MICHIGAN FIREBALL OF JANUARY 17, 2018

BILL COOKE AND DANIELLE MOSER

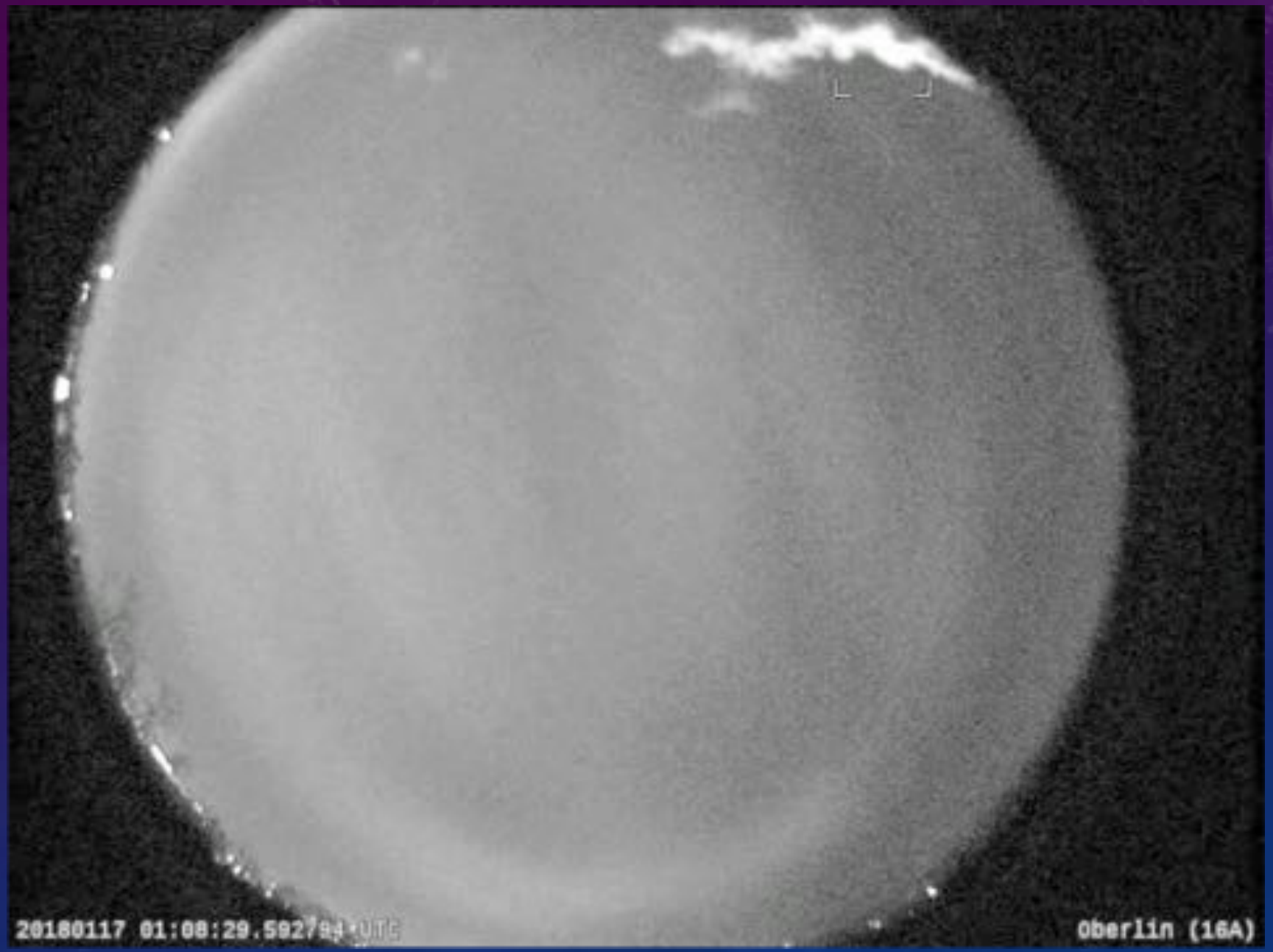
NASA METEOROID ENVIRONMENT OFFICE

WILLIAM.J.COOKE@NASA.GOV

BASIC OVERVIEW

- Occurred on January 17, 2018 at 01:08:30 UTC (2018 January 17 7:08:30 PM CST)
- Over 600 eyewitness accounts
- Caught on security and dash cameras throughout the region
- Detected by the NASA all sky meteor camera at Oberlin College
- Superbolide class event (superbolides have a magnitude of -17 or brighter, in between the Full Moon and Sun in brightness)

American Meteor Society (AMS) observer heat map


20180117 01:08:29.592794 UTC
Oberlin (16A)

Toledo

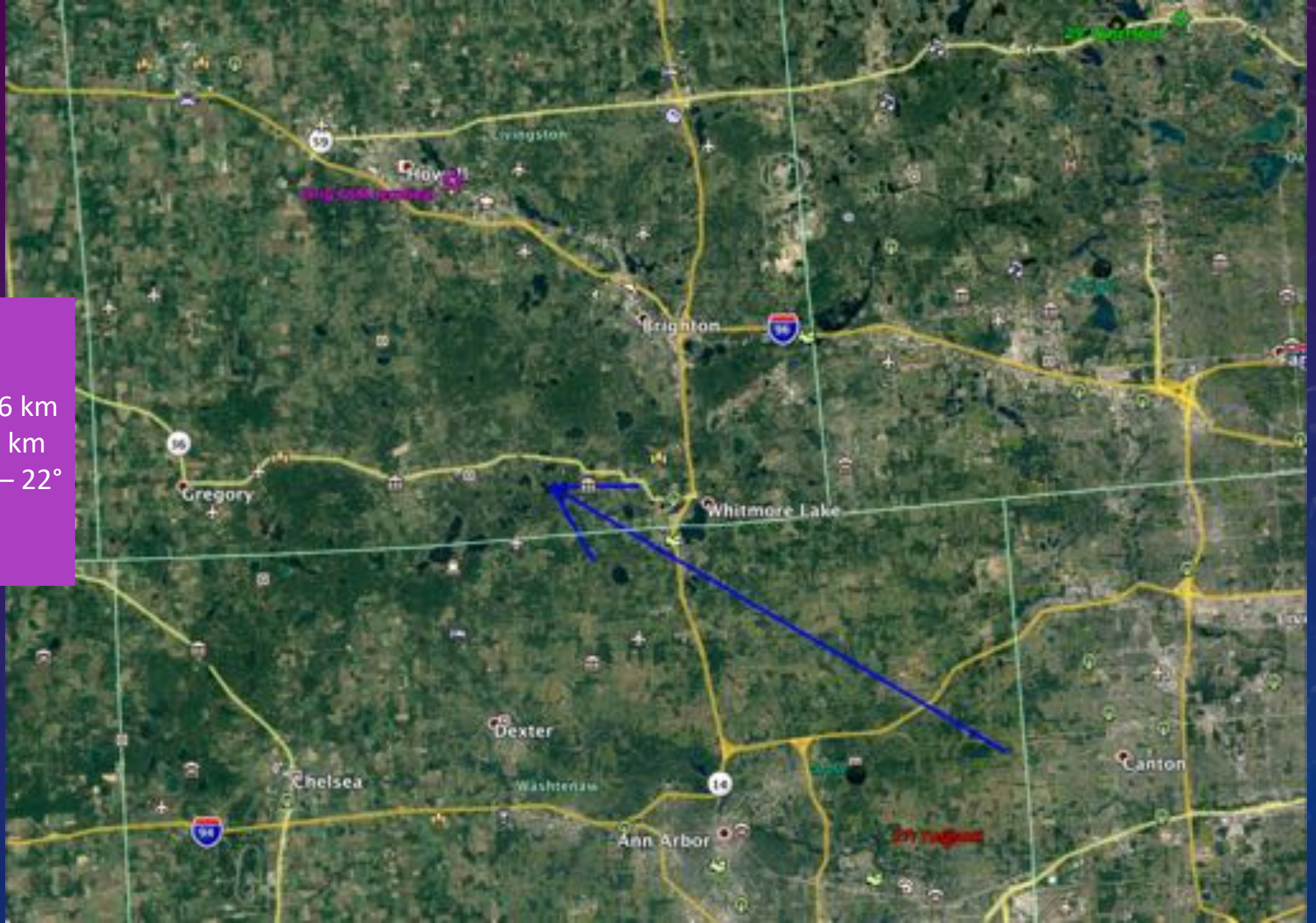

nest
Windsor, ON

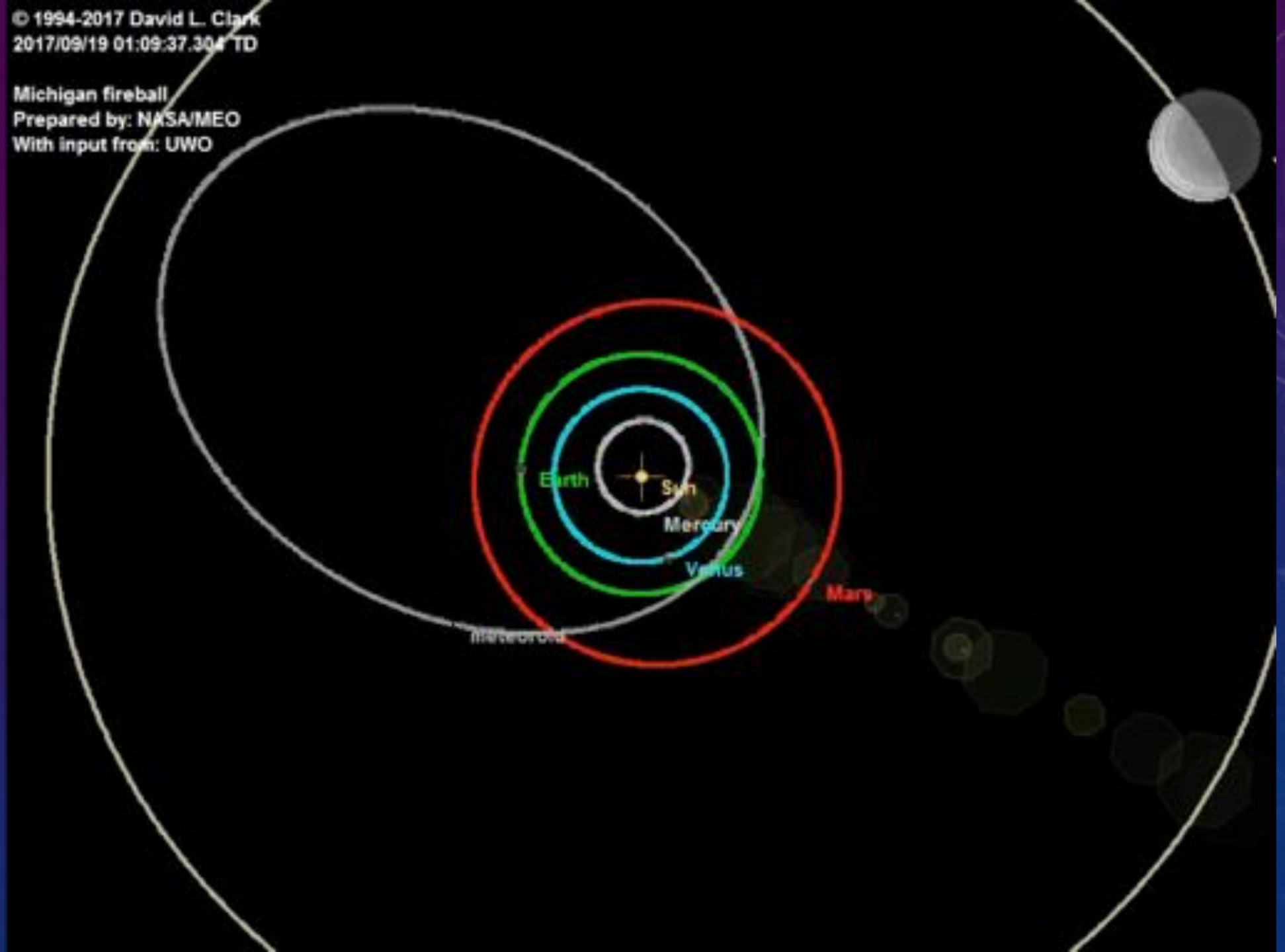

RailStream, LLC. - MH Tower (Chicago, IL) 2018-01-16 19:08:26

Rochester Hills

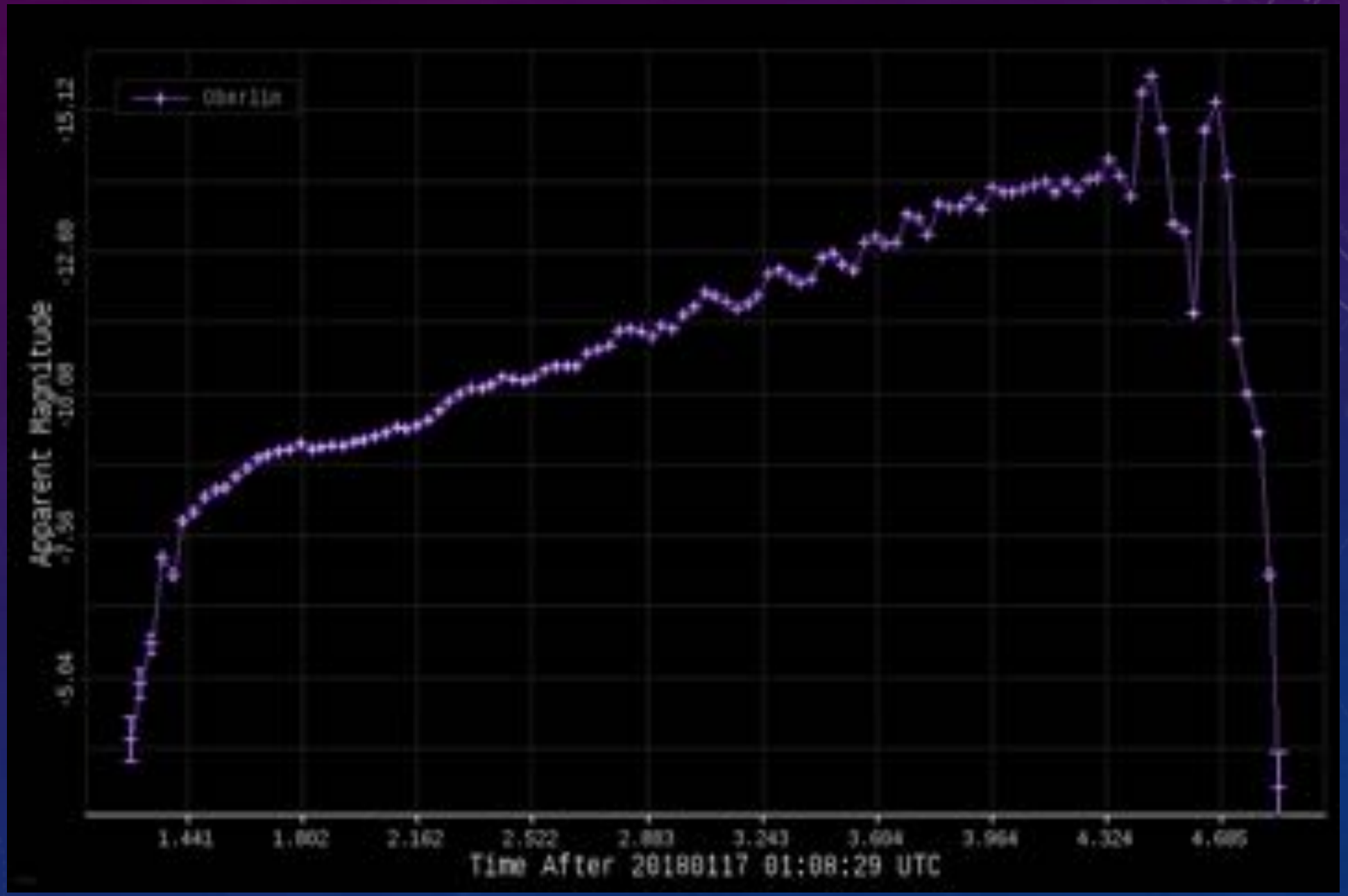
WHAT WE KNOW

Speed – 15 km/s
Start height (video) – 86 km
End height (video) – 18 km
Very steep entry angle – 22° from vertical

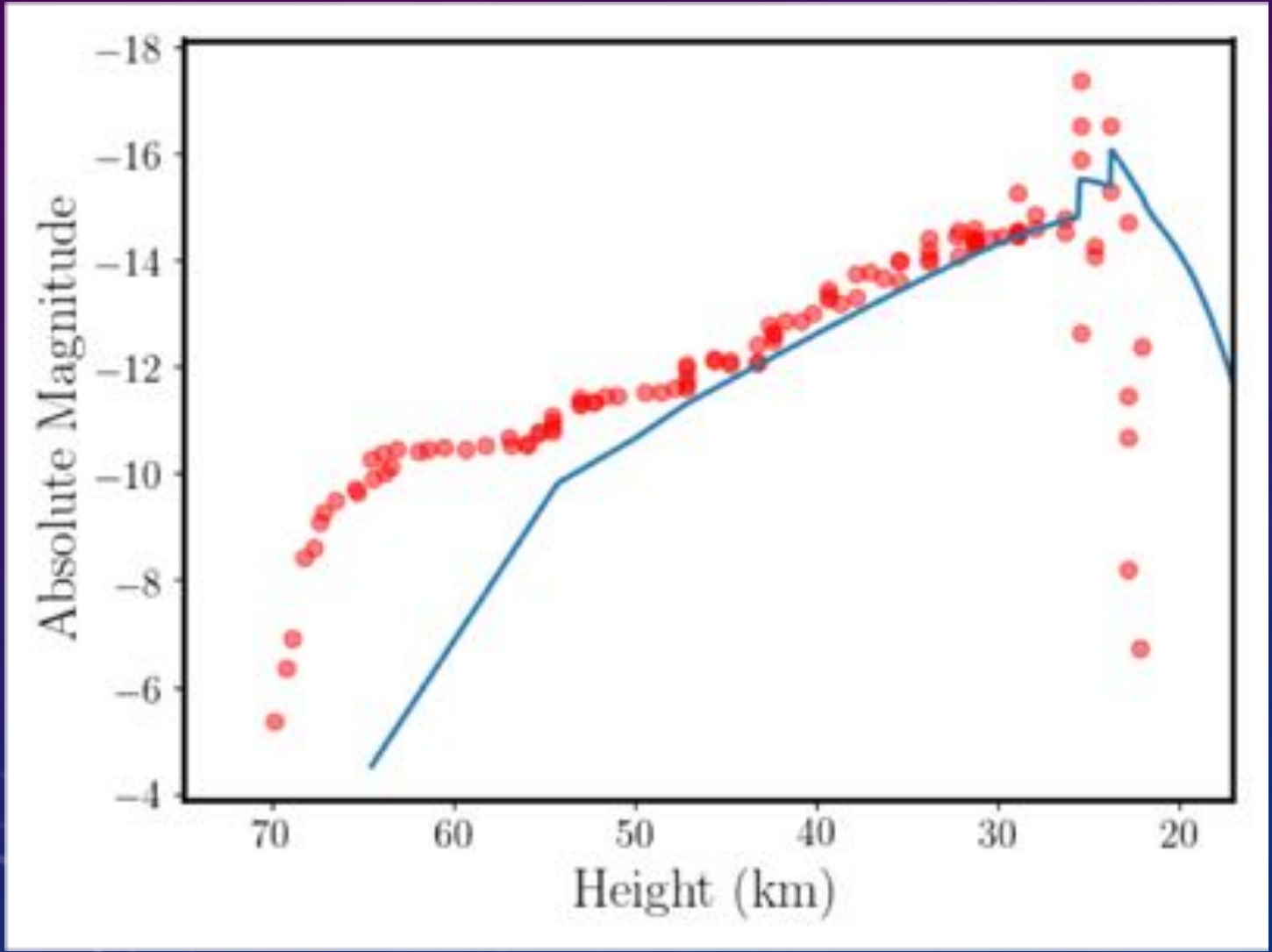



© 1994-2017 David L. Clark
2017/09/19 01:09:37.304 TD
Michigan fireball
Prepared by: NASA/MEO
With input from: UWO
Earth
Sun
Mercury
Venus
Mars
Meteoroid

Light curve


Oberlin
Apparent Magnitude
-15.12
-12.60
-10.08
-7.56
-5.04
1.441
1.802
2.162
2.522
2.883
3.243
3.604
3.964
4.324
4.685
Time After 20180117 01:08:29 UTC

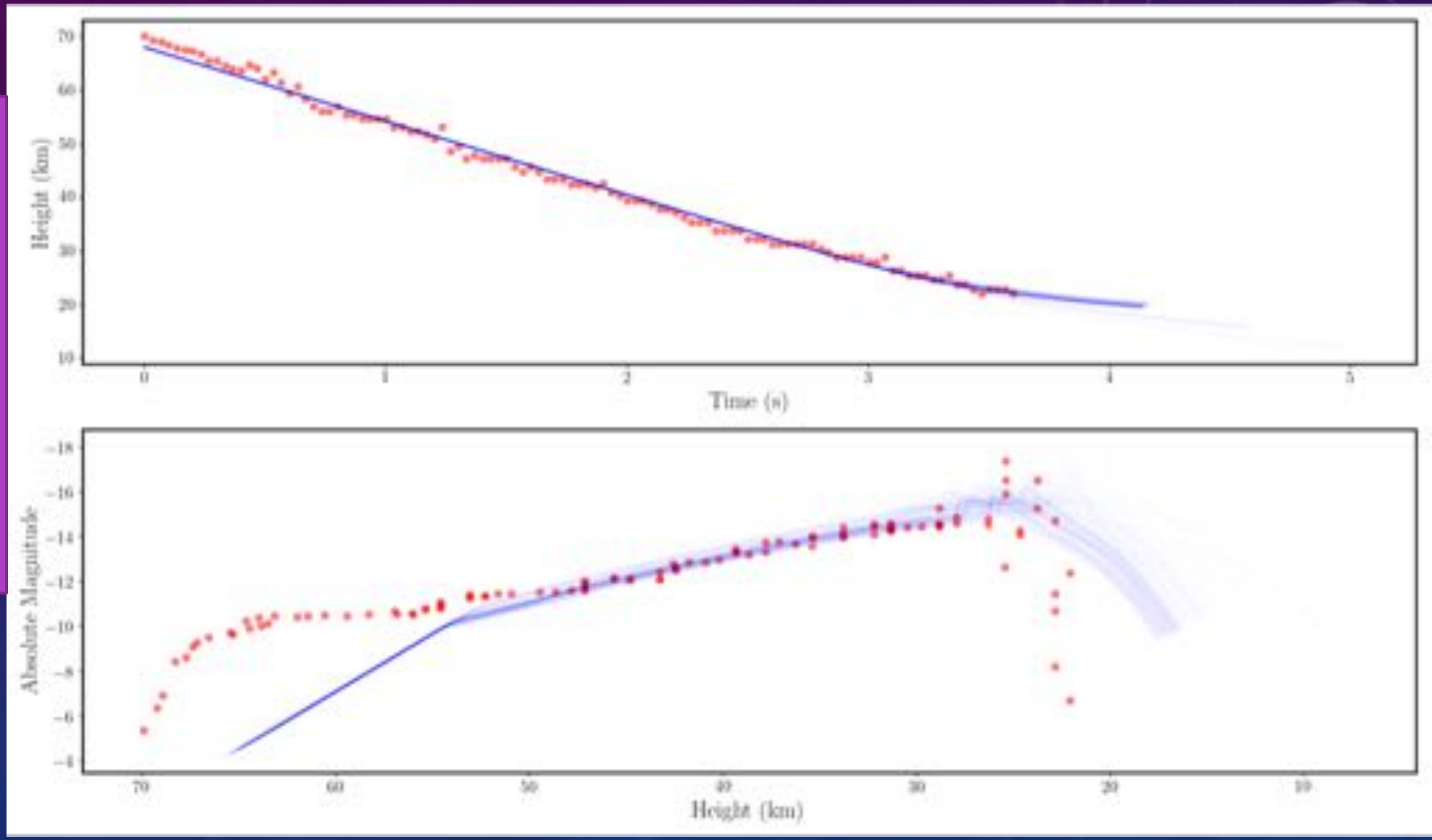
MANUAL TPFM MODEL FIT



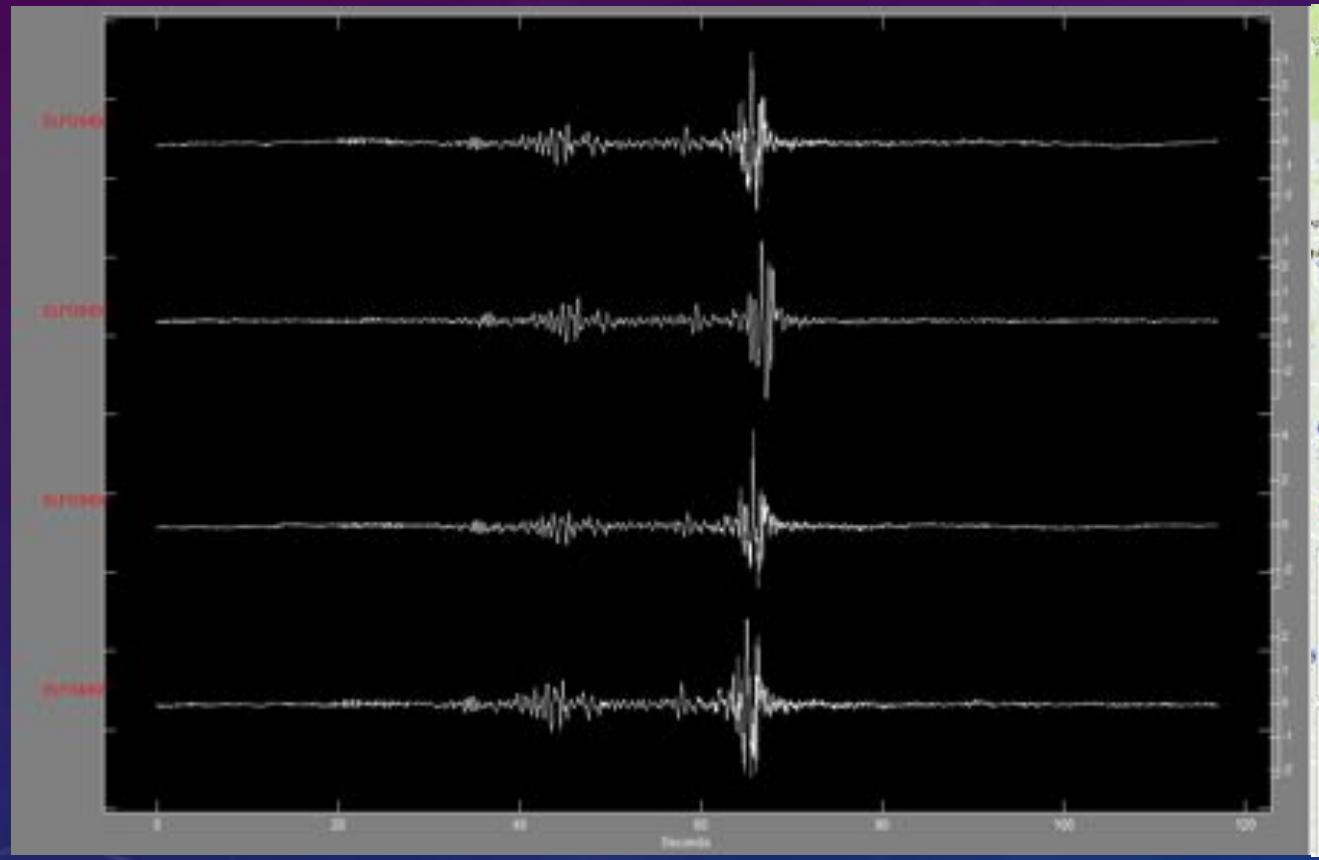
Diameter = 68 cm
Strength = 2.7 Mpa
Bulk density = 3700 kg m^{-3}
Mass = 609 kg
KE = 16.4 tons TNT

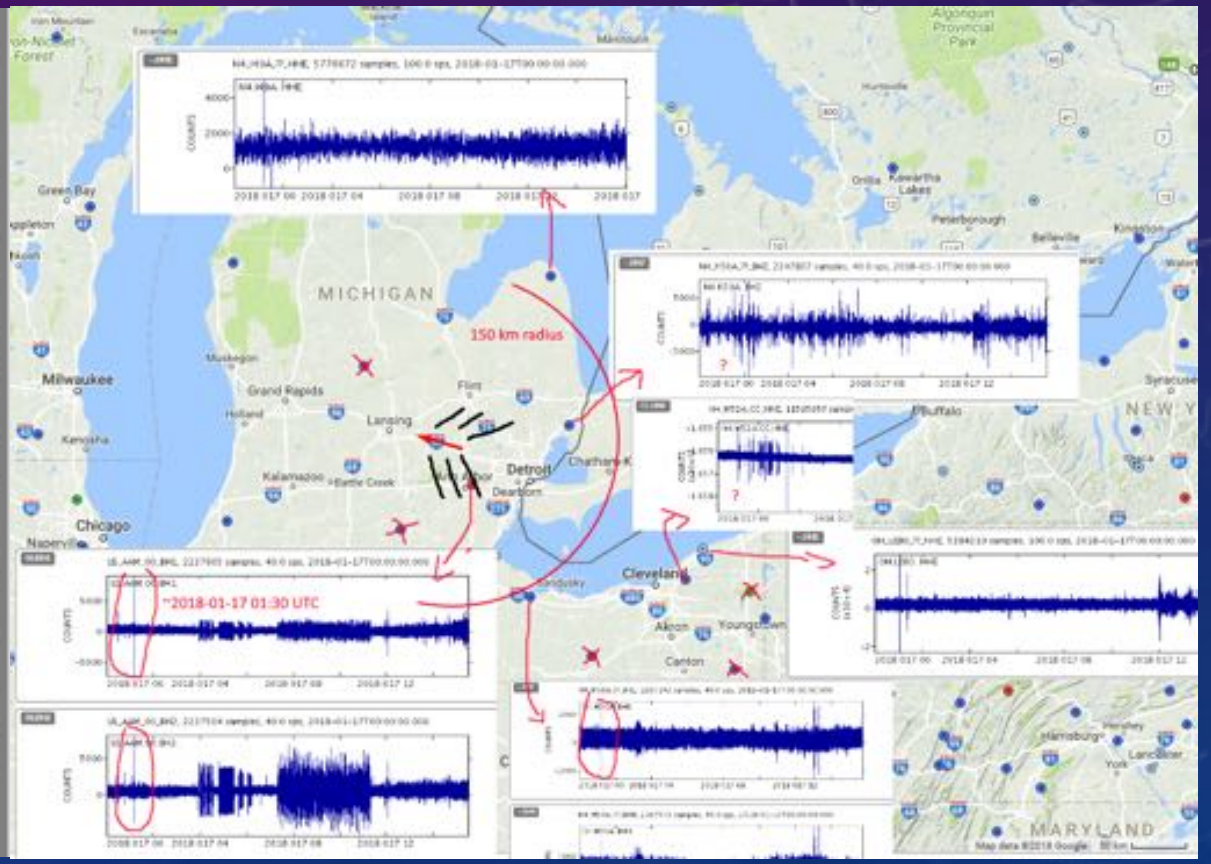
MCMC TPFM RESULTS

RINF: 0.311 - -0.020 + 0.039 (meters)
VINF: 14.904 - -0.006 + 0.004 (km/s)
ZR: 22.479 - -0.003 + 0.008 (degrees)
NUMBMAX: 256.000 - 0.000 + 0.000
SFINF: 1.209 - -0.005 + 0.007
MU: 0.667 - -0.008 + 0.007
POR CLASS: 1 (ordinary chondrite)
STRMOD: 1.267 - -0.171 + 0.140
TSTROVER: 2.583e+06 - -6.071e+05 + 1.230e+06 (Pascals)
SIGMA_HEIGHT: 1.125 - -0.070 + 0.082 (km)
SIGMA_MAG: 1.260 - -0.184 + 0.168 (magnitude)



INFRASOUND AND SEISMIC SIGNATURE





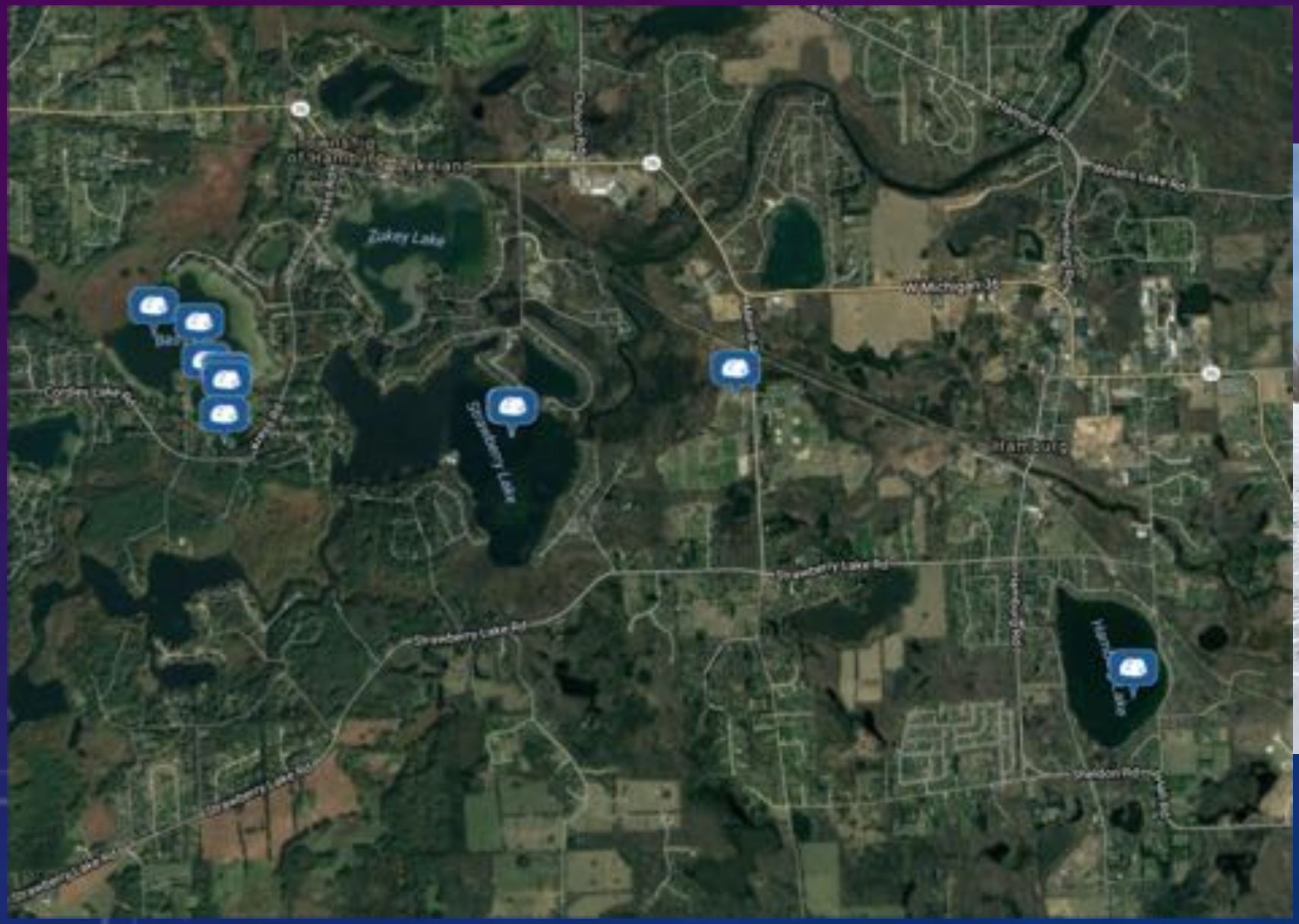
Energy upper limit of 50 tons TNT; nominal close to 10 tons TNT

Event caused a magnitude 2 tremor

Dark flight calculations

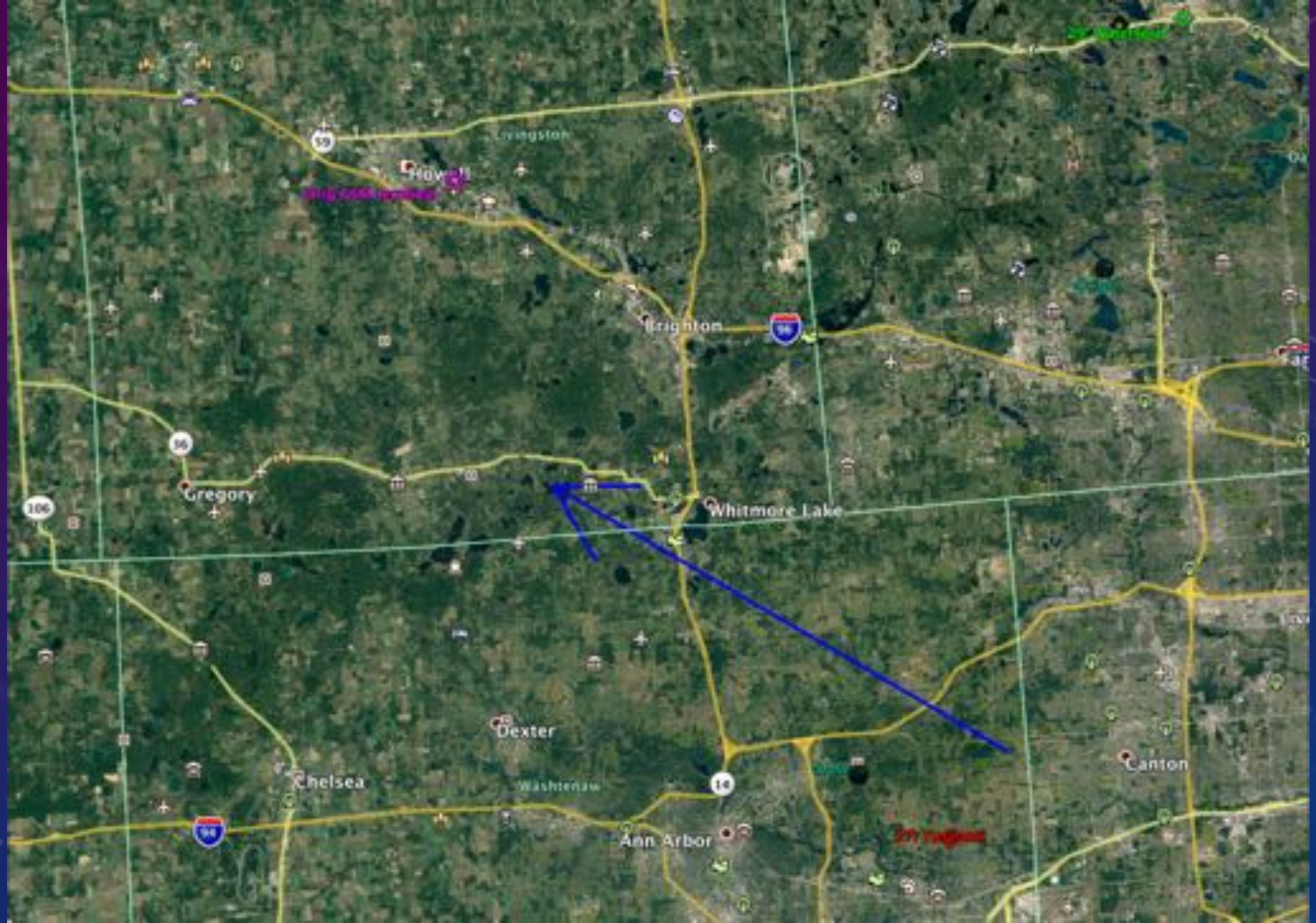
Doppler radar signature of falling meteoritic dust

METEORITE FINDS



GLM DATA

Courtesy Kevin McGrath


Livingston
Howell
Brighton
96
Gregory
106
Whitmore Lake
Dexter
Chelsea
Washtenaw
14
Ann Arbor
Canton

GLM level 2 match to light curve