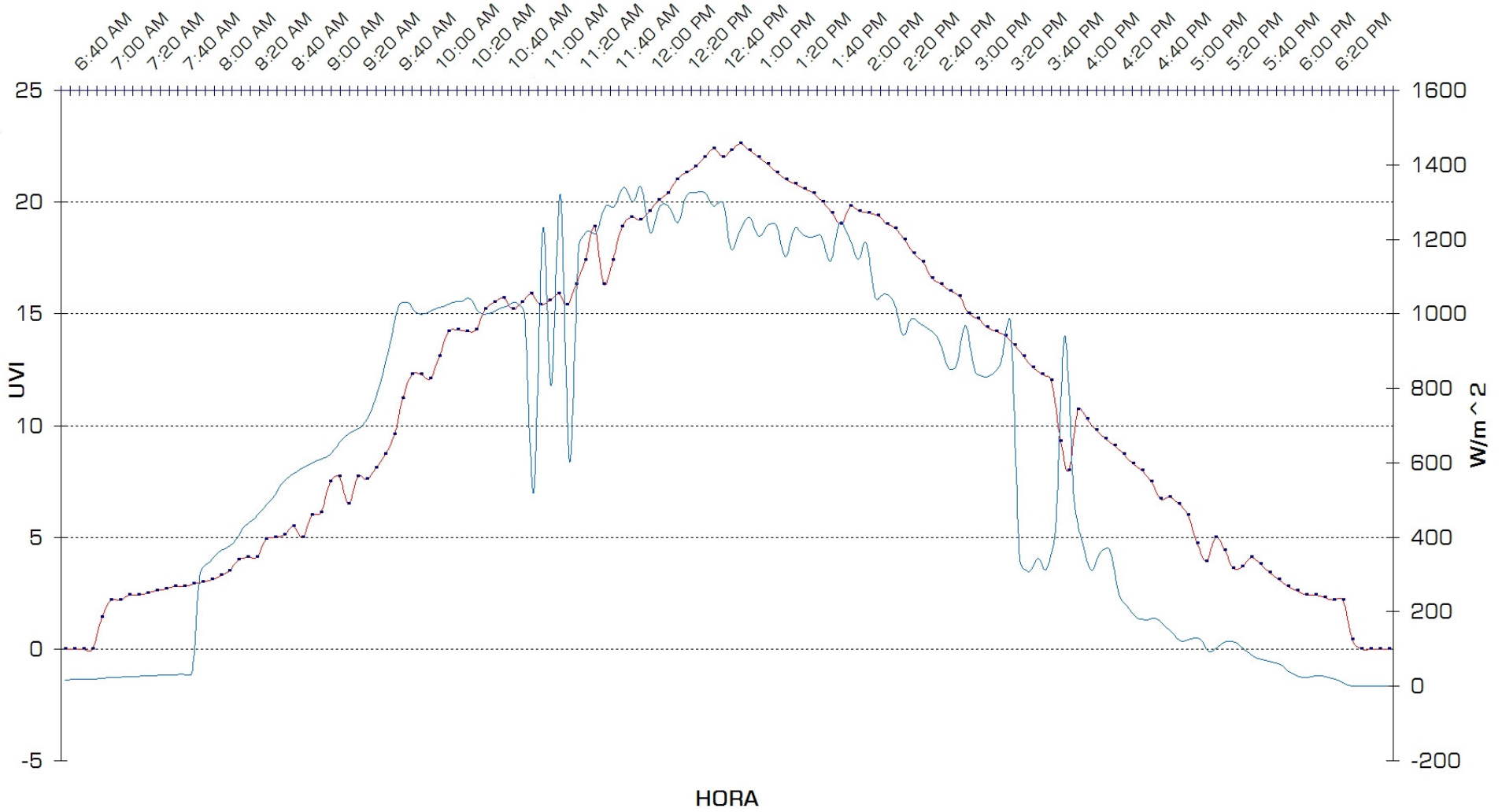
PROYECTO HIPERION  
INDICE DE RADIACION UV EN QUITO - AGOSTO 2008



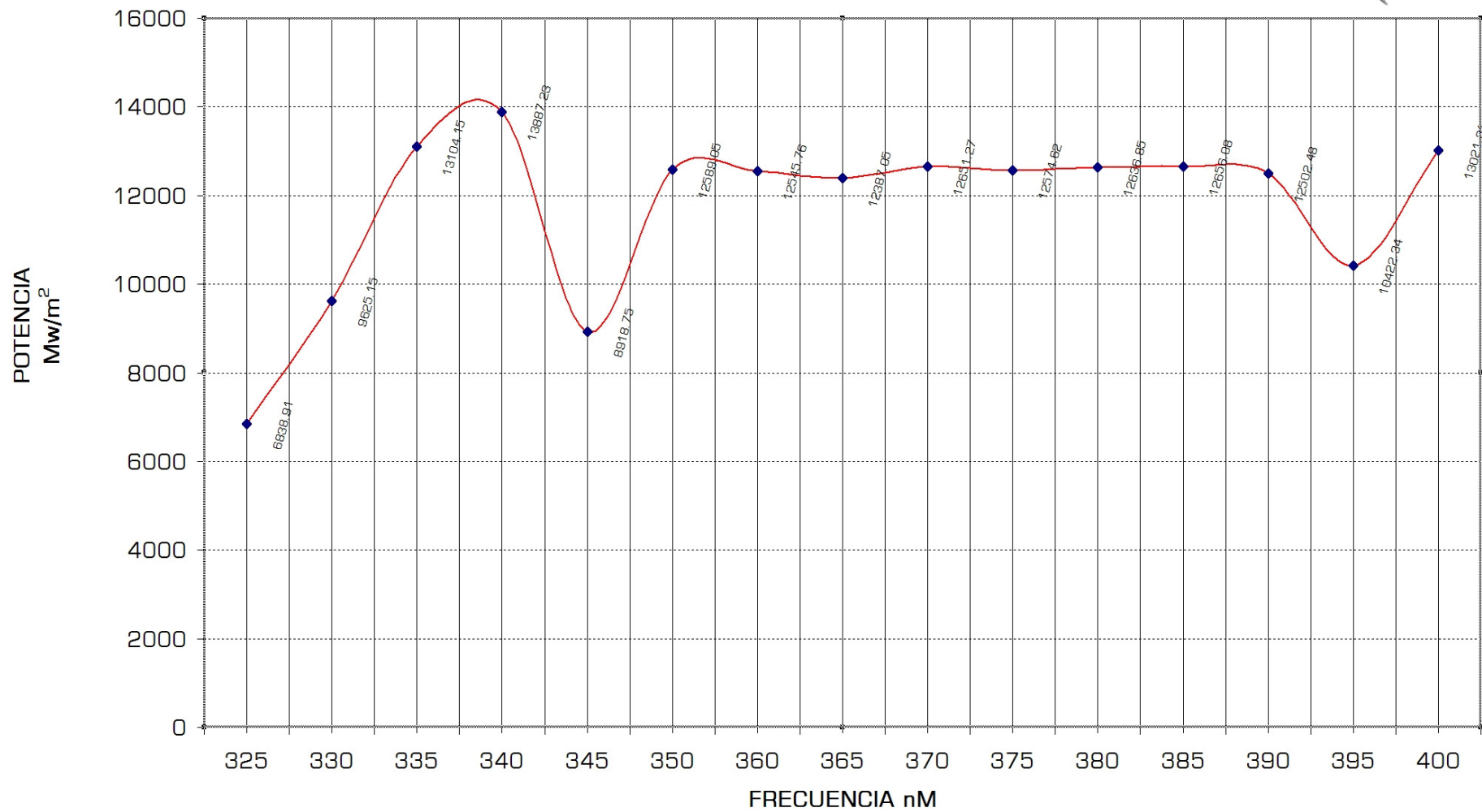
Índice UV máximo = 24

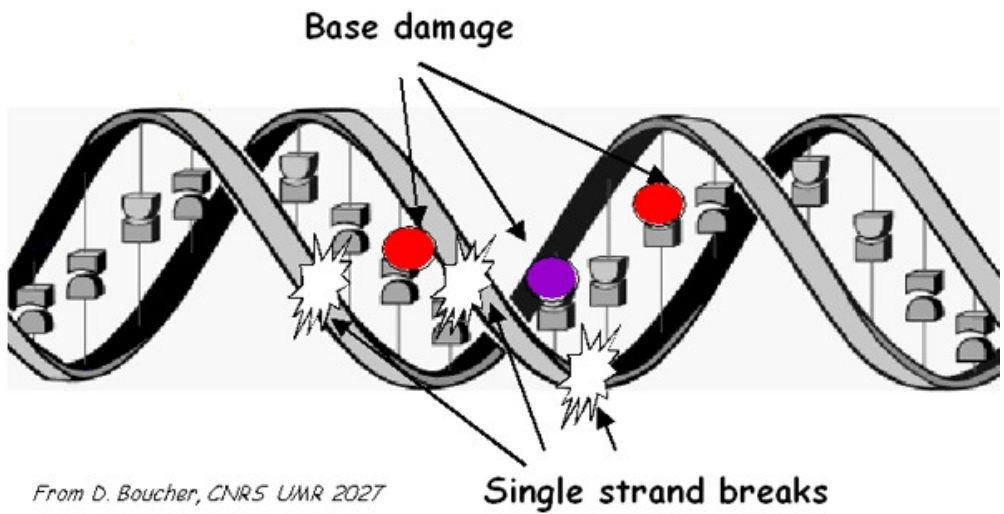


PROYECTO HIPERION  
INDICE DE RADIACION UV EN QUITO - AGOSTO 7 2008

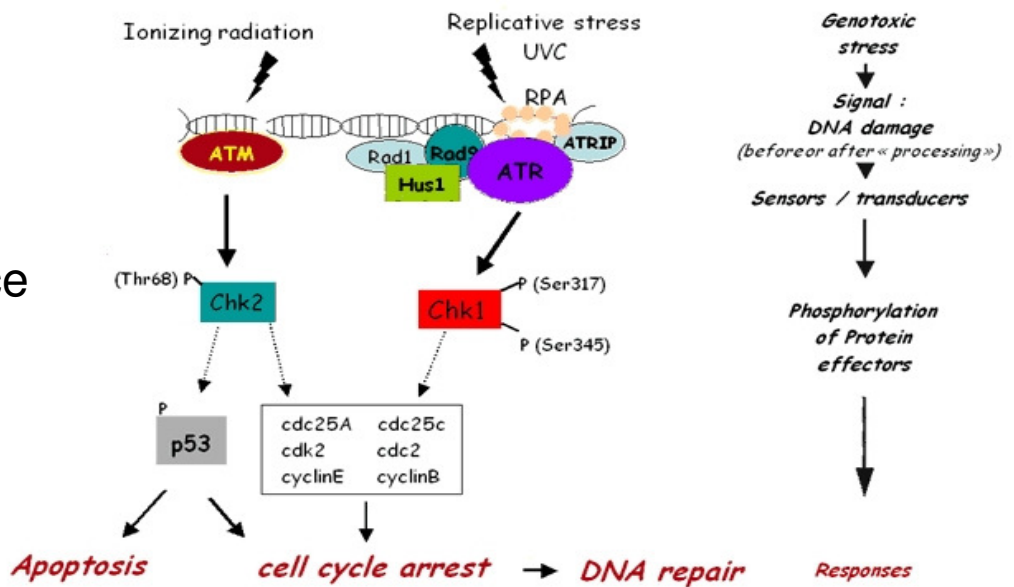


PROYECTO HIPERION  
ANALISIS DE FRECUENCIAS DE RADIACION UVA1 Y UVA-2 EN QUITO



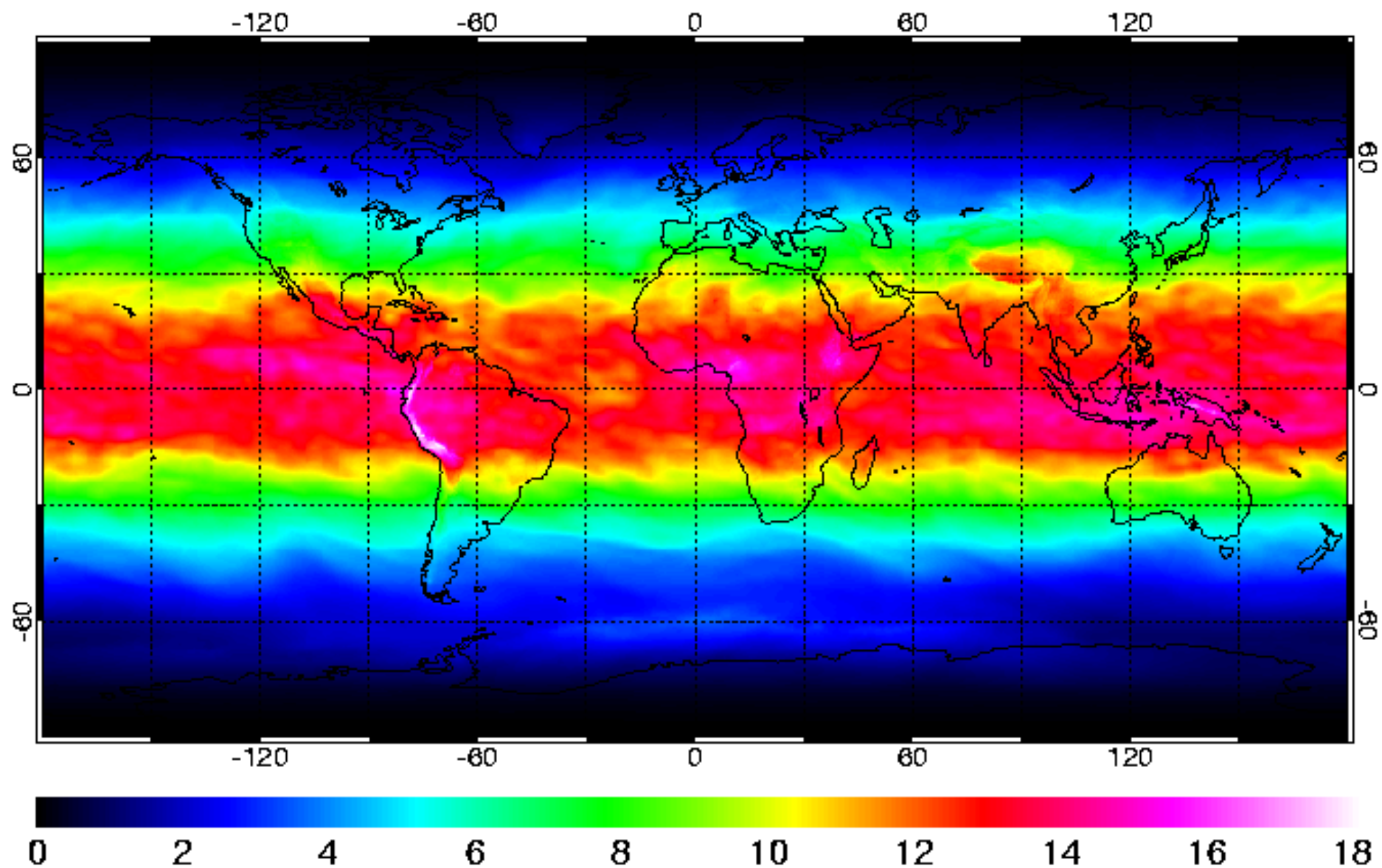


SOURCE: Curie Institute - France



Erythemal UV index  
SCIAMACHY - KNMI/ESA

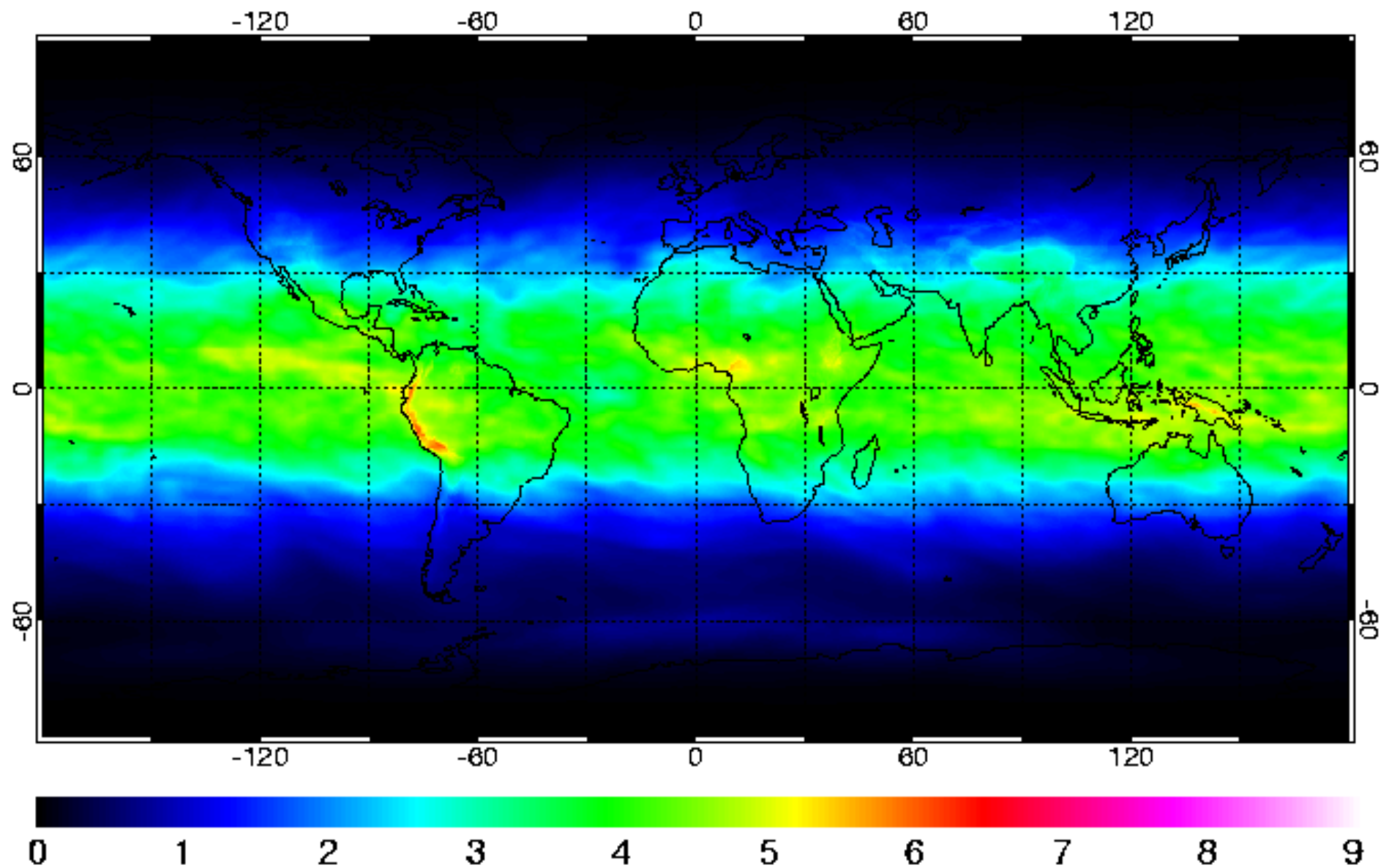
Clear-sky  
19 September 2008



DNA-damage UV dose (kJ/m<sup>2</sup>)

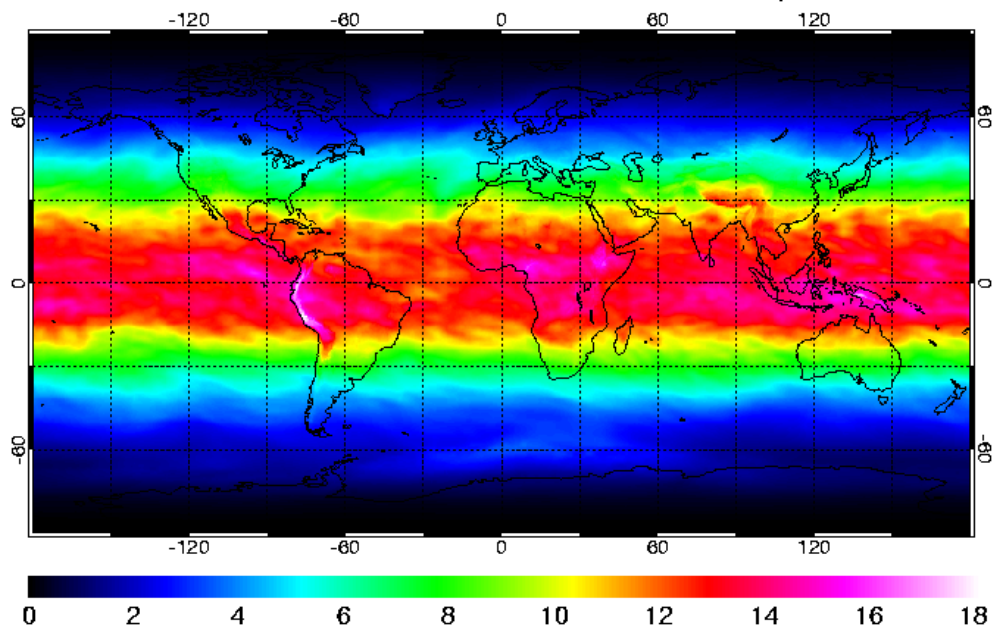
SCIAMACHY - KNMI/ESA

Clear-sky  
19 September 2008



Erythemat UV index  
SCIAMACHY - KNMI/ESA

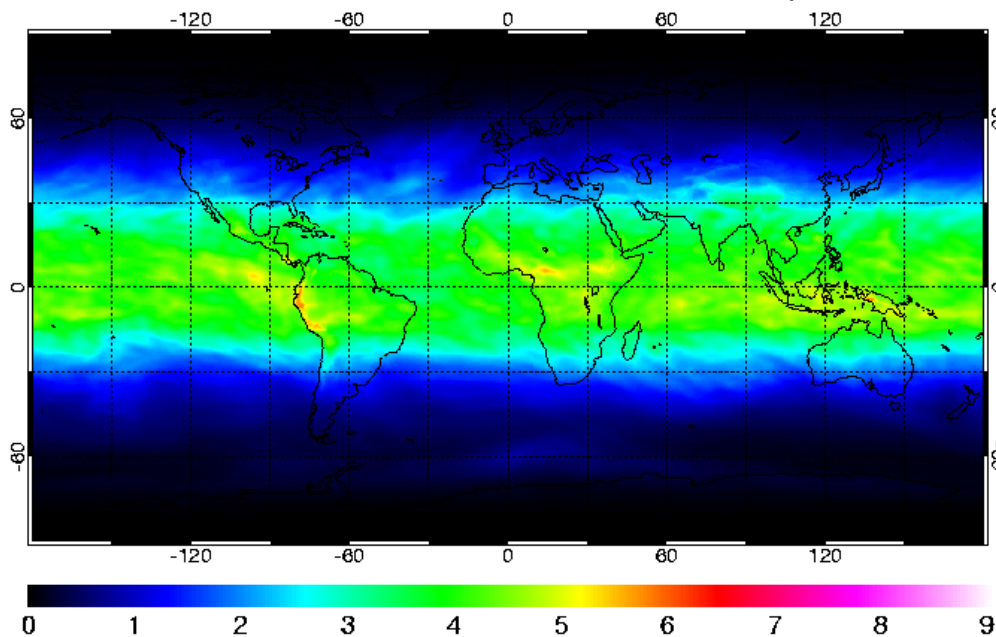
Clear-sky  
18 September 2008



Satelite: SCIAMACHY-KNMI  
Indice UV mundial  
Septiembre - Octubre

DNA-damage UV dose (kJ/m<sup>2</sup>)  
SCIAMACHY - KNMI/ESA

Clear-sky  
17 September 2008

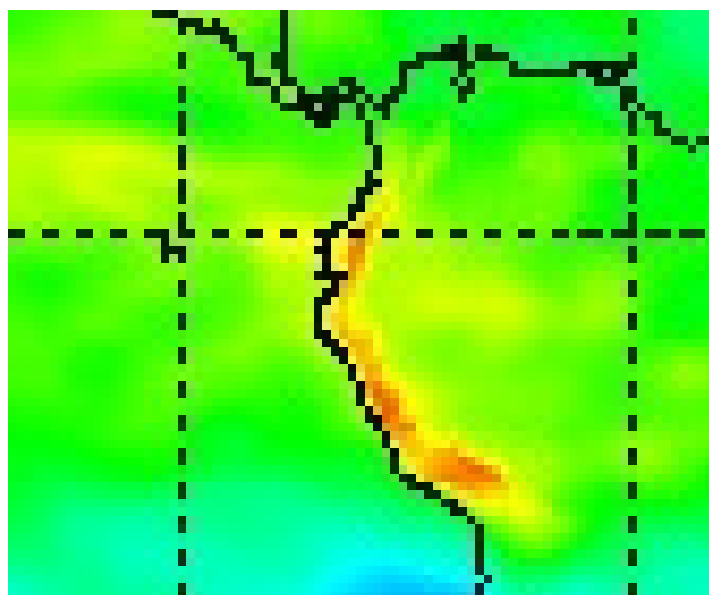


Satelite: SCIAMACHY-KNMI  
Incidencia UV mutagénica mundial  
Septiembre - Octubre

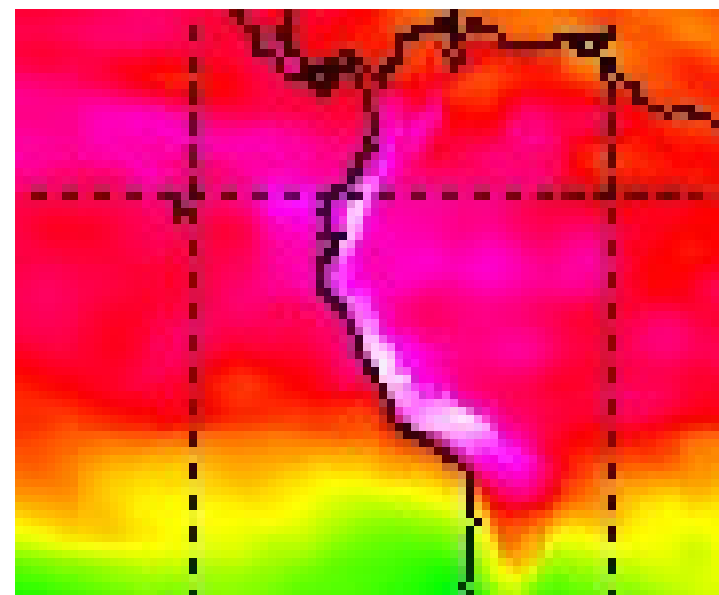
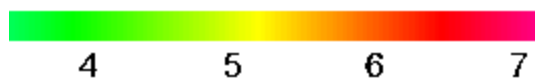


## SATELLITE CONFIRMATION FOR THE GROUND READINGS

SATELITE: SCIAMACHY/GOME-2 DATE: SEPTEMBER 19 2008



MUTAGENIC RADIATION POWER  
340NM >6.6



ERYTHERMAL UV RADIATION  
INDEX >18



**THE HIGHEST UV RADIATION ON THE PLANET**

## ONLINE SOURCES FOR COMPARISON PURPOSES EXA



FUENTE: AGENCIA AMBIENTAL DE CANADA

[http://exp-studies.tor.ec.gc.ca/e/ozone/Curr\\_allmap\\_g.htm](http://exp-studies.tor.ec.gc.ca/e/ozone/Curr_allmap_g.htm)

FUENTE: Agencia de Estudios Aeroespaciales - Holanda

[http://www.temis.nl/uvradiation/world\\_uvd.html](http://www.temis.nl/uvradiation/world_uvd.html)

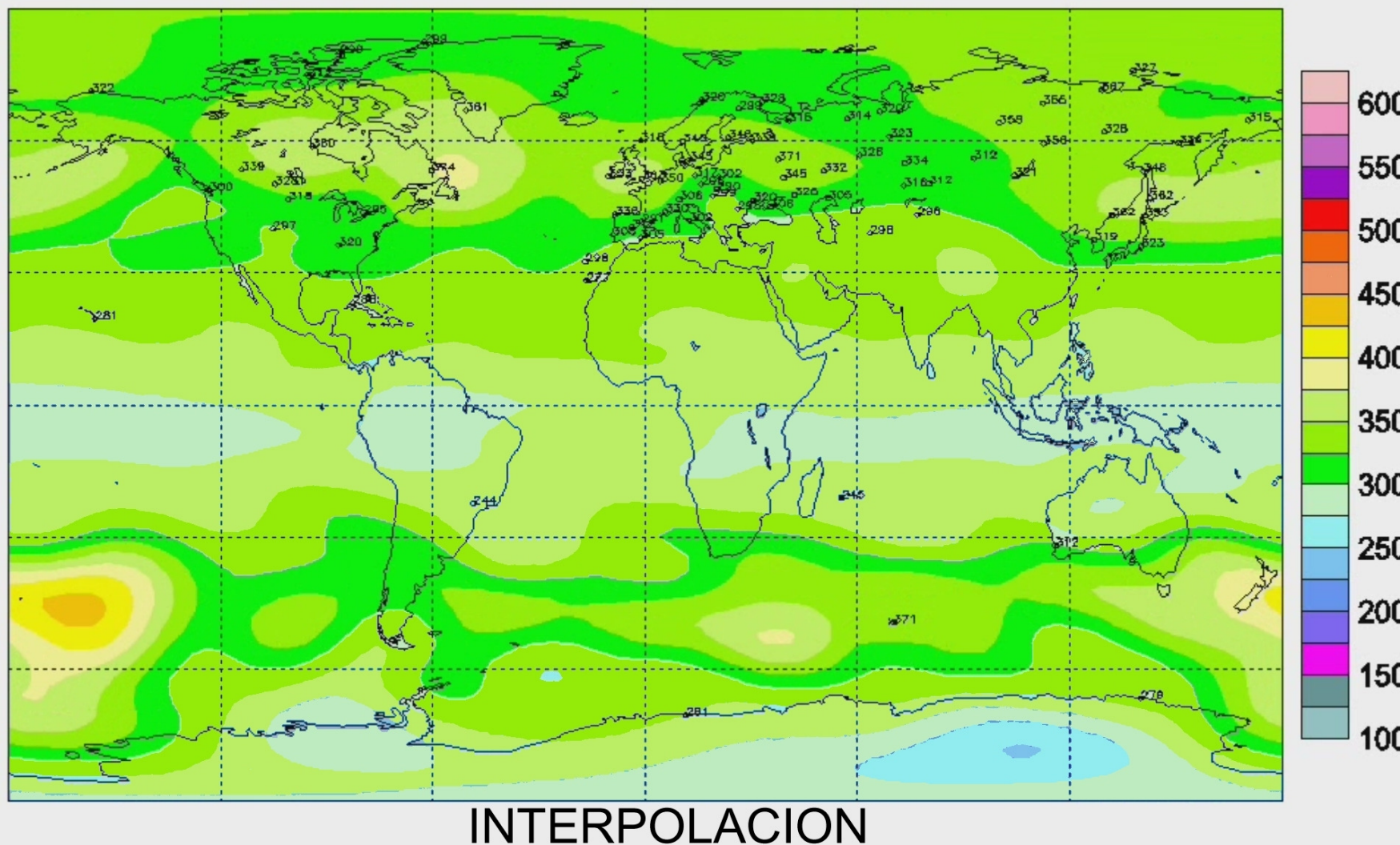
<http://www.temis.nl/protocols/O3global.html>

El potencial mutagénico de la radiación UVA - Instituto Curie - Francia

[http://www.curie.fr/recherche/themes/detail\\_equipe.cfm/lang/gb/id\\_equipe/45.htm](http://www.curie.fr/recherche/themes/detail_equipe.cfm/lang/gb/id_equipe/45.htm)

## INTERPOLATION TO 1950

### DENSIDAD DE LA CAPA DE OZONO HACE 50 AÑOS

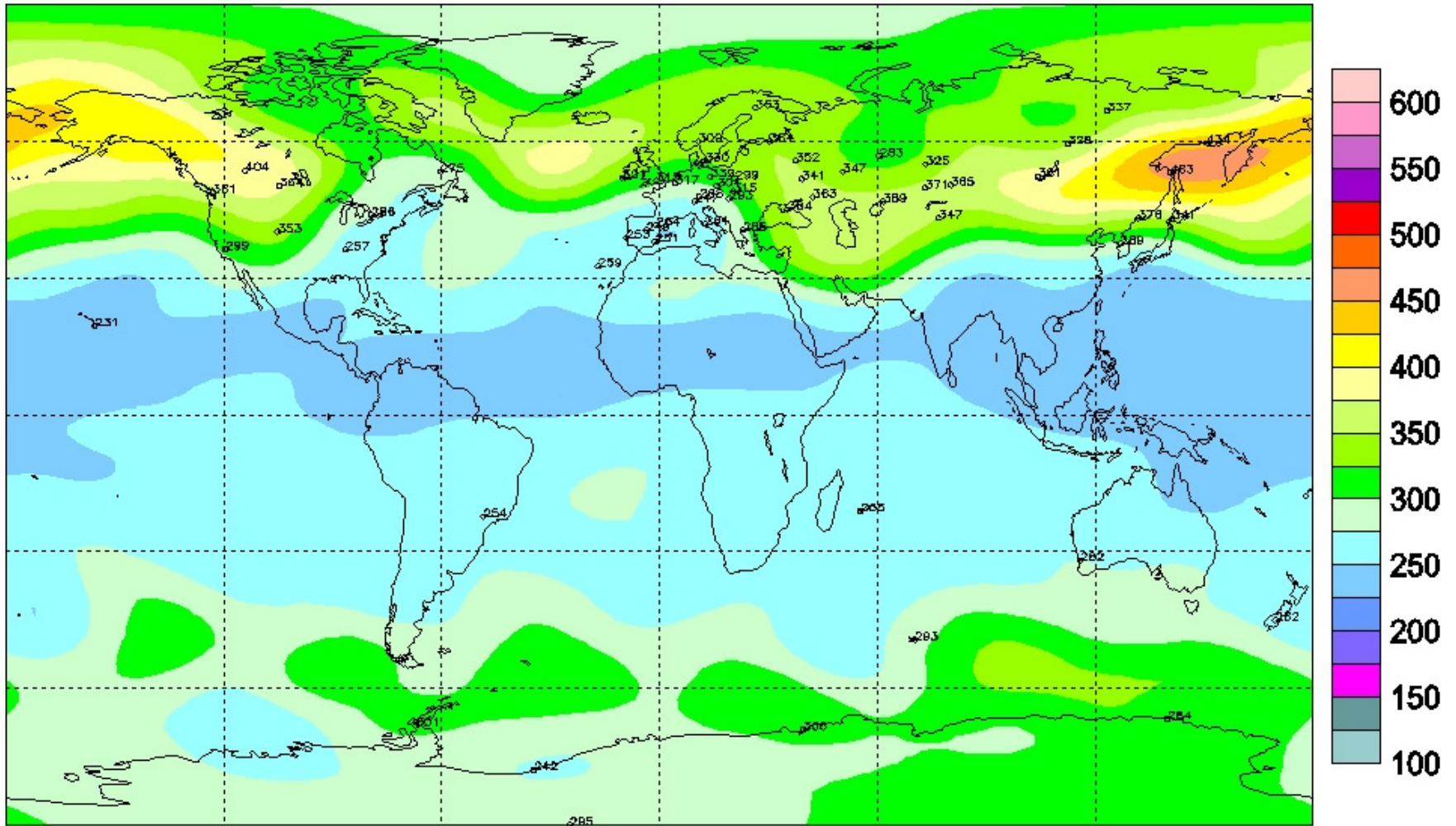


Source: EXA, based on data from Environmental Canada

# ACTUAL DATA



## Total ozone (DU) / Ozone total (UD), 2008/01/07

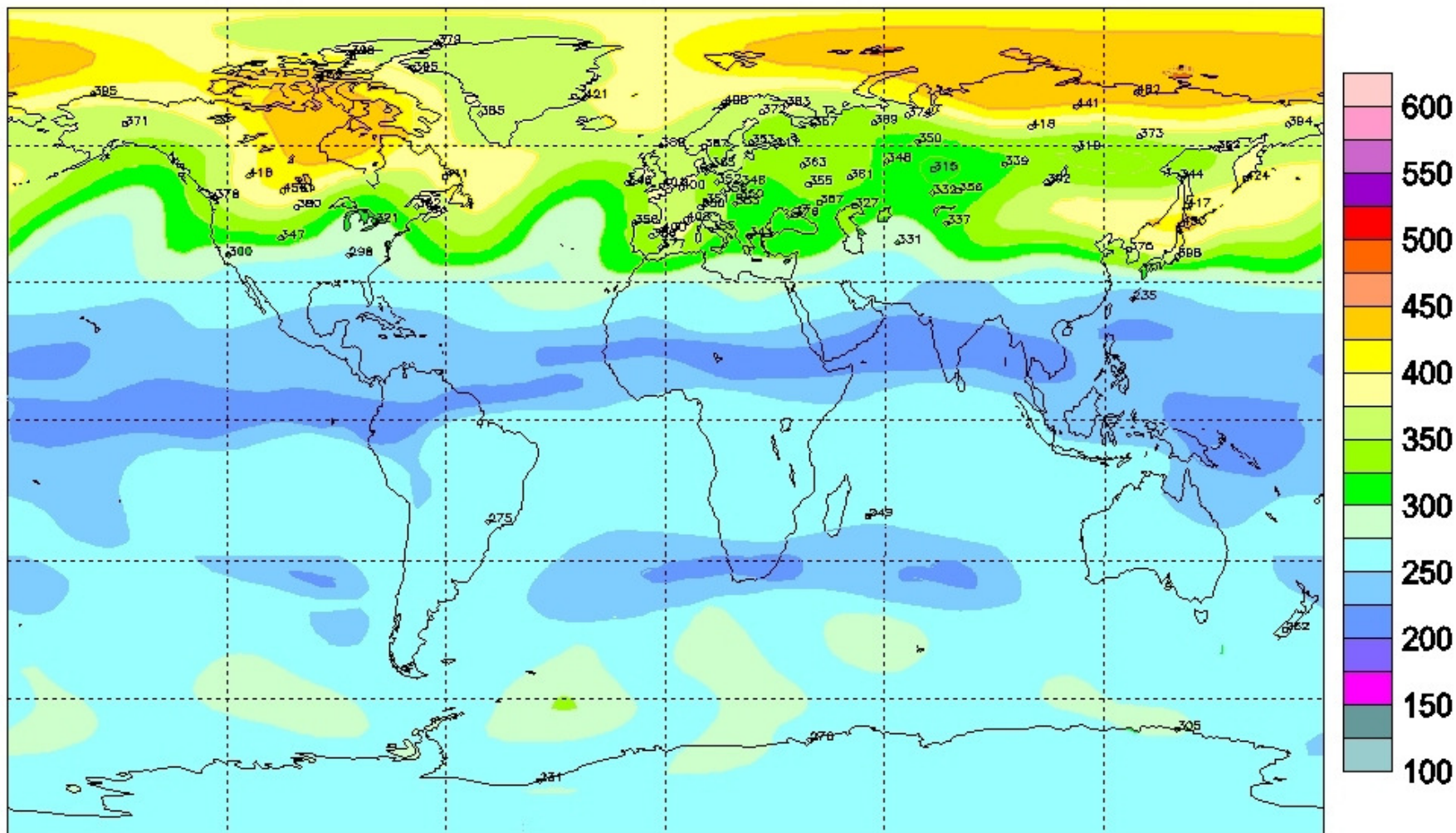


Source: Environmental Canada

# EXTRAPOLATION TO 2020



## Total ozone (DU) / Ozone total (UD), 2020/03/31

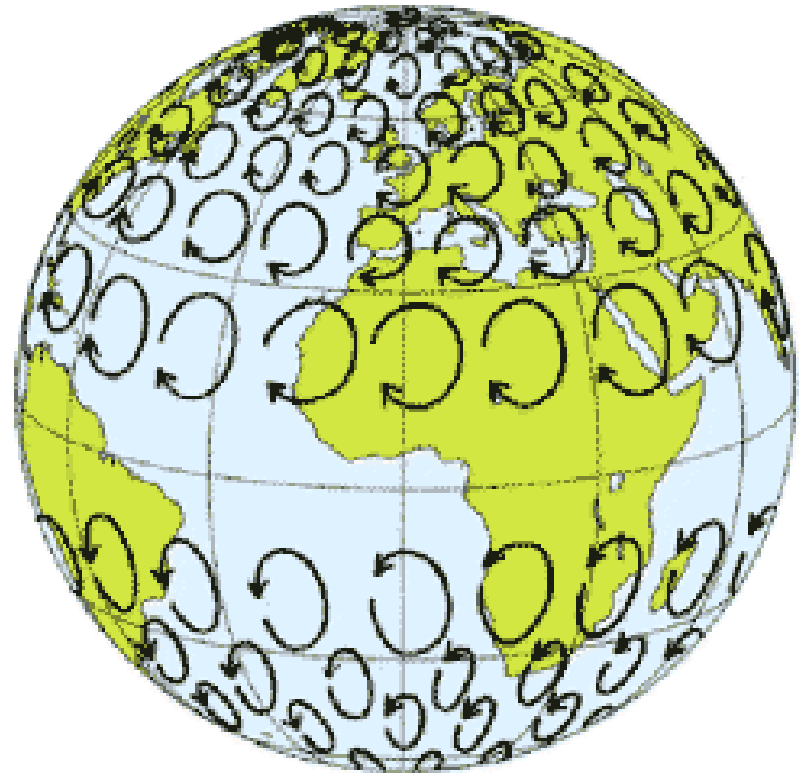


Source: EXA, based on data from Environmental Canada

# The HIPERION Report

## Why Ozone is destroyed?

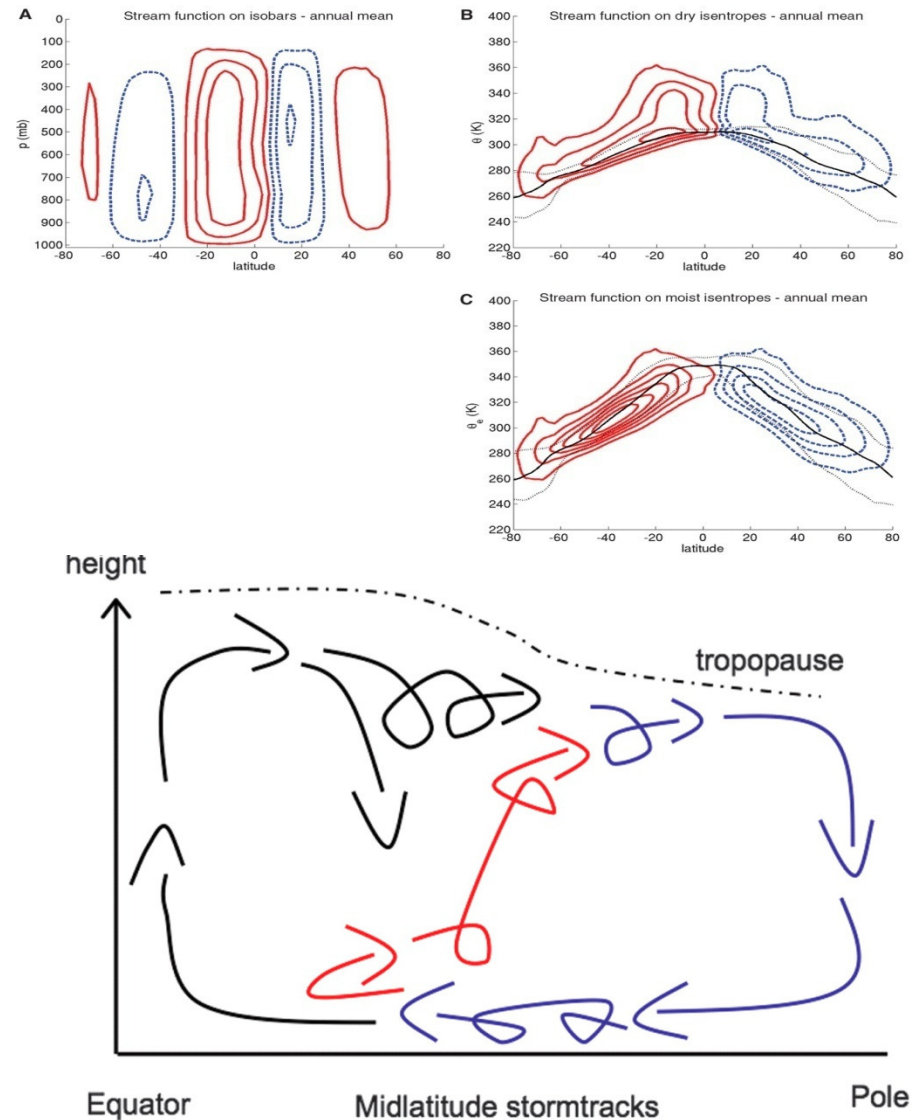
1. Even when the most of the ozone is produced over equatorial areas , the gas is redistributed pole ward thanks to the CORIOLIS effect in part.
2. It is natural that a weaker density of ozone should exist over the equatorial band, but this density should not drop below 280 Dobson units.
3. The CORIOLIS effect, among many other factors, helps define the master wind patterns on the planets.
4. When the ozone reaches south pole is destroyed there by the chlorine present in the Polar Stratospheric Clouds PSC and the seasonal south pole ozone hole forms , so there is not enough ozone left to maintain an acceptable level due to this loss.
5. There is also an smaller seasonal hole over the north pole.



# The HIPERION Report

## Why Ozone is destroyed?

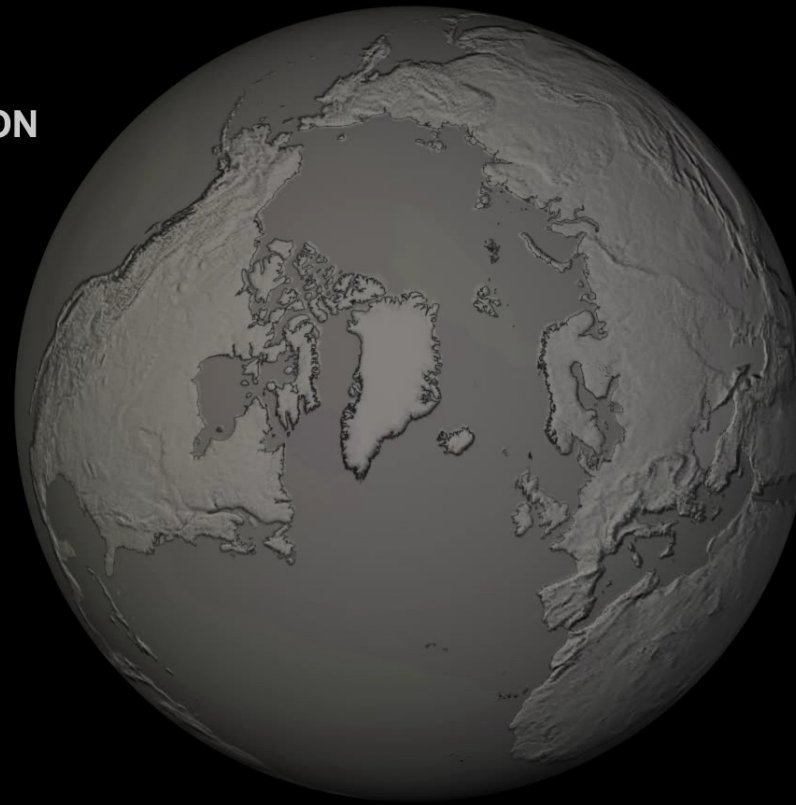
1. This atmospheric circulation pattern has just recently revised by one study published in the *SCIENCE* magazine of September 2008
2. The study, by **Pauluis** (*Courant Institute of Mathematical Sciences, New York University*), **Czaja** (*Space and Atmospheric Physics Group, Department of Physics, Imperial College*) and **Korty** (*Department of Atmospheric Sciences, Texas A&M University*), details the atmospheric redistribution pattern that sends the gases from the equator to the poles.
3. Direct observations from the GOME-2 instrument detail the Ozone destruction process in the south pole



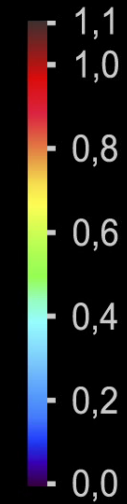
# SEASONAL ACTIVATION OF CHLORINE ON THE SOUTH POLE



GOME-2 / MetOp  
ANALYSED  
CHLORINE ACTIVATION  
AT 20 KM ALTITUDE



Volume  
Mixing Ratio  
[ppb]



DLR



APR-11-2008

<http://wdc.dlr.de>

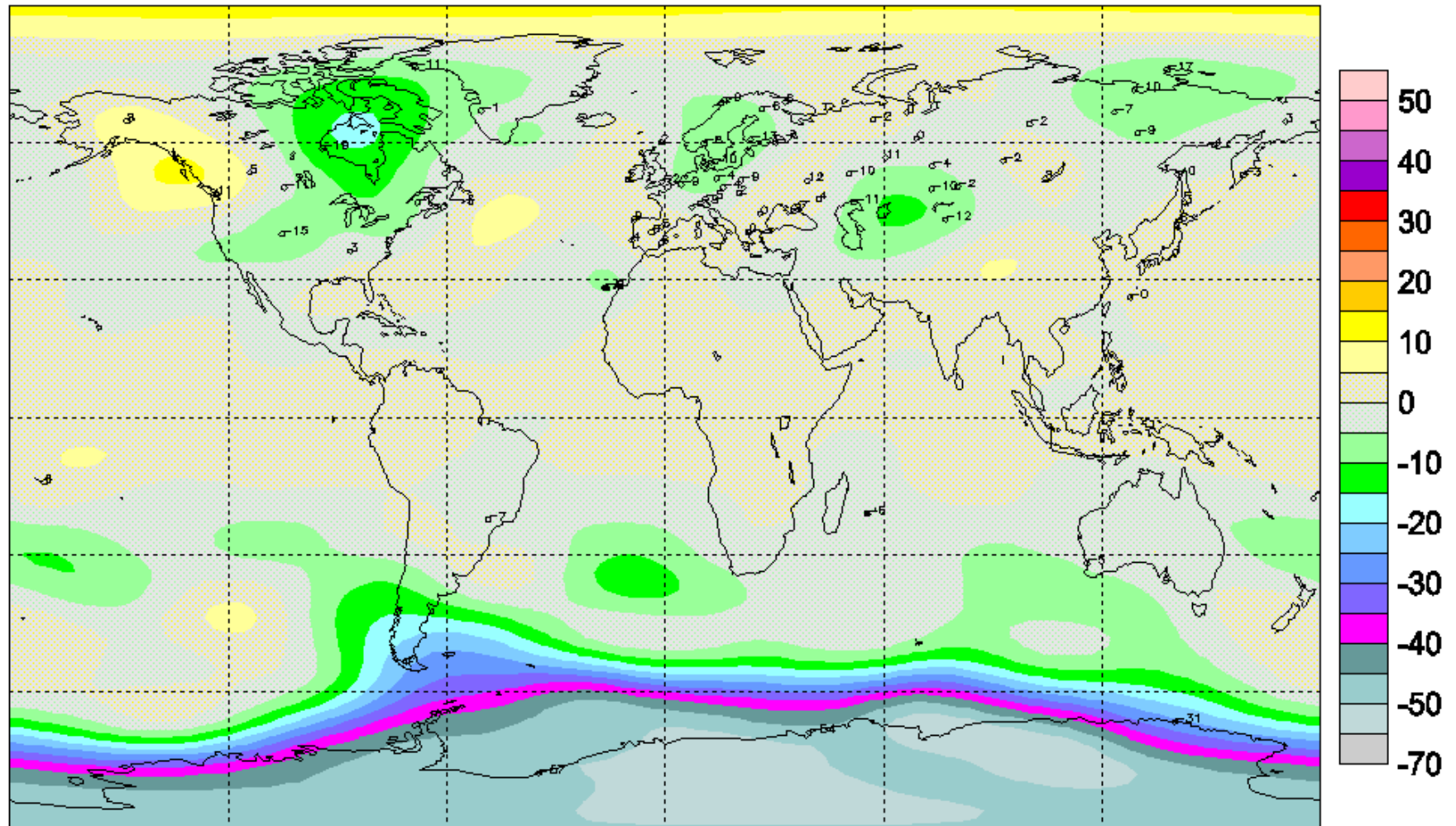
Source: DLR Germany - EUMESAT



# OZONE DESTRUCTION PERCENT ON THE PSCs



## Deviations (%) / Ecartis (%), 2008/10/08





# The HIPERION Report

1. We have use satellite images dating from 1980 from reliable sources like NASA, ESA, KNMI, Environmental CANADA and the Russian Meteorology.
2. We have take ground readings using automatic equipment of proven reliability, avoiding human intervention in the data gathering and reading taking process.
3. Satellite data are in agreement with ground data readings.
4. We have abided to parameters specified by the UV index.
5. We have made no data interpretation.

# The HIPERION Report Findings



- The Ozone layer over equatorial regions has weakened over the last 15 years. This phenomenon could be a direct consequence of the seasonal south pole ozone depletion.
- As a result we have verified that the UV radiation levels reaching Ecuadorian territory **EXCEEDS** the last number in the WHO UV index scale for acceptable human tolerance.
- The power of the radiation that reaches our region is the **HIGHEST IN THE PLANET** and represents a clear and present danger to all the Ecuadorian, Peruvian and Colombian population, the most affected areas are the Andean regions.

# The HIPERION Report Findings



1. Due to its position in the planet, our region receives much more radiation than the polar region, and the weakening of the ozone layer over our coordinates occurs **the whole year.**
- As a result of this excessive exposition to high levels of radiation and due to its cumulative nature, is statistically safe to say that many Ecuadorians will suffer from Skin cancer, some types of blindness and weakening of the immunological system.
  - Due to the high power of the UV-A 340nm radiation it is probable a rise in the cases of illnesses that arise from DNA damage.



# The HIPERION Report RECOMMENDATIONS

- More research is needed in this field in the country and more resources are needed for this job.
- Childs are to be protected, and something will have to be done about the times of the day they spend in the open during school time.
- Activities in the open should be taken very seriously from now on.
- Sunscreens should be used, in the coastal, Amazonia and Galapagos areas they should be of at least SPF 70, in the Andean region should be SPF 100, and they should have UV-B and UV-A protection.



# The HIPERION Report RECOMMENDATIONS

- Foreigners visiting our country should be properly informed of this conditions, so they can take appropriate measures.
- Every vehicle should be equipped with anti-UV windshields films to avoid exposition in a place where people is trapped and cannot avoid being exposed.
- The medical community should investigate if there is a clear statistical correlation between the high UV-A 340nm radiation dose and the apparent increment of congenital malformations in the last 10 years in Ecuador.
- The state should intervene **URGENTLY** to protect the Ecuadorian population from an immediate, clear and present danger.



# The HIPERION Report

## EXA Reactive Alert Systems

- In an effort to help fight this phenomenon, EXA wants to take the first step in the protection of the Ecuadorian population..
- Using our own resources, science and technology, we have setup 3 systems that starting today will empower 4 million people with the capacity to react against high levels of UV radiation.
- The front line system is the **NRM**: the **NATIONAL RADIATION MONITOR**, which is a near real-time system that reports, every 5 minutes which is the level of UV radiation in Guayaquil and Quito and emits a recommendation accordingly to the actual UV level.
- The second system is the **RTSIC**: The **Real Time Satellite Imaging Center**, a system that gathers images from 10 different meteorological satellites monitoring UV radiation, clouds and ozone levels from space, this system will help in the investigation of the phenomenon and will help forecast radiation surges.
- The third system is the **RTCR**: **Real Time Climate Reporter**, which give any person direct access to the EXA meteorological stations with more than 100 measuring parameters and data history up to 1 year.

# EXA METEOROLOGICAL STATIONS ON GUAYAQUIL AND QUITO



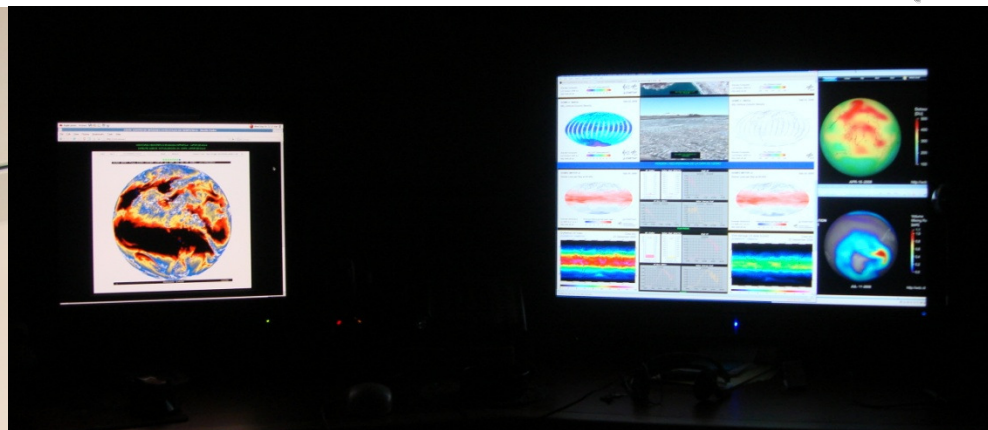
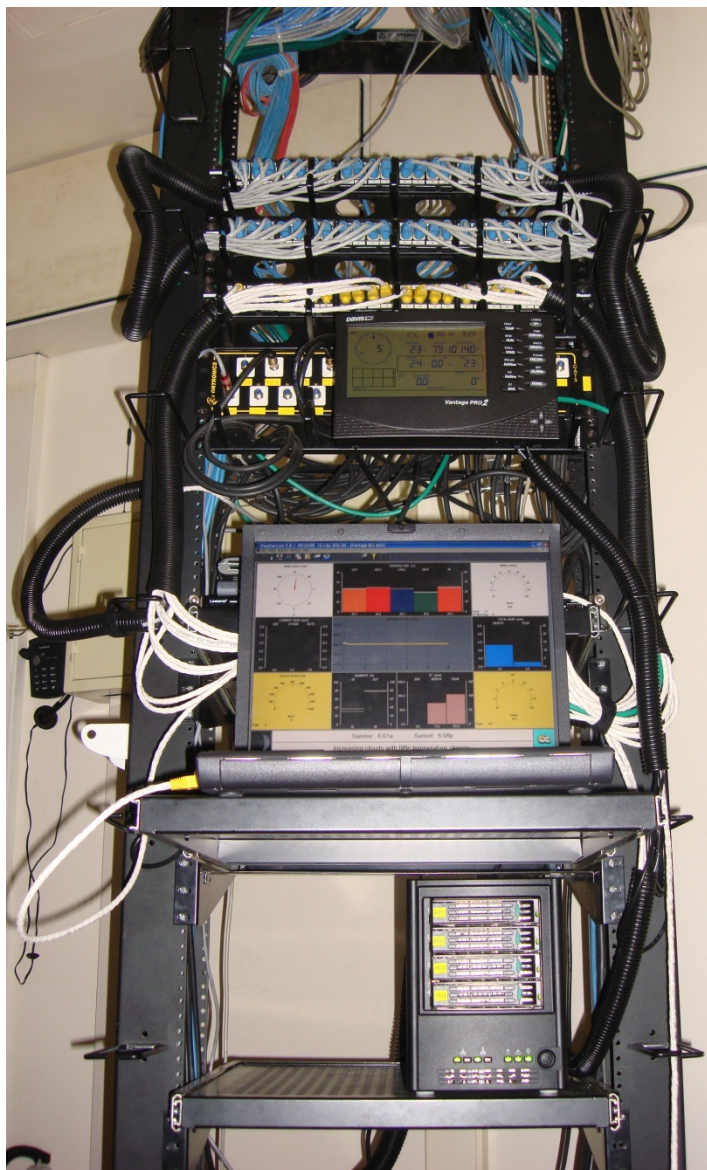
**EXA-ISS-1 GUAYAQUIL**  
Latitude: 2° 08' 00" S  
Longitude: 79° 52' 58" W

**EXA-ISS-2 QUITO**  
Latitude: 0° 08' 18" S  
Longitude: 78° 32' 58" W





# CONTROL and PROCESSING CENTER OF EXA PLANETARY SCIENCES IN GUAYAQUIL



# The HIPERION Report Suggestions



- Help is needed from the mass media to maintain a permanent information campaign for the population in order to help them get aware of the risks and how to avoid them.
- Real time media like (TV, Radio and Internet) should inform the population when the UV levels are dangerous, this information can be taken from the EXA NRM
- Mobile phone companies should use this information to alert its customers in real-time when the radiation is reaching high levels.

# The HIPERION Report Suggestions



- EXA offers the FREE use of their systems to the society, any person, worldwide, can access them over the internet.
- EXA maintains daily archives of all the information collected by all our systems so any researcher can make free use of it, as long as there is no commercial use is involved.
- EXA will notify the diplomatic delegations of the countries affected by this problem.



# The HIPERION Report Reflexions

- HIPERION is part of the Ecuadorian Space Program and has been entirely developed by EXA.
- Executing the Space Program, we have discovered a very serious problem for the present and future of our country, thanks to space sciences and technology.
- We raised the alarm and wanted to go further by giving 4 million people the power to react and protect themselves, using our own resources and without help from any other institutions.

# The HIPERION Report Reflexions



- In this case, timely and precise information about when the UV levels are dangerous can mean, in the long term, the difference between a healthy life and a personal tragedy or even death.
- Over the media and mobile operators weights the SOCIAL RESPONSABILITY of making this information reach all the Ecuadorian population that needs it URGENTLY
- We have come forward with this very serious announcement only because it was necessary: Without this information, the population would be helpless, unaware of the dangers and being expose to cumulative UV levels that in many cases would lead to illness and even death.
- Such destiny can be avoided with the information provided by HIPERION.



# The HIPERION Reactive Alert System

- National Radiation Monitor:
  - <http://uv.exa.ec>
- Real Time Satellite Imaging Center:
  - <http://cistr.exa.ec>
- RTCR Guayaquil:
  - <http://gye.exa.ec>
- RTCR Quito:
  - <http://uio.exa.ec>