SOLAR-TERRESTRIAL DATA ANALYSIS AND REFERENCE SYSTEM (STARS) - ITS HIGH POTENTIALITY FOR COLLABORATIVE RESEARCH

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ABSTRACT

Cross-sectional studies have become important for an improved understanding of various Solar-Terrestrial Physics (STP) fields, given the great variety and different types of observations from the Sun to the Earth. In order to better combine, compare, and analyze different types of data together, a system named STARS (Solar-Terrestrial data Analysis and Reference System) has been developed. Cross-sectional study requires cooperative work. STARS has two functions for cooperative work, the "Stars Project List (SPL)" and the "Event Listing". The SPL is used for exchanges of plotting information by cooperating persons. The event list database provides all users of STARS hints for recognizing typical occurrences of STP phenomena.

Keywords: Cross-sectional studies, Cooperative work, Combined plot, XML, Collaborative analysis, Common knowledge, Experience sharing, Solar-terrestrial physics, Common use

1 INTRODUCTION

A variety of cross-sectional studies have become important for further understanding of the Solar-Terrestrial Physics (STP) fields. We need to combine, compare, and analyze different types of data together, for example, both satellite-based and ground-based observation data. To support such cross-over searches and analyses of data, we have developed a system named STARS (Solar-Terrestrial data Analysis and Reference System) (Murata, Yahara, & Toyota, 2005; Ishikura, Kimura, Murata, Kubo, & Shinohara, 2006). A brief explanation of STARS can be found at: http://aoswa.nict.go.jp/application.html. A detailed description of STARS can be found at: http://seg-web.nict.go.jp/e-sw/download/data/STARS5manual_e.pdf. Figure 1 shows an overview of STARS including meta-data and data flow. STARS has functions that search for the existence of expected data, make a combined plot, and save the plot or data. Figure 2 shows an example of a combined plot.

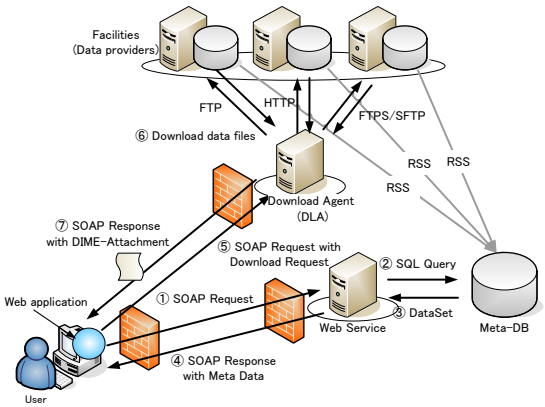

Figure 1. The structure of STARS and the flow of meta-data and data

Cross-sectional study often requires cooperative work by researchers with different specialties. Usually, a single researcher can cover only one or a few of the fields. If the findings and experiences of the researchers are exchanged, the cooperating analysis receives a boost. STARS has two special functions for cooperative work. These are the "Stars Project List (SPL)" and the "event listing". In this paper, we focus on these two functions.

2 STARS PROJECT LIST (SPL)

After a user makes a combined plot on STARS, information about the plot can be stored in an XML file known as a Stars Project List (SPL). SPL includes information with which any user can make the same combined plot in STARS. Figure 3 shows an example of SPL. The information contains start/end date and time, data ID, ID number, plotting status, and details for plotting. Using SPL, any user can easily make the same plot without checking detailed download file options or plotting options. Further, any user can revise the combined plot by adding a data file or by changing plotting options. We introduce two cases of cross-sectional studies that use SPL.

Case 1. Exchange of plotting information for cooperating analysis

SPL is used for exchange of plotting information between user "X" and user "Y". The detailed example is as follows. After user "X" makes a combined plot, user "X" stores the plotting information in an SPL. When user "X" sends the SPL to another user "Y", user "Y" can make the same plot on STARS based on the information stored in the SPL. Therefore, user "Y" can easily reach the same viewpoint as user "X" did. Then, user "Y" modifies the plot based on Y's own special knowledge after viewing the original plot. After user "Y" makes a revised plot, saves the SPL under a new name, and sends the new SPL to user "X", user "X" can discover the additional viewpoints by looking through the modified plot. Such an interactive exchange of SPLs is a quick way to do collaborative analysis.

Case 2. Accumulation of common research knowledge

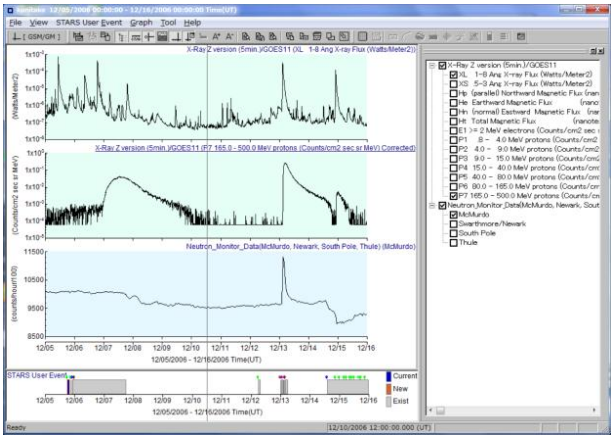

Figure 2. An example of a combined plot drawn using STARS. The time period of the plot includes several phenomena in Solar-Terrestrial Physics. The top panel of the plot shows the solar X-ray flux observed at the GOES 11 geostationary satellite. The second panel shows the proton flux observed at the GOES 11 geostationary satellite. The third panel shows cosmic ray counts observed by a neutron monitor on the ground (McMurdo station).

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figexampleGLE20061205(000000UT)-20061216(000000UT).StarsProjectList - メモ帳
ファイル(F) 編集(E) 書式(O) 表示(V) ヘルプ(H)
<?xml version="1.0" encoding="UTF-8"?>
<StarsEventList st="2454074.5" et="2454085.5">
  <User id="300007" name="kunitake">
    <Mission id="460000" name="Magnetogram" />
    <Team id="140100" name="NICT" />
    <Group id="300000" name="Space Environment Group/NICT" />
    <Config>
      <WindowState>0</WindowState>
      <WindowTop>21</WindowTop>
      <WindowLeft>30</WindowLeft>
      <WindowWidth>640</WindowWidth>
      <WindowHeight>507</WindowHeight>
      <VerticalSplitterPos>200</VerticalSplitterPos>
      <HorizontalSplitterPos>113</HorizontalSplitterPos>
      <PropertyPanelStatus>True</PropertyPanelStatus>
    </Config>
  </User>
  <Mission id="170000" name="GOES">
    <Team id="170550" name="GOES11">
      <Data id="151951" name="X-Ray Z version (5min.)/GOES11"
folder="D151951" plot="False">
        <File name="Z1150612.TXT" st="2454070.5" et="2454101.5" />
        <Component name="XL" plot="True" />
        <Component name="P7" plot="True" />
      </Data>
    </Team>
  </Mission>
  <Mission id="470000" name="Neutron Monitor">
    <Team id="470100" name="Bartol">
      <Data id="470101" name="Neutron_Monitor_Data(McMurdo, Newark,
South Pole, Thule)" folder="D470101" plot="False">
        <File name="BRI2006.txt" st="2453736.5" et="2454101.5" />
        <Component name="McMurdo" plot="True" />
      </Data>
```

Figure 3. Example of an SPL. SPL is an XML file that includes the information with which the user worked with STARS: start/end date and time, the name of downloaded data file, and plot information.

If many researchers save their SPLs in a common location, the accumulated SPLs could be used for a SPL database. If a coordinator makes a subset of a database from the SPL database with a clear focus, such an SPL subset would be useful not only for plot makers but also for any STARS users.

One actual example is our SPL subset website for space weather researchers and users (Figure 4) (http://seg-web.nict.go.jp/e-sw/spl/index_e.html). On the web site, typical outstanding space weather occurrences are collected. Any persons who are interested in one of the occurrences can select the corresponding SPL file and download it from this website to make a plot.

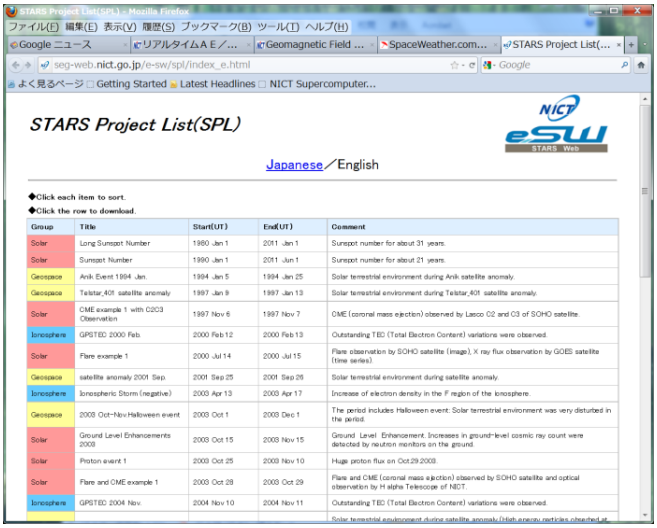

Figure 4. SPL subset website for space weather

3 EVENT LISTING

3.1 Making and viewing an event list

When a STARS user finds an interesting variation of typical phenomena in the plot, the user recognizes it as an "event". The user can in turn register the "event" in the STARS event list. Each "event" is described in XML and has detailed information (title, start/end time, person who registered the "event", etc.). Registered "events" are accumulated in the event list database.

Any user can then view those "events" that have already been registered by other users as well as his/her own registrations. When many "events" are registered in the event list database and many of the users share the "event" information by quick viewing, the event list will become common knowledge among STARS users.

When a user makes a combined plot on STARS, the user can discover any of the "events" that exist in the analyzing time period. There are two ways that this can happen. One is for the user to look through the extracted event list. Out of the whole registered event database, the extracted event list extracts "events" that exist in the analyzing time period. The other is to glance at the "event" marks on the combined plot. Each "event" is shown as one pin mark in the combined plot. When a user double-clicks on a pin mark, detailed information of the selected "event" appears.

3.2 Effectiveness of the event list

The "event" information is shared by users through the event list. As Solar-Terrestrial Physics (STP) phenomena have been observed by a wide variety of techniques, it is rather hard for one person to become a specialist in all types of observations. If some researchers come together for collaborative research, the total number and kind of unfamiliar observations will be minimized. Figure 5 shows schematically the way for an effective usage of the event list to proceed. Suppose that three researchers participate in analyzing data that cover several different fields and that each participant has some special knowledge about one particular observation. If participant "C" is a specialist in "observation CCC" but not a specialist in "observation DDD or EEE", then participant "C" can make a contribution by registering "event" #C1. If participant "D" is a specialist in "observation DDD" but is not a specialist in "observation CCC or EEE", then participant "D" can make a contribution by registering "event" #D1. When participants C, D, and E have all added their "events" to the event list, the event list will become richer and more informative from the contributions of the specific expertise of each registrant.

4 FUTURE WORK

A large number of "events" have been accumulated in the STARS event list. A large number of SPLs have been collected in another useful list. We are developing a useful portal website (I-space weather). We plan to customize a variety of types of services for space weather researchers in the web site. Information related to space weather forecasts is to be shown also. One of the customized services has crossover search functions using key parameters of "event" or by SPL. Another customized service is adding information to the SPL. It is also possible to add comment descriptions to the SPL. This will be helpful in analysis by cooperating persons and search by any user.

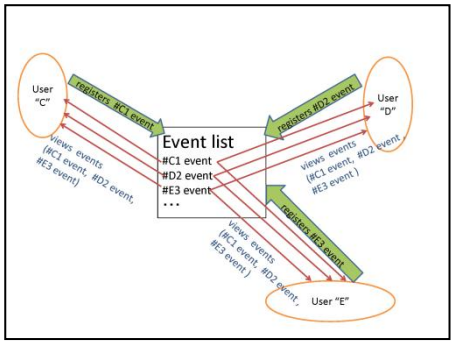

Figure 5. An effective usage of the event list. Each person can register each "event". Any person can view all of the accumulated events from the event list.

5 CONCLUSION

STARS is a system that realizes the crossover searches and integrated analyses of the ground-based and satellite observations of Solar-Terrestrial Physics. STARS has several advanced functions (data search, crossover comparison, plotting information exchange using SPL, and common use of event list). Stars Project List (SPL) plotting information exchange and common use of the event list are useful for collaborative work.

As an SPL contains detailed information about a combined plot, not only the user who made the combined plot but also any other users can easily make the same plot without checking data file download options and plotting options. When any user modifies the plot, the modification can be saved in a new SPL. Through information exchange using SPL, cooperating analysis by cross-sectional fields will progress effectively.

If domain experts and specialists in other research fields are expected to register many "events" in the event list database, the database will in turn provide users of STARS crossover hints for recognizing typical phenomena. In other words, the event list database will be used as common research knowledge for all STARS users.

6 ACKNOWLEDGEMENTS

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7 REFERENCES

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