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
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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

Comisión Internacional de Protección contra la Radiación no Ionizante
<table>
<thead>
<tr>
<th>CATEGORÍA DE EXPOSICIÓN</th>
<th>INTERVALO DE VALORES DEL IUV</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAJA</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>MODERADA</td>
<td>3 A 5</td>
</tr>
<tr>
<td>ALTA</td>
<td>6 A 7</td>
</tr>
<tr>
<td>MUY ALTA</td>
<td>8 A 10</td>
</tr>
<tr>
<td>EXTREMADAMENTE ALTA</td>
<td>11+</td>
</tr>
</tbody>
</table>

Tabla 1: Categorías de exposición a la radiación UV
Figura 2: Sistema de protección solar recomendado, con mensajes sencillos y fáciles de recordar.
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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:
Índice UV máximo = 14
Índice UV máximo = 24
PROYECTO HIPERION
ANALISIS DE FRECUENCIAS DE RADIACION UVA1 Y UVA-2 EN QUITO

POTENCIA (Mw/m²)

FRECUENCIA (nM)
SOURCE: Curie Institute - France

[Diagram showing interactions between DNA damage and cell cycle regulation, with key pathways and molecules labeled.]
Erythematic UV index
SCIAMACHY - KNMI/ESA
Clear-sky
19 September 2008
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

FUENTE: AGENCIA ESPACIAL EUROPEA / DLR ALEMANIA / NASA
ONLINE SOURCES FOR COMPARISON PURPOSES EXA

FUENTE: AGENCIA AMBIENTAL DE CANADA

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/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

SATELITES: KNMI-GOME-TOVS-SMOBA-TEMIS
INTERPOLATION TO 1950

DENSIDAD DE LA CAPA DE OZONO HACE 50 AÑOS

INTERPOLACION

Source: EXA, based on data from Environmental Canada
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
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Why Ozone is destroyed?

1. Even when the most of the ozone is produced over equatorial areas, the gas is redistributed poleward 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.
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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 (2Space and Atmospheric Physics Group, Department of Physics, Imperial College) and Korty (3Department 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.
OZONE DESTRUCTION PERCENT ON THE PSCs

Deviations (%) / Ecarts (%), 2008/10/08

Fuente: Agencia Ambiental del Canada
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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.
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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.
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.
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.
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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.
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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

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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.
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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.
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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.
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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 weighs 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](http://uv.exa.ec)

- **Real Time Satellite Imaging Center:**
  - [http://cistr.exa.ec](http://cistr.exa.ec)

- **RTCR Guayaquil:**
  - [http://gye.exa.ec](http://gye.exa.ec)

- **RTCR Quito:**
  - [http://uio.exa.ec](http://uio.exa.ec)