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Section 7. Magnetospheric Radio Emissions

The routine observation of ELF-VLF emissions has been continued at Moshiri,by the minimum level reading method for hiss type emissions,at four specific frequencies of 8kHz, 5kHz, 2.5kHz and 0.8kHz and by the method of wide band(0.5-8kHz) recording on magnetic tapes for the discrete and hiss type emissions.

Morphological characteristics of ELF hiss observed at Moshiri have been studied(Hayakawa and Tanaka,1978), using the wide band data during four years from January 1973 to December 1976, from which about 160 ELF emissions were identified. Main obtained results are as follows;(1) They are mainly hiss type emissions and few remainings are chorus and risers. From these ELF hiss the frequency band of 2-3kHz is most often seen,independent of both local time and magnetic K_p index,while hiss of lower frequency are seldom found. (2) The ELF emissions occur predominantly in the daytime(0500-1800 LT) with a tendency that the occurrence concentrates in the afternoon during magnetically quiet periods($K_p \leq 2$) and in the morning during moderate disturbance($3 \leq K_p \leq 5$). The occurrence probability shows an abrupt increase from Kp=4 and a broad maximum in the K_p range from 5-7. From comparison of these results with those by POGO and ISIS data and from a similarity of the ELF hiss to the plasmaspheric hiss,it is suggested that the generation region may be located in the equatorial plane within the plasmasphere. In order to confirm this suggestion,however,further studies are necessary on the generation and propagation mechanisms of the low and medium latitude ELF hiss. Considering the frequency band of ELF hiss,the receiving frequency of the hiss recorder at 1.5kHz at Moshiri was changed to 2.5kHz in December 1977.

The behaviours of VLF emissions during two moderate magnetic storms on 5-7 June and 19-21 September 1967 are investigated based on the Ariel 3 satellite data and ground observation at Moshiri(Hayakawa et al.,1977).

From this investigation the followings are found; (1) Emissions on the morning side occurred soon after the onset of main phase,while emissions on the evening side were at a very low level during this period and they could be recognized only after the recovery phase advanced.(2) The emissions on the morning side during the main phase located outside the plasmasphere and showed a property of discrete emissions,which means chorus type emissions. On the other hand,the emissions on the evening side located within the plasmapause and were narrow band hiss type emissions. (3) The Cyclotron instability by ring current electrons,on the whole,account for the many properties of the storm-time emissions.These results reconfirm the behaviours of spatial and temporal evolution of storm-time mid-latitude VLF emissions,previously deduced from the Ariel 3 data during the severe magnetic storm on 25-27 May,1967,although the type of emissions were not identified at that time and the postulated generation mechanism of emissions differ for the morning emissions in the main phase.

In order to study further the spatial and temporal evolution of storm-time mid-latitude VLF emissions,an international cooperative scientific program was started in November 1967 under a grant of the Japan Society for the Promotion of Science. This measurement intends to observe the ionospheric exit points as well as their field intensity at two stations in Europe, Chambon-la-Foret in France and Brorfelde in Denmark and also at Moshiri. During the first time observation the magnetic activity was very depressed and the VLF events were scare. As is shown in a preliminary report of this observation in this volume(Tanaka et al.),a couple of improvements of the observing apparatus were made after examing the data from the first time observation. The second time observation was commenced in the end of November 1977 and will be continued until the middle of March 1978. Due to the increasing geomagnetic activity and improved performance of the apparatus,the measurement in this season is being successfully carried out.

In order to get a more clear picture of relationship of auroral hiss to auroral display and precipitating electrons,a new direction finding system of auroral hiss will be operated before long at Syowa Station in Antarctica, as one of the projects by National Institute of Polar Research. This system measures the difference in arriving times of auroral hiss between a master station at Syowa Station and each of two slave stations,lying about twenty kilometers away in the south and west from the master station. Wide band signals(5-20kHz) observed at each slave station

are sent to the master station by a 2GHz microwave transmitter,where the time difference of arrival is measured every half second in real time base,by detecting the maximum cross-correlation coefficient. It is expected to measure the azimuthal and incident angles with an accuracy of ten degrees under good conditions.

Rocket experiments to know the wave normal direction of VLF emissions in the ionosphere during auroral display will be made this year at Syowa Station, by measuring the polarization ratio of the wave, which will give us useful informations to understand the generation and propagation mechanisms of the wave,in combination with the above mentioned ground observation.

The Exos-B satellite is scheduled to be launched at the Kagoshima Space Center of University of Tokyo in August 1978,aiming at the study of wave-particle and wave-wave interactions in the ionosphere and magnetosphere,in which we are involved in measuring the natural plasma waves.

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- Jinsuke OHTSU -

Publications

Hayakawa,M.,K.Bullough and T.R.Kaiser ; Properties of storm-time magnetospheric VLF emissions as deduced from the Ariel 3 satellite and ground observations, Planet.Space Sci., 25,353(1977).

Hayakawa,M. and Y.Tanaka ; ELF emissions observed at Moshiri,Nature (Physical Sci.), 270 ,703(1977).

Tanaka,Y.,M.Hayakawa and M.Nishino ; Study of auroral VLF hiss observed at Syowa Station,Antarctica, Memoirs Nat'l Inst.Polar Res., Tokyo, Series A13(Aeronomy),p.1-58(1976).

Tanaka,Y.,M.Hayakawa and M.Nishino ; An observing plan of wave normal direction of auroral VLF emissions on board a rocket at Syowa Station,Antarctica, Memoirs Nat'l Inst.Polar Res., Tokyo, in press, 1978.

Tanaka,Y.,M.Hayakawa,A.Iwai,T.Okada,M.Satoh and J.Ohtsu ; Preliminary report on the simultaneous observation of VLF emissions at Brorfelde (Denmark), Chambon-la-Foret(France) and Moshiri, Proc.Res.Inst. Atmos. Nagoya Univ., this volume,1978.