

DPS-4 Installation at Multan, Pakistan

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Introduction

April 1st 2008 was a great day for Pakistan Space & Upper Atmosphere Research Commission (SUPARCO) as a new ionosonde DPS-4 was installed at Space Application & Research Station (SPARS) situated at Bahauddin Zakariya University (BZU) Campus in Multan (30.18°N, 71.48°E), URSI station ID MU230.

Pakistan has been engaged in ionospheric data collection and research for more than three decades using a network of three ionosondes; two of these are DGS-256 one each at Karachi (24.95°N, 67.14°E) and Islamabad (33.75°N, 72.87°E); the third ionosonde Panoramic Ionospheric Recorder (PIR-9) at Multan has been recently replaced as mentioned above.

Historical Review

The analogue PIR-9 sounder working at Multan was in operation since May 1987, acquiring the ionospheric data of Multan at 1 hour interval round the clock. Prior to its installation at SPARS, Multan this sounder had continuously and satisfactorily operated at Karachi for about 12½ years. Thus, PIR-9 Sounder operated for about 24 years. Due to the aging of components, the sensitivity of the receiver section of PIR-9 was severely affected, which in turn affected the quality of ionograms (output of the sounder on 35mm film). The said sounder became obsolete and most of its spares and modules were not available. Moreover, PIR-9 sounder being operated at SPARS, Multan was unable to communicate real time ionospheric data to user agencies. Keeping these in view the DPS-4 was procured and installed at SPARS, Multan.

All digisondes installed in Pakistan (owned by SUPARCO) were procured from the University of Massachusetts Lowell, Centre for Atmospheric Research (UMLCAR), USA and were commissioned, at Karachi and Islamabad in March 1987 and December 1992, respectively.

Present Status

It may be noted that the two Digisondes, one each at Karachi and Islamabad, cover the southern and northern parts of the ionosphere over Pakistan, while the DPS-4 Sounder at Multan covers the central-east part. The comparison between DGS-256 & DPS-4 is given below in Table 1. These sounders have been programmed to take ionograms at 15 minutes interval round the clock as normal routine. The ionograms obtained are then scaled by using SAO-Explorer whereas manual scaling is also carried out for special events.

Future Prospects

The immediate future for ionospheric research in Pakistan is bright. Together with data from the two older digisondes at Karachi & Islamabad we will analyze the data to search for precursors of earthquakes. All digisonde data of Pakistan will be permanently archived in international World Data Centers and the Digital Ionogram Data Base DIDBase at UML (<http://ulcer.uml.edu/DIDBase/>). The high quality data from the new DPS-4 particularly and from two DGS-256 sounders generally will allow our scientists to contribute to international ionospheric modeling projects like the International Reference Ionosphere (IRI) Working Group (<http://modelweb.gsfc.nasa.gov/ionos/iri.html>).

The country map in figure 1 shows these ionospheric stations marked with red circles, whereas the entrance to SPARS with the PIR-9 & DPS-4 is shown in figure 2 with transmitting antenna in the background.

Examples of some initial ionograms obtained by DPS-4 at Multan have been shown in figure 3-5. The ionograms show the time UT, for LT add 5hrs to UT.

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References:

Murtaza G., S. Iqbal, M.A. Ameen, A. Iqbal, Comparing IRI and a regional model with ionosonde measurements in Pakistan, *Advances in Space Research*, Volume 42, Issue 4, 18 August 2008, Pages 682-690

Khan Z. M., Mrs. H. Ara, Ionosonde network in Pakistan, INAG-59, July 1993

Reinisch, B.W. The digisonde network and data-basing, UAG-104, Proceedings of Session G6 at XXIVth GA of URSI, Kyoto, Japan, Aug 25 – Sep 2, 1993
<http://www.ips.gov.au/IPSHosted/INAG/uag-104/text/bodo.html>

Reinisch, B. W., Modern Ionosondes, in *Modern Ionospheric Science*, edited by H. Kohl, R. Ruster, and K. Schlegel, European Geophysical Society, 37191 Katlenburg-Lindau, Germany, pp. 440-458, 1996.

Table 1: The salient features of these Sounders are given below:

FEATURE	DGS-256	DPS-4	COMMENTS
Vertical Inc. Ionogram.	128/256 Height	128/256 Heights	2.5, 5.0 and 10km
Oblique Inc. Ionogram.	Pulse	Pulse or CW	Binary Phase Coding
Peak Trans. Power	10kW	500W	
Beam Forming	Analog	Digital	
GPS synchronous.	Optional	Standard	1msec Accuracy
Phase Coding	Interpulse	Inter & Intrapulse	Pulse Compression in DPS
Waveform	67/133ms 50,100,200Hz PRF	<i>m x 67ms</i> 50,58,100,200Hz PRF	Pulse Compr. in DPS m=1,8,127 or 255
Transmit Antenna	Linear	Circular or Linear	
Receive Antennas	7 Loops	4 Loops	O/X Switching
Drift Measurements	2 Ranges, 2 Freqs. 128 Dopplers	128 Ranges, 8 Freqs. 128 Dopplers	Skymaps, Drift Velocity
Max. Doppler Range	±25 Hz	±100 Hz	
Doppler Resolution	0.025Hz	0.006Hz	
Prec. Group Height	Optional	1 km Accuracy	
Autoscaling	ARTIST	ARTIST	Real Time
N(h) Profile	ARTIST	ARTIST	Real Time
Output Storage	1/2" Tape, 30MB	DVD	
Volume	1.1m ³	0.25m ³	
Weight	475Kg	55Kg	
Input Power	110/220Vac, 2kW Avg	24VDC, 300W Avg.	Waveform dependent
Remote Control	Modem, asynchronous.	Modem, asynchronous.	
Data Editing	SAO-X	SAO-X	

Figure 1: Country map of Pakistan showing the location of three ionosonde stations

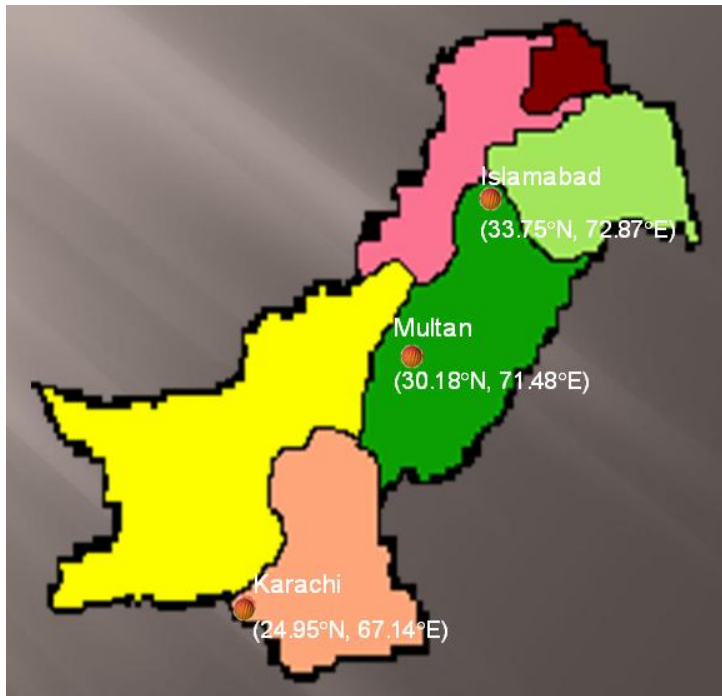


Figure 2: Entrance to SPARS along with the previous and present ionosondes



Figure 3: The first ionogram obtained by DPS-4 installed at SPARS Multan on 1st April 2008 at 0407UT = 0907LT

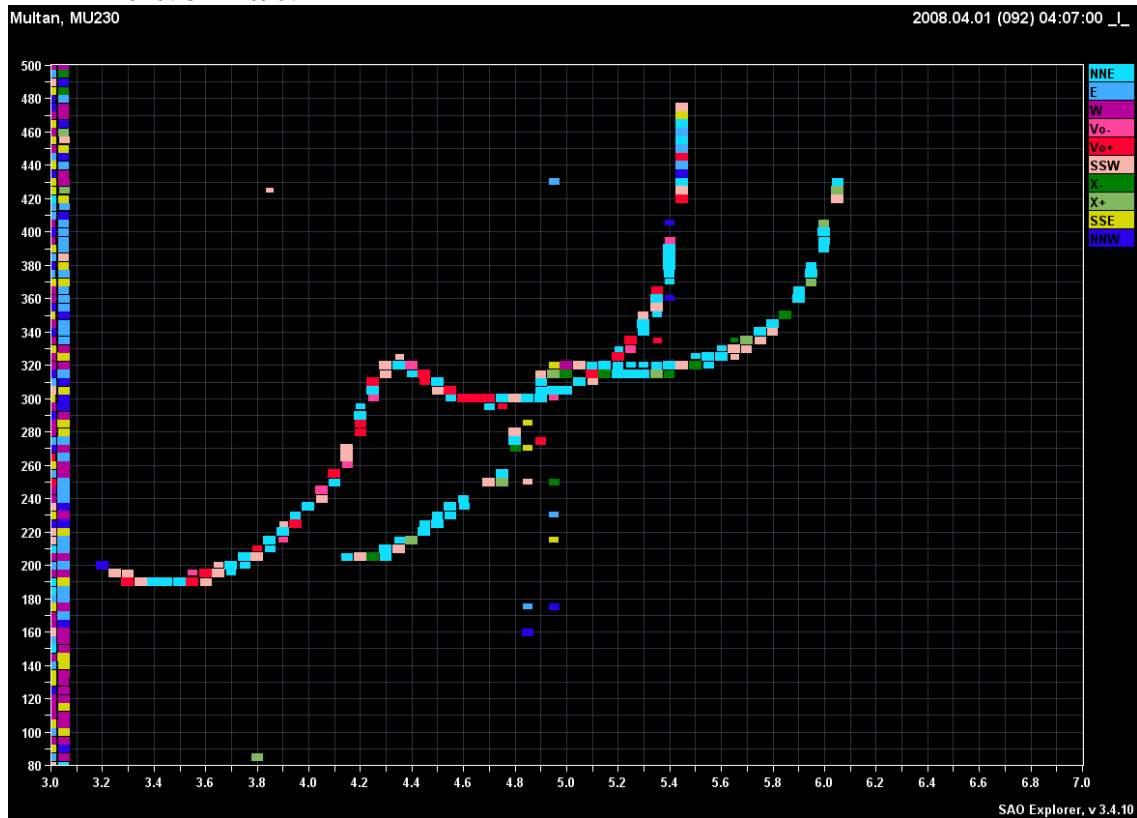


Figure 4: Initial daytime ionograms acquired by DPS-4 at Multan on 1st April 2008 between 0500UT – 0545UT

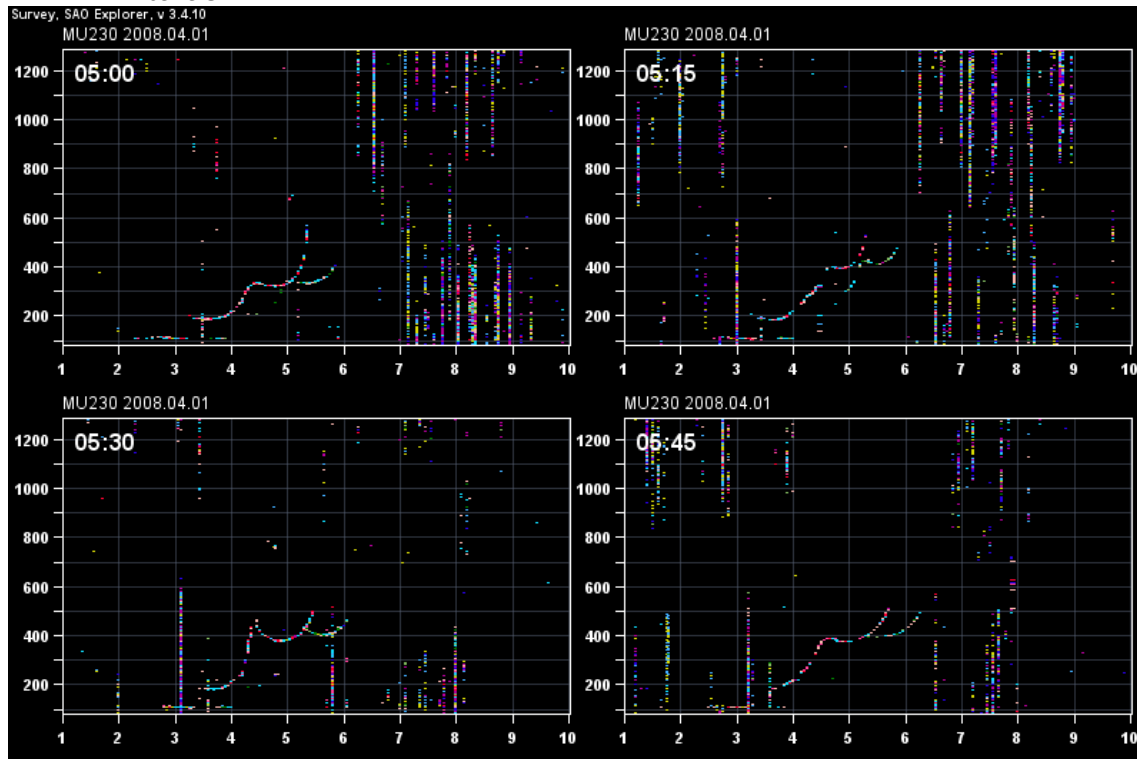


Figure 5: Nighttime ionograms recorded by DPS-4 at Multan on 11th July 2008 between 1545UT – 1630UT

