

The Simpson Neutron Monitor Network Measurements of the 2025 November 11 GLE



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Introduction

An exceptionally intense Ground Level Enhancement occurred on 2025 November 11, GLE77. It produced a signal in all the neutron monitors in the Simpson Neutron Monitor network. The prompt component was well measured in the eastern US stations with a 100% increase at Mount Washington. Other stations highlighted the later, slower components for several hours. Even the 13 GV cutoff station on Haleakala Maui exhibited a signal of short duration on the event leading edge. We attribute the nonuniform network response to the overall isotropizing distribution and a moving particle beam axis registered by stations with differing asymptotic directions..

The Network

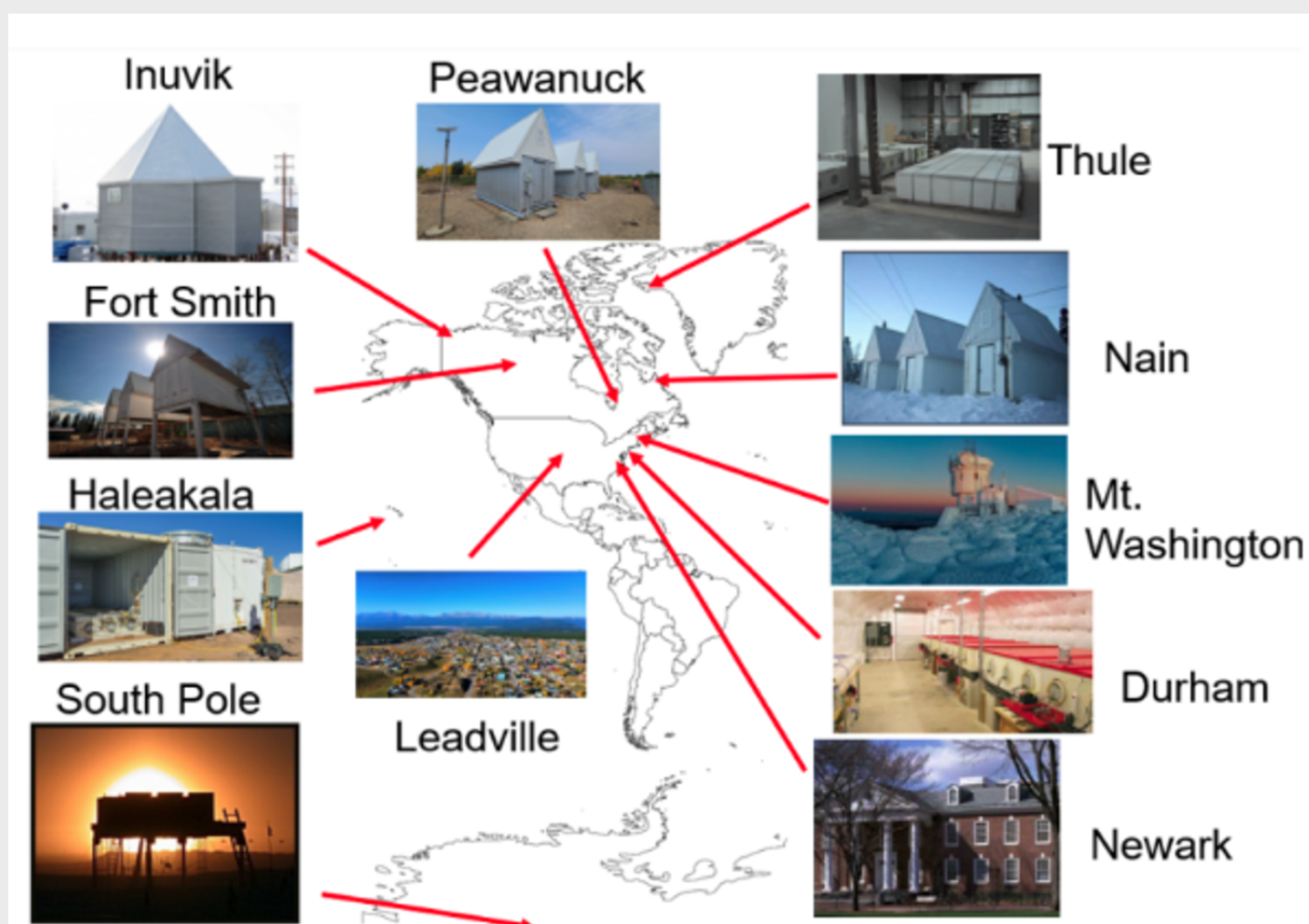


Fig. 1 The Simpson Neutron Monitor Network.

The Simpson Neutron Monitor Network, named after John Simpson, represents the consolidation of monitors from four US institutions—the University of New Hampshire, the University of Delaware, the University of Hawaii, Manoa and the University of Wisconsin, River Falls. The stations sit at high altitudes and sea level with cutoff rigidities ranging from 0 GV (atmospheric) to 13 GV with asymptotic directions from 50° to 200°E longitude. As of 2025, the network is formally an NSF national facility with the aim of providing a reliable data stream of GCR and SEP count rates for the community. Despite the age of some of the monitors, the network is coming up to its original design goals, by replacing or repairing faulty or failing components, computers and communications.

Network Data

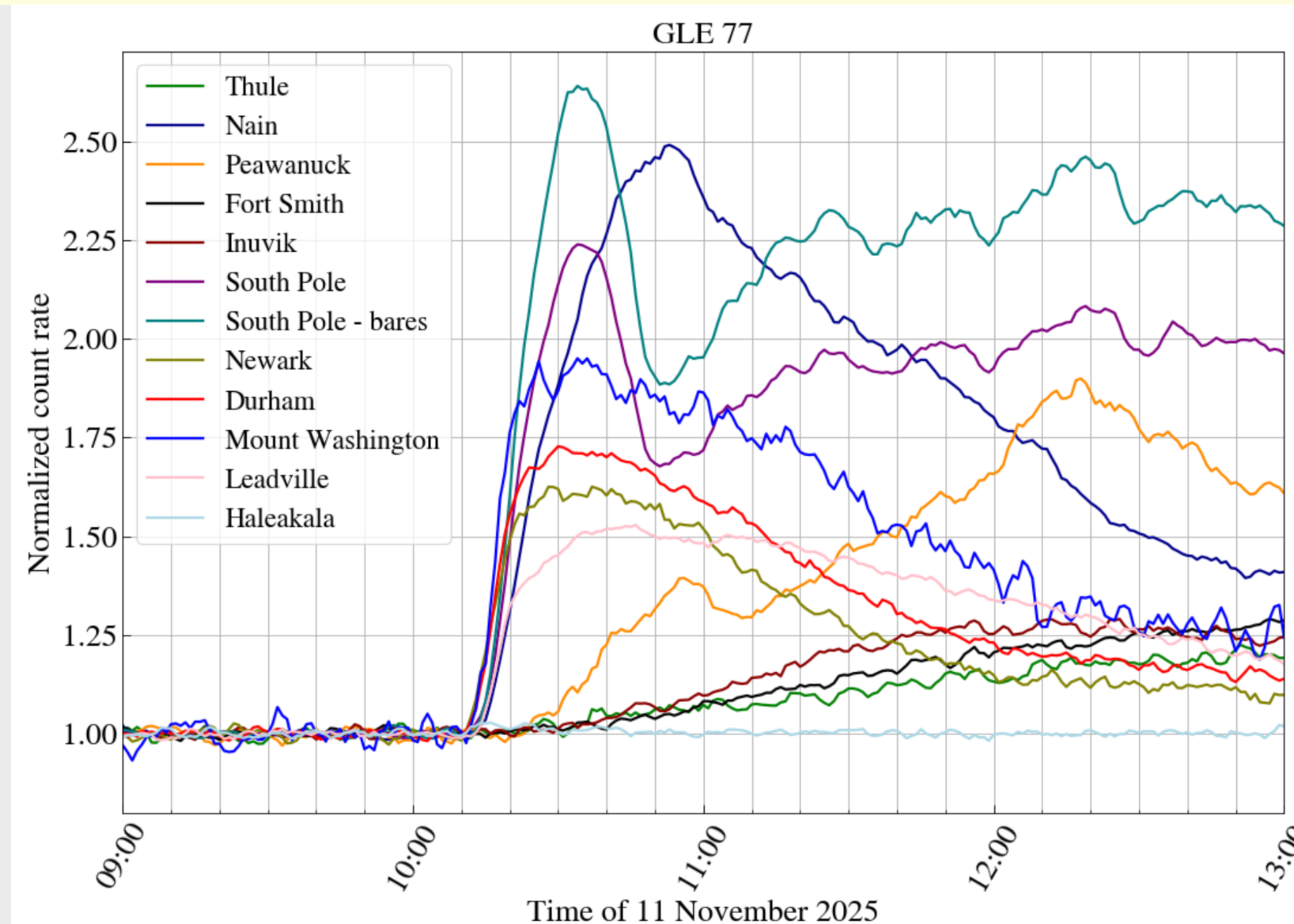


Fig. 2. Count rate curves for stations in the Simpson Network, including stations on Haleakala (not apparent without scaling.)

Fig. 3. Graphically shown here are the count rates of different stations at the indicated time. This figure is taken from the data during the rise of the impulsive phase. The signal is relatively strong in stations on the East Coast of the CONUS. The hard spectrum lights up Haleakala and Mexico City, but the high latitude, low cutoff Canadian stations have yet to see a strong signal.

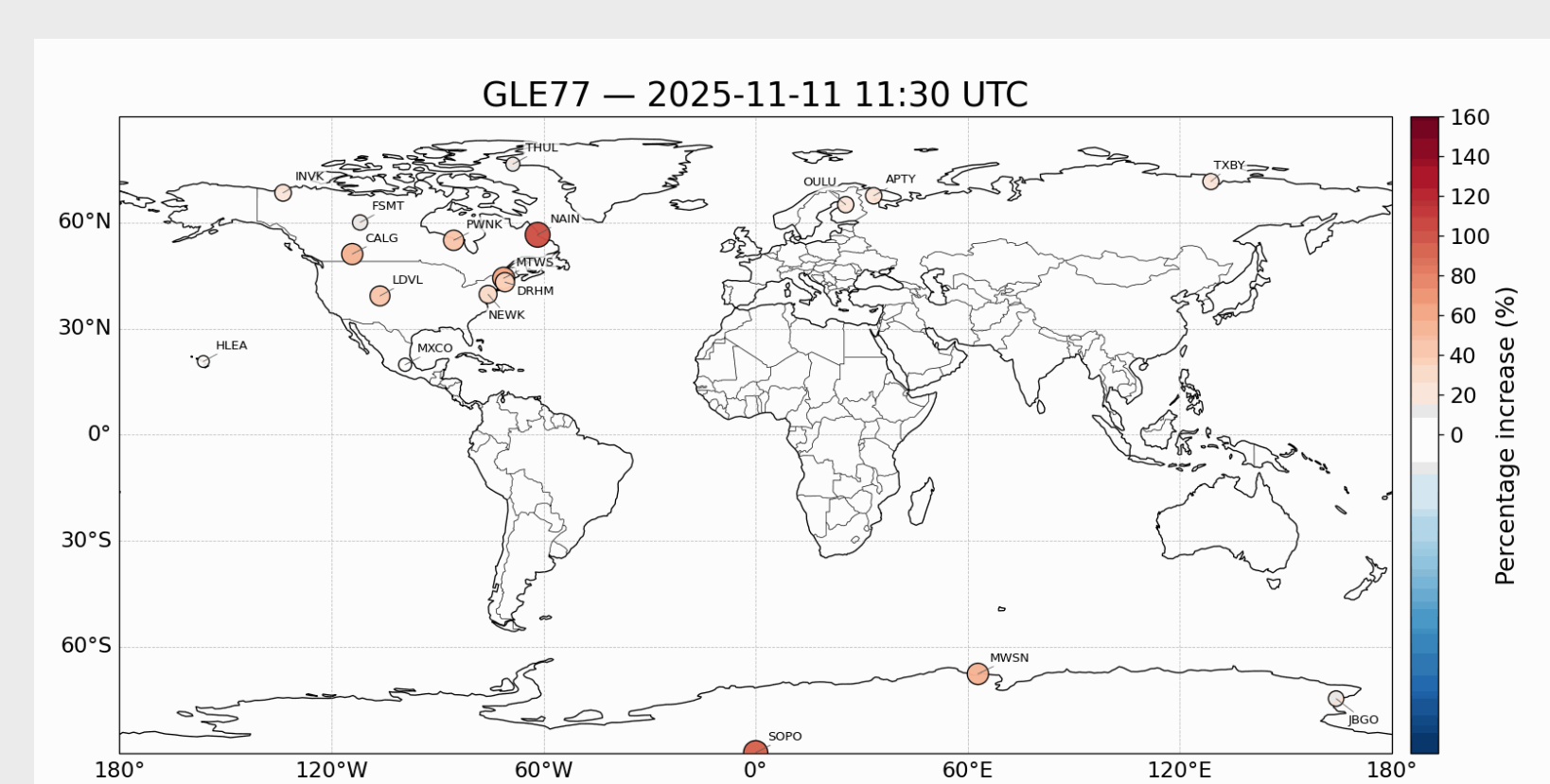
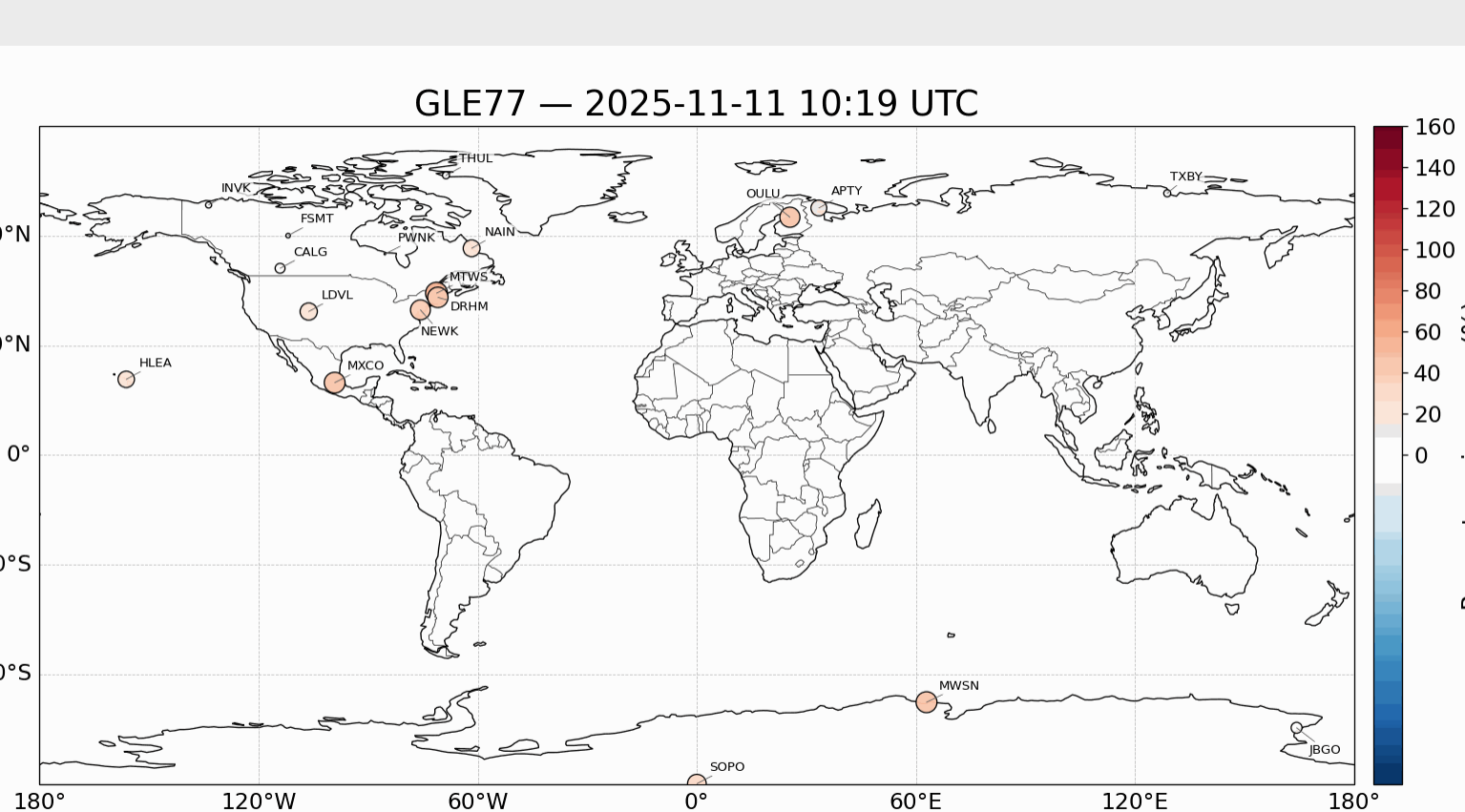
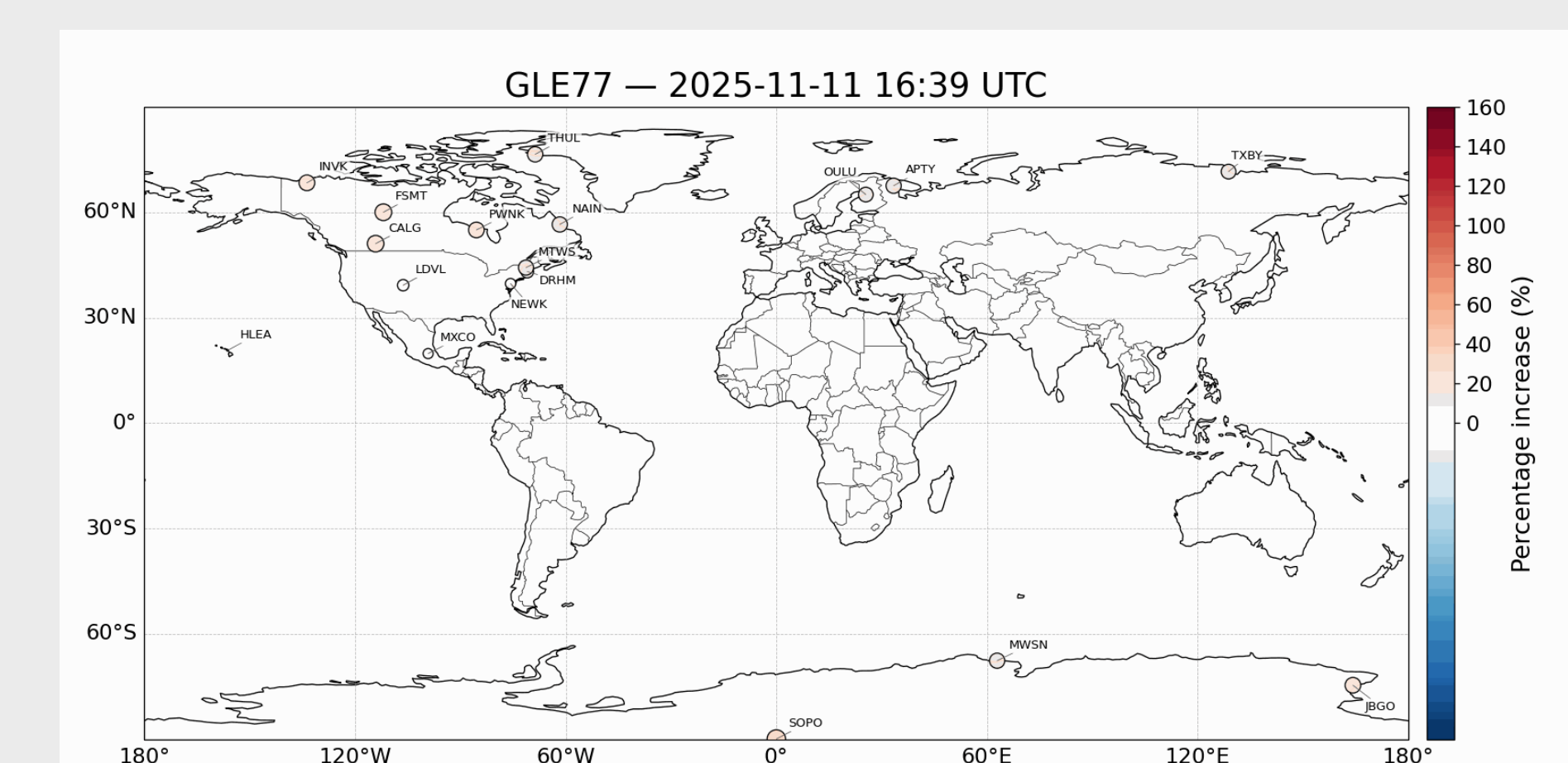


Fig. 5. We are well into the gradual phase with the high latitude Canadian stations showing good signals.



Oulu, Apatity and Mawson are included for reference. Other stations can be added.

Fig. 4. Same as Fig. 3, but after the impulsive phase, transitioning to a gradual isotropic phase.

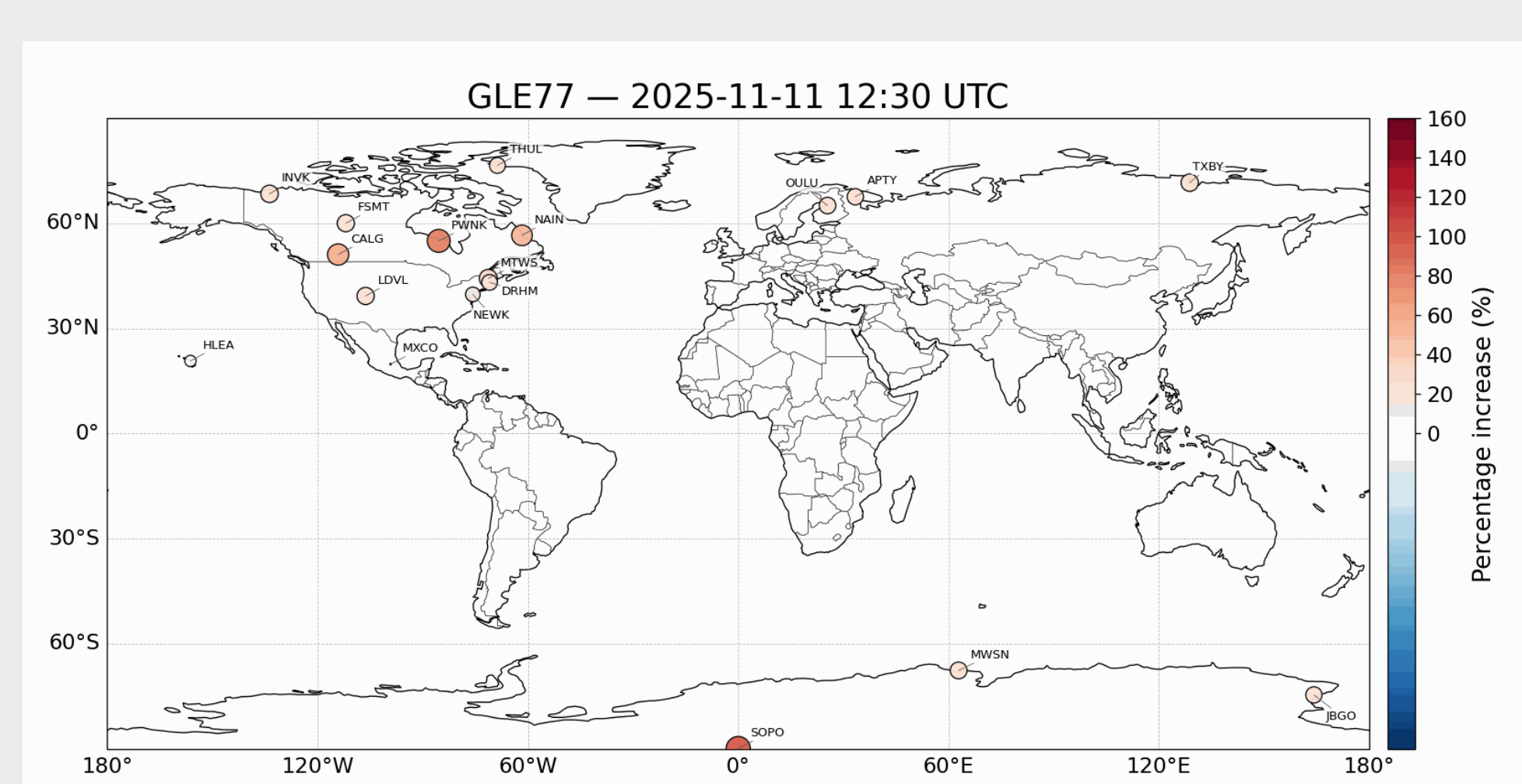


Fig. 6. Over four hours into the gradual phase. All stations show signals, except Haleakala at 13 GV. The spectrum is too soft at this epoch.

Spectral Shape

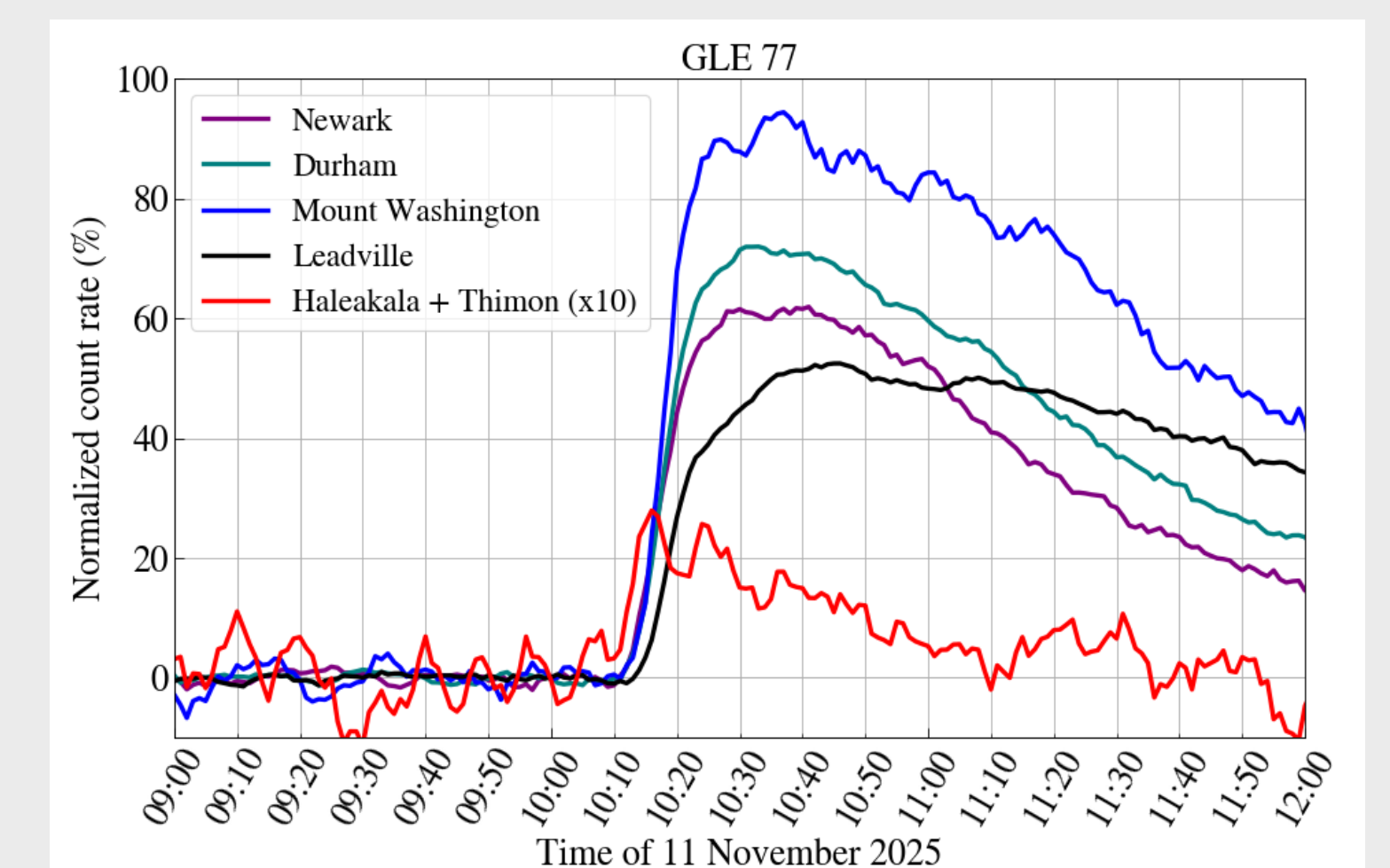


Fig. 7. A blowup of the impulsive phase with the Haleakala signal amplified by 10x. The Hawaii signal at 13 GV “appears” to slightly lead the other stations, but this requires careful analysis. The Hawaii signal is hard to discern after 1200 UT, making the particle spectrum difficult to nail down well into the gradual isotropic phase (Fig. 6.). Its morphology seems to resemble that of Leadville with a much slower day into the gradual phase, as compared to the East Coast stations.

Discussion

GLE77 follows the classical picture of an impulsive phase followed by a gradual phase, where the impulsive phase exhibits significant anisotropy, while the gradual phase has signals in all stations at low enough cutoff, indicative of an isotropic distribution.

In terms of the US Simpson NM Network, the North America stations captured the full behavior of GLE 77. All stations contributed to the understanding of this event in one way or another.

Not mentioned yet in this poster, the South Pole station, SOPO, throughout the entire event fulfilled its usual role, amongst the other stations, i.e., “zero” geomagnetic cutoff and high altitude.

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