

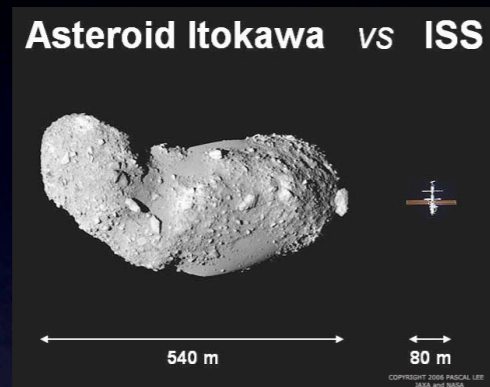
Uses of Amateur Meteor Data in NASA Spacecraft Operations and Design

Bill Cooke

NASA Meteoroid Environments Office

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How NASA handles space debris



Earth-approaching asteroids



Meteoroids and meteors



Man-made orbital debris



Near Earth
Object
Office
(JPL)



Meteoroid
Environment
Office
(MSFC)



Orbital
Debris
Program
Office (JSC)

MEO Overview

History

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- Located at Marshall Space Flight Center in Huntsville, Alabama.

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- Roles and responsibilities spelled out in NASA NPR 8715.3c (http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_8715_003C_&page_name=Chapter11)

MEO Staff

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Web site: <http://meo.nasa.gov>

Who cares?



Navy Transit Satellite
(before being shot with a 5 cm Aluminum ball
moving at 6 kilometers per second)

Who cares?



The Aftermath

Meteor shower forecasting



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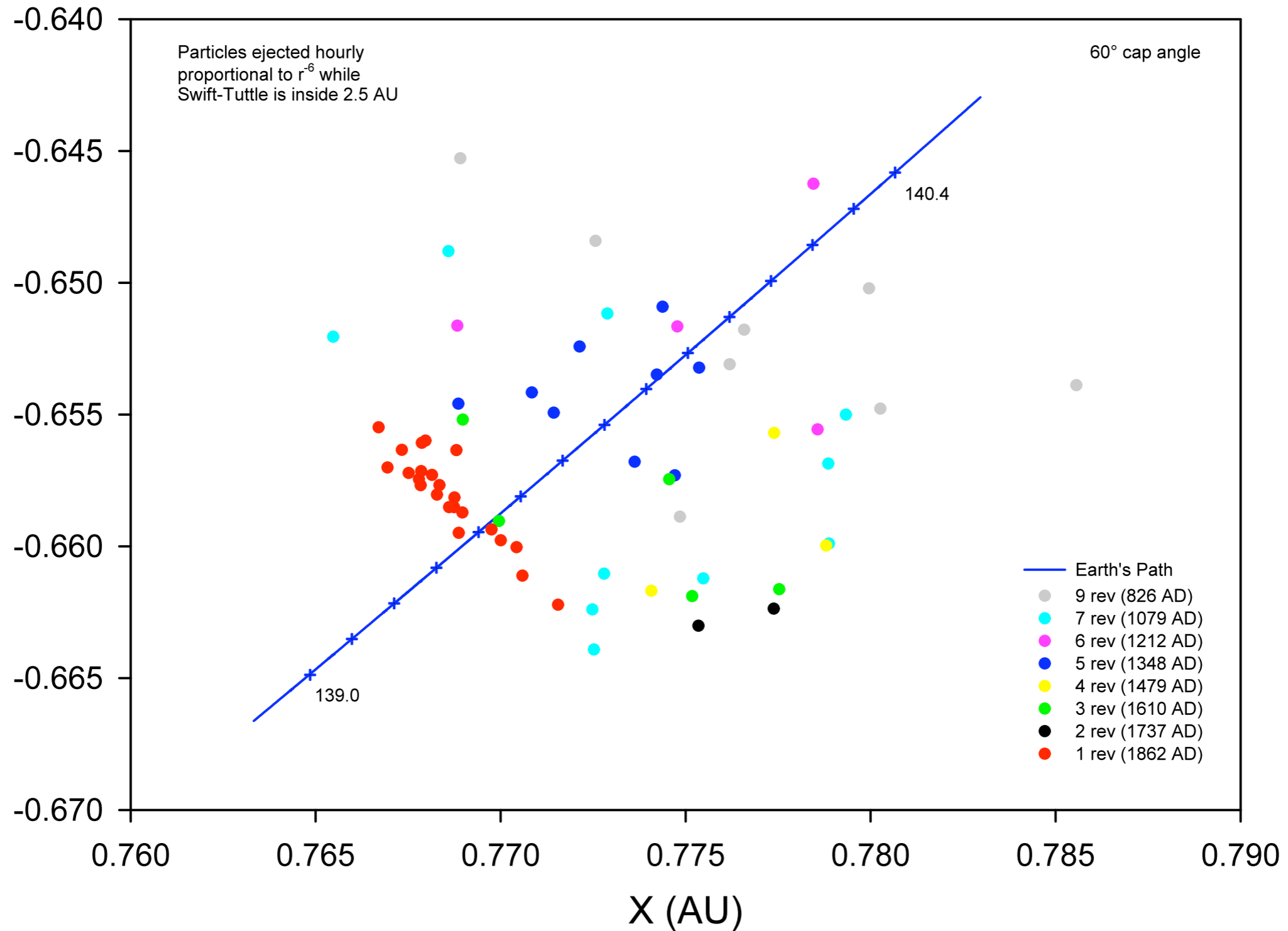
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 - Shower durations difficult to derive.

2004 Perseids



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- ZHRs converted to fluxes using visually-determined population/mass indices.

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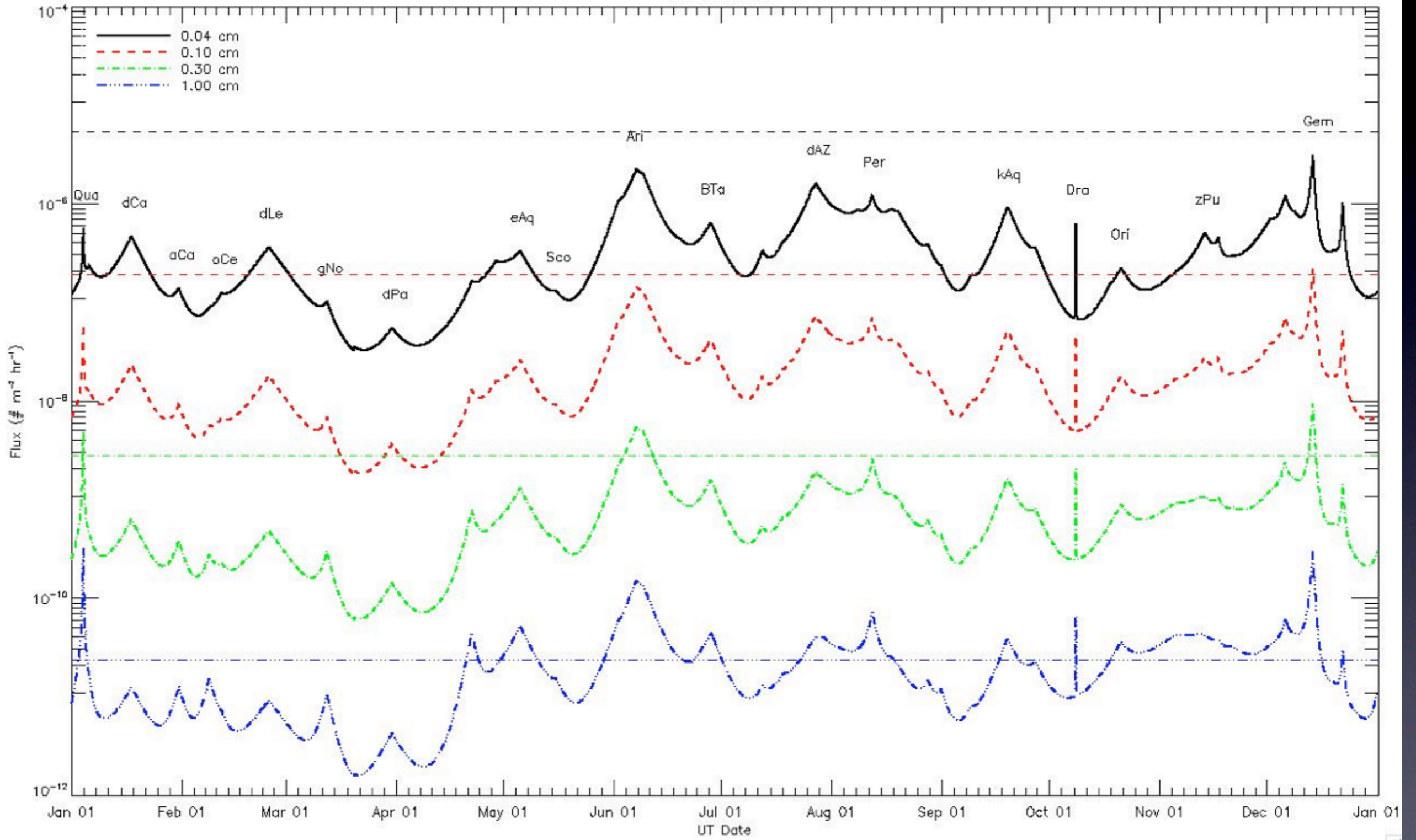
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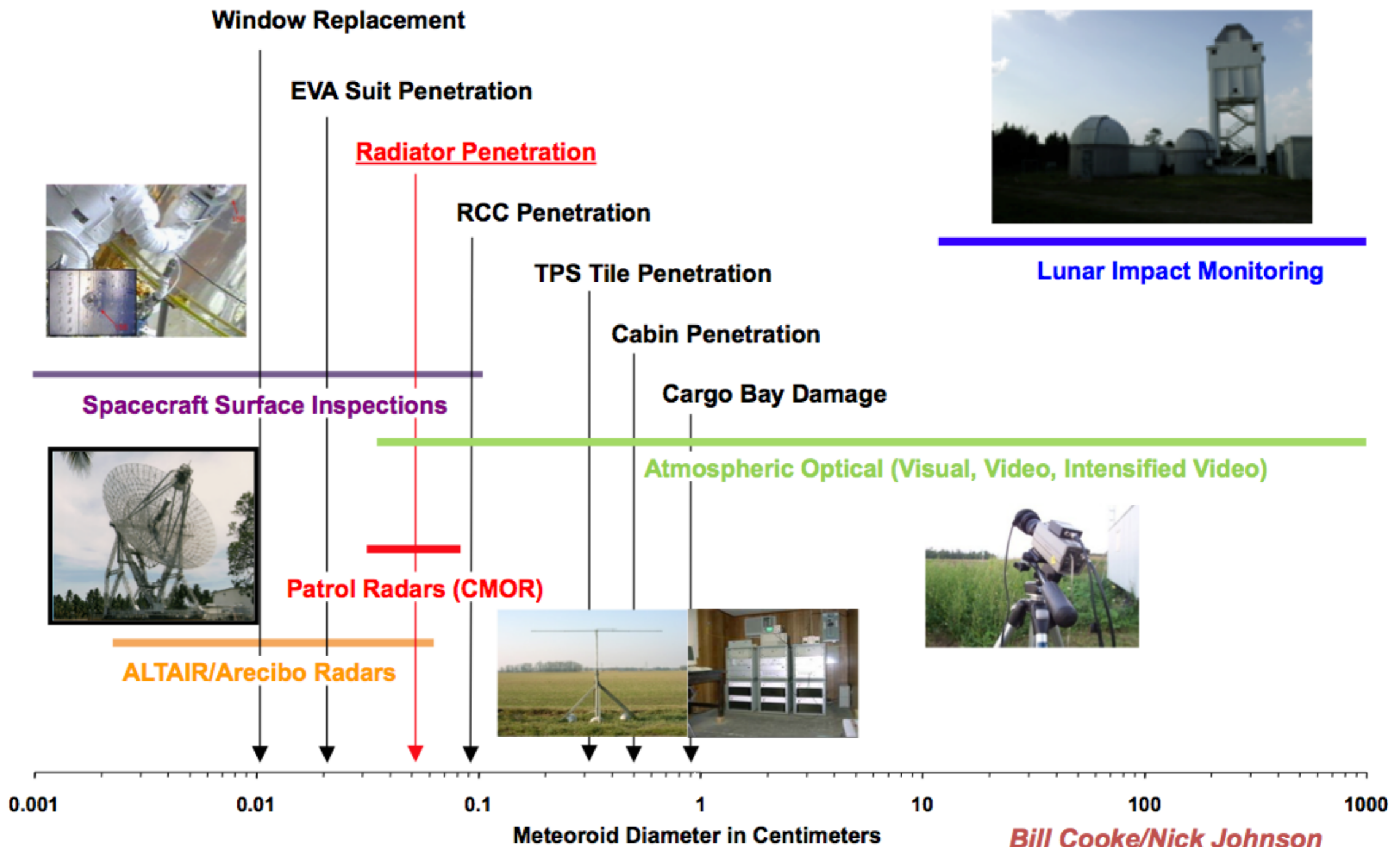
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- Penetrating fluxes are generated at 1 hour intervals for entire year.

2008 Fluxes



Why these sizes?

Potential Shuttle Damage



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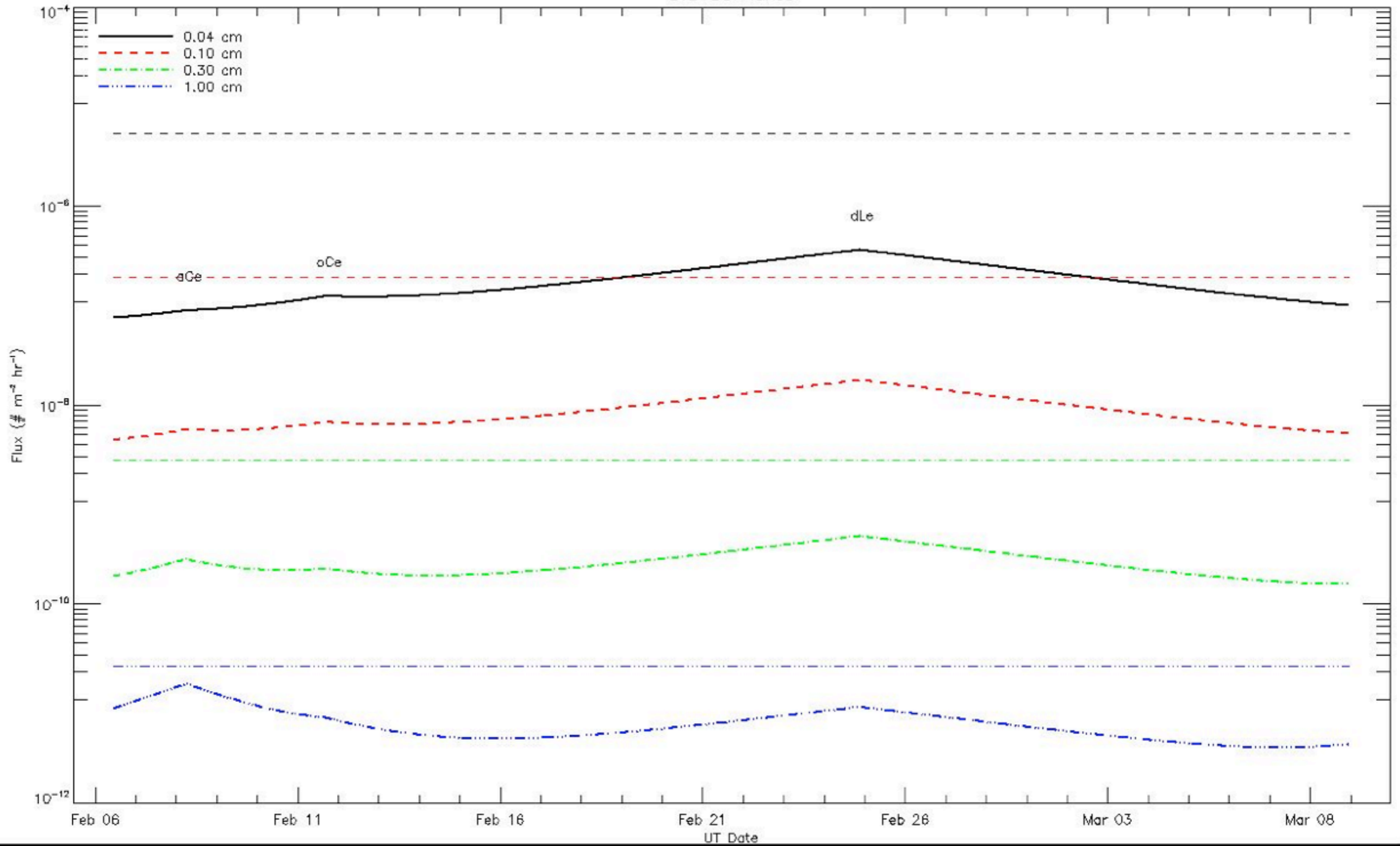
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- 6-hour fluences also calculated for EVA risk.

STS130 Fluxes

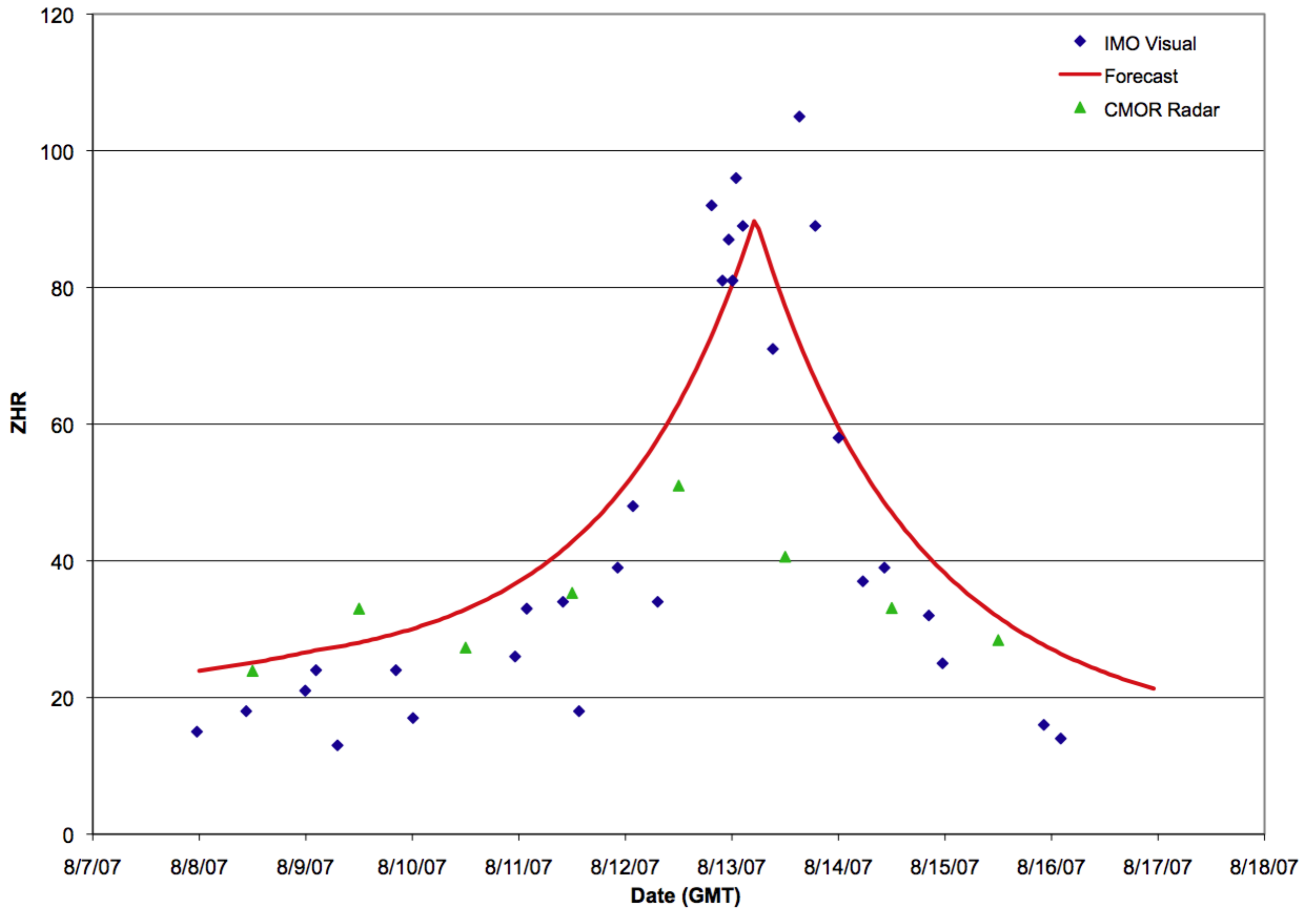


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- A few weeks are allowed for the numbers to be revised. We do not use the “real-time” ZHRs unless there is an anomaly investigation with tight deadlines.



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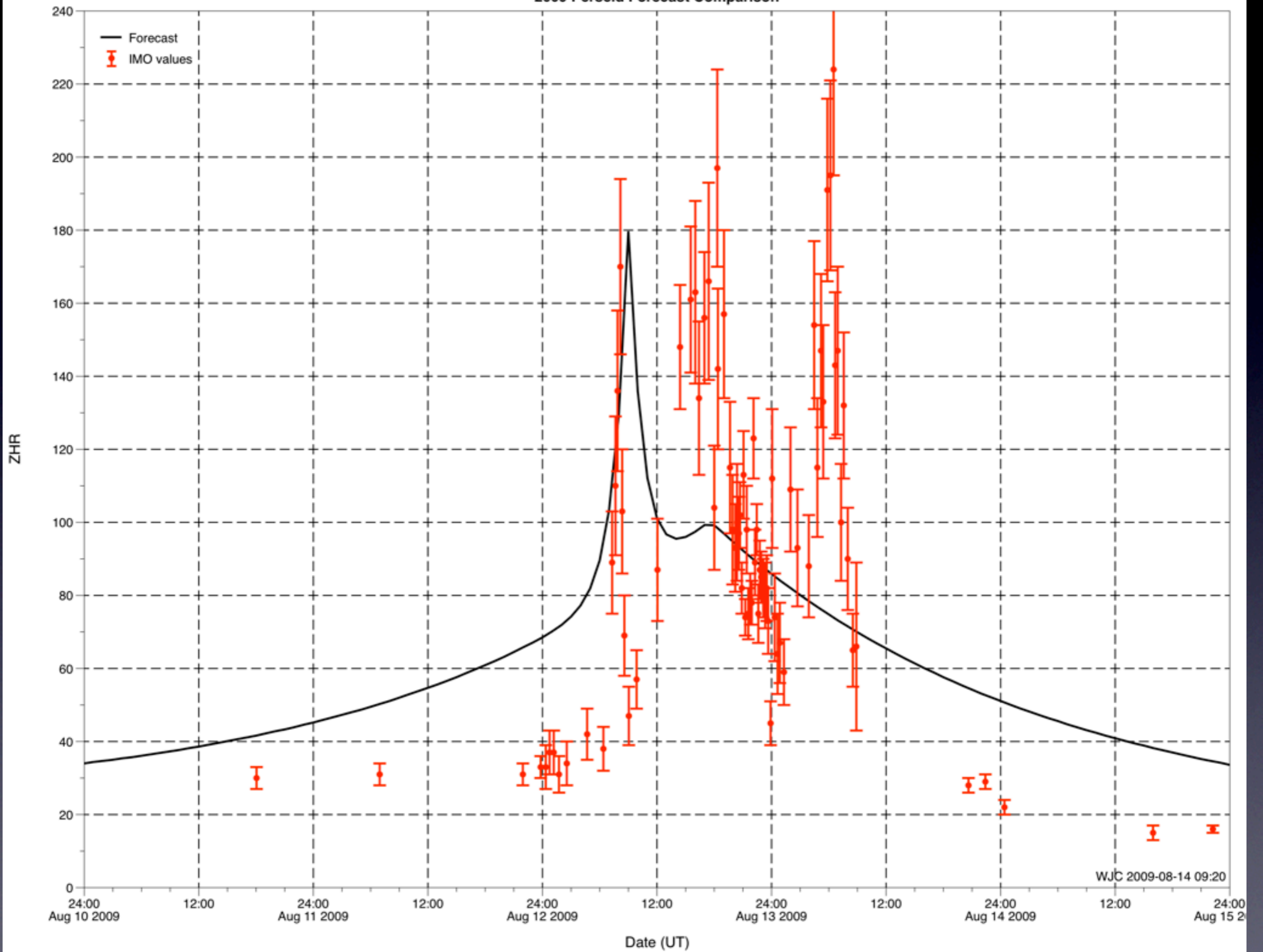
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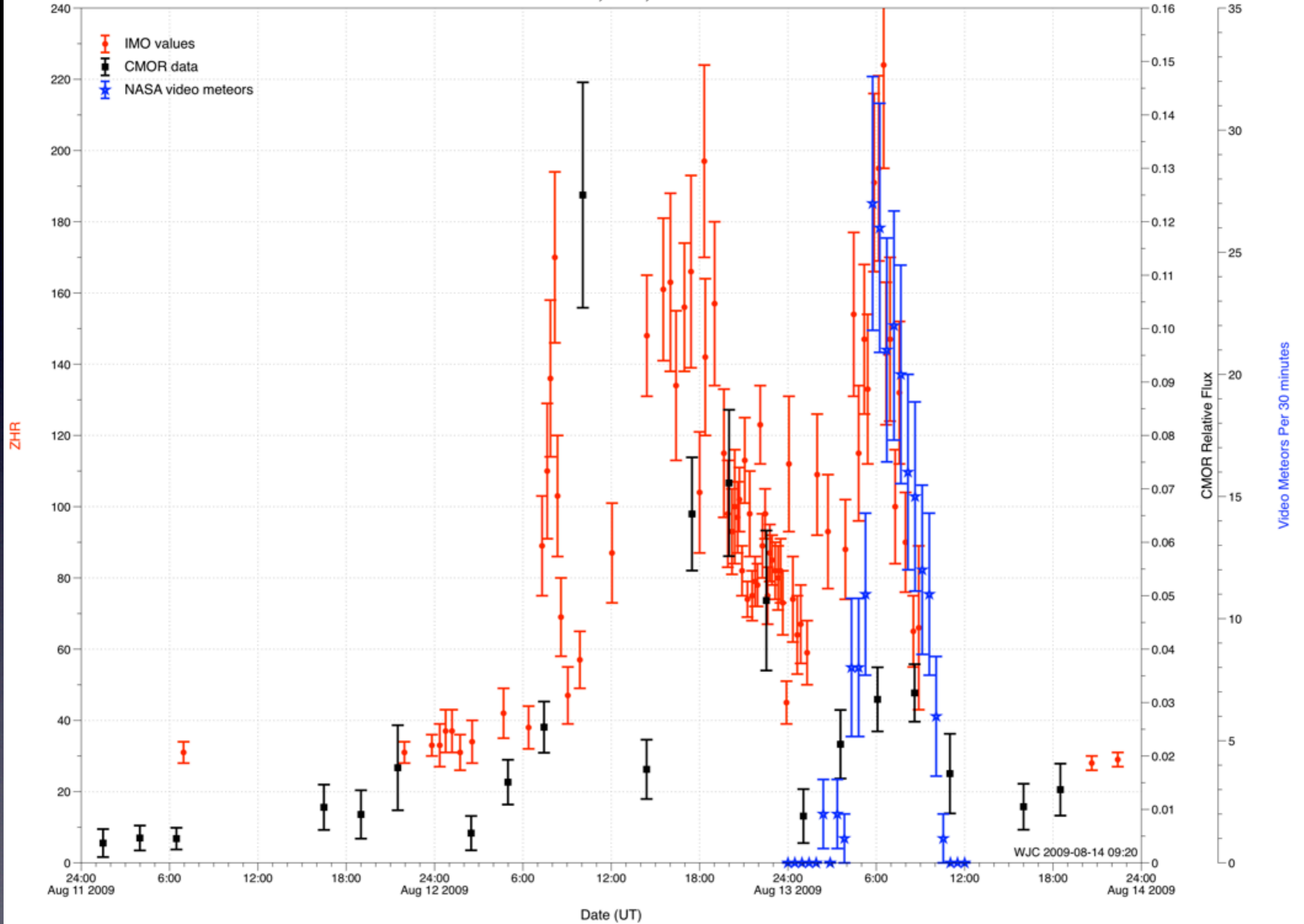
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- Analysis showed Perseid radiant was visible from satellite at time of loss of control - Perseid strike possible.

2009 Perseid Forecast Comparison

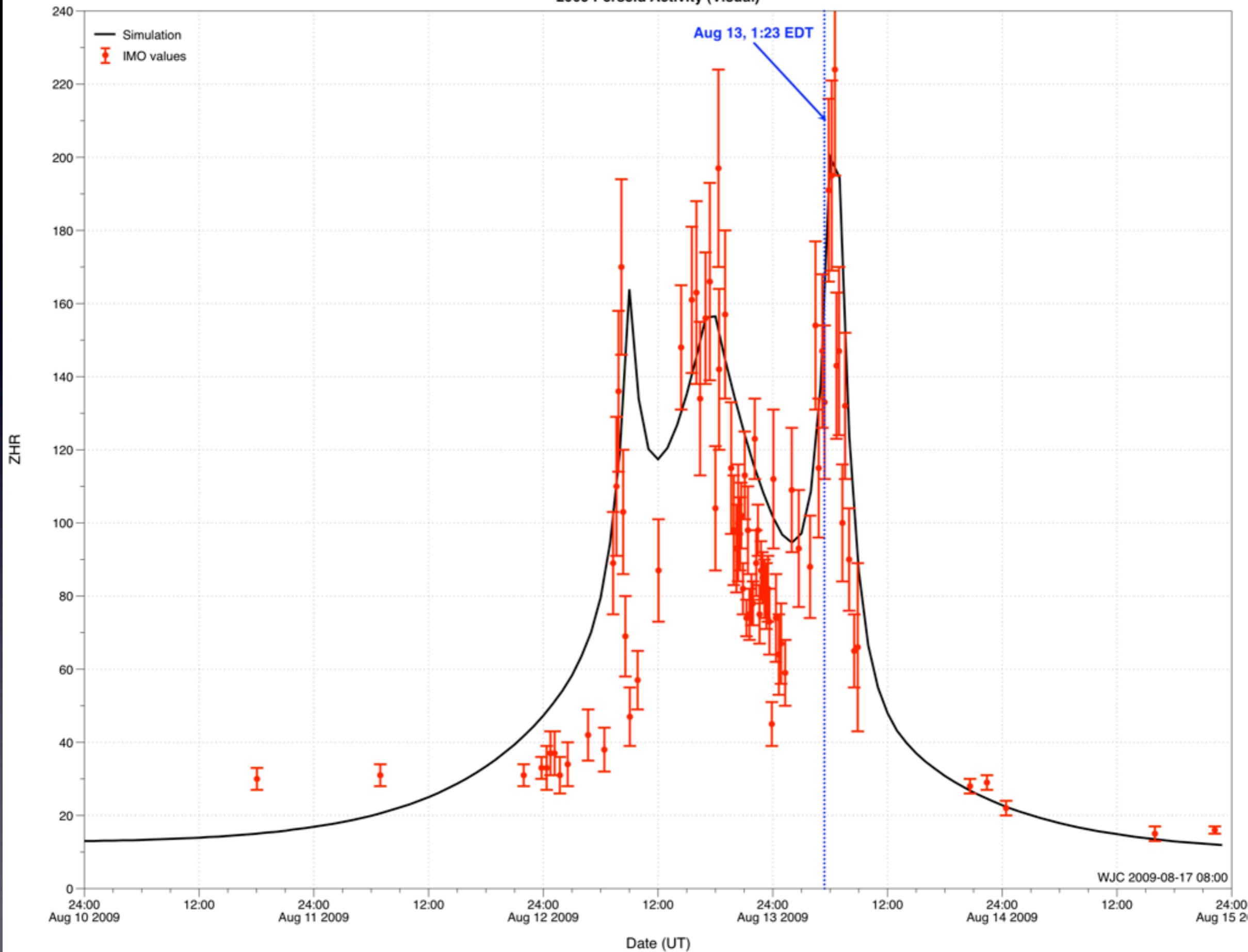


WJC 2009-08-14 09:20

2009 Perseid Visual, Radar, and Video Data

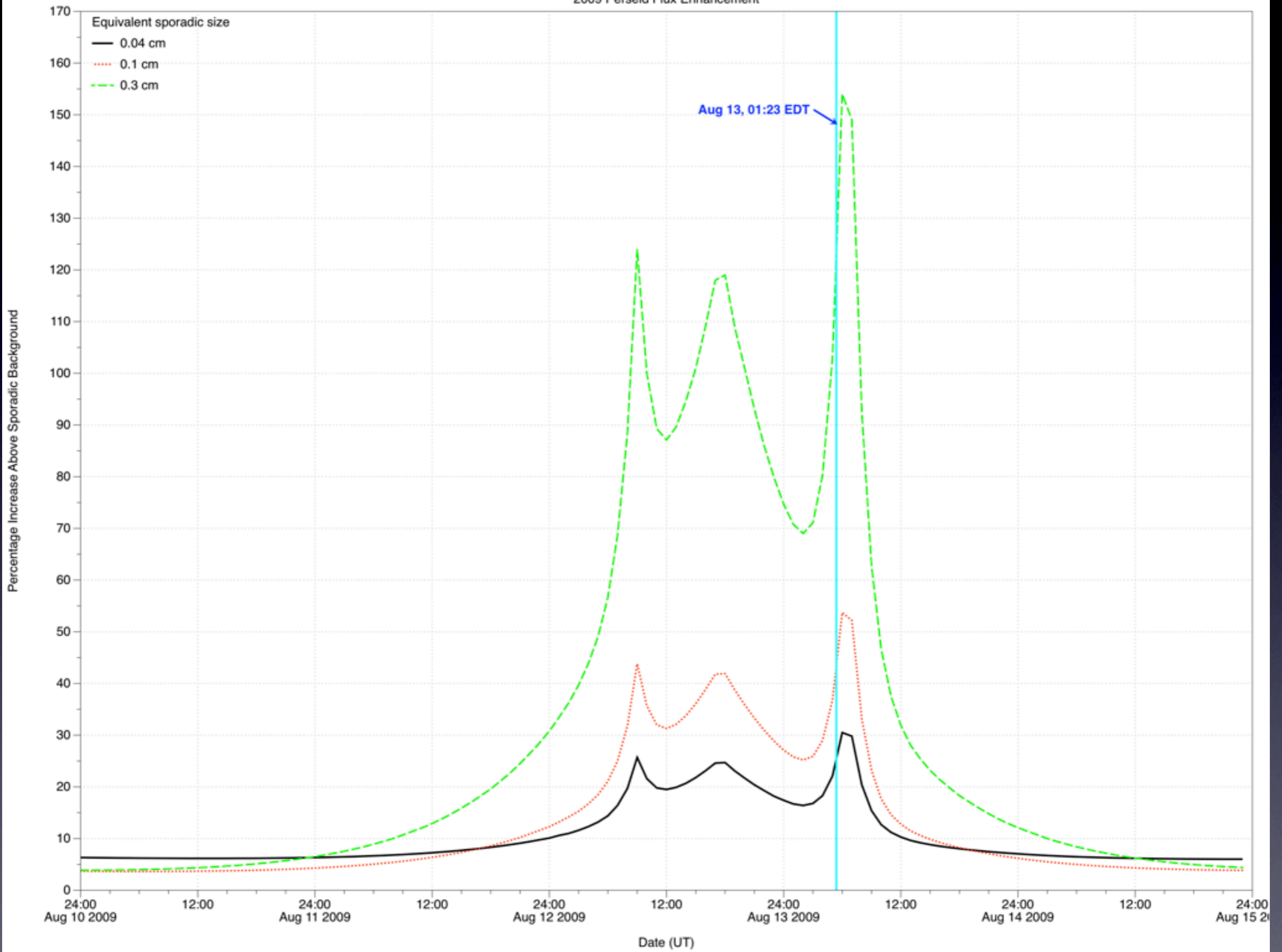


2009 Perseid Activity (Visual)



WJC 2009-08-17 08:00

2009 Perseid Flux Enhancement



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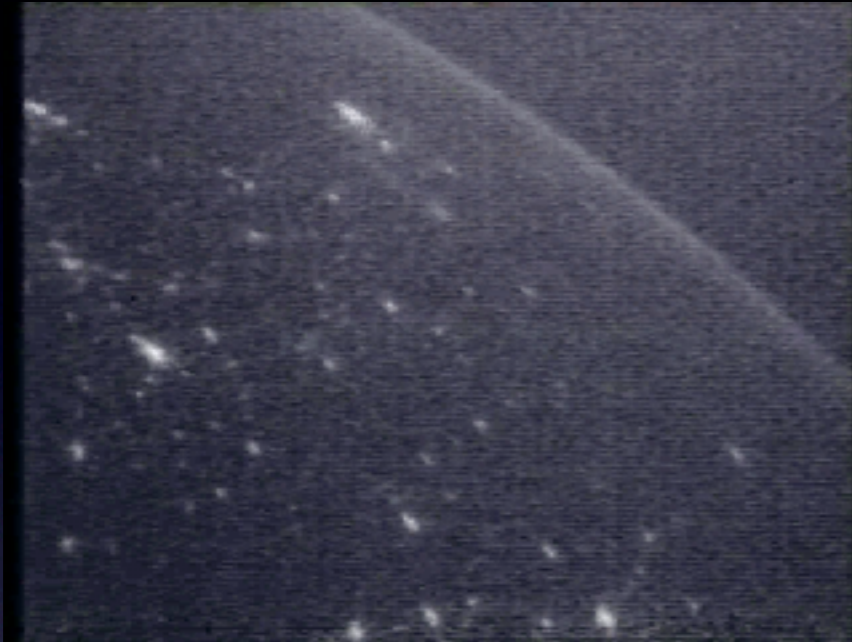
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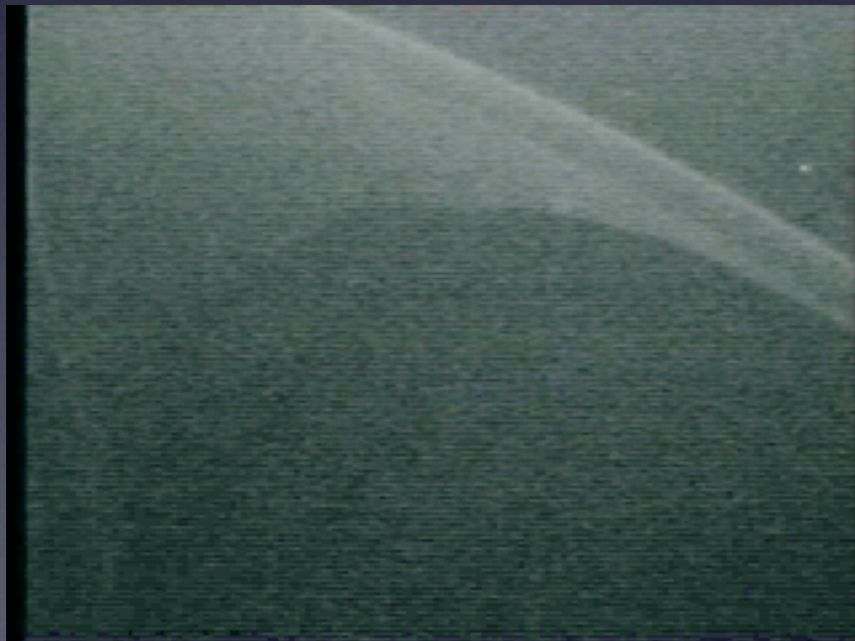
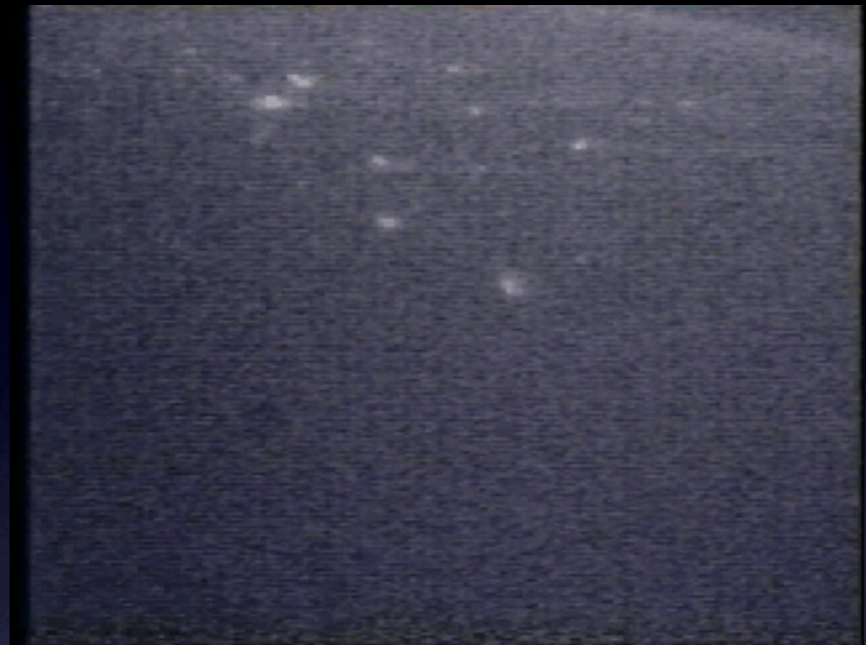
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 - Forecasts bias observers

Perseids from Space



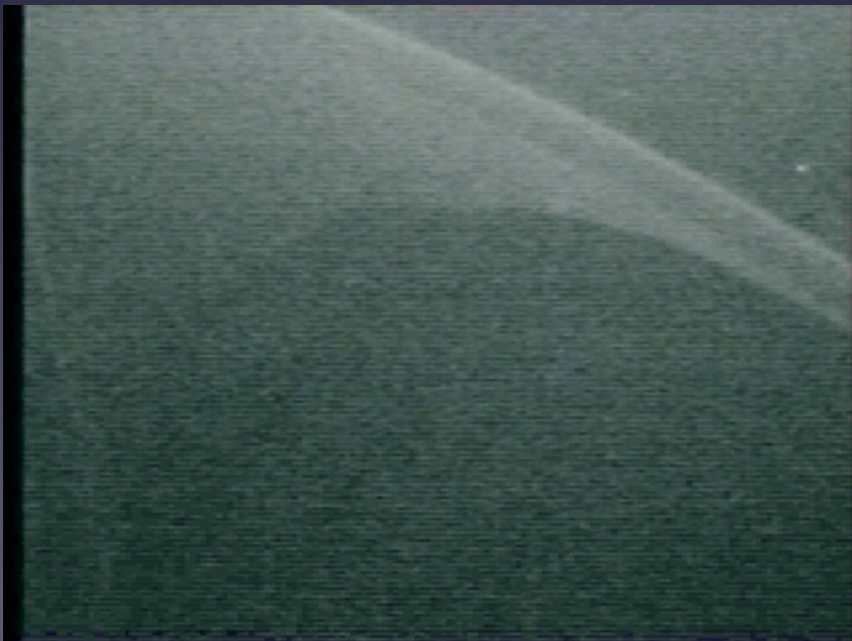
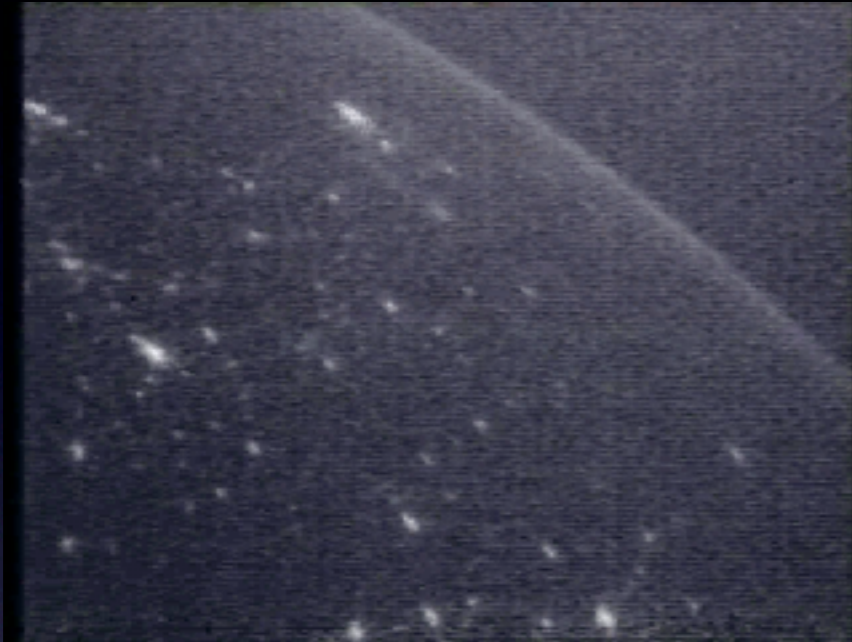
STS-105
August 10-22, 2001

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