Analysis of ELF/VLF/LF band plasma waves with Polar Patrol Balloon in the Antarctic region

Taketoshi Miyake[1], Toshimi Okada[2], Hisao Yamagishi[3], Akihiro Chino[4], Akira Kadokura[5], Natsuo Sato[5]

[1] Elec. and Inf., Eng., Toyama Pref. Univ., [2] Electronics and Infomatics,Toyama Pref Univ, [3] Upper Atmos. Phys., Natl. Inst. Polar Res., [4] Electronics and Informatics, Eng., Toyama Pref. Univ., [5] NIPR

From late December in 2002 to middle February in 2003, NIPR(National Institute of Polar Research) is planning to carry out a long-duration balloon experiment, which is called PPB(Polar Patrol Balloon) experiment, in the Antarctic region in collaboration with ISAS(The Institute of Space and Astronautical Science). In this experiment, four stratospheric balloons will be launched from Syowa station Antarctica, one balloon for astrophysics observation and three balloons for geophysics observation. PPB experiment aims to fly balloons in a circumpolar wind to make observations of an extremely long duration. For geophysics observation, three balloons form a formation flight in order to separate the spatial and temporal variations of phenomena, and observe spatial profiles of various phenomena occurred in the Antarctic region.

The objectives of this study are to join PPB experiment and observe ELF/VLF/LF band plasma waves, then to clarify the generation mechanism of these plasma waves and their spatial profile in the Antarctic region. Among various plasma phenomena observed in this region, we investigate the mechanism of the VLF band wave modulation due to compressive MHD waves, which propagate across the L-shell. We have to observe various plasma waves with a very wide-band frequency range, ELF, VLF and LF band waves, in order to analyze these VLF band wave modulation phenomena. We are now developing a new radio and plasma wave receiver with a wide-band frequency range, and will install on the three stratospheric balloons. This wave receiver contains three individual tuning circuits for ELF, VLF and LF band waves, respectively. These parallel tuning circuits carry out the very wide-band frequency range of this wave receiver. In this experiment, we use huge two loop antennas which is on the balloon surface. These two loop antennas cross at right angles, and we can avoid influences due to the balloon's spin, by adding two outputs of loop antennas. Our receiver have three different analyzers for each waves with different frequencies, WFC(Wave Form Capture) for ELF band waves, MCA(Multi Channel Analyzer) for VLF band waves, and SFA(Sweep Frequency Analyzer) for LF band waves. WFC is a waveform receiver, MCA and SFA are spectrum analyzer.

According to the theoretical analysis and past observation works, it is confirmed that our wave receiver can observe usual ELF/VLF/LF band plasma waves in the Antarctic region. We will finish the development of this wave receiver as soon as possible, and then prepare for Sanriku balloon experiment, which is planned on late May in 2002.