Comparison of Electric Fields Measured at F-region Heights with 150 km - Irregularity Drift Measurements

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The potential to observe the E-W electric field in the equatorial ionosphere using the strong coherent echoes obtained by the Jicamarca radar from irregularities present at the Magnetic Equator, in the altitude range between 135 and 175 km, has been established by Kudeki and Fawcett (September, 1993). They based their claims by comparing vertical drift measurements at these altitudes with simultaneous ground magnetogram records made in Ancon, which showed a high non linear correlation between the two. In this paper we present more direct correspondence by comparing simultaneous measurements made at F-region heights, using the standard I.S. technique with measurements made using the coherent echoes at the 135-175 km altitude. The correspondence is one to one. In addition, it is shown that there is also correspondence between the E-W drifts (vertical component of the electric field) measured at these two altitude ranges.

Furthermore, it is shown that samples taken, for the last 3 years, at the 190 km nominal altitude, with the usual Jicamarca F-region drift mode, are strongly "contaminated" by the filtered tail from the stronger lower altitude coherent echoes and carry the same vertical drift information. The correspondence again is one to one, with the added advantage that their error bars are much smaller. This "contaminated" data was excluded in the past from the usual analysis. We are now recovering it to produce cleaner vertical and E-W drifts drift series during the day.

The new data presents special advantages in studding the effects of magnetic storms at a higher resolution. Previously, one minute resolution data was too noisy to detect small and fast electric field perturbations.

Figure captions

Figure 1). Typical on line plot of the information obtained with our standard E-W drift mode experiment. The two panels at the left correspond to the drift velocities obtained by the two used beams, perpendicular to B, east and west of the vertical plane. The next panel shows the correlation of the signal pair used to obtain the velocity, and the last, the corresponding signal power profiles. Note the high correlation and enhanced power of the point at 190 km nominal altitude. The high value indicates it is not an IS echo, but its velocity can be measured with higher precision. Its originated by coherent echoes from the 150-170 altitude. It has been

determined empirically that its value is practically the same as the noisier value obtained from the average of the IS F-region drift velocities.

Figure 2). Vertical velocities (a) and E-W (b) drift velocities obtained by both, the average of the IS velocities of the F-region (dotted line) and from the coherent echoes at 190 km nominal altitude (solid line). The E-W velocities represent 5 minute averages. The selected date is the oldest record of this type in the data archives.

Figure 3). Just as in Figure 2), but for a later date. Note the clean identification, with good time resolution and amplitude accuracy, of electric field disturbances produced by a magnetic disturbance.

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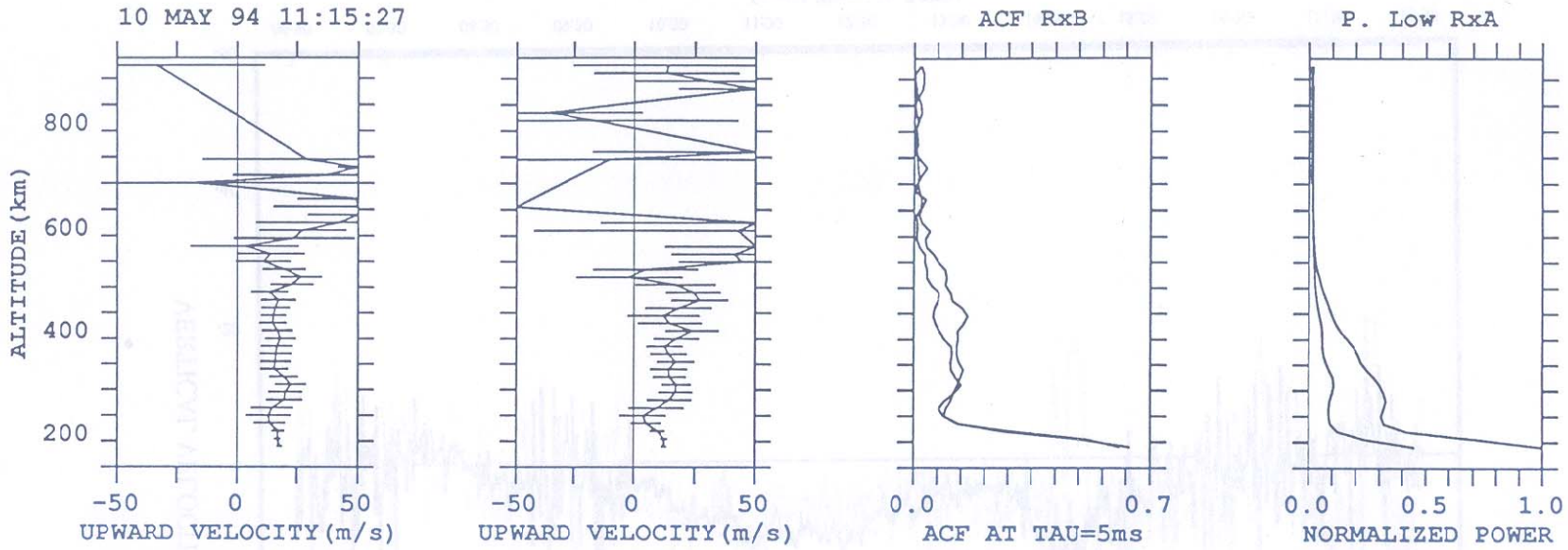
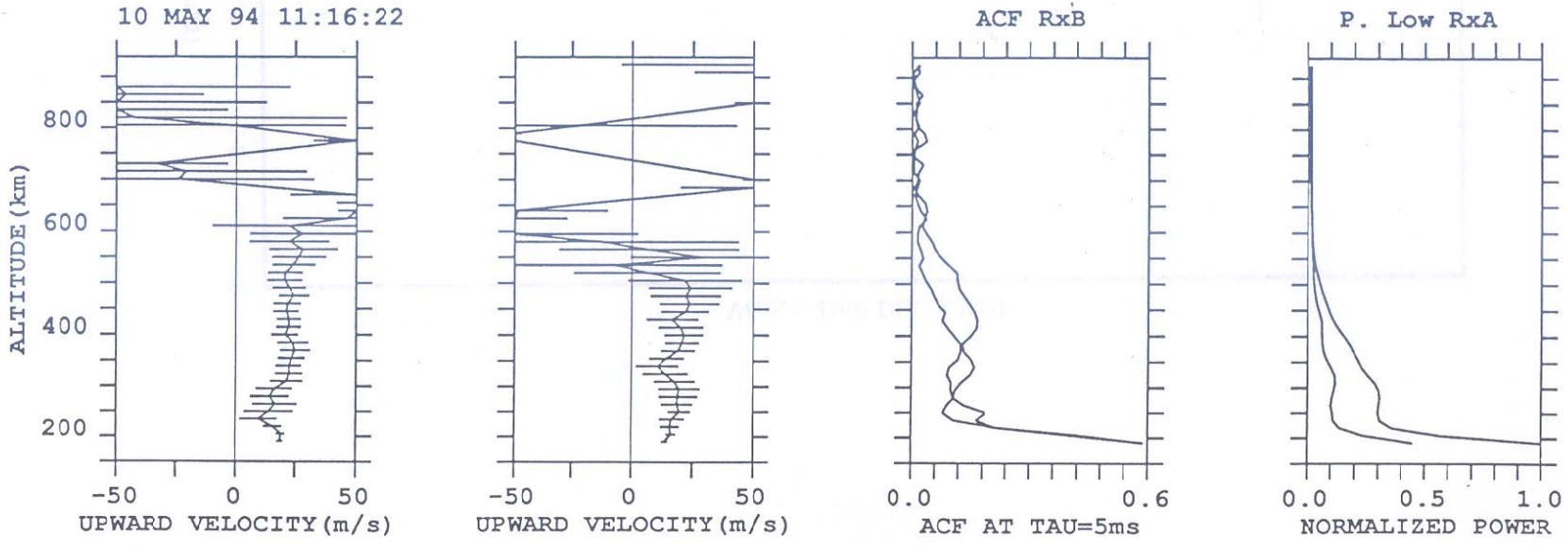
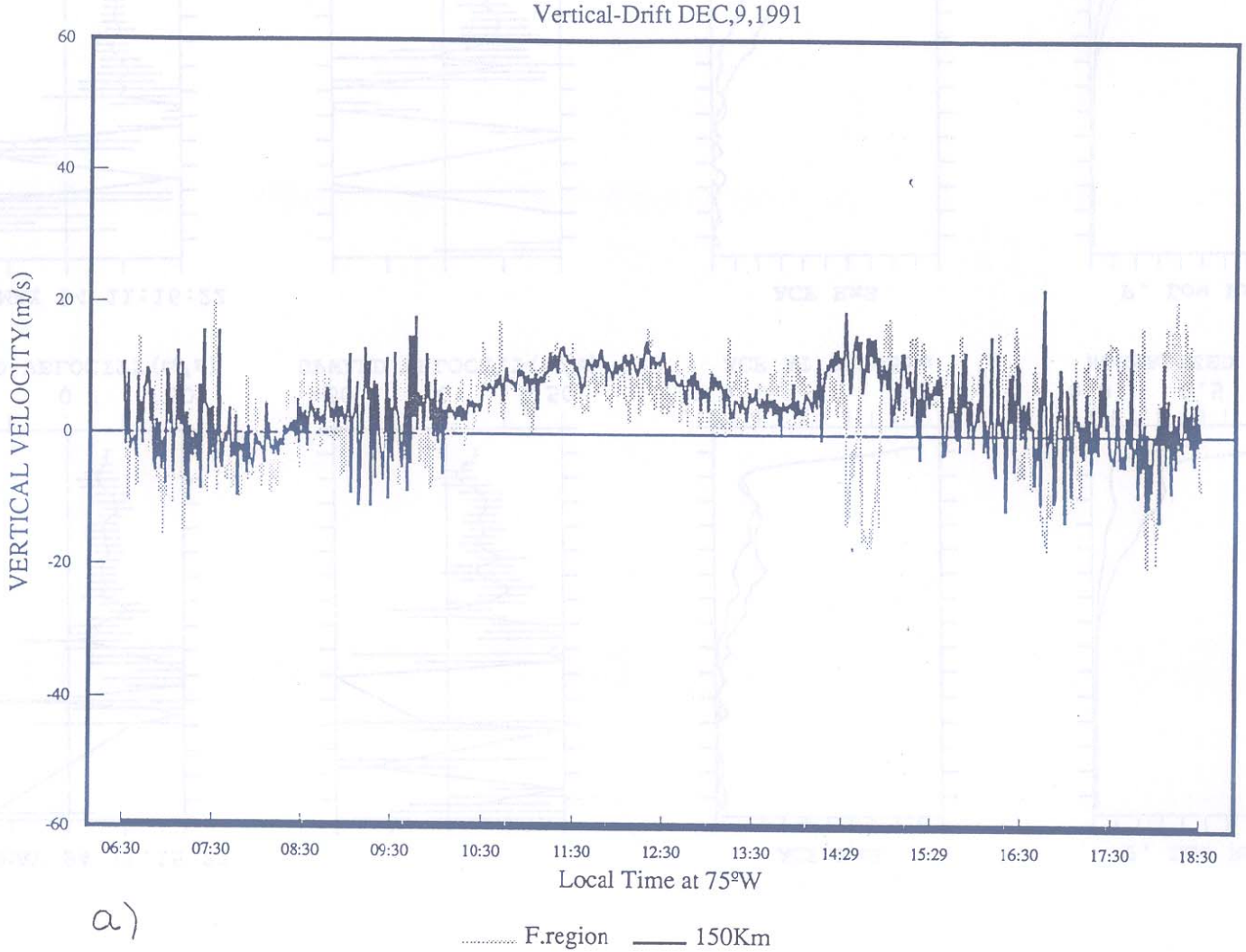
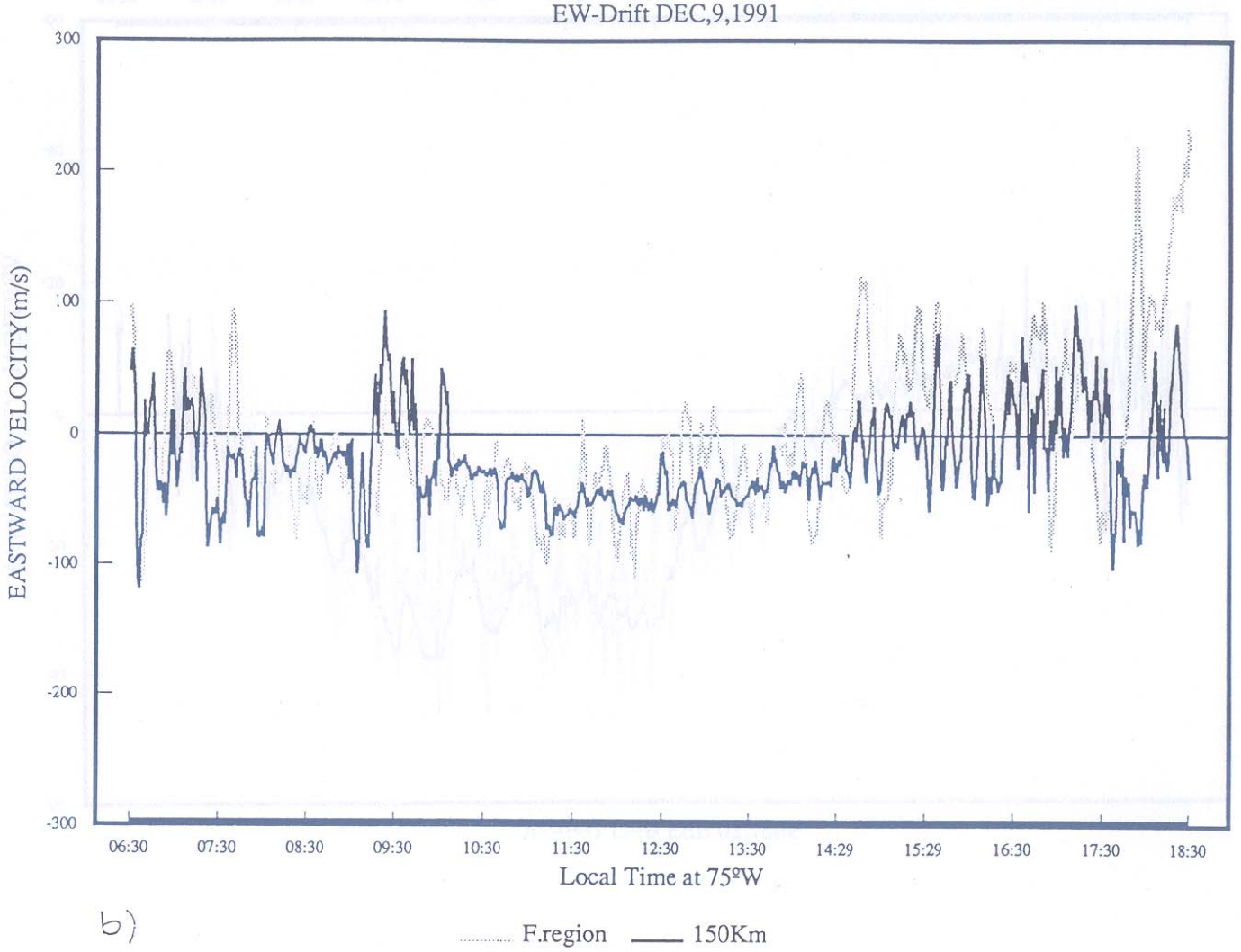





Vertical-Drift DEC,9,1991
VERTICAL VELOCITY(m/s)
60
40
20
0
-20
-40
-60
06:30
07:30
08:30
09:30
10:30
11:30
12:30
13:30
14:29
15:29
16:30
17:30
18:30
Local Time at 75ºW
F.region
150Km

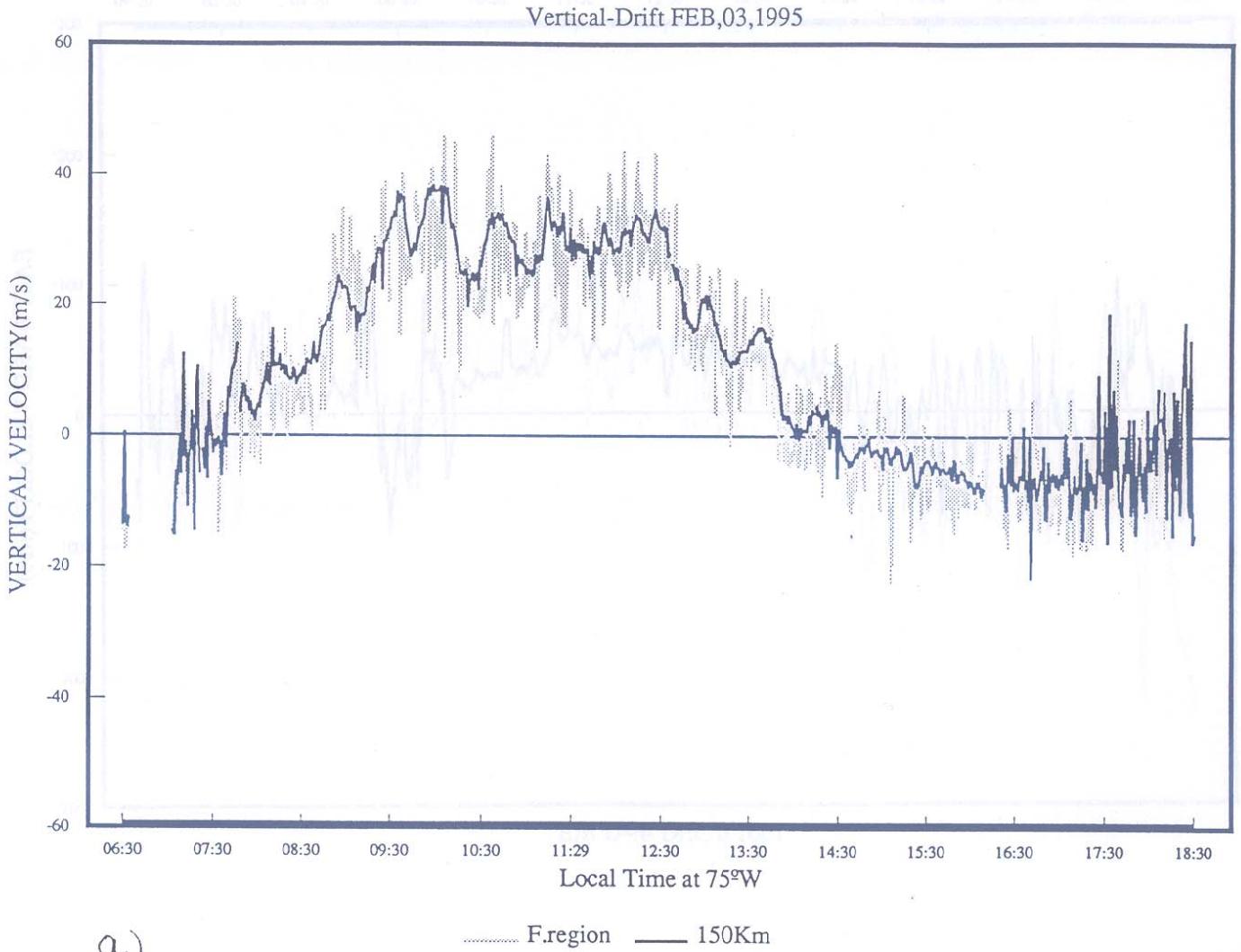
a)

Fig 2


EW-Drift DEC,9,1991
EASTWARD VELOCITY(m/s)
300
200
100
0
-100
-200
-300
06:30
07:30
08:30
09:30
10:30
11:30
12:30
13:30
14:29
15:29
16:30
17:30
18:30
Local Time at 75ºW
F.region
150Km

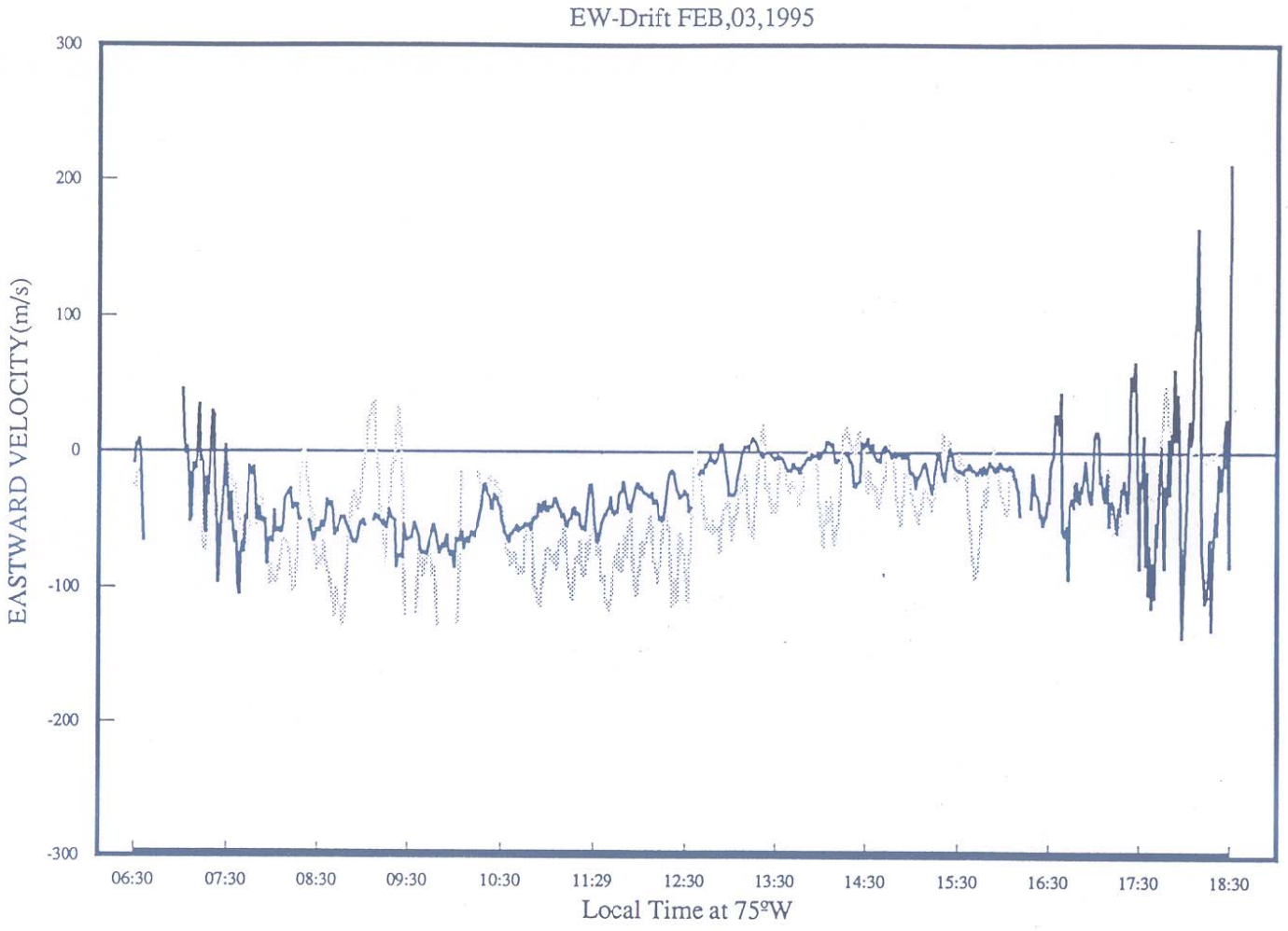
b)

Fig 2


Vertical-Drift FEB,03,1995
VERTICAL VELOCITY(m/s)
60
40
20
0
-20
-40
-60
06:30
07:30
08:30
09:30
10:30
11:29
12:30
13:30
14:30
15:30
16:30
17:30
18:30
Local Time at 75ºW
F.region
150Km

a)

Fig 3


EW-Drift FEB,03,1995
EASTWARD VELOCITY(m/s)
300
200
100
0
-100
-200
-300
06:30
07:30
08:30
09:30
10:30
11:29
12:30
13:30
14:30
15:30
16:30
17:30
18:30
Local Time at 75°W
F.region
150Km

b)