Mem. Natl Inst. Polar Res., Spec. Issue, **48**, 318–322, 1987

IONOSONDE MEASUREMENTS AT MARSH, KING GEORGE ISLAND: FIRST RESULTS

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Abstract: Routine ionospheric vertical-incidence soundings were started on 15 February 1986 at 1615 LT in Marsh using an IPS 42 model ionosonde coupled to Delta antennae. Sample ionograms are shown indicating the range of phenomena that can be observed. Conspicuous traces likely to be related to interference from a nearby ionosonde are discussed.

1. Introduction

This note reports first results of vertical-incidence ionosonde measurements started on 15 February 1986 at 1615 h local time (60°W) in Marsh, King George Island. Table 1 gives geophysical and geomagnetic data for Marsh. An IPS 42 model ionosonde produced by Kel Aerospace Corp., Australia, is used. Vertical Delta antennae are coupled to the ionosonde through impedance matching baluns and 50 Ω coaxial cables. Details of ionosonde and antennae are given by IRIBARREN and FIGUEROA (1986).

Table 1. Geophysical and geomagnetic data for Marsh.

Geographic coordinates	62°12′S	58°54′W
Geomagnetic coordinates	−51.0°	8.2°
Corrected geomagnetic coordinates	−46.5	11.0
Invariant latitude		−46.4°
Dip angle		55°
Gyrofrequency at height of 100 km		1.06 MHz
L-shell value		2.1 R_E

Ionograms shown in Figs. 1 and 2 correspond to a few days of late summer conditions and indicate the range of phenomena that can be observed at middle latidtudes, in the American longitude sector, where particle precipitation patterns may be unique (GLEDHILL, 1987). See Table 2 for detailed information on the ionograms. Note that times printed on ionograms, and used here, relate to hours of local time for the 30°W time zone while nearest time zone should be 60°W.

2. Results

Ionograms for 19 February 1986 are shown in Figs. 1a to 1d. These could be taken as representative of quiet to unsettled conditions which followed the large magnetic storm of 7 to 9 February. Stable overhead nighttime type F-region echoes (0030) are followed (0830) by frequently observed stratification between E-layer and F-region

Table 2. Date, time and geophysical indices for ionograms shown in Figs. 1 and 2.

Figure number	Date	Day of year	Local time (30°W)	Daily solar and geomagnetic indices*						
				Radio flux Ottawa, 10.7 cm	Sunspot number	X-ray background flux	*A*-index	Fredricksburg *K*-indices	*A*-index	Anchorage *K*-indices
1a 1b 1c 1d	19.02.86	50	0030 0830 1700 2100	70	0	B0.0	7	3-2-1-2-2-1-2-2	12	3-2-2-4-3-2-3-2
1e 1f	20.02.86	51	0145 0245	70	11	B0.0	13	3-3-3-2-3-2-3-3	25	3-3-4-4-4-5-4-3
2a 2b 2c	22.02.86	53	0200 0930 1930	69	11	B0.0	23	4-4-4-4-3-3-3-4	50	4-5-5-5-5-7-3-4
2d	27.02.86	58	0015	77	16	B1.0	19	4-4-4-4-2-2-3-3	29	4-4-4-6-4-3-3-3
2e 2f	03.03.86	62	0530 2115	92	36	B1.9	11	2-2-1-1-2-3-3-4	15	3-3-2-3-3-3-3-4

* Preliminary Report and Forecast of Solar-Geophysical Activity, National Oceanic and Atmospheric Administration, Space Environment Services Center, Boulder, Colorado, USA.

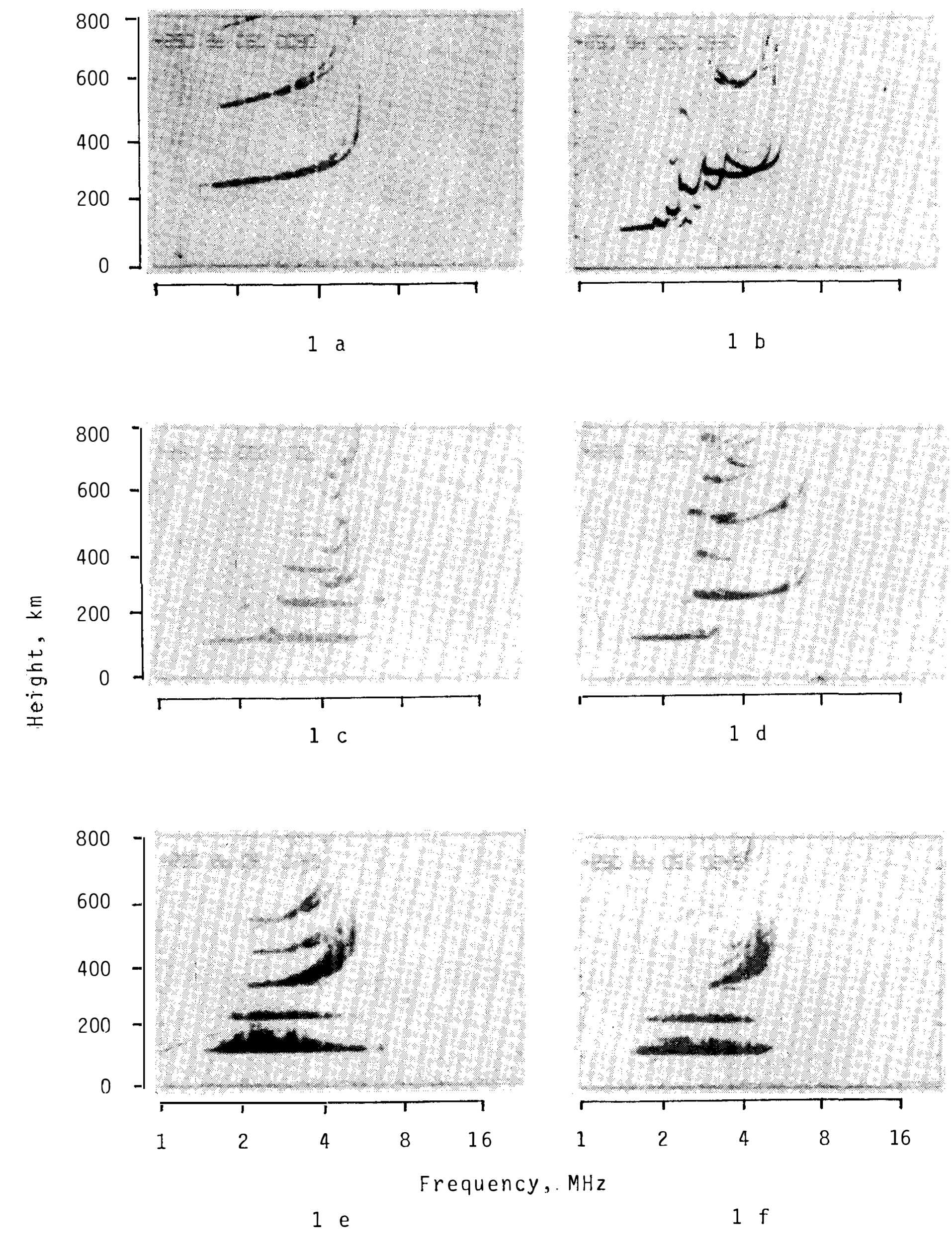

Fig. 1. Marsh ionograms (see Table 2).

after sunrise at middle latitudes. It should be noted that for Marsh, however, the F-region is sunlit all day long and that sunrise at E-region heights occurs around 0400. A blanketing $E_{s\text{-}c}$ is seen in the afternoon (1700) together with a combination of mixed-mode traces. One and a half hours before sunset at E-region heights some traces between the second and third order reflections from the F-region (2100) are probably due to oblique propagation. E-region echoes may indicate the presence of $E_{s\text{-}r}$ since f_0E should be lower than the frequency suggested by the trace retardation at the higher frequency end.

Spread echoes are evident at 0145 and 0245 of 20 February (Figs. 1e and 1f). Spread-F, frequency type, and E_s range spreading which could be associated to auroral

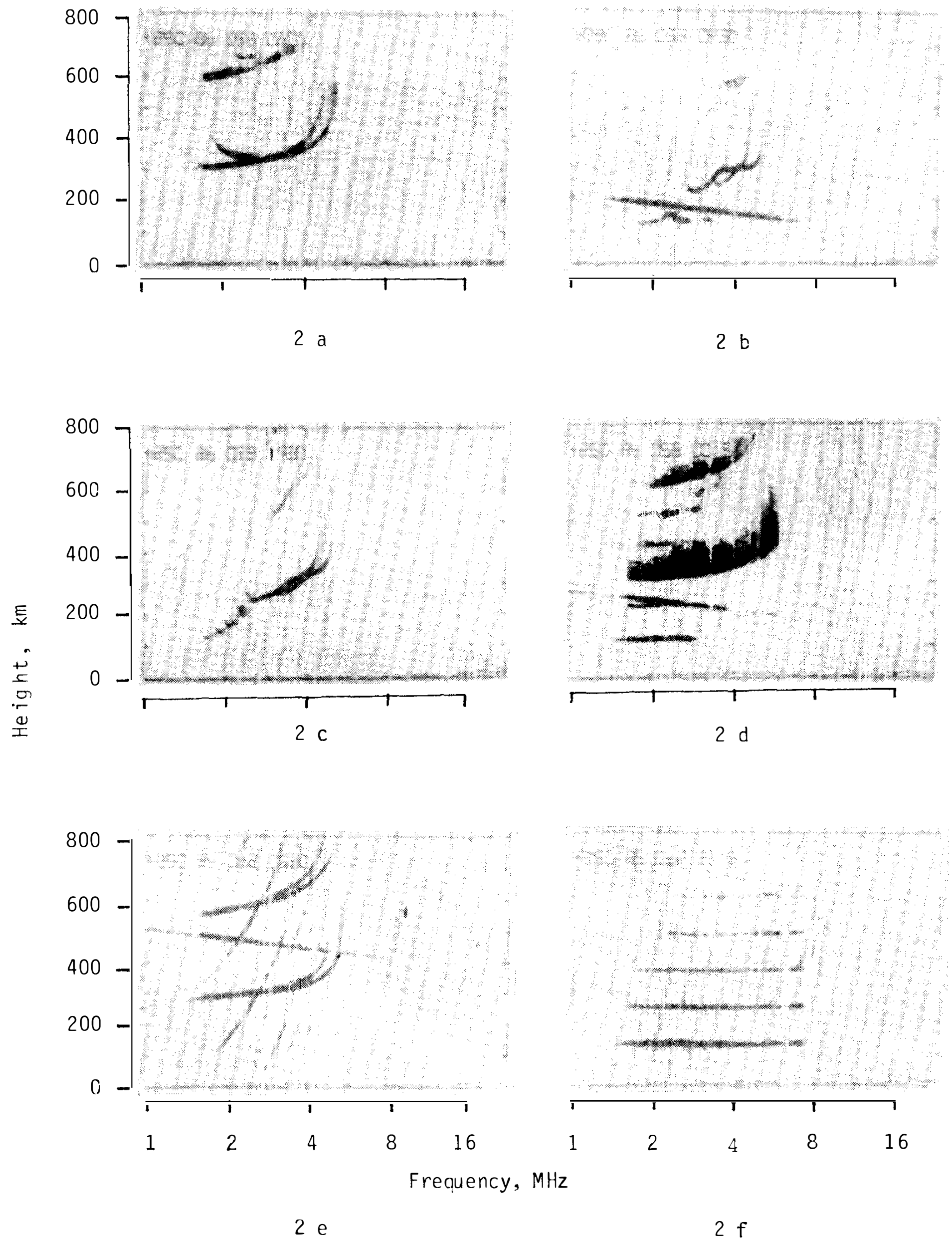

Fig. 2. Marsh ionograms (see Table 2).

E_s occur simultaneously. These conditions lasted for several hours. An indication of the presence of a thick nighttime E-layer (0200 of 22 February) is presented in Fig. 2a where bending of the x-trace at the low frequency end of the F-region echo is apparent. There is no evidence of this neither 15 min before or half an hour later. The same day normal day-time echoes are seen at 0930 and short lived (less than 30 min) stratification are apparent at 1930. A long sequence (several hours) of range Spread-F was observed at nighttime of 26–27 February. An example is given in Fig. 2d. No association between Spread-F and $E_{s\text{-}a}$ is found here.

Two hours after sunrise at 300 km, clear multiple high order F-region traces are evident (0530, 3 March) in Fig. 2e. This condition is also short lived (less than 30 min). The same day, prior to sunset, multiple E_{s-1} are observed (2115) as shown in Fig. 2f.

A final comment on Figs. 2b, 2d and 2e seems appropriate. They show a conspicuous straight trace, over several MHz, decreasing in height for increasing frequency. It is most likely that these relate to interference from a nearby radio equipment. They appeared on ionograms after the Great Wall base ionosonde (located about 4 km from Marsh ionosonde) started soundings, and they did not show again when an agreement on timing was reached between operators of both ionospheric stations.

Acknowledgments

The Instituto Antártico Chileno made funds and partial logistic support available to buy, install and operate the ionosonde at Marsh. Logistic support was also provided by the Fuerza Aérea de Chile.

References

Gledhill, J. A. (1987): Particle precipitation patterns in southern hemisphere high latitudes, longitude dependence. Mem. Natl Inst. Polar Res., Spec. Issue, **48**, 216–228.

Iribarren, N. M. and Figueroa, C. H. (1986): Un ionosonda para la estación ionosférica de Base Tte, Marsh. Ser. Cient. INACH, **34**, 99–103.

(Received November 13, 1986)