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Study on a new algorithm on similar data retrieval from plasma wave spectrum observed by solar-terrestrial satellites

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In recent years, the total amount of data measured by scientific spacecraft has drastically increased as the resolution of each instrument becomes higher. It is a difficult task to find some interesting phenomena in it. It is necessary to develop a new computation method for automated classification and data analysis. There are two issues to be solved for similar data retrieval. One is to develope a method which can be applied to different types of satellite data, and the other is to increase efficiency of the retrieval method. In this study, we show how to solve these two problems, and we applied our proposed method to the plasma wave data measured by WFC-H, and WFC-L onboard KAGUYA and MCA onboard Akebono for evaluation.

First, in order to reduce the amount of data retrieved, we need to define the characteristic parameters of the data. In general DCT or Wavelet is applied for natural picture to extract the characteristic quantity. In the present study, we applied DCT transform to the spectrogram data and extracted DC and low frequency part of AC components as characteristic quantities. It is noted that the characteristics of spectrogram of the plasma wave measured by solar-terrestrial satellites are different from the ones of natural image data, that is, the transformed components of the spectrogram using DCT are mainly left in the first row and first column.

Faced with a large number of observation data, retrieval using walkthroughs is impossible. In order to improve the efficiency, we adopted multi-dimension index as a solution. The multi-dimensional index is mainly used for similar image retrieval, to reduce computation time for retrieval from large amount of multi-dimensional characteristic parameters. In our study we use the algorithm named SR-Tree, which combines the advantages of the S-Tree and R-Tree. In the presentation, we introduce the way to put SR-Tree in the retrieval of satellite spectrum data.

Keywords: plasma wave, similar data retrieval, database, scientific satellite