

Automatic classification of electromagnetic waves from database obtained by the Akebono satellite

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In the study of plasma waves observed by scientific satellites, it is general to extract and analyze the data in manual operation. The amounts of data obtained by satellites are so huge that it is quite difficult to survey all of them, and the data of most part remain without being analyzed. From these backgrounds, it is necessary to develop a computational method to extract and classify plasma waves automatically. In the present study, we develop a new general-purpose computational technique for extracting the attributes of the plasma waves from enormous scientific database of multi-channel analyzer (MCA) on board Akebono and classifying them in a systematic way.

Firstly, we introduce several key parameters to represent the characteristics of wave phenomena quantitatively. Secondly, we propose a two-step cluster analysis for the classification. Applying this cluster analysis to the key parameters, we could shorten the calculation time and make some representative classes. In order to estimate suitable class number, we propose an evaluation function with AIC.

As a next step, we developed a new technique to discriminate all the data to the representative classes. We evaluated this technique using the MCA data obtained from 1989 to 1992. It was demonstrated that we could successfully identify some representative waves such as chorus emission and plasmaspheric hiss. Finally, we discuss a technique to detect exceptional data that doesn't belong to any representative classes. With this technique, we could detect some exceptional data that was quite difficult to detect in manual operation.