The Atmospheric Sounding Station “El Arenosillo”

By Dr. Benito A. De la Morena Carretero and Nicolás Mélida Garrido

The Atmospheric Sounding Station “El Arenosillo” (hereinafter called ESAt) dependent on the Earth’s Observation, Remote Sensing and Atmosphere Department of the Search and Atmospheric Instrumentation of Instituto Técnica Aeroespacial (INTA), is situated at CEDEA (El Arenosillo Experimental Centre) in Mazagón - Moguer, Huelva, Spain.

Located in Southwest Europe (37.1 N-6.7 W) ESAt is an Observatory dedicated to the atmospheric research since 1969. It is integrated in the Ionosphere International Network with the INAG code EA-036, and in the World Ozone Ultraviolet Data Centre with the number 213.

Due to the almost 300 clear sky days a year and uniform albedo El Arenosillo is considered to be a good platform for optical observations. Numerous Institutions and groups, national and international, take advantage of its optimal conditions for campaigns or permanent observation of the most varied atmospheric parameters: aerosols, UV.B., UV.A, PAR, NO2, stratospheric ozone, tropospheric ozone, radon, erythemal dose in the human beings by biofilm techniques, among others.

Huelva, a city of Tartessus origin, surrounded by beautiful and white villages, is internationally known by its gastronomy (wines, ham, seafood, fish...) and the quality of its beaches and tourist towns perfectly communicated by its local and national road network. It is situated 45’ from San Pablo’s Airport at Seville by the Madrid-Huelva motorway A-49, and 1h 20’ from Faro’s Airport in Portugal. In this beautiful region with 40% natural parks, intensive agriculture (orange, strawberry...) and a high quality tourism INTA has available for you the scientific means for the observation of the atmosphere at the Atmospheric Sounding Station El Arenosillo.

1 RADIO PROPAGATION RESEARCH GROUP ACTIVITIES

The INTA, through the Atmospheric Sounding Station “El Arenosillo” (37.1 N; 6.7W), comes developing from 1966 a work of observation of the Atmosphere (dynamic stratospheric and total electron content in the Ionosphere) by means of systematic soundings carried out by rockets, globes, ionosondes, radiometers..., thanks to co-operative agreements with the most significant Organisms of the time, NASA, Max Planck Institute of Lindau, CNES...

Since 1969, ionospheric systems of vertical incidence soundings and absorption by Method A3 are available to study the evolution and the behaviour of the ionospheric regions F2, F1, E, and D respectively. And from 1993, a new sounder, the Digisonde 256, is acquired integrating the Station
in the World-wide Ionospheric Network with the code EA036, and in the European Network of Ionosphere.
The ionospheric digital data base of the Arenosillo covers from 1974 up to date.

2 COLLABORATIONS
The ESA frequently work together national and international research centers:
- Ebro Observatory (Tarragona, Spain)
- Institute of Solar-Terrestrial Physics (Irkutsk, Russia)
- Institute of Atmospheric Physics (Prague, Czech Republic)
- Hungarian Academy of Sciences (Sopron, Hungary)
- Centro de Investigaciones Regionales (San Juan, Argentina)
- Istituto Nazionale di Geofisica, (Roma, Italy)
- Istituto di Ricerca, (Firenze, Italy)
- Abdus Salam International Center for Theoretical Physics ICTP-(Trieste, Italy)
- Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation
- (Moscow, Russia)
- Lowell University (Massachusetts, USA)
- National Observatory of (Athens, Greece)
- Rutherford Appleton Laboratory (RAL) (Chilton, UK),
- Royal Meteorological Institute (Dourbes, Belgium)
- Complutense University (Madrid, Spain)
- Algarve University (Faro, Portugal).
- Huelva University (Huelva, Spain)

3 PROJECTS & RESEARCH LINES
- Project COST251 IITS of UE: “Improved Quality of Ionospheric Telecommunication System Planning and Operation”. From 1995-1999
- Spanish Project CICYT (TIC 97/0787-C02): “Ionospheric Communications Link with Spread Spectrum INTA (El Arenosillo)-La Salle(University Ramón Llull)” in collaboration with La Salle School of Engineering, Polytechnical School of La Rabida (Huelva University) and INTA, from 1997 to 1999.

In addition to this research task, this Station sends its ionospheric data to the following Data Centers every year:
- World Data Center A (Boulder, USA)
- World Data Center C1 (Slough, UK)
World Data Center C2 (Tokio, Japan)
European Data Center (Trieste, Italy)

Besides, foF2 and M(3000)F2 data are daily sent to the RAL (Chilton, UK) and to the Space Research Centre (Warsaw, Poland).

4 INSTRUMENTATION

4.1 Radio Wave Absorption In The Lower Ionosphere – Method A3

This ground-base sounding system records electromagnetic wave variations after the pass through ionospheric layer D.

<table>
<thead>
<tr>
<th>Ionospheric absorption (60-90 Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oblique sounding.</td>
</tr>
<tr>
<td>Tx: Torrejon 40 N 20W</td>
</tr>
<tr>
<td>Rx: El Arenosillo 37 N 6 W</td>
</tr>
<tr>
<td>Reflection point: 38.8N, 5.2W.</td>
</tr>
<tr>
<td>Distance: 440 Km.</td>
</tr>
<tr>
<td>Frequency: 2,830 Mhz.</td>
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<tr>
<td>Power transmission: 1 Kw</td>
</tr>
</tbody>
</table>

4.2 Digisonde 256

This is a digital ionospheric high frequency pulse sounding system (0.4-30 MHz) designed by the Center for Atmospheric Research of the University of Massachusetts – Lowell (USA). The system measures and analyses the behaviour of the overhead ionosphere, especially the E and F layers. It automatically records, displays and transmits vertical ionospheric information in the form of digital ionograms, ionospheric parameters (foF2, h'F2...foF, h'F...foE, h'E....MUF, M(3000)...) and electron density profiles. It can carry out both vertical and oblique soundings.

Digisonde DGS 256

<table>
<thead>
<tr>
<th>Ionospheric variability (100-400 Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical sounding.</td>
</tr>
<tr>
<td>El Arenosillo 37 N 6 W</td>
</tr>
<tr>
<td>Range of frequencies: 0.4-30 Mhz.</td>
</tr>
<tr>
<td>Pulse Wide Band Transmitter:10Kw</td>
</tr>
</tbody>
</table>
Figure: One of the seven receiving antenna of the array with North-South and East-West oriented loops which doing a equilateral triangle with 62 meters of side.

WWW page: http://www.inta.es/ino. Where is possible to see the last ionogram realized by DGS256 which has been sent automatically via ftp. This ionogram is sent simultaneously at RAL too.

5 RESEARCH PUBLICATIONS

5.1 Doctoral Thesis

From the ESAt have been realized the following Physical Doctoral Thesis:

- Morena, B.A., Stratosphere lower Inosphere Coupling, Granada University, 1995
- Miró, G., Characterization Inospheric Channel for a point to point HF link by raytracing techniques, Complutense University, Madrid, 2000.

5.2 Publications (From 1999)


Pancheva D., L. F. Alberca and B. A. de la Morena, Simultaneous observations of the quasi-two-day variations in the lower and upper ionosphere over Europe, Journal of Atmospheric and Terrestrial Physics, Vol. 56, No 1, 43-50, 1999


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