Effect of system noise on CNA observed with the imaging riometer

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The 256-element imaging riometer (IR) installed at Poker Flat, Alaska, can obtain the high-spatial-resolution two-dimensional images of cosmic noise absorption (CNA). Recently, we compared CNA with the electron flux measured by the satellite not only qualitatively but also quantitatively. However, the CNA has an ambiguity due to some observational factors, so we need to remove or estimate this ambiguity.

The system noise is one of these factors. When the cosmic noise (called as the quiet day curve (QDC) in the quiet condition) received with the IR is much greater than the system noise level, the ambiguity of CNA due to the system noise is regarded to be small. On the other hand, when the cosmic noise is small, the percentage of system noise level in the observed value relatively increases and CNA may be underestimated.

In order to investigate the effect of system noise on CNA, we analyze the CNA accompanied by the solar proton events observed from October 26 to November 10, 2003. We assume that the CNA generated by the solar energetic protons is uniform in the field of view of the IR, because the solar proton events have large horizontal scale in the polar region. However, the observed CNA is not actually uniform because of the following two reasons; one is the zenith angle dependence of CNA and the other is the system noise effect.

We first correct the zenith angle dependence of CNA by applying a factor, cos(x), where x is the zenith angle of beam and examine the spatial distribution of CNA. It is found that CNA has a clear dependence on QDC, indicating that CNA is affected by the system noise. Further, we estimate the system noise level and the correction function for the zenith angle dependence so that CNA are equal at all beams, by means of the least square fitting.