# From wiring fault to cross-sensor anomaly



***Working hypothesis: Intermittent measurement error at ~30-second sampling; physical cause not fully known.***

| | |
|---|---|
| **Initial observation** | Isolated sub-4K readings surrounded by 4,000 m observations; implausibly rapid drops and returns. |
| **Known repair** | Clifford Hall wiring fault corrected in late summer 2026. Anomalies persist past correction but occur at a lower rate. |
| **Replication** | Similar isolated downward observations found with MiniOFS data collected at Gorman Field (UND) and at UC Santa Cruz. |

# Three hypothesized error mechanisms

02 | Current cleaning rule is designed for Type 1 only

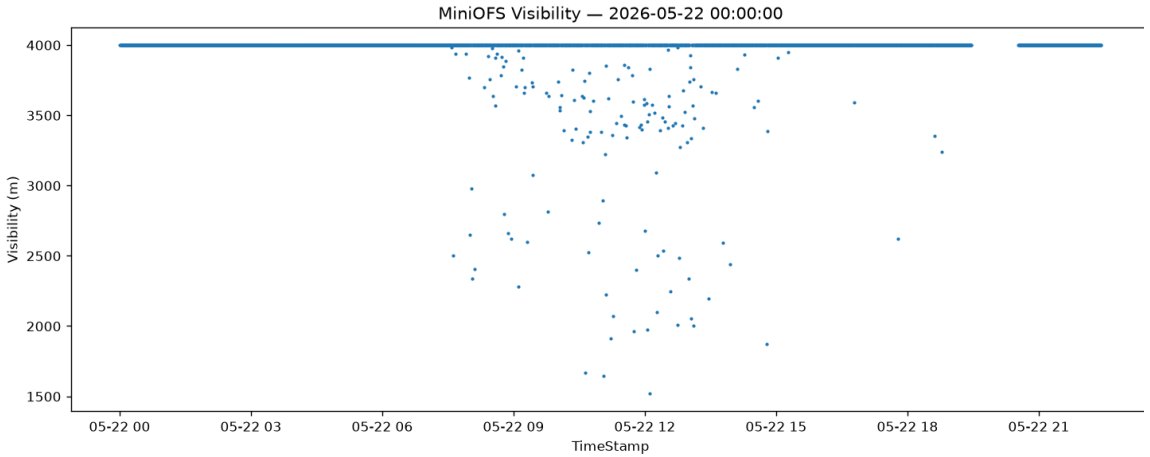
| | | |
|---|---|---|
| **TYPE 1 • TESTING** | **True 4000 → recorded 2500 → true 4000** | False abrupt downward and return reading from the 4K ceiling. |
| **TYPE 2 • NOT TESTING** | **True 3500 → recorded 4000 → true 3500** | False upward reading; 4K-only observation days accepted as accurate. |
| **TYPE 3 • POTENTIAL TO EXPLORE** | **True 3500 → 3400 → 3200**<br>**Recorded 3500 → 2500 → 3200** | Additional false drop during genuine sub-4K conditions. Only observed in May 2026 in Clifford Hall thus far. |

Note: Type 2 and Type 3 remain hypotheses; no error mechanism has been independently verified.

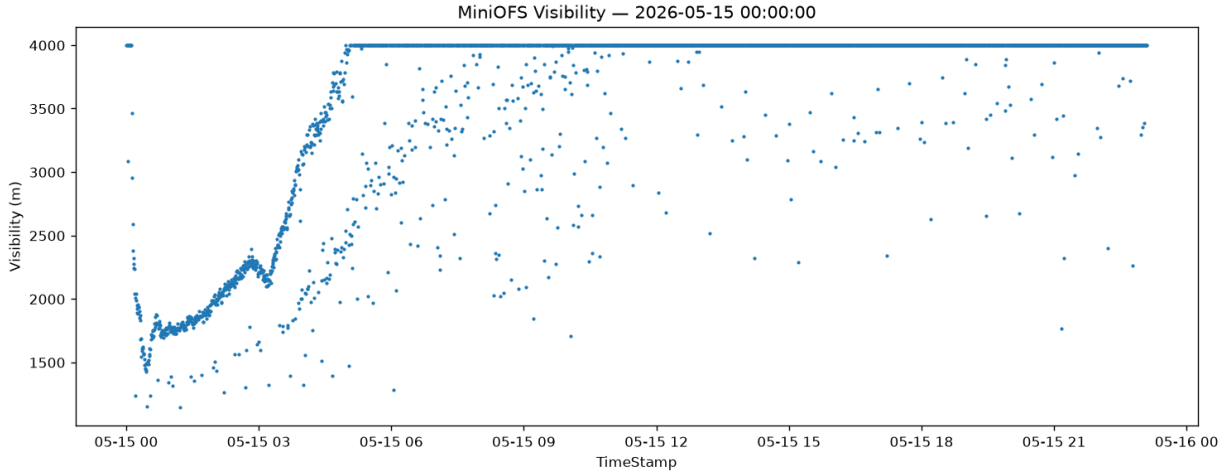
# Exploratory plots showing hypothesized Type 1 and Type 3 errors

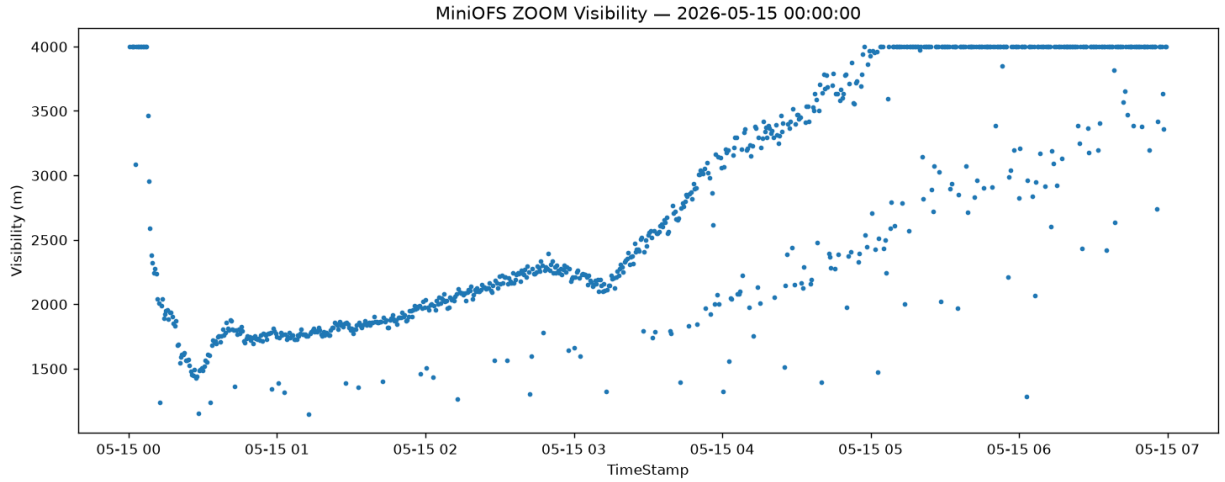
03 | Days screened using >250 original sub-4K observations; not a prevalence sample

## TYPE 1 • TESTING




## TYPE 3 • POTENTIAL TO EXPLORE



# Comparable Type 1 patterns across three MiniOFS datasets

04 | Preliminary five-observation isolation rule; flagged ≠ confirmed error

| Dataset / period | All readings | Flagged | Flagged rate | Sub-4K rate | Flagged / sub-4K |
|---|---|---|---|---|---|
| **Clifford Hall · Sep 2026** | 75,213 | 154 | 0.205% | 5.471% | ~3.74% |
| **Gorman Field · Sep 2026** | 86,621 | 78 | 0.090% | 3.025% | 2.98% |
| **UC Santa Cruz · reference** | 34,635 | 72 | 0.209% | ~1.89% | 10.99% |

**Current Erroneous Observation Detection Rule: a single sub-4K observation with two 4K readings immediately before and two immediately after.**

Rates describe different sites and periods; weather exposure and approximate sub-4K counts limit direct comparison.

# Ground truth: substantiate reported low-visibility days



| | |
|---|---|
| **1 PRIORITIZE** | Days with substantial reported sub-4K readings; do not prioritize observed data all-4K days under current Type 2 assumption. |
| **2 ALIGN** | Compare MiniOFS with independent ground truth data sets |
| **3 EVALUATE** | Apply rule to all days with at least 1 sub 4K observation. For the subset of these days established by ground truth as clear visibility days, count sub-4K observations before cleaning, removed, and remaining. |
| **4 Calculate** | Calculate probability of detection statistics. |

# Independent weather evidence: what we have tested

06 | Sources, screening logic, and current validation status

| | |
|---|---|
| **Airport METAR · visibility** | Screen for airport visibility <2.485 miles (~4 km); compare timing with MiniOFS sub-4K episodes. Spatial separation and METAR reporting cadence limit certainty. |
| **NDAWN · humidity / rain** | Use RH >95% and recorded precipitation as weather indicators. No high RH, no rain define candidate fair-weather days—not necessarily confirmed clear conditions. |
| **MiniOFS · comparison** | Gorman Field provides a second sensor comparison. |

**STATUS • Screening rules and exploratory plots established; matched external-weather classifications for the showcased days remain to be completed.**

# EFM: proposed electrical-activity screening rule

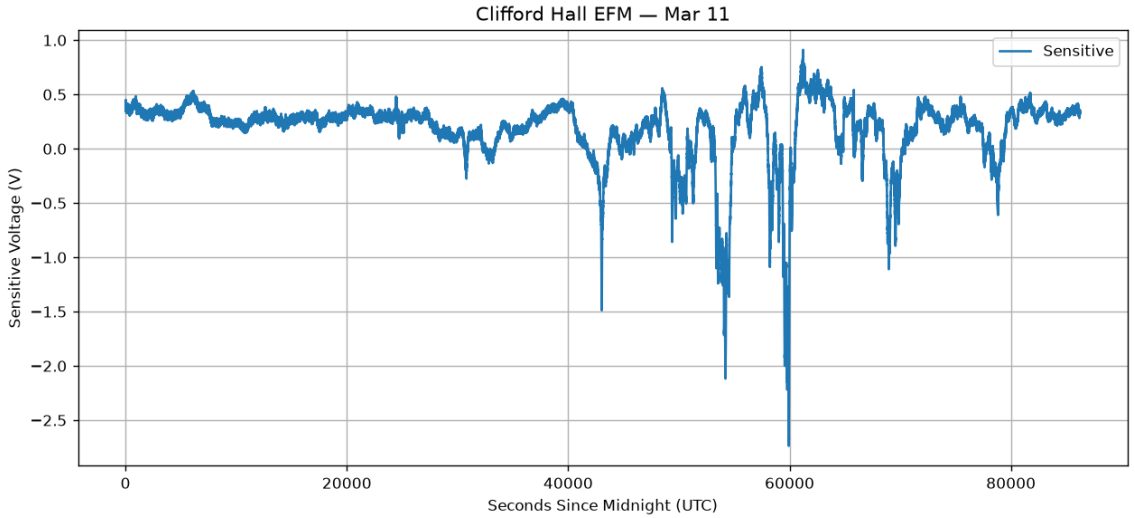


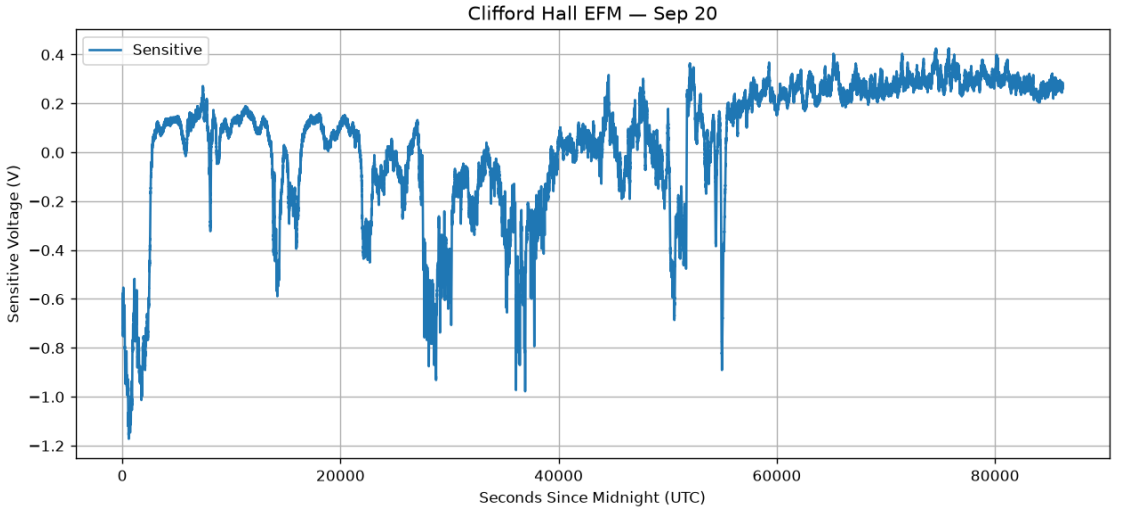
| | |
|---|---|
| **Input and channel** | EFM Sensitive voltage versus UTC seconds; Insensitive channel examined but heavily quantized. Timestamps appear ~1 second apart despite “10 Hz” in file header. |
| **30-minute net slope** | Slope = [Sensitive(t) − Sensitive(t−1800 rows)] / [Time(t) − Time(t−1800 rows)]. Take absolute value to capture rising and falling electric-field activity. |
| **Baseline → flag** | Pool slopes from independently selected fair-weather days. Set one fixed empirical \|slope\| cutoff (test 95th, 99th, 99.9th percentiles), then apply consistently to other days. |

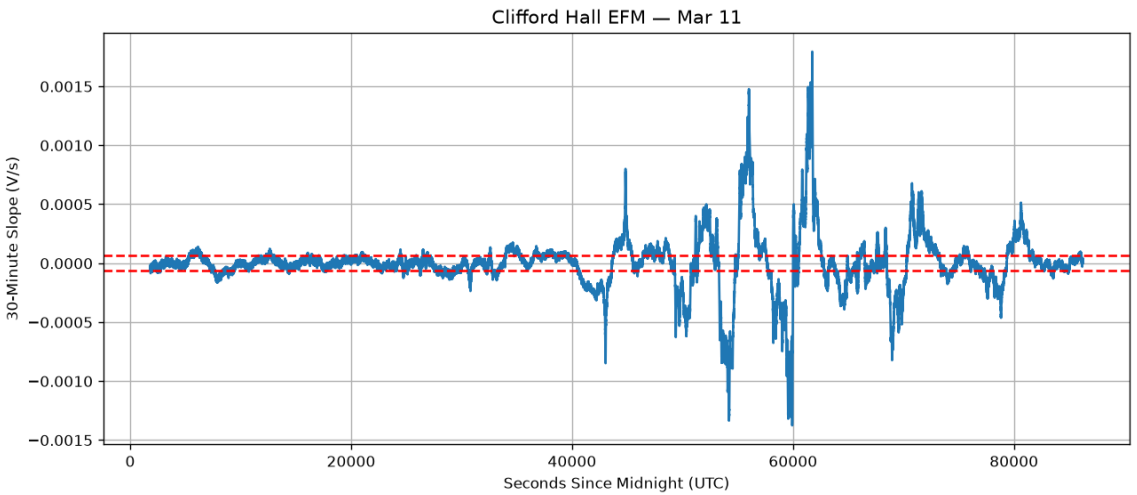
**WORKING RULE • Flag |30-minute slope| above a fixed fair-weather baseline threshold; compare flagged intervals with MiniOFS and other weather evidence.**

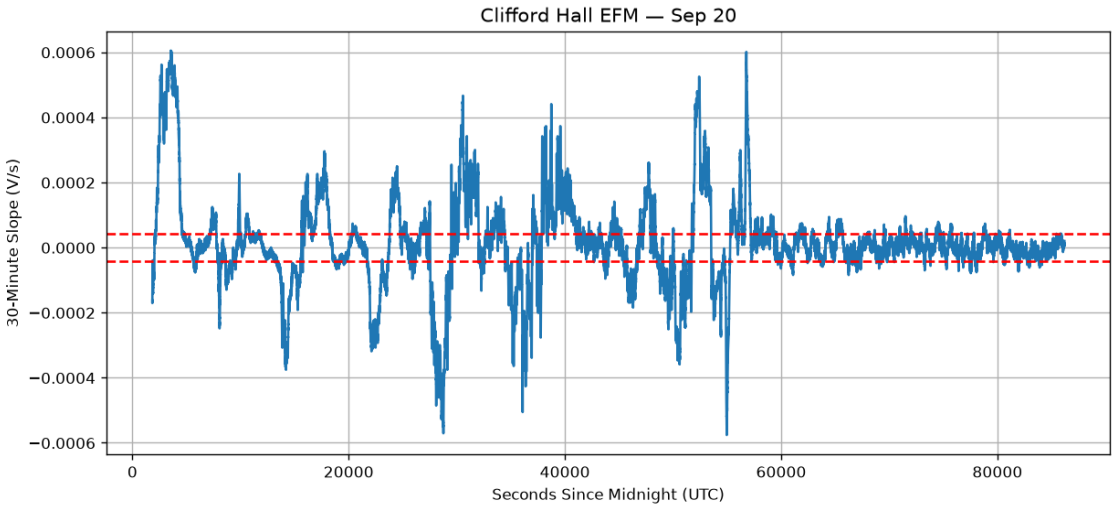
# EFM: Visibility Data vs EFM Sensitive Data Rate of Change

08 | Contextual weather evidence—not a direct visibility measurement



# EFM: early calculations and unresolved decisions

09 | Illustrative distributions; not yet a validated event classifier

| | |
|---|---|
| **11 March 2026** | Median \|slope\| ≈ 0.000065 V/s; 95th percentile ≈ 0.000572 V/s; 99th ≈ 0.001062 V/s (Sensitive channel). |
| **20 September 2026** | Median \|slope\| ≈ 0.00004234 V/s; 95th percentile ≈ 0.00033054 V/s; 99th ≈ 0.0005083281123119261 V/s. Day-to-day thresholds differ markedly. |
| **Method limitations** | 1,800 rows ≈ 30 minutes only with continuous ~1 Hz data. Overlapping slopes are correlated; net change can miss brief disturbances returning to baseline. |

**DISCUSSION • Confirm fair-weather reference days; select fixed percentile; inspect event duration; determine whether EFM adds useful context beyond METAR / NDAWN.**