

Section 7. Magnetospheric Radio Emissions

Wave-particle interactions play an important role in the dynamics of the magnetosphere, hence studies of VLF/ELF emissions contribute to the knowledge of magnetospheric structure and behaviour. VLF and ELF emissions are observed in three distinct regions; (a) high-, (b) medium- and (c) equatorial latitudes.

As for the high-latitude emissions, Tanaka et al. (1976) have reviewed their result on direction finding (DF) for auroral hiss carried out at Syowa Station, Antarctica and then put forward some problems on DF. In order to get a more definite picture of its relationship to auroral display and precipitating electrons, we are planning a new system of DF for auroral hiss. This observation will be in operation at Syowa Station next year as one of the projects by National Institute of Polar Research. Synchronously with the ground observation, we will measure the characteristics of emissions in the auroral ionosphere on board a few rockets.

Hayakawa et al. (1975a) have extensively compared the morphological properties between the auroral hiss observed at Syowa Station and medium- or low-latitude hiss observed at Moshiri. Then they came to a conclusion that the emissions at Moshiri are not likely to be the consequence of the earth-ionosphere waveguide mode propagation of auroral hiss, being peculiar to medium latitudes. Emissions at Moshiri are furthermore classified into two groups; (a) storm-associated one and (b) quiet-time one. Of the two, the behaviours of storm-time medium-latitude VLF emissions have been studied by Hayakawa et al. (1975b) and Hayakawa et al. (1976a) for a few selected geomagnetic storms based on the Ariel 3 satellite and ground-based VLF and riometer measurements. They have shown that the VLF emissions on the morning side respond very rapidly to magnetic activity, while at the beginning of a storm the emissions on the evening side are at a low level, only becoming significant during the recovery phase, and then they have discussed their generation mechanism. On the other hand, the quiet-time emissions may correspond to the equa-

torial emissions described later.

In order to aid the understanding of above-mentioned medium-latitude emissions, we commenced the DF measurement for them to know the detailed temporal and spatial variations of their exit point from the ionosphere. Observations were made at two stations in Europe; (a) at Chambon-la-Forêt (France), and (b) at Tollose (Denmark). This international cooperative science program is sponsored by the Japan Society for the Promotion of Science and will be continued in two more autumn seasons.

In a close association with the storm-time medium-latitude VLF emissions, Hayakawa et al. (1976b) have studied the storm-time behaviour of the magnetospheric plasma using the Ariel 3 satellite measurement of whistler-mode signal from the terrestrial GBR transmission. Then they have obtained evidences of detached plasma region in the plasma-trough region and refilling of the plasmopause from the underlying ionosphere exclusively during the recovery phase. The maximum intensity at $L \sim 2$ shows an enhancement during active periods and an additional one several days behind the storm. The former enhancement seems to be attributed to the gyroresonance with the higher energy storm-time electrons and the latter one is closely associated with the formation of magnetospheric field-aligned ducts.

Hayakawa et al. (1976c) have studied various characteristics of the equatorial VLF emissions with the VLF data from the Ariel 4 satellite during a 3 months' period and have shown that maximums in emissions are frequently observed at latitudes less than 40° with high intensity. We need further investigation to make clear the generation as well as propagation processes of equatorial emissions.

We are involved in the project of EXOS-B satellite which is scheduled to be launched in 1978, aiming at the study of wave-particle and wave-wave interactions in the magnetosphere. Kashiwagi has been making the design of a loop antenna to be used on board the proto-type EXOS-B satellite for the measurement of ELF-VLF electromagnetic waves.

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Publications

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