

Study of VLF band electromagnetic waves in the Antarctica observed by Polar Patrol Ballons

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The two large scientific balloons (PPB:Polar Patrol Balloons) were launched on Jan. 13th, 2003 at Syowa Station in the Antarctica. The balloons reached the altitude of 33km, and observed various data for about two weeks. All the equipments worked properly, and clear data are obtained. We developed wide-band electromagnetic wave receiver (EMW) onboard PPB and observed ELF/VLF waves in the Antarctica.

VLF band waves observed in the Antarctica are frequently modulated in frequency.

Among these frequency modulations, the modulations in about 20sec are considered to be due to the compressional MHD waves. This phenomenon is identified by the correlation between the phase of ELF waves and the frequency modulations of VLF waves. To observed this correlation, we developed wide-band wave receiver (EMW) which can observe waveforms of ELF waves and power spectra of VLF waves.

By taking cross correlations between data observed by two balloons, we can identify the direction from which VLF waves propagate as well as the source region where these waves are excited. We compared one event observed by both balloons on Jan. 17th, and found the time when the strong VLF wave observed by the 8th PPB was 3 minutes earlier than that observed by the 10th PPB. This result indicates that this VLF wave propagates with the velocity of about 67km/s. The projection of this velocity on the equator plane is about 1800km/s, which is almost the same order as the estimated velocity of the compressional MHD waves in this region. Further, we will study the relation between VLF band waves and compressional MHD waves in detail by using VLF wave data observed at the Antarctic Showa base.