

Development of automatic detection and tracking technique for pulsating aurora

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Pulsating aurora is a kind of aurora blinking with several tens of seconds period and having a patchy structure with several to hundreds of kilometers spatial scale. It is difficult to automatically detect pulsating aurora in a video image because the spatial and temporal features of pulsating aurora are complex. Then, statistical analysis would not be enough due to the difficulties. In this study, in order to perform the statistical analysis of pulsating aurora, we have developed an automatic detection and tracking technique for pulsating aurora. Pulsating aurora usually appears simultaneously with diffuse aurora. We apply Low Pass Filter to the brightness variations to reduce the effect of diffuse aurora. Then, we use the Level Set Method to detect the outer shape of pulsating auroral patches. However, the aurora images include a lot of noise so that we are not able to accurately extract pulsating aurora. Here, we evaluated two noise reduction techniques. First is enhancement of the brightness values of aurora images by using a nonlinear function to compress the noise. Second is using the spectral entropy, which is a signal processing method for classifying signal and noise. As a result of evaluation using test data, the first method showed lower error rate of detection (less than 10%) at a signal-to-noise ratio of -5 dB or more in comparison with the second method. We track the motion of pulsating aurora by using a particle tracking technique. We evaluate the accuracy of the tracking technique with a test movie including a simulated auroral patch. The result showed that the tracking error was less than 1 pixel at the signal-to-noise ratio of -10 dB or more.

In this presentation, we will discuss our automatic detection and tracking method for pulsating aurora in detail.

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