

南極周回気球による ELF/VLF 波動観測結果

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ELF/VLF wave observation by Polar Patrol Balloons

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Polar Patrol Balloon (PPB) No. 8 and 10 were launched from Antarctic Syowa Station in January, 2003. Two balloons equipped with identical instruments for auroral study accomplished halfway round the Antarctica in two weeks, and the distance between the two balloons increased from 100 to 700 km during the flight. ELF/VLF wave instrument onboard the balloon utilized wires surrounding the balloon body as loop antennas and observed wave magnetic field in 0.2Hz-36kHz band in three different ways; WFC (waveform capture) observing waveform in 0.2-4 Hz, MCA (multi-channel analyzer) observing wave intensities at 0.3, 0.6, 1.2, 2.4 kHz, and SFA (sweep frequency analyzer) observing wave intensities at 5, 10, 20, and 36 kHz. During the first half of the flight, the balloons moved from auroral to sub-auroral zone and the geomagnetic activity was quiet. In the second half of the flight, the balloons moved from sub-auroral zone to mid-latitudes and the geomagnetic activity was very active. WFC observed strong (several tens of pT) bursty fluctuations followed by damping oscillations lasting for 30s. These can be related to local lightning activity. Similar bursty waveform was observed at Syowa Station. However, one-to-one correspondence was not found yet. MCA observed ELF hiss, polar chorus and auroral hiss during most of the flights. Similarity of the time profiles of the emissions was dependent upon the distance between the two balloons, suggesting a finite spatial extent of the emission from the source. SFA observed quasi-periodic (10-20 minute) variations of 20 kHz wave intensity for most of the flight. It seems that these were spatial variations detected by the moving balloons, and caused by the interference between multiple propagation modes transmitted from VLF broadcast station.

オーロラ観測用の同一観測機を搭載した南極周回気球 8 号機と 10 号機は 2003 年 1 月、南極昭和基地から放球され、2 週間で南極大陸を半周する観測を行なった。この間、2 つの気球の間の距離は 100 ~ 700km にわたり変化した。ELF/VLF 帯電磁波動観測機は気球本体を縦に一周する導線をループアンテナとし、0.2Hz ~ 36kHz の帯域を 3 つの受信方式、WFC (0.2 ~ 4Hz の波形伝送)、MCA (0.3, 0.6, 1.2, 2.4kHz のフィルターバンクによる検波強度)、SFA (5, 10, 20, 36kHz の掃引受信による検波強度) により観測した。WFC では空電によく見られるようなバースト性の波形が観測された。MCA では ELF ヒス、オーロラヒス放射が観測され、2 気球間での波動強度変化の相関は気球間距離とともに変化し、放射が有限な広がりを持つことを示した。SFA では VLF 局信号の干渉波形が明瞭に観測された。