GOES-13 EPEAD P1B Failure

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In early May 2017, NCEI noticed that the lowest energy proton channel (P1) from the westward-facing EPEAD instrument on GOES-13 exhibited anomalous behavior during the entire month of April (Figure 1). The behavior in the westward-facing detector (P1B) should have been similar to, though not identical to, the P1A time series. Instead, the peak flux was observed around UT midnight rather than near noon local time (17 UT); the rates were much greater in P1B than in P1A; and the P1B rates exhibited a slow, elevated background variation that is not characteristic of a properly-functioning channel such as P1A. Similar behavior continued throughout May (Figure 2). Anomalous behavior was not observed in the higher energy channels (P2B-P7B); they maintained their typically flat time series in the absence of large SEP events.

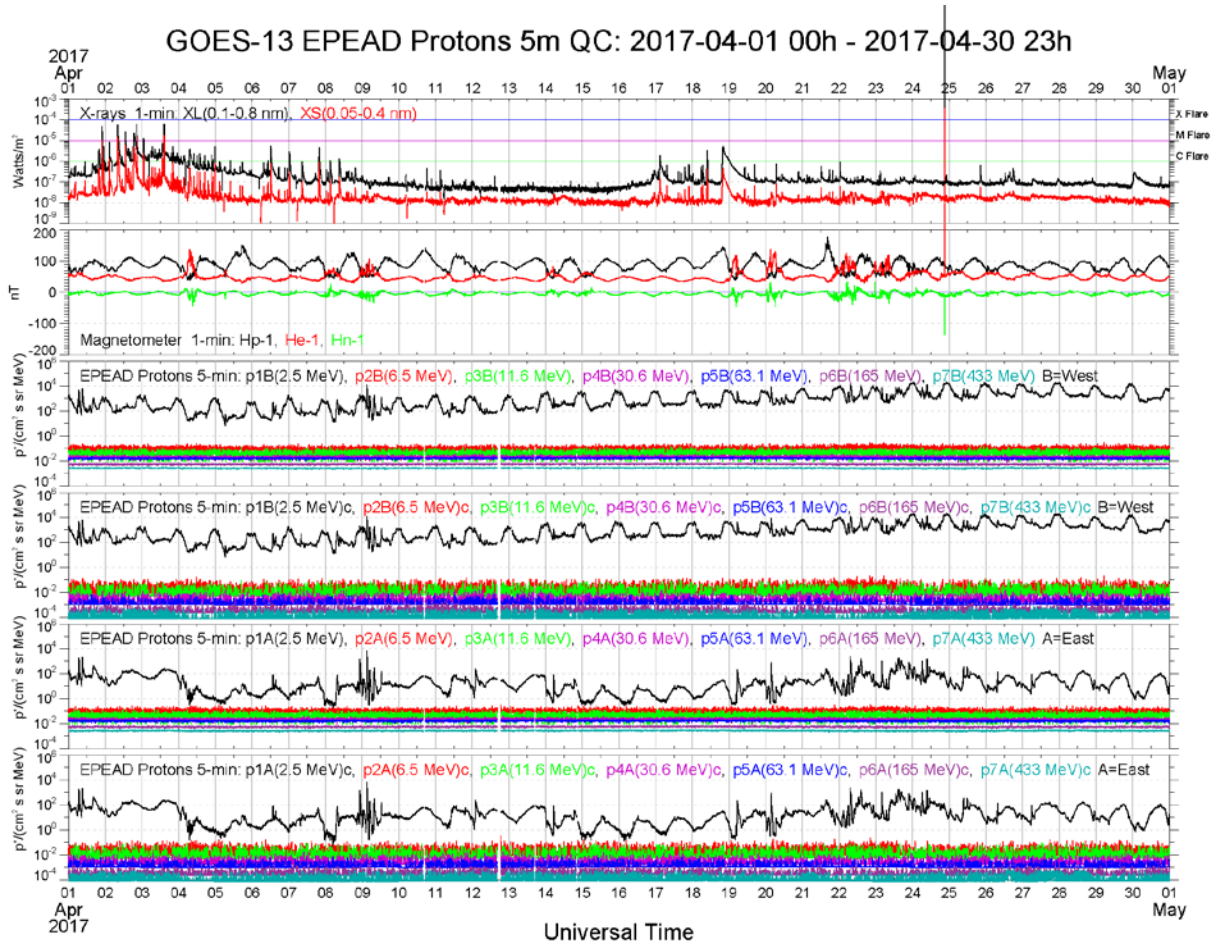

Figure 1. GOES-13 EPEAD proton quality control plot for April 2017.

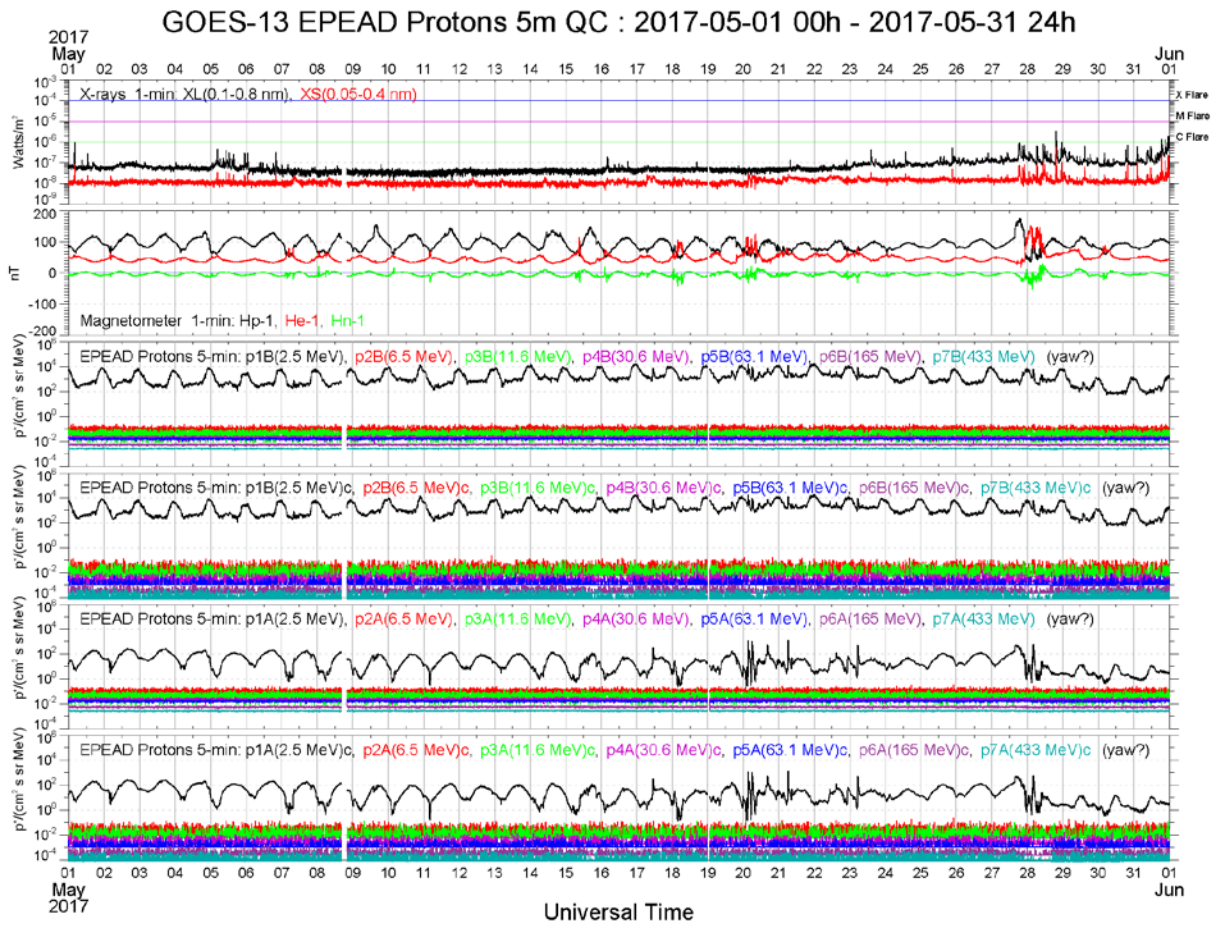

Figure 2. GOES-13 EPEAD proton quality control plot for May 2017.

At the end of March, five days of elevated activity, characterized by repeated particle injections (Figure 3), preceded the elevated noise levels observed in April. Prior to that, P1B exhibited a combination of geophysical fluxes with peaks near 17 UT and elevated detector noise with peaks near 0 UT. Such a peak due to detector noise is first clearly evident straddling the March 6 / March 7 divide.

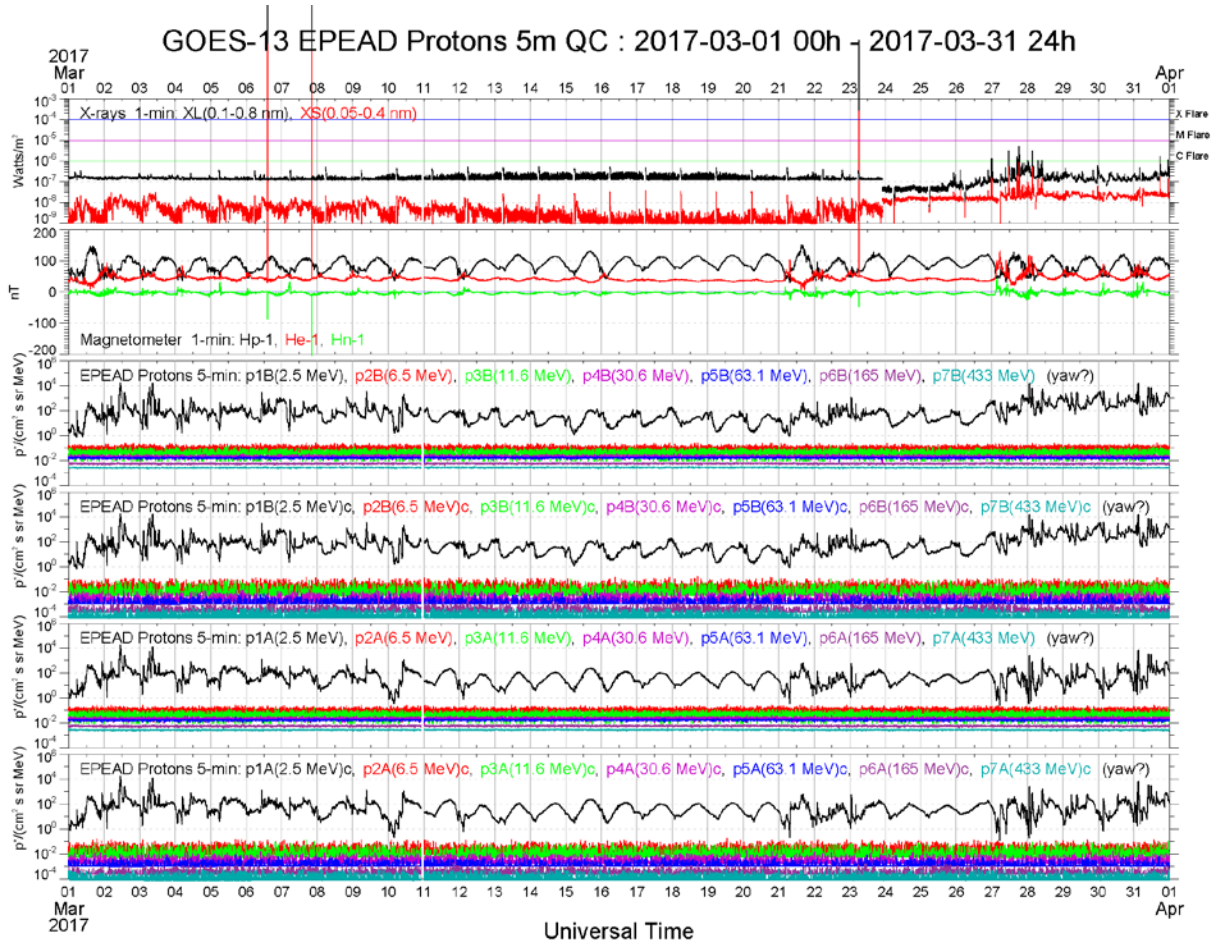

Figure 3. GOES-13 EPEAD proton quality control plot for March 2017.

The P1-P3 channels come from the EPEAD telescope. The P4-P7 channels as well as the E1-E3 electron channels come from separate dome detectors that are also part of EPEAD. This issue only affects the lowest energy proton (P1) channel from the telescope. P1 is derived from the coincidence of a 0.325 MeV and a 0.490 MeV threshold from the front detector. P2 is derived from the triple coincidence of these two thresholds and a 3.20 MeV threshold from the rear detector. P3 is derived from a coincidence between the 0.325 MeV and 3.20 MeV thresholds. This suggests that the noise levels are great enough to cause chance coincidences between the 0.325 and 0.490 MeV thresholds, but either the noise is not present in the rear detector or it is too low to trigger the 3.20 MeV threshold. Therefore, the P2 and P3 channels are so far not affected by this detector noise issue.

For now, NCEI will replace the GOES-13 P1B fluxes (full resolution and 1-minute and 5-minute averages) with fill values starting with the March 2017 data. The >1 MeV fluxes (5-minute averages) will also be replaced with fill values. The integral fluxes are derived from channel fluxes, and P1 dominates the >1 MeV fluxes.

These are the fields that have plot labels beginning with P1B:

File template: g13_epead_p17ew_1m_*
Fields: P1E_NUM_PTS, P1E_QUAL_FLAG, P1E_UNCOR_FLUX

file template: g13_epead_p17ew_5m_*
Fields: P1E_NUM_PTS, P1E_QUAL_FLAG, P1E_UNCOR_FLUX, P1E_COR_FLUX

File template: g13_epead_p1ew_8s_*
Fields: P1E_QUAL_FLAG, P1E_UNCOR_CR, P1E_UNCOR_FLUX

File template: tb_g13_epead_cpflux_5m_*
Fields: ZPGT1E_QUAL_FLAG, ZPGT1E