Status of the NOAA/CU wind profiler at Piura, Peru

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The wind profiler at Piura, Peru (81° West, 6° South) has been in almost continuous operation since January 1989. The profiler is operated jointly by the University of Colorado (CIRES), NOAA's Aeronomy Lab, and the University of Piura (Peru). It is the eastern-most profiler in a chain of profilers extending across the tropical Pacific.

An airborne photograph of the profiler appears in Fig.1 and shows the 100m x 100m array of coaxial-colinear (COCO) antennas in the foreground and the laboratory trailer on the far side of the antenna array.

Fig.1 Wind profiler at Piura, Peru.

An artist's sketch of the antenna array showing the three possible beam directions is shown in Fig.2. Both figures appear in roughly the same geographic configuration. The antenna beams in the current

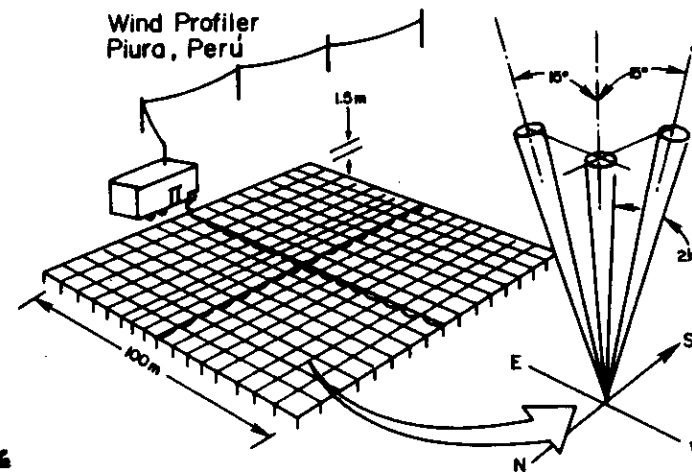

Fig.2 Site sketch showing antenna beam positions.

(standard) arrangement are directed sequentially through the vertical to 15 degrees off vertical toward the geographic south and east. The antenna beamwidth in all cases is roughly 2.5°.

Typical operating parameters for the Piura profiler include an antenna area of 100m x 100m, an operating frequency of 49.920 MHz, a transmitter peak pulse power ~ 40kW,

average transmitted power ~ 200W, and a vertical range resolution of 2.4 km.

An example of the on-line data output, in this case for the vertical beam position, appears in Fig.3. This type of plot is available on-line roughly every two minutes (?) as the programs cycles through the sequence of beam positions. Thus a complete 3-beam sequence is available about every six minutes(?). The Fig.3 plot shows

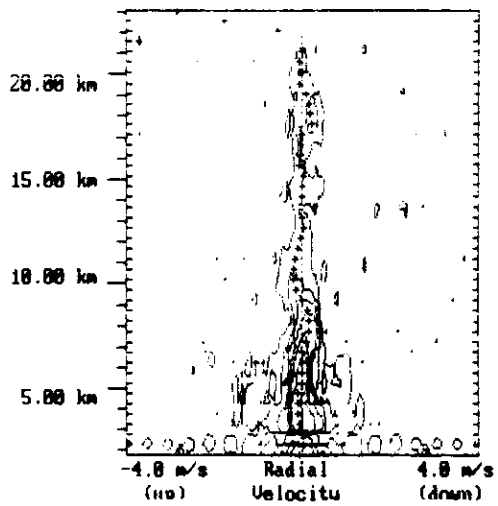

Fig.3 Typical online data readout from the vertical beam position.

contours of signal-to-noise values as a function of both height and radial velocity. In addition to the contour plot, information is available for each interval for a variety of surface parameters (i.e., surface wind magnitude and direction, temperature, humidity, pressure, pyranometer, and rainfall). Additional radar system data recorded for each interval include echo spectral width and receiver system noise level.

An example of the ground station data available from the profiler site appears in Fig.4. This figure shows high-time-resolution data for March 1991. Note the day-to-day consistency of most of the variables in this dry, arid climate of the coastal desert region of northern Peru.

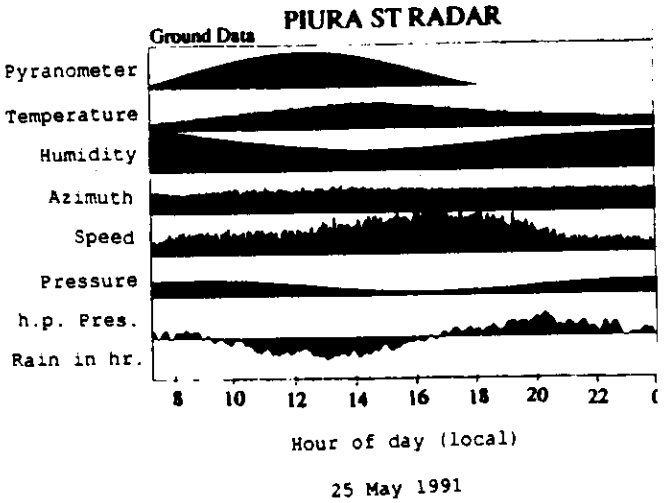

Fig.4 Ground station data also recorded on profiler optical data discs

All of the above information is recorded directly onto optical discs. Disk capacity is such that one standard 750 MByte (?)disc is sufficient for about thirty days of operation. Discs are duplicated on site, with one copy being retained at Piura for local studies, and the other being sent periodically back NOAA/CU in Boulder, Colorado for further analysis, reduction, and archiving.

The profiler system at Piura is essentially identical to most of the other profilers in the Pacific network. This uniformity of profiler systems and data taking techniques greatly facilitates data analysis.

In Fig.5 we show an example of vertical velocity fluctuations as a function of time for a series of heights from the Piura profiler for the month of March 1990. Note that the time resolution of the vertical velocity data obtained during 1990 is excellent, since the system was operated in a vertical-only mode for that entire year.

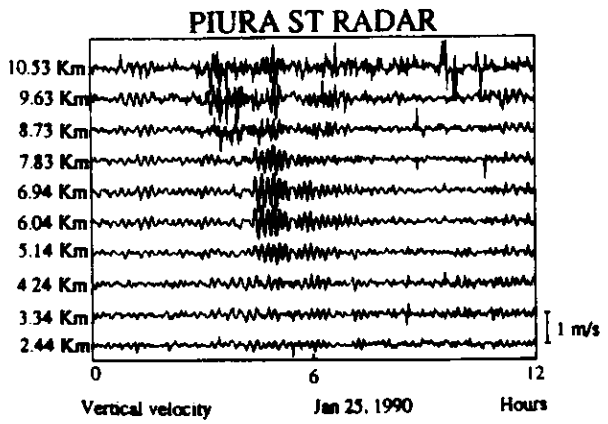

Fig.5 Vertical velocity vs time showing typical quasi-sinusoidal motions. Blank regions near 15km correspond to weak echoing region.

Examination of this figure shows a remarkable and unique feature of the Piura profiler data: vertical velocity fluctuations throughout the entire height range exhibit pronounced quasi-sinusoidal fluctuations. The period of these fluctuations is in the range 4-15 minutes(?), and the magnitude can exceed ± 1 ms^{-1}. While such fluctuations are observed occasionally in the vertical velocity data from other sites, the quasi-sinusoidal fluctuations over the Piura profiler are a much more prevalent feature. Indeed, they are noteable more by their absence than by their presence, and appear to be causally related to the presence of the nearby Andean Cordillera.

The Piura profiler was modified to obtain all three wind components in late January of 1991. Examples of profiles of the monthly mean vertical (x), zonal (u) and meridional (v) wind components for the March 1991 are shown in Fig.6. Note that the zonal mean wind is considerably stronger than the meridional wind, although the maximum zonal magnitude is only about xxx ms^{-1}.

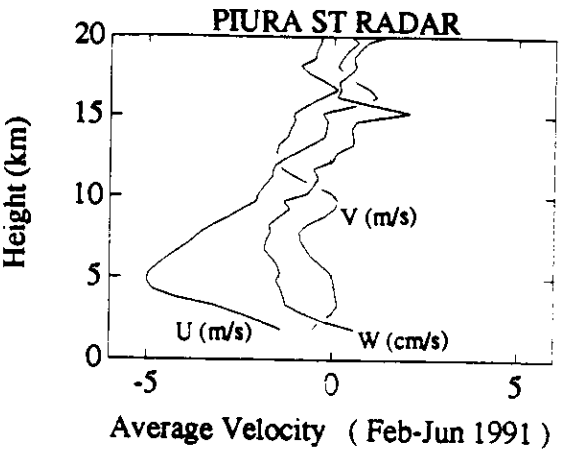

Fig.6 Six-month average wind field for February-June 1991.

One example of more extensive analysis of the three component wind data is shown in Fig.7. In this

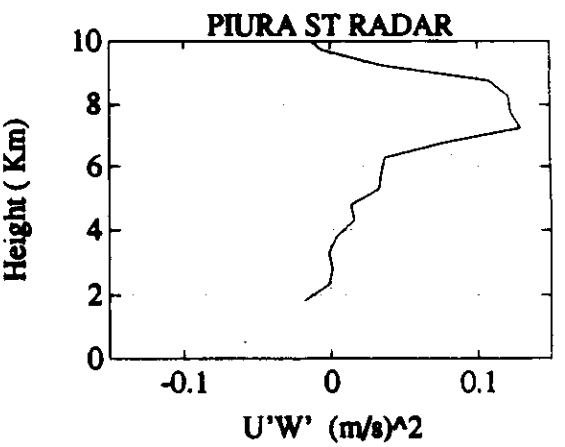

Fig.7 Mean gravity wave momentum flux for 1-15 April 1991.

example we show two-week averaged vertical profiles of gravity wave momentum flux, u'w', where the primes indicate time-varying quantities for each variable. These

results depict u'w' for wave periods longer than 15 minutes. The importance of this type of data lies in determining the effect of upward propagating, dissipating gravity wave on the mean atmospheric circulation patterns.

Data from the Piura profiler is expected to continue for the next few years as part of the Pacific profiler network observations. Careful study of the unique wave activity at this site and its effects on local circulation should cast additional light on the complex tropical circulation patterns and their relationship to climate variability.

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