

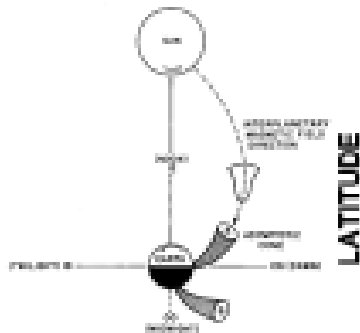
Re-examination of the First Five Ground-Level Events

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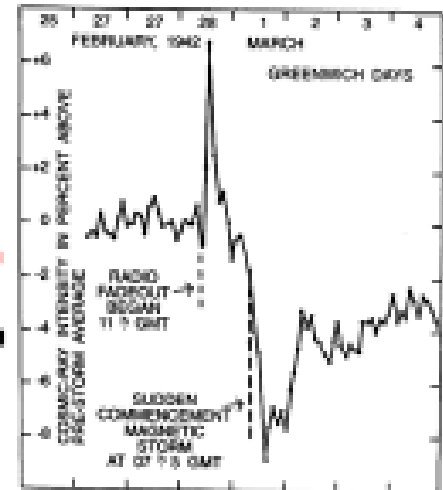
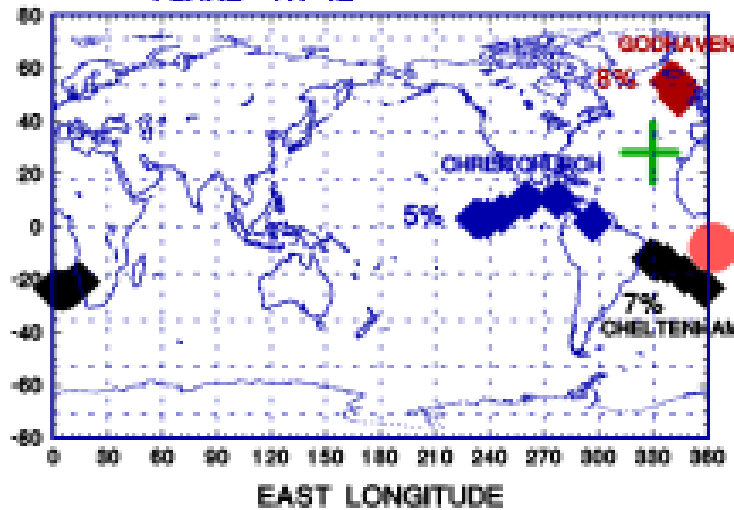
FIRST FIVE GLEs

DATE	SOLAR LONGITUDE
27 February 1942	04 E
7 March 1942	90 W
25 July 1946	15 E
19 November 1949	70 W
23 February 1956	80 W

CONCEPT OF ASYMPTOTIC DIRECTIONS



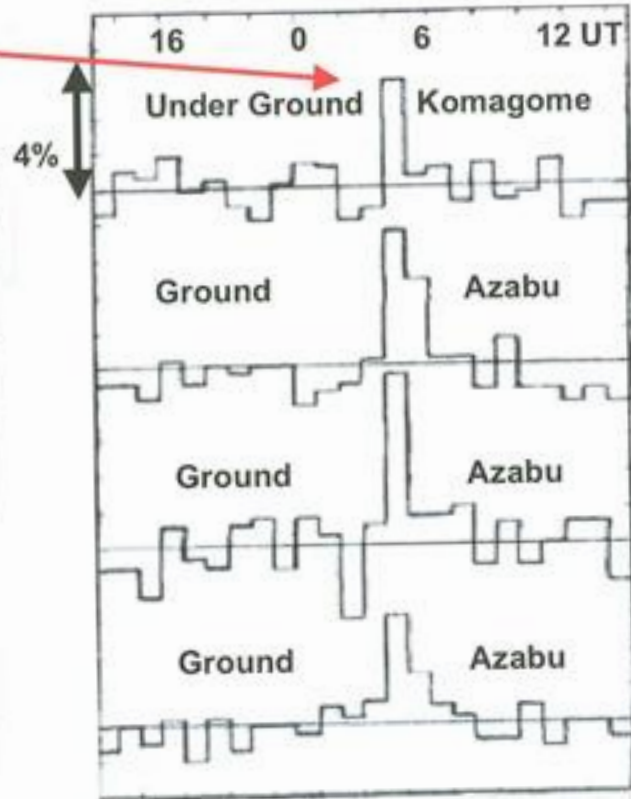
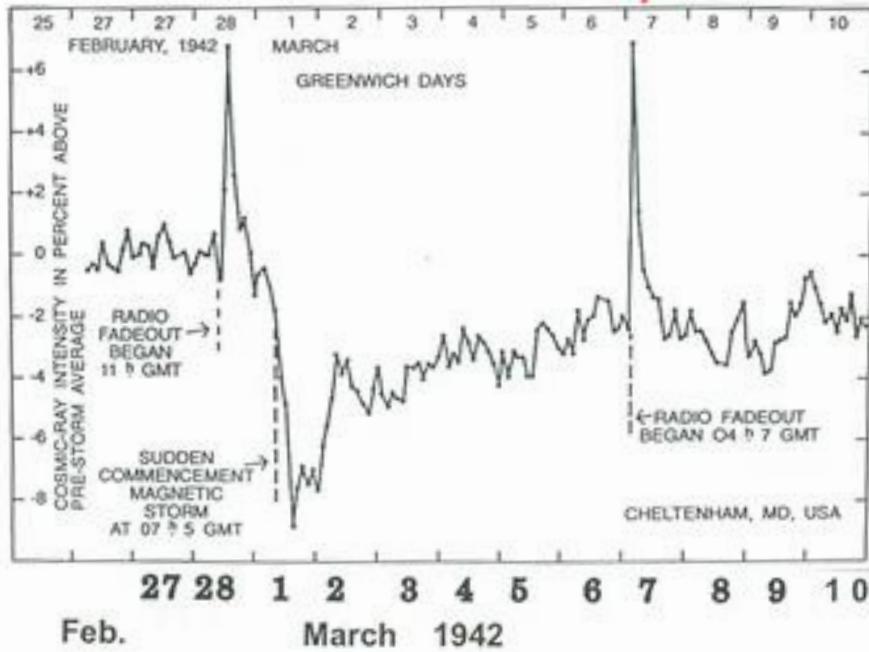
ASYMPTOTIC DIRECTIONS
GLE 01 (1942 02 28) 12:00 UT
FLARE 7N 4E



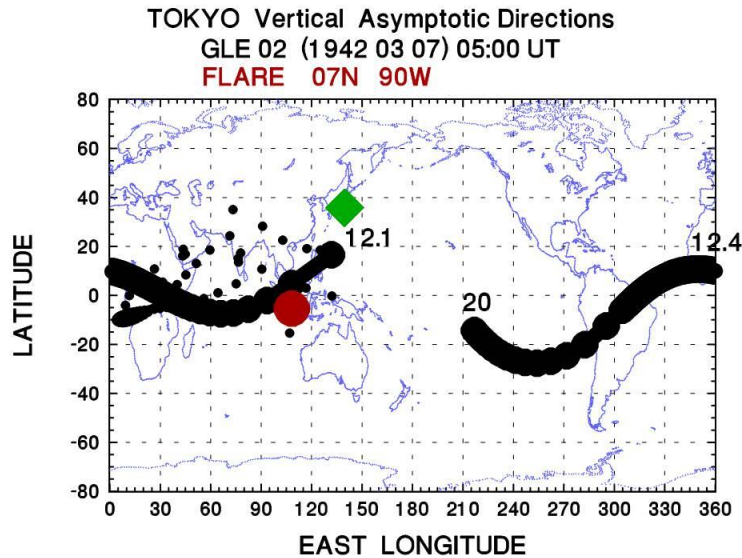
March 7, 1942

Tokyo, Pc=11.4GV

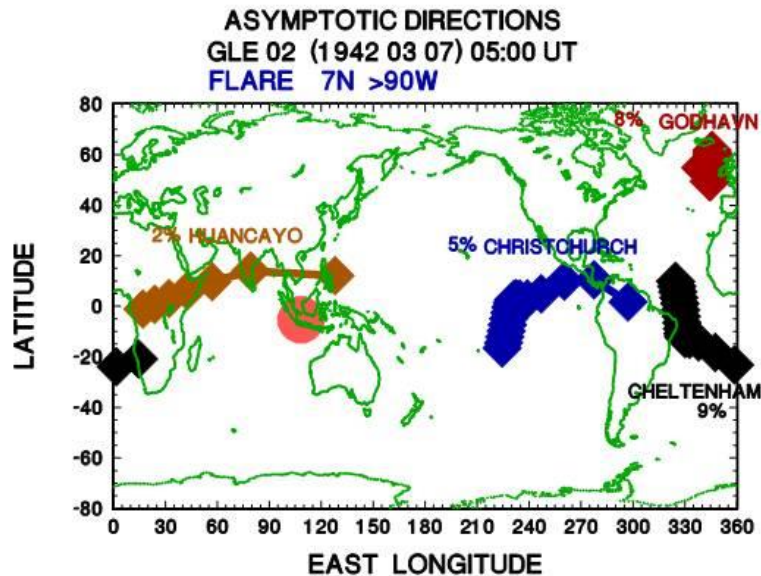
Cheltenham Pc= 2.16GV



Tokyo data courtesy Jun Nishimura, ISAS/JAXA

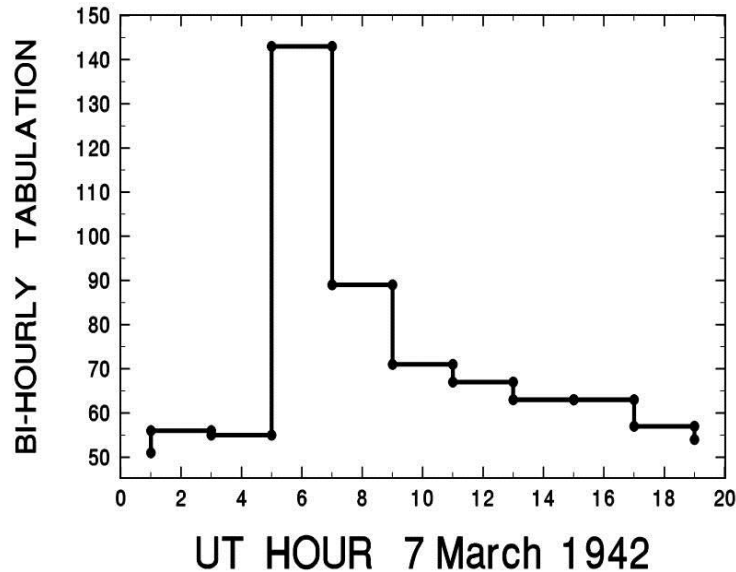


The asymptotic directions for a detector at Tokyo are similar to the asymptotic directions for a detector at Huancayo.

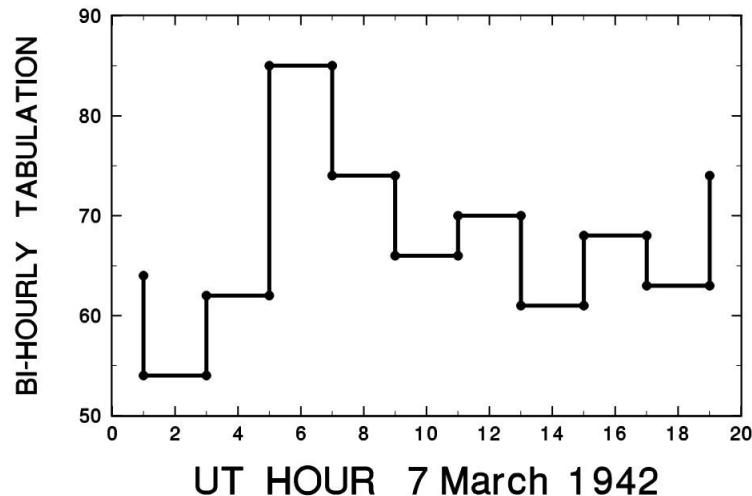


Question: Were solar particles detected by the ionization chamber at Huancayo during the GLE on 7 March 1942?

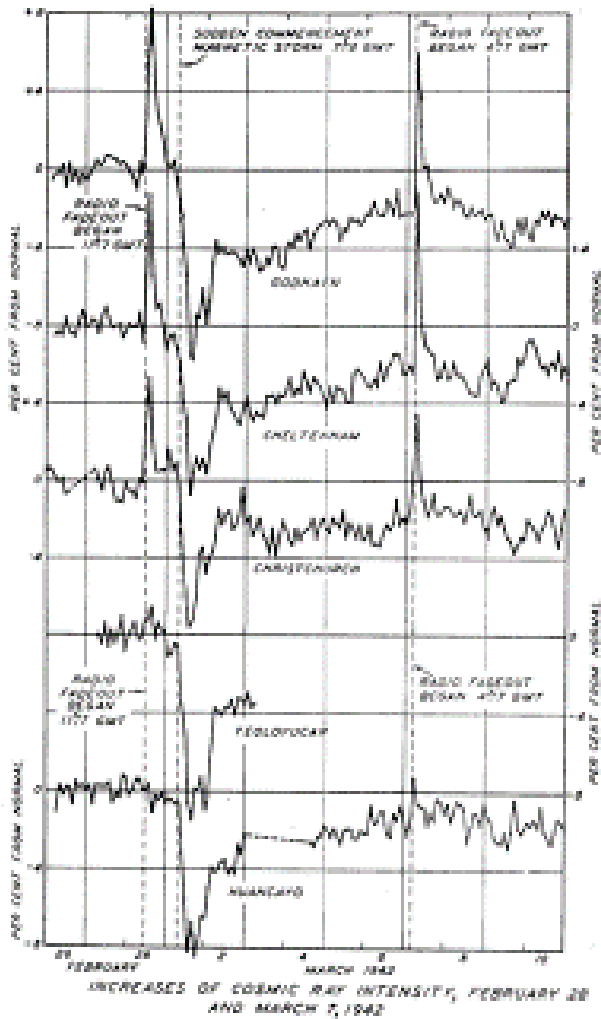
CHELTENHAM IONIZATION CHAMBER



HUANCAYO IONIZATION CHAMBER

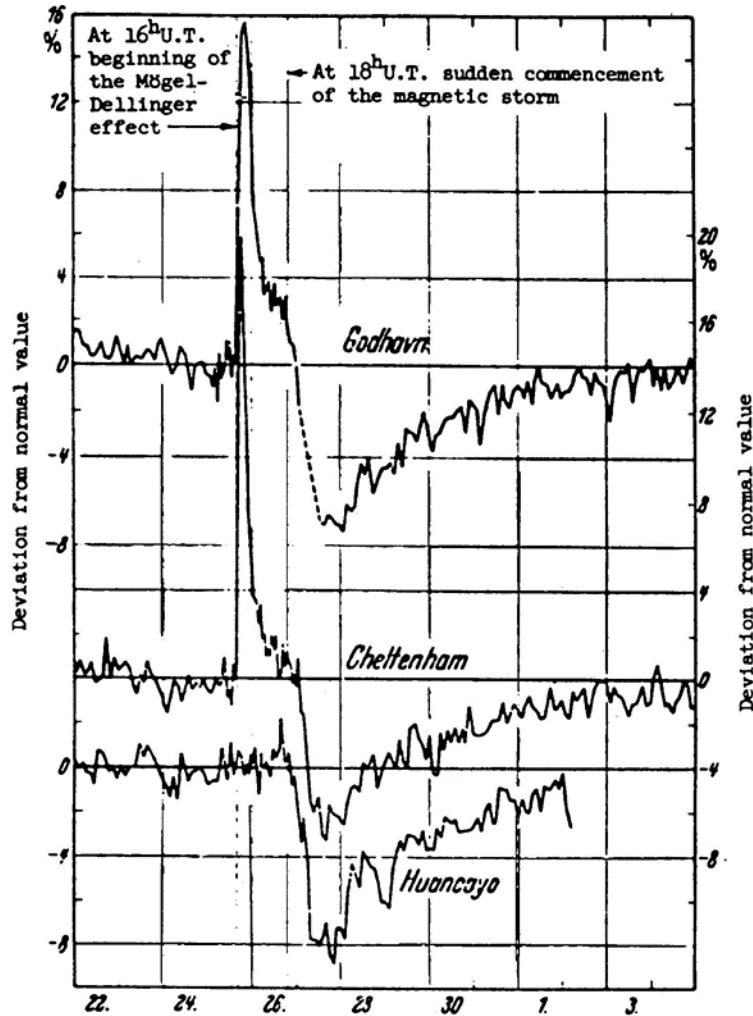


Bi-hourly tabulation of Cheltenham and Huancayo IC data for 7 March 1942. The solar radio onset of 0442 UT. The active solar region, the same one that was associated with the GLE on 27 February 1942, was located at $\sim 90^\circ\text{W}$. There were no H-alpha observations.

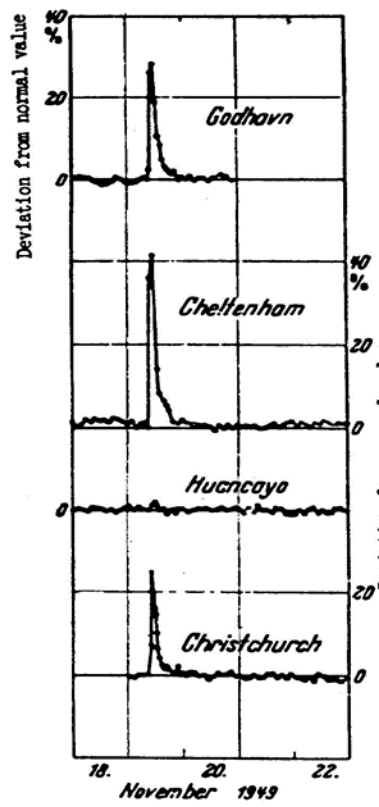


7 March 1942 GLE data from the Forbush ionization chambers.

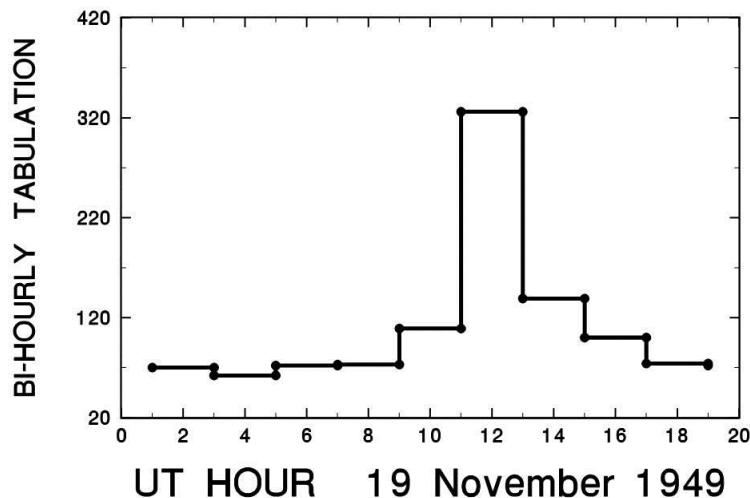
Looking at the original data published by Forbush, a very small increase is seen at Huancayo in time coincidence with the larger increases at Godhavn, Cheltenham and Christchurch. This was noted by Ellison et al. (1961) as a 1% increase.



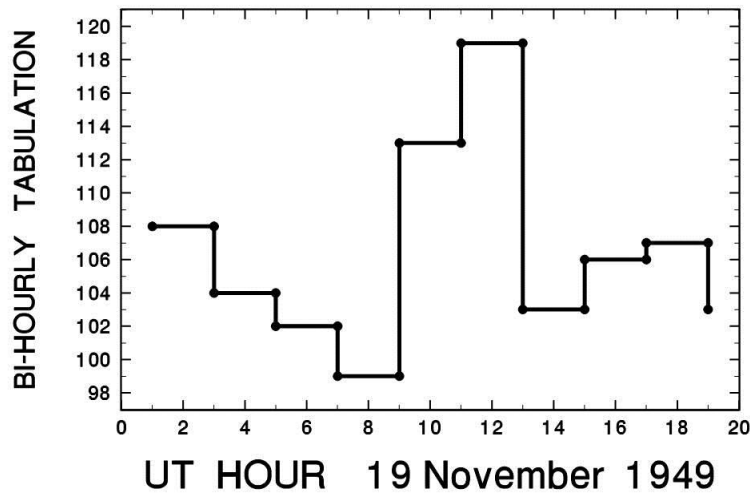
25 July 1946 GLE data from the Forbush ionization chambers. While this was a large GLE at Godhavn and Cheltenham, there is no noticeable increase at Huancayo. Since the solar activity was at the central meridian of the sun, this is not unexpected as events from the western limb area have harder spectra.



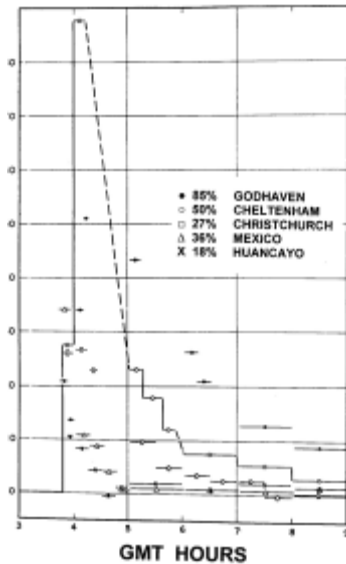
CHELTHENHAM IONIZATION CHAMBER



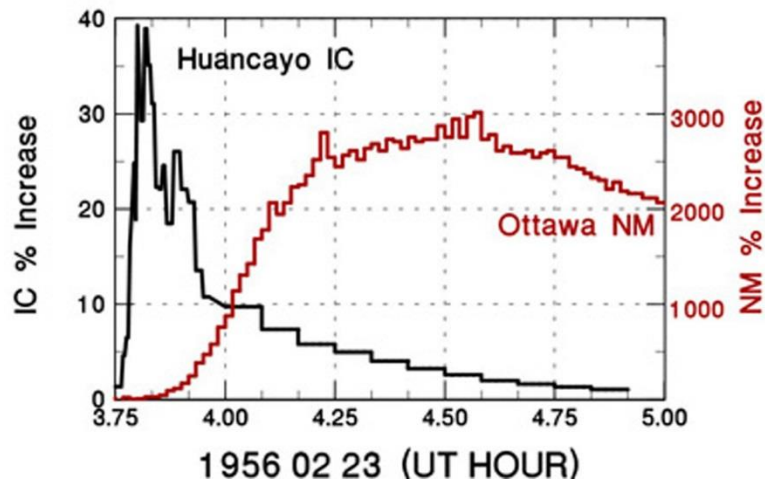
HUANCAYO IONIZATION CHAMBER



Bi-hourly tabulation of Cheltenham and Huancayo IC data for 19 November 1949. The solar flare was located at 70° W. The H-alpha onset time was 1029 UT.



The GLE on 23 February 1956 is the largest GLE in modern times as measured neutron monitors using 15 minute data. The Godhavn IC recorded an increase of 85%; the Huancayo IC recorded an increase of 22% using 15-minute data. In a detailed inspection of the original analog data from Huancayo, it is possible to determine 1 minute time resolution data during this GLE.



Why should the cosmic ray community be interested in these early ionization chamber data?

- 1. To obtain better time resolution for these early events.**
- 2. To identify possible GLEs that may have not been identified during the period 1936-1956.**

The original analog data were sent to the US National Geophysical Data Center in Boulder, Colorado where they were partially scanned for archival purposes. The data have since been moved to the National Centers for Environmental Information, Data Services Division, Asheville, North Carolina, USA.

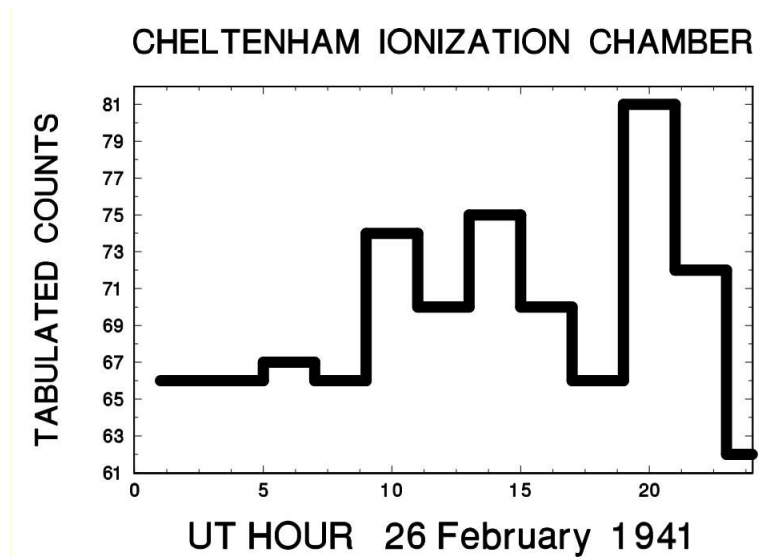
Suggestions for possible identification of early GLEs

Start with the lists of possible proton events (e.g. Švestka, 1966)

Use lists of magnetic crochets (indicative of large X-ray events)

Possible proton event: 26 Feb 1941;

Active region 9W; Magnetic crochets: 0928 UT; 1911 UT



SUMMARY

Two of the first four GLEs identified by Forbush may have been more intense than currently realized with particles > 15 GeV having been detected near the equator.

The archived Forbush ionization chamber data have the possibly of fine time resolution of the known GLEs for several stations.

The archived data have the potential of identifying possible GLEs during the active 17th and 18th solar cycles (1936-1956). Any additional ionization chamber data available during this time period should be utilized in this type of investigation.