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Interplanetary Energetic Particle Observations of the March 1989 Events

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The IMP-8 spacecraft placed in an elongated $\sim 25 R_E \times R_E$ orbit around the Earth was the only monitor of the energetic particle environment of the near interplanetary space during the period of the solar particle events associated with the Active Region 5395 in March 1989.

Measurements of energetic ion and electron intensities were obtained by the CPME experiment of the Applied Physics Laboratory, the Johns Hopkins University in a series of channels within the energy ranges: 0.3–440 MeV for protons, 0.6–52 MeV/nuc for alpha particles, 0.7–3.3 MeV/nuc for nuclei with $Z \geq 3$, 3–9 MeV/nuc for nuclei with $Z \geq 20$ and 0.2–2.5 MeV for electrons.

Figure 1 displays the responses of selected energy channels during the period 5–23 March 1989. It is clearly noted that the most prominent energetic ion intensity enhancements in that time interval were associated with the interplanetary shock wave of March 13 (07:43 UT) as well as that of March 8 (17:56 UT), which have distinct particle acceleration signatures. These shock waves play a major role in determining the near Earth energetic ion intensities during the above period by accelerating and modulating the ambient solar energetic particle population, which was already present in high intensities in the interplanetary medium due to the superposition of a series of solar flare particle events originating in AR 5395.

The differential ion intensities at the lowest energy channel (0.3–0.5 MeV) of the CPME experiment, which were associated with the March 13 shock wave, reached the highest level ($j \sim 10^5$ p/cm²·sec·sr·MeV) in the life of the IMP-8 spacecraft at this energy. At high energies, i.e., in the energy range 190–440 MeV, the shock associated intensity peak was smaller by less than a factor of 3 than the maxima of solar flare particle intensities from some other major flares, in particular from those with sites well connected to the Earth's magnetic flux tube.

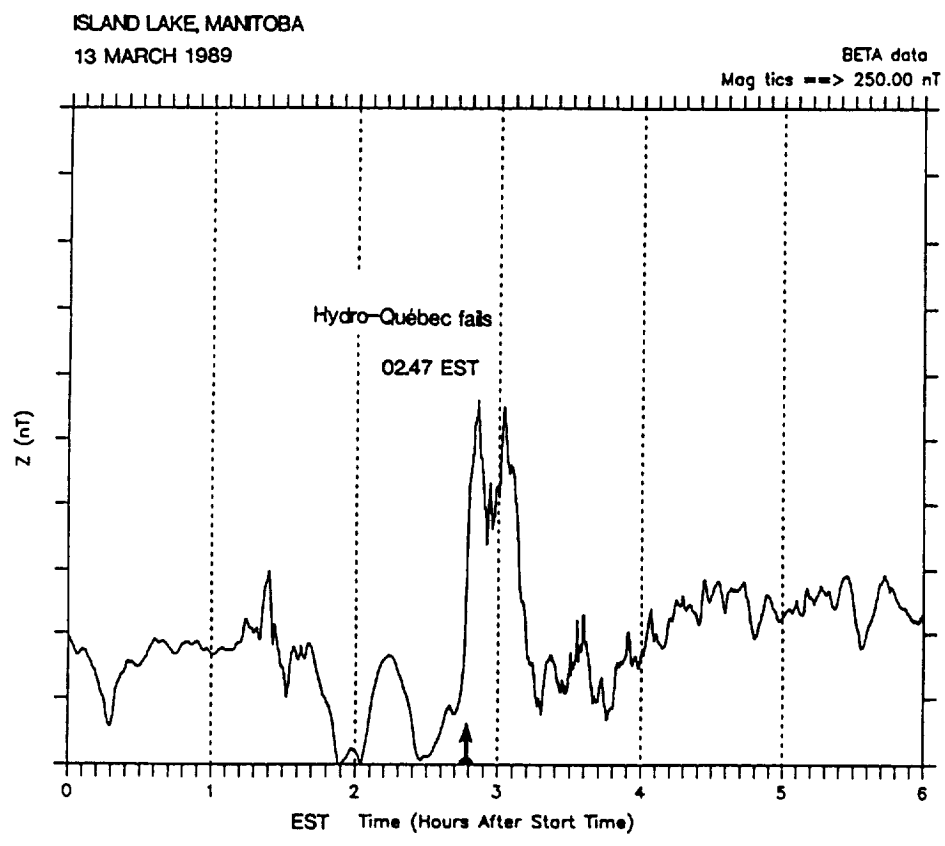
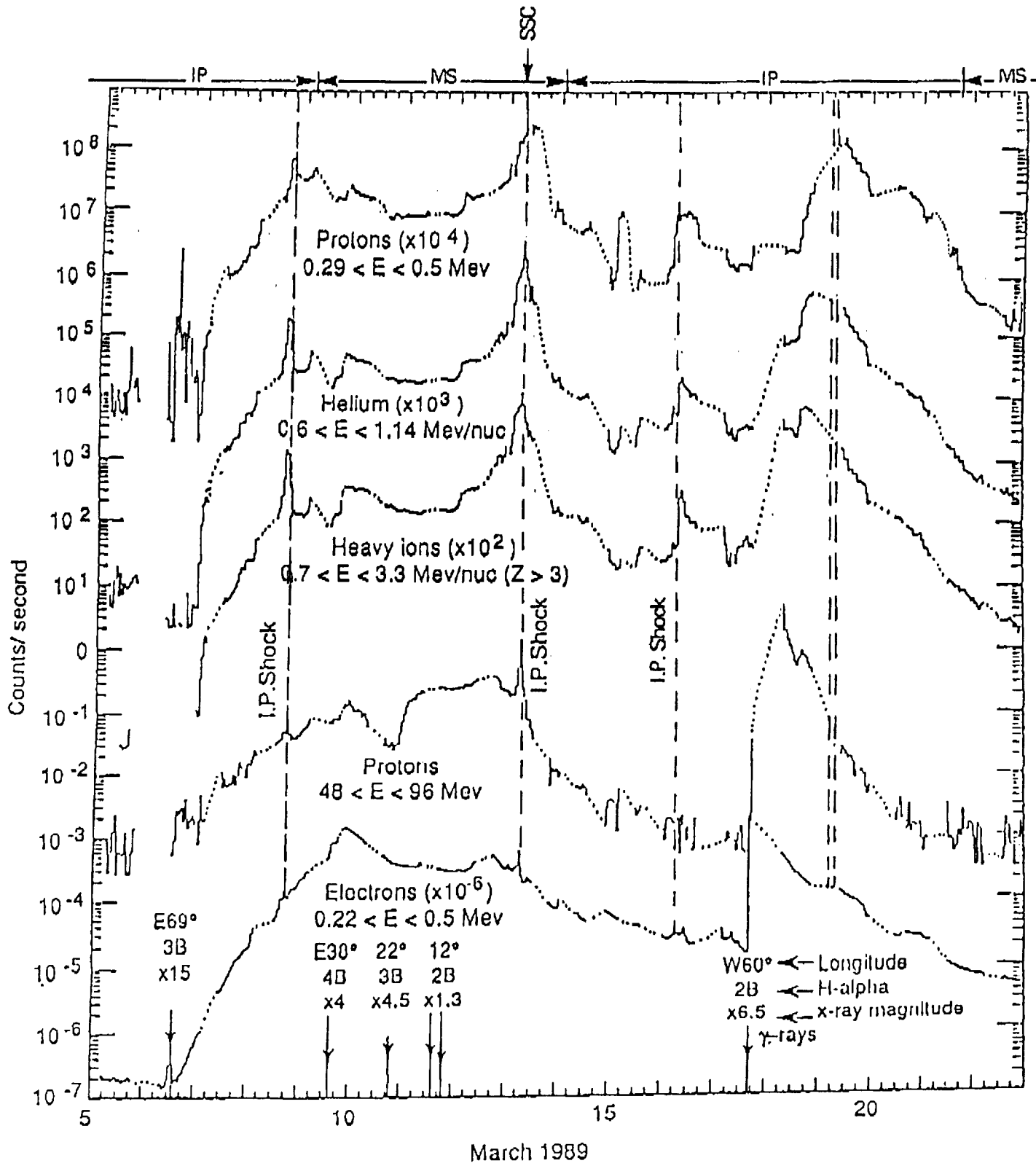


Figure 3. Vertical component of the Earth's magnetic field in Northern Manitoba.



APL/JHU Experiment on IMP - 8