LETTERS TO THE EDITOR

ON THE CAUSE OF TRIANGLE SIZE EFFECT IN SPACED RECEIVER DRIFT EXPERIMENT

HORIZONTAL drift velocities of the ionization irregularities in the ionospheric D, E and F regions are commonly measured by the spaced receiver technique. The full correlation analysis[1–3] is usually employed to determine the true drift velocity from the fading records. Investigations using more than the conventional three aerials have been attempted by several authors and a decrease in the true drift velocity at low receiver separation is found. From an investigation using 89 aerials Golley and Rossiter[4] concluded that the 'triangle size effect' could be due to instrumental limitations in the recording and digitizing processes. Fedor and Plywaski[5] on the other hand suggested antenna coupling as the cause of this effect.

Recently Chandra[6,7] has simulated triangle size effects by introducing small errors in the cross-correlation curves and shown that (1) observed variation of true drift velocity with receiver separation and (2) that of the size of the ground diffraction pattern as well as (3) apparent alignment of the ground diffraction pattern along the hypotenuse when a small right angled triangle is in use can be explained by small errors of about 5% in the cross-correlation values. In this note we are presenting an evidence of the lowered cross-correlation at small receiver separation from the multi-aerial system used earlier at Thumba and described by Rastogi *et al.*[8].

The fadings were recorded at nine aerials placed such that E-W separation could be obtained from 60 m to 240 m in steps of 60 m and N-S separation from 120 m to 480 m in steps of 120 m. These observations were recorded only when good echoes free from noise were present. The peak cross-correlation at different aerial separations along E-W line for a F-region reflection case is shown in Fig. 1. Since the fading records at Thumba do not show any time shifts along the N-S even at a separation of 480 m and drift is purely along west or east the cross correlograms along N-S are not shown here. The apparent and the true drift velocities computed from these recordings are also plotted in Fig. 1. A clear dip in peak cross-correlation value at 60 m is evident from the observed variation of peak correlation with receiver separation. Examining the variation of drift speed with the separation it is seen that the true drift speed is underestimated at 60 m separation while the apparent drift speed is independent of the separation. The pattern size is of the order of 60 m hence the receiver separation must be greater than the pattern size for

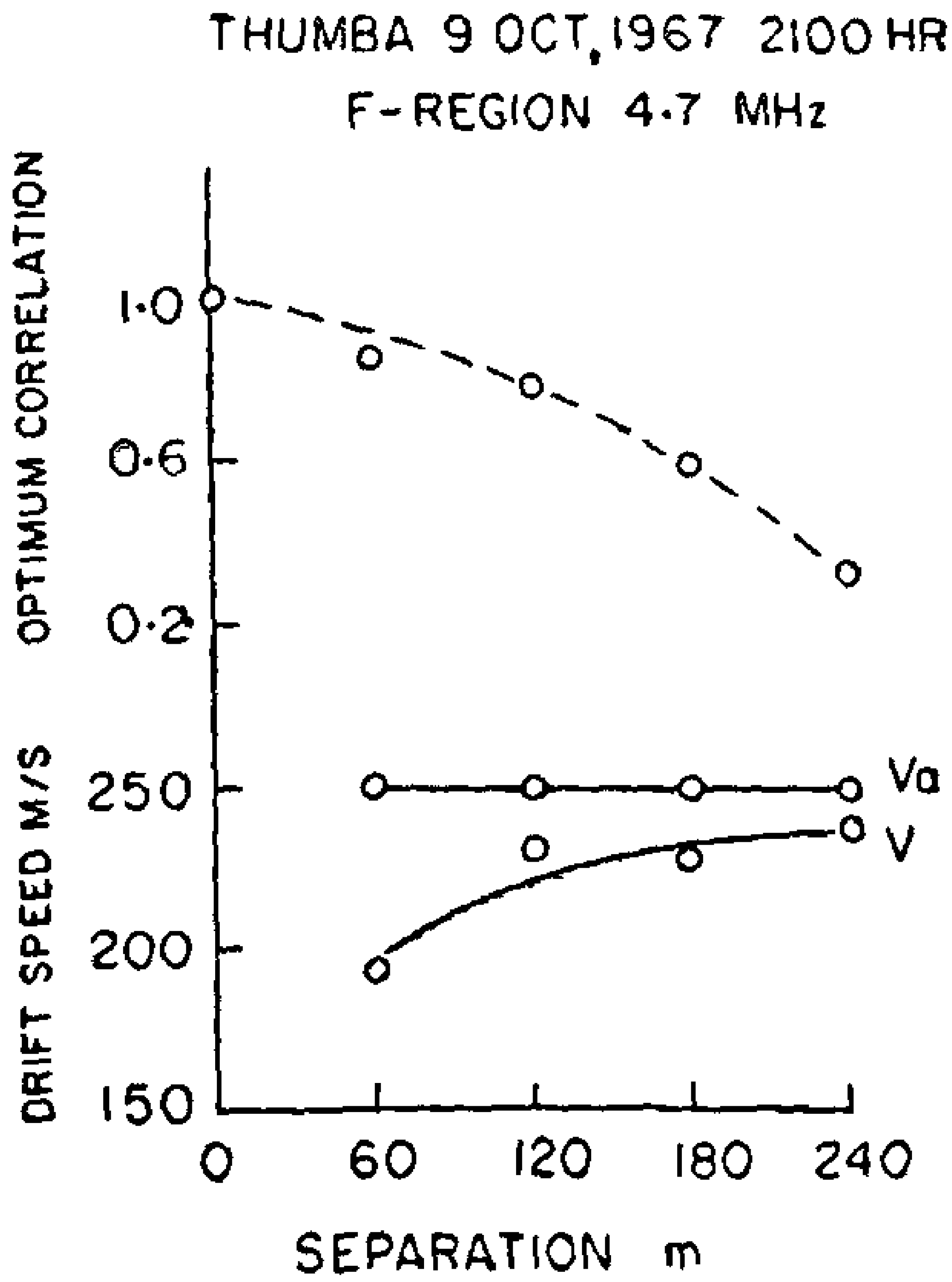

FIG. 1. Variation of the maximum cross-correlation with E-W receiver separation obtained for F-region reflections at Thumba. Also shown are the velocities estimated from different receiver separations.

reliable measurements of the velocity. Thus these observations support the conclusions[4] that the observed triangle size effects are due to the instrumental limitations in recording data which result in the underestimation of cross-correlation at small receiver separation[4]. The fact that the apparent drift speed is independent of separation also favours this explanation as the antenna coupling will result in the change of apparent drift speed also[5].

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STUDIES OF COPPER(I) COMPLEXES WITH N,N′-SUBSTITUTED THIOUREAS

THIOUREA is potentially capable of forming coordinate bonds through both 'S' and 'N', eventhough the extremely low basicity[1] of ligand militates against the formation of M–N bonds. Cu(I) complexes derived from substituted thioureas are of increasing interest to coordinate chemists. Several Cu(I) complexes of N-ethyl thiourea[2] showed M–S bonding, but Lane *et al.*[3] observed M–N bonding in Cu(I) complex derived from N-methyl thiourea. The present study describes the synthesis of Cu(I)Cl complexes with benzoylthiourea (bztu), N-benzoyl-N′-methylthiourea(bzmetu), N-benzoyl-N′-ethylthiourea(bzetu), N-benzoyl-N′-*o*-chlorophenylthiourea(bz-*o*-clptu), N-benzyol N′-phenyl thiourea(bzptu), N-benzoyl-N′-*o*-tolylthiourea(bz-*o*-totu) and *N*-benzoyl-N′-*o*-methoxyphenylthiourea(bz-*o*-meoptu). These complexes are characterized with the aid of conductance, spectral and thermal studies.

The standard methods were used for the preparation of substituted thioureas[4]. All the chemicals used were of B.D.H. reagent grade. The purity of ligands was confirmed by nitrogen and sulphur estimations.

The complexes were prepared by treating $CuCl_2 \cdot 2H_2O$ and ligand in the appropriate ratio in ethanol. The complex separated on concentration of the solutuion. In the case of bz-*o*-meoptu complex, cooling in a freezing mixture was necessary. The products were washed with hot ethanol and dried over P_2O_5 in vacuum. The complexes were analysed for copper, nitrogen, sulphur and chlorine by standard procedures. The analytical data are presented in Table I.

The molar conductivity was measured in DMF (1×10^{-3} M) with the aid of ELICO conductivity bridge. The infrared spectra have been recorded on PE-257 (4000–600 cm^{-1}) and far i.r. from Beckman IR-12 spectrophotometer (600–200 cm^{-1}).

TABLE I

Complex	*Elemental analysis				Infrared frequencies		
	Cu%	N%	S%	Cl%	C=S	M–Cl	M—S
bztu	..	..	..	..	710s	..	..
CuCl · bztu	22·45 (22·74)	10·32 (10·00)	11·61 (11·43)	13·02 (12·68)	705ms	252ms(b)	235ms
bzmtu	..	..	..	..	700mbr	..	..
CuCl · bzmtu	21·57 (21·45)	9·75 (9·55)	11·18 (10·91)	11·79 (12·12)	685ms	..	247br**
bzetu	..	..	..	..	710s	..	..
CuCl · 2bzetu	12·33 (12·28)	11·23 (10·92)	12·10 (11·43)	7·03 (6·89)	695ms	..	246mw**
bzptu	..	..	..	..	720ms	..	..
CuCl · 2bzptu	11·55 (11·18)	9·09 (9·17)	10·72 (10·47)	6·14 (5·81)	710w	249w (b)	245w
bz-*o*-meoptu	..	..	..	..	695s	..	..
CuCl · 2bz-*o*-meoptu	9·72 (9·39)	8·40 (8·44)	9·74 (9·54)	4·89 (5·30)	692ms	251s (b)	250s
bz-*o*-Clptu	..	..	..	..	706s	..	..
CuCl · 2bz-*o*-Clptu	9·38 (9·35)	8·32 (8·25)	9·18 (9·44)	16·19 (15·70)	740s	251w (b)	..
bz-*o*-totu	..	..	..	..	741s	..	..
CuCl · 3bz-*o* tuto	6·80 (7·00)	9·12 (9·24)	10·43 (10·56)	3·70 (3·90)	727w	298w (t)	230w

* The figures in the parenthesis show expected values.
** Overlapped with M–Cl band.
s = sharp; ms = medium sharp; w = weak; br = broad; b = bridge; t = terminal.