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The new international GLE database

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Abstract. The Australian Antarctic Division has agreed to host the international GLE database. Access to the database is via a world-wide-web interface and initially covers all GLEs since the start of the 22nd solar cycle. Access restriction for recent events is controlled by password protection and these data are available only to those groups contributing data to the database. The restrictions to data will be automatically removed for events older than 2 years, in accordance with the data exchange provisions of the Antarctic Treaty. Use of the data requires acknowledgment of the database as the source of the data and acknowledgment of the specific groups that provided the data used. Furthermore, some groups that provide data to the database have specific acknowledgment requirements or wording.

A new submission format has been developed that will allow easier exchange of data, although the old format will be acceptable for some time. Data download options include direct web based download and email. Data may also be viewed as listings or plots with web browsers. Search options have also been incorporated.

Development of the database will be ongoing with extension to viewing and delivery options, addition of earlier data and the development of mirror sites. It is expected that two mirror sites, one in North America and one in Europe, will be developed to enable fast access for the whole cosmic ray community.

1 Introduction.

At the meeting of Monitoring of the Sun Earth Environment (MONSEE) group during the 26th International Cosmic Ray Conference in Salt Lake City in 1999 it was agreed that the Australian Antarctic Division would take over the role of hosting the international Ground Level Enhancement (GLE) database. Since 1986 the database has been hosted at the US Air Force Research Laboratories under the careful guidance of Peggy Shea, Don Smart and Louise Gentile (Gentile 1991, 1993; Gentile et al. 1993). Over a number of years a standardised format for data submission and storage in the database was developed (Gentile et al. 1990; Shea et al. 1985, 1987).

The database has gradually been enhanced with data both from more recent events and with addition of older datasets once they had been recovered, checked, collated and coded. The addition of older data to the database is an ongoing process (Shea et al., 2001).

The changing status of staff at the Air Force laboratories resulted in the need to find a new permanent home for the GLE database and at the same time a fully world-wide-web integrated interface with a more modern data structure was envisaged.

2 The new GLE database.

The new world-wide-web based GLE database is now operational and can be accessed at:

www-aadc.aad.gov.au/datasets/gle

A sample view of the public access web page is shown in Fig. 1. The database can be searched by event date, event number, minimum number of stations observing the event, size (in % above background) of the event, rigidity of the event (through approximate vertical cutoff rigidity) or a combination of these parameters.

There is also provision for feedback via the web page and the turnaround time to respond to queries is planned to be 24 hours.

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Fig 1. The public access web page of the new GLE database showing the search options that can be invoked.

On entering a selection into the search, a table of available data will be presented to the browser with the ability to mark those files required. Options for data delivery initially include screen listing and electronic mailing to a nominated email address. Screen plots are also available but are restricted to a single station per plot. An example plot from Mawson for 22-23 October 1989 is shown in Fig 2. It is expected that plotting options will be progressively developed over time with the inclusion of multiple stations per plot.

Data availability is, in general, public but password restrictions will be placed on new data submitted to the database for a period of two years. This is in accordance with the requirements for data exchange under the Antarctic Treaty and gives data owners some protection to have first use of the data whilst still encouraging them to deposit data with the database. Research groups that submit data to the database for a particular GLE will have access to all data available for that GLE immediately.

A new data structure, based on XML, has been developed for the database. Under this structure each record is tagged with a label that identifies the type of data within the record. This allows much greater freedom in preparing, storing and searching through data in the database. A full description of the structure will be posted on the web site and will be published at a later date. Initially, requests for data have the option of receiving the data in the older revised standard format defined in Shea et al. (1987) or in the new XML format. Similarly, data submitted to the database will be accepted in either format. Over time it is expected that researchers will adopt the new format and the old format will be discarded but this will not be done until the research community is happy to complete the changeover.

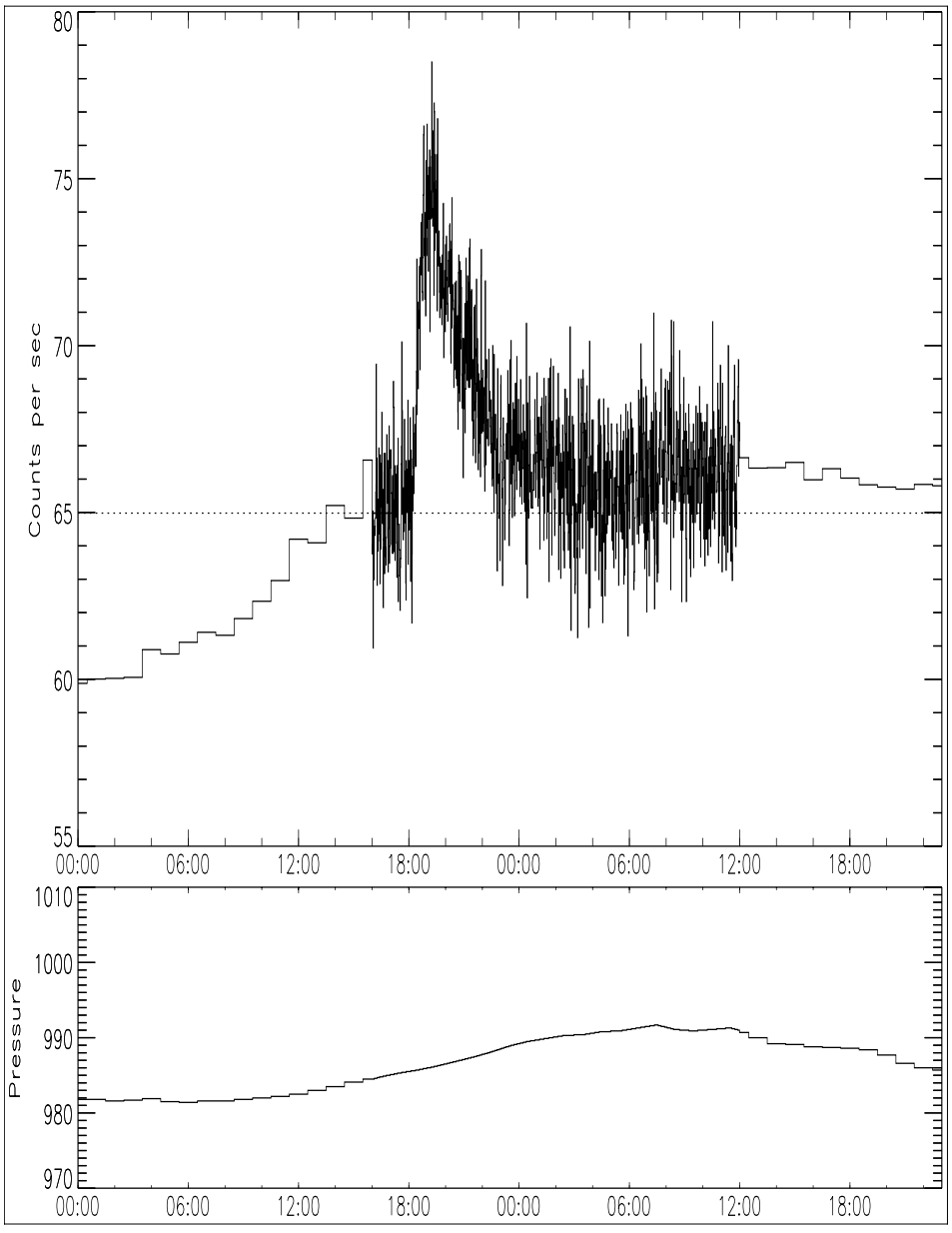

Fig 2. Sample plot from the new GLE database site showing the Mawson response on 22–23 October 1989.

Once the database has been operational for some time and has been thoroughly tested by users it is hoped that mirror sites can be established to increase access speed. Initial plans are for one mirror site in North America and another in Europe.

3 Data submission to the database.

At the 26th International Cosmic Ray Conference MONSEE meeting consideration was also given to the time resolution of data submitted to the database. Subsequent discussions between neutron monitor operators has led to the decision that hourly data should be submitted for the day prior to a GLE and for the day following a GLE. Data with as small a sampling time as possible should be provided from at least two hours before the earliest onset until the levels have decreased to background levels. Note that this may involve considering other modulations that may be present concurrently. The background level at the end of the GLE could be quite different from the baseline level at the start. It is therefore important that widespread consultation about events takes place as soon as possible after the event to establish agreed baseline times and intervals for hourly and fine time resolution sampling. As soon as these intervals are defined they will be posted on the web site so that researchers can submit their data with agreed timing.

Submitted data will be automatically vetted for consistency and notification of any problems will be made promptly before the data are attached to the database. The data will also be visually inspected for possible problems or inconsistencies. Data submitted to the database will be tagged as preliminary until it is confirmed as final by the principal investigator who supplied the data.

4 Additional information in the database.

Another aspect of the new database is the opportunity for research groups to include links to their home web sites and email contact addresses with their stored data. Under the XML structure this is quite easy to maintain. Changed web or email addresses can be accommodated with little difficulty and can be associated with every relevant record instantly.

Similarly, any text associated with data from a particular station can be readily attached and adapted. This will be particularly important where accreditation of data is required such as acknowledgment of research grants where the grant codes change with time. Text files will be appended to all data that require specific accreditation or additional commentary. In the case of important comments about the data the comments may be attached to a particular station for a particular GLE or may be more general.

It is also hoped that other information will be added to the database relevant to each GLE. Information about the source flare region and emissions and possibly the availability of IMF data could be included. These data have not been included in the database initially but should be progressively added in the future.

5 User responsibilities.

All database users are required to include all appropriate acknowledgments in any publication resulting from use of data from the database. This means acknowledgment of the originating institutions providing the data, any grant listing required by them and acknowledgment of the Australian Antarctic Division as the database custodian. Failure to follow these simple guidelines may result in database access to individuals or institutions being blocked.

Users should also provide details of all publications resulting from the use of data retrieved from the database. A form on the web site will be provided to do this. Standard reference information such as author/s, title, journal or book, page range, date of publication and which data were used will be required. Publications in conference proceedings and conference abstracts should also be included. This information will be passed back to the principal investigators who submitted data that were used. They will be able to use this feedback for research justification and funding proposals. The information will also be used in support of the continued operation and enhancement of the database. It is therefore extremely important that users take the few minutes time necessary to pass on this information. It will be for the benefit of all researchers to do so.

All requests for data from the database are logged and this information will also be passed on to relevant principal investigators. This will show the demand for the data but it is hoped that authors will comply with the above request and that this logging will simply reflect later publication.

6 Summary.

A new interactive web-based GLE database, hosted by the Australian Antarctic Division is now operational. Searches of the database against a number of parameters are possible. Data delivery is by email or browser initially but other options may be added in future. The system will be continuously improved and upgraded over time and it is hoped that mirror sites in Europe and North America will be established. Eventually, as much GLE data as possible, going back to the earliest recorded events, will be included. Feedback on usage of the data will be passed on to principal investigators to assist them in research justification and funding proposals.

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