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Comments on a Paper 'Auroral Sporadic-E Ionization' by Robert D. Hunsucker and Leif Owren

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Hunsucker and Owren [1962] have compared auroral activity from all-sky camera photographs with simultaneous E-region ionization from ionograms. They used the standard IGY classifications of sporadic E types described by Beynon and Brown [1957].

Unfortunately, when the standard classifications were drawn up, ionogram interpretation was very much an art—in fact this is still partly true. Thus, while this observatory also uses the standard classifications, we disagree in major detail with each interpretation offered by Hunsucker and Owren.

The most obvious point of disagreement is in the interpretation of E region traces showing group retardation. In their figure 4 (18.30 and 19.30), figure 5 (23.05), figure 6 (00.05 and 00.30), and figure 10 (02.30), Hunsucker and Owren call such traces Esr. We call all these examples night E [Beynon and Brown, 1957, sec. 5.53]. Likewise, in all the other illustrations of this paper, we find, evidence of the night E layer although in association with, and largely confused by various types of Es.

Type Esr is a nonblanketing sporadic E, and in our experience it does not have multiples or Z component, is rapidly moving, and is generally associated with a sporadic trace of type c coming from either the normal E or night E. It seems always to be due to an oblique reflection.

Night E, on the other hand, occults the F region, often has multiples and sometimes a Z component (see fig. (6), 00.30), and while it can change appreciably in a few minutes, has more the character of an overhead layer reflection.

One must allow that the night E layer often has horizontal structure. For example, figure 6, 01.15, seems to show two night E layers, one with $f_0E\approx$ 7.5 Mc/s and the other with $f_0E\approx 2.8$ Mc/s. Generally speaking our experience would indicate that the lower frequency night E layer and the F region associated with it are both oblique—but it is not possible to make a firm interpretation without a sequence of ionograms at close intervals. Similar remarks apply to figure 4, 21.05; figure 5, 22.55; figure 7, 23.55; and figure 9, 21.55.

A thick layer in the E region at the time of auroral activity has great significance. Omholt [1955] found a direct relation between the critical frequency of such a layer and the zenith luminosity of the aurora, and our preliminary studies support this. On these grounds, we expect that there would be considerable auroral light in the sky at the time of the night E layers in figure 10, which Hunsucker and Owren record as 'no auroral activity'; but there are no auroral 'forms' to catch the eye, and an overall glow is easily missed on all-sky camera photographs, especially if the exposure time be short.

Table 1 gives our interpretations of the ionograms in this paper, although some are made with reservation in the absence of the original ionograms.

References

Beynon, W., and G. Brown (1957), Annals of the IGY **3**, sec. 5 (Pergamon Press, London).

Hunsucker, R. D., and L. Owren (1962), Auroral sporadic-E ionization, J. Research NBS **66D** (Radio Prop.), No. 5, 581–592.

Omholt, A. (1955), The auroral E layer ionization and the auroral luminosity, J. Atmospheric Terrest. Phys. **7**, 73–79.

TABLE 1

Time—Date (150°WMT)	Ionospheric events	Remarks
Figure 3, 3 Dec. 1958		
2145	$f_0E \approx 3.6$ Mc/s	Multiple of E-region trace present.
	f_0Es N type $Esca$	Both Esc and Esa oblique.
2305	$f_0E \approx 3.4$ Mc/s f_0Es N type $Esca$	Both Esc and Esa oblique.
2355	$f_0E \approx 4.7$ Mc/s $f_0Es \approx 9.5$ Mc/s type $Esca$	Sporadic at high frequency end of trace is oblique.
Figure 4, 4 Dec. 1958		
1830	$f_0E \approx 3.6$ Mc/s	Multiple of E-region trace present. Slight overlap of E and F traces indicates F-region echoes a little oblique.
1930	$f_0E \approx 3.7$ Mc/s	As above.
2105	$f_0E \approx 9.0$ Mc/s f_0Es N type Esa	Interpretation difficult without trend. Appears to be overhead E region with oblique echoes from F region.
Figure 5, 4 Dec. 1958		
2255	$f_0E \approx 3.0$ Mc/s spread 2.3–3.1 Mc/s $f_0E \approx 6.3$ Mc/s type $Esrca$	Interpretation difficult without trend.
2305	$f_0Es \approx 3.2$ Mc/s	Multiple of E-region trace present.
	f_0Es N type $Esca$	Both Esc and Esa oblique.
Figure 6, 5 Dec. 1958		
0005	$f_0E \approx 3.1$ Mc/s spread 2.7–3.2 Mc/s	Multiple of E-region trace present.
0030	$f_0E \approx 3.0$ Mc/s	Multiples of E-region trace present. Z component present.
0115	$f_0E \approx 7.5$ Mc/s f_0Es N type Esa	Oblique $f_0E \approx 2.8$ Mc/s. Spread 2.6–3.2 Mc/s. Oblique E and F regions showing retardation at corresponding frequencies.
Figure 7, 5 Dec. 1958		
2345	$f_0E \approx 2.7$ Mc/s	Some oblique echoes above f_0E. These are not Ess which has characteristic slope.
2355	$f_0E \approx 5.8$ Mc/s Spread 3.0–7.5 Mc/s $f_0Es \approx 8.0$ Mc/s type $Esca$	Most probable interpretation of f_0E given. Interpretation difficult without trend. F-region echoes oblique.
Figure 8, 6 Dec. 1958		
0005	$f_0E \approx 5.0$ Mc/s f_0Es N type Esa	
0015	$f_0E \approx 5.0$ Mc/s	Fadeout and enhanced E closely associated.
Figure 9, 8 Dec. 1958		
2145	$f_0E \approx 6.3$ Mc/s $f_0Es \approx 11.0$ Mc/s type $Esla$	
2155	$f_0E \approx 4.7$ Mc/s spread 3.5–6.0 Mc/s $f_0Es \approx 8.3$ Mc/s type $Esla$	Interpretation difficult without trend. Alternatively could be overhead E region in addition to oblique E and F regions.
Figure 10, 9 Dec. 1958		
0130	$f_0E \approx 4.1$ Mc/s $f_0Es \approx 5.5$ Mc/s type Esc	Slightly oblique F region.
0230	$f_0E \approx 4.4$ Mc/s spread 3.9–4.4 Mc/s	Multiple of E-region trace present. Slightly oblique F region.

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