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LONG-TERM PRESERVATION OF SOLAR TERRESTRIAL DATA

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Humans are now capable of observing Earth to a significant fraction of the universe using a wide variety of techniques. For solar terrestrial physics, we observe the Sun and Earth and everything in between to understand the changing influence of the Sun and Earth on the terrestrial environment in which life thrives. In addition to observing the solar-terrestrial phenomena, scientists are involved in tapping into the natural archives, which have preserved the effect of cosmic rays and solar activity on the terrestrial environment. One of the best examples of long-term observations that have been well preserved is the record of sunspot number. The sunspot number has been extended to the pre-telescope era to understand the influence of the Sun as indicated by the variation of C-14 in tree rings and Be-10 in ice cores (Eddy, 1976).

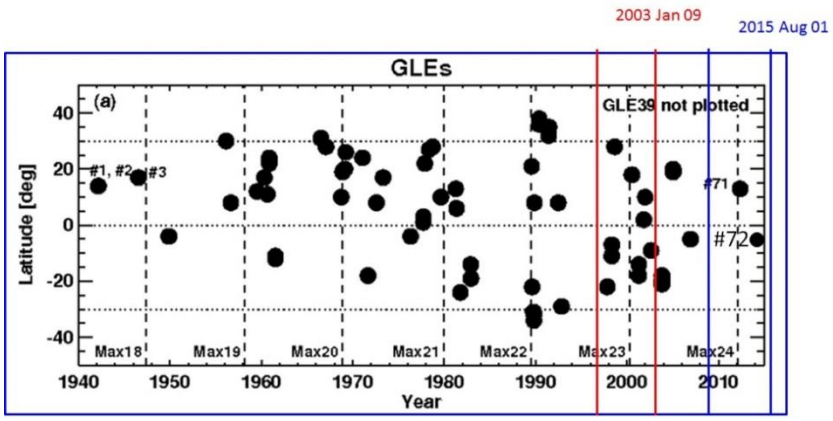

Figure 1. Latitudes of the 72 GLE source regions since 1942. The period between the first set of vertical lines (May 1996 to January 2009) in solar cycle 23 is compared with the corresponding epoch in cycle 24 (December 2008 to August 2015). One can see a clear dearth of GLE events in cycle 24. The approximate maximum phase of each solar cycle are marked by the vertical dashed line. (From Gopalswamy and Mäkelä, 2014).

I will emphasize that preservation of data helps future investigations on problems that are completely different from the original ones for which the data were acquired. A good example is the record of ground level enhancement (GLE) in solar energetic particle events. Figure 1 shows the latitudes GLE events since their discovery in 1942. GLEs were discovered almost three decades prior to the discovery of coronal mass ejections (CMEs), which are now thought to be responsible for accelerating GLE particles via MHD shocks. The dearth of GLEs in solar cycle 24 (there are only two events compared to 10 in cycle 23 over the corresponding epoch) is clear from Figure 1. The significance is realized when compared with all solar cycles since the 19th.

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