

Minor meteor shower anomalies 2018: predictions and observations

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Outline

- Motivation

- annual meteor shower calendar: predictions
 - find evidence from observations

Events 2018

- shower calendar
 - data availability
 - details for a series of events

- Conclusions



Data availability

visual data, ZHR – VMDB

video data, flux density – fluxviewer

radio forward scatter, ZHR equivalent – Sugimoto (& Ogawa)

additional: radar (on request)

independent samples – calibration and confirmation

2018 events

Event	Remarks
May 06	η -Aquariids, „Maya-peaks“ (Kinsman & Asher)
Sep 09, 19:12	weak activity (Sato)
Sep 20, 13:24	meteors from 2009SG18, rad. Cep (Vaubailon) ⁽¹⁾
Oct 06, 02:16	Oct. Camelopardalids (Lyytinen) ⁽²⁾
Oct 08/09	Draconids (Vaubailon, Sato, Maslov) ⁽³⁾
Nov 22, 00:55	α -Monocerotids (Sato) ⁽⁴⁾
Dec 06	Dec. ϕ -Cassiopeids – former And (Wiegert et al.)
Dec 22, 19-20	Ursid filaments (Jenniskens)

⁽¹⁾ no suitable data currently available (visual none; video extra search necessary)

⁽²⁾ Rendtel & Molau, 2018: October Camelopardalid outburst 2018 October 6. WGN **46**,173

⁽³⁾ Rendtel, 2018: Oktober 2018: Draconiden-Outburst, Camelopardaliden-Aktivität und normale Orioniden. Meteoros **21**, 246

⁽⁴⁾ no suitable data (visual and radio – none; video 2 data points)

η -Aquariids - „Maya-peaks“

Kinsman & Asher: events found in ancient records

Idea: meteoroids trapped in Jovian resonances

Prediction for 2018-ETA - 164BC-trail:

May 3, 19:11UT (43.042°)

May 5, 05:49UT, 07:34UT (2) (44.441°; 44.511°)

predominantly small meteoroids (faint meteors)

Optical observations affected by moonlight (last quarter May 8)

ETA 2018 May 08
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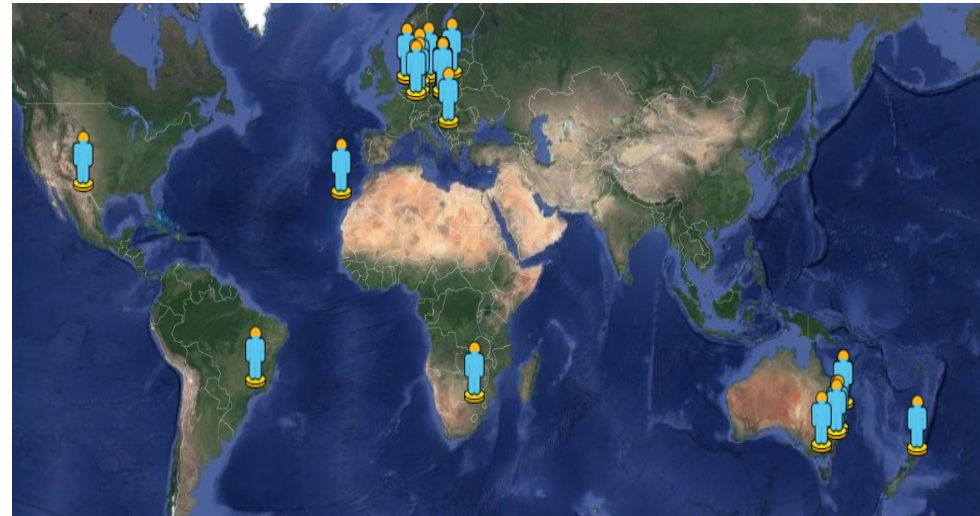
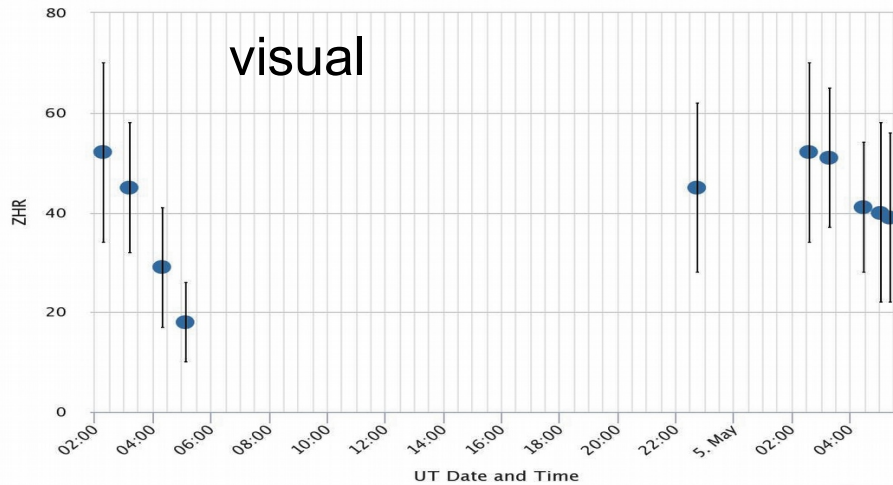
η -Aquariids - „Maya-peaks“

Prediction for 2018 ETA - 164BC-trail:

May 3, 19:11UT (43.042°)

May 5, 05:49UT, 07:34UT (2) (44.441°; 44.511°)

eta -Aquariids 2018 ZHR



69 ETA, 10 intervals only, N=4 (!)

May 3, 19UT – cot covered; May 5, 06UT in descending branch, 07:30UT not covered

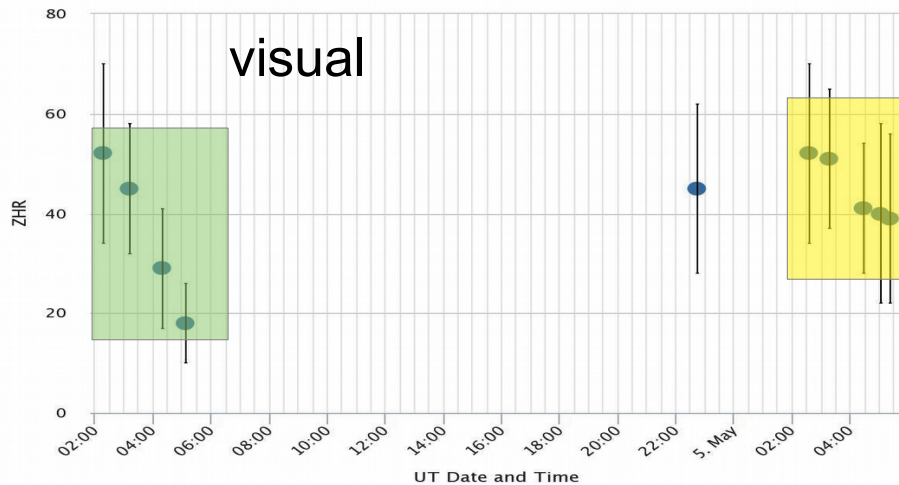
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Prediction for 2018 ETA - 164BC-trail:

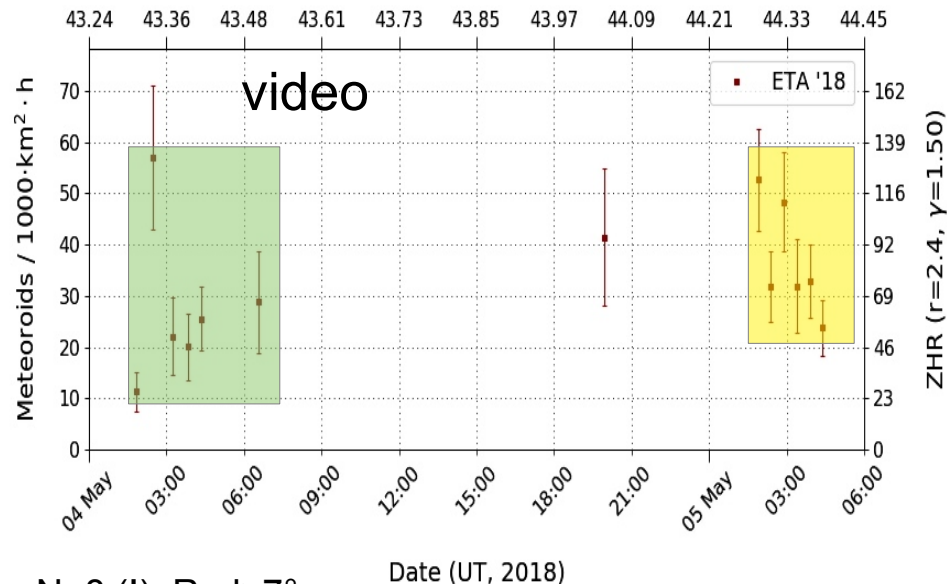
May 3, 19:11UT (43.042°)

May 5, 05:49UT, 07:34UT (2) (44.441°; 44.511°)

eta -Aquariids 2018 ZHR



Solar longitude (J2000.0)



69 ETA, 10 intervals only, N=4 (!)

at limit for detection and rate/flux, no evidence of additional peak(s)

May 3, 19UT – cot covered; May 5, 06UT in descending branch, 07:30UT not covered

N=8 (!), Rad>7°

η -Aquariids - „Maya-peaks“

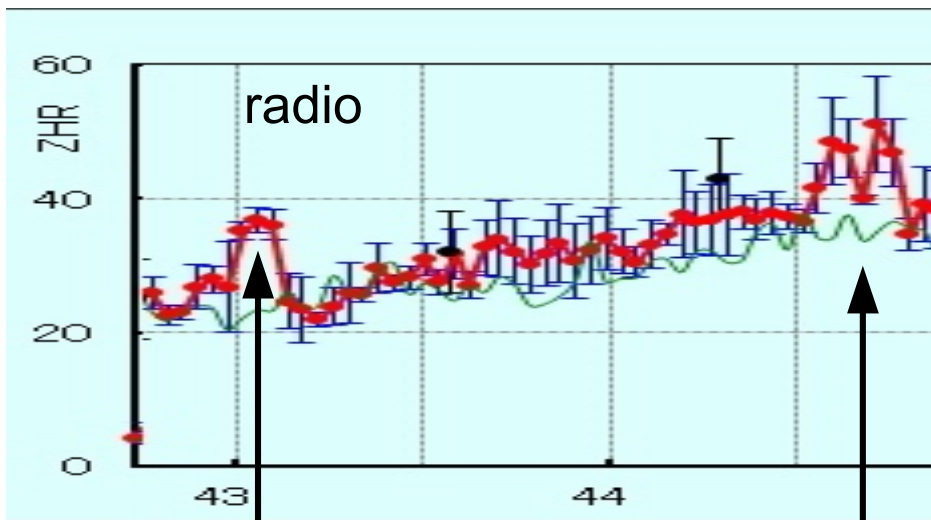
Prediction for 2018 ETA - 164BC-trail:

May 3, 19:11UT

(43.042°)

May 5, 05:49UT, 07:34UT (2)

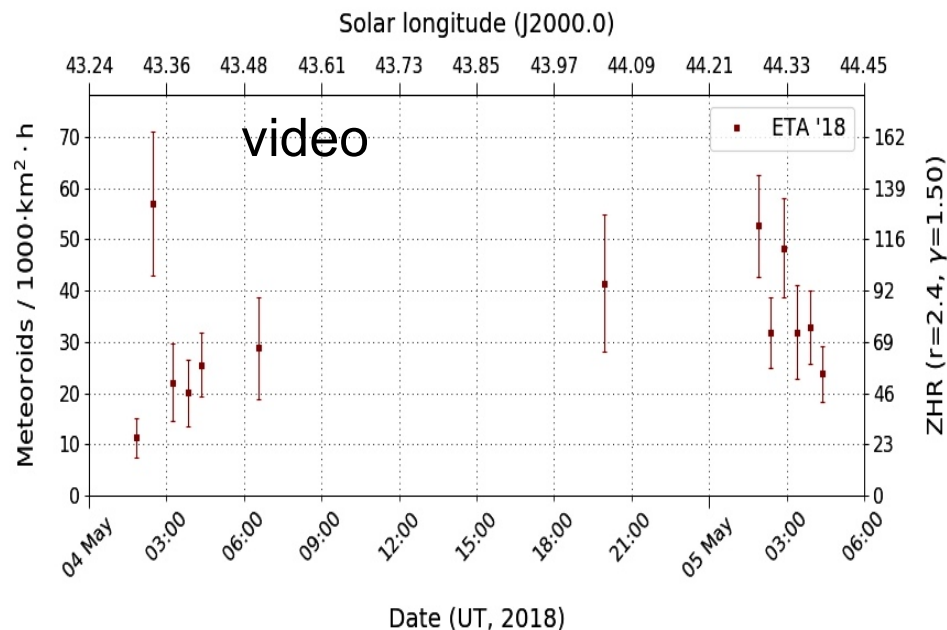
(44.441°; 44.511°)



May 3 19UT signature?

May 5 06-08UT nothing, but peak ~4-6 hours later

(source: Hirofumi Sugimoto, <http://www5f.biglobe.ne.jp/~hro/Flash/index.html>)

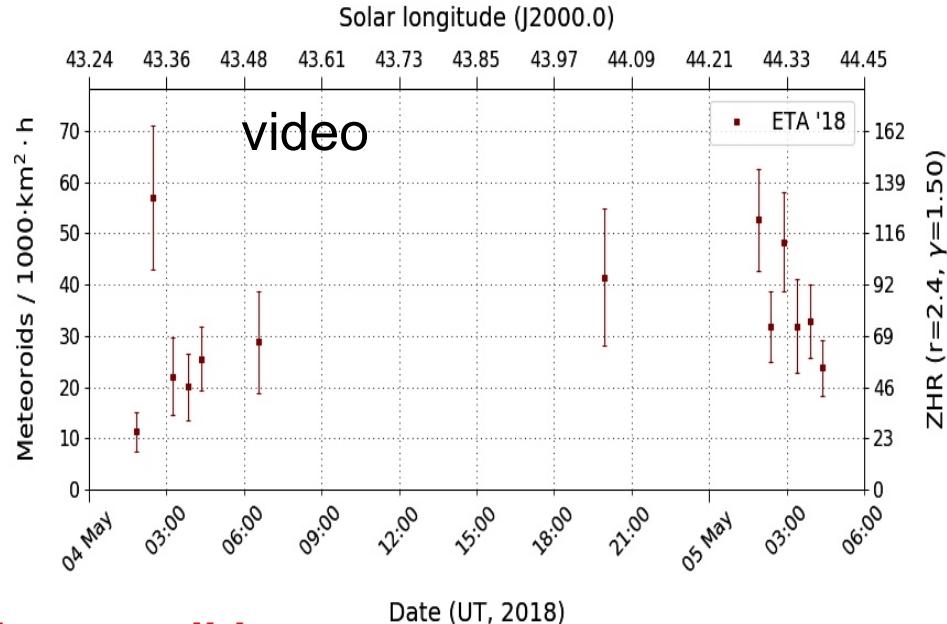
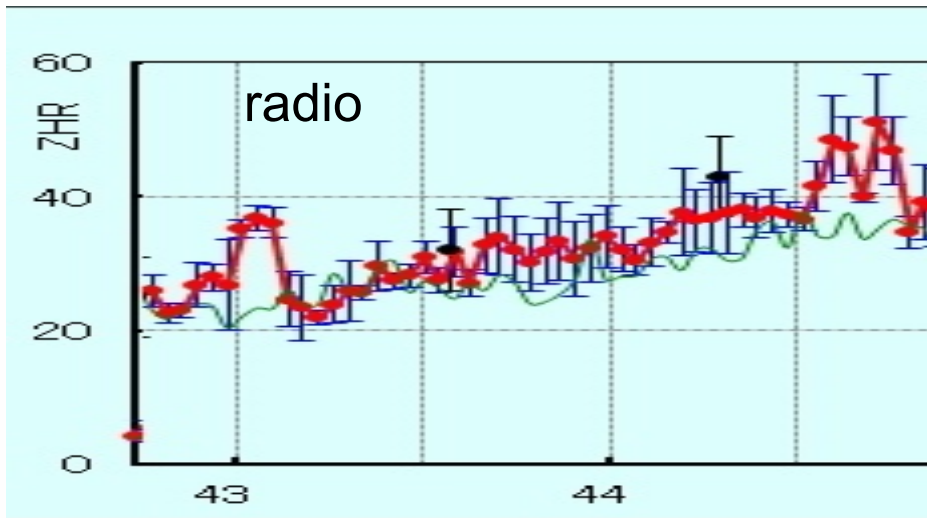


η -Aquariids - „Maya-peaks“

Prediction for 2018 ETA - 164BC-trail:

May 3, 19:11UT (43.042°)

May 5, 05:49UT, 07:34UT (2) (44.441°; 44.511°)



Conclusion: optical data – no decision possible
radio data – weak indications for enhanced rate

September ϵ -Perseids

Annual maximum $166.7^\circ = 2018 \text{ Sep } 9, 16 \text{ UT}$

Assumptions (Sato):

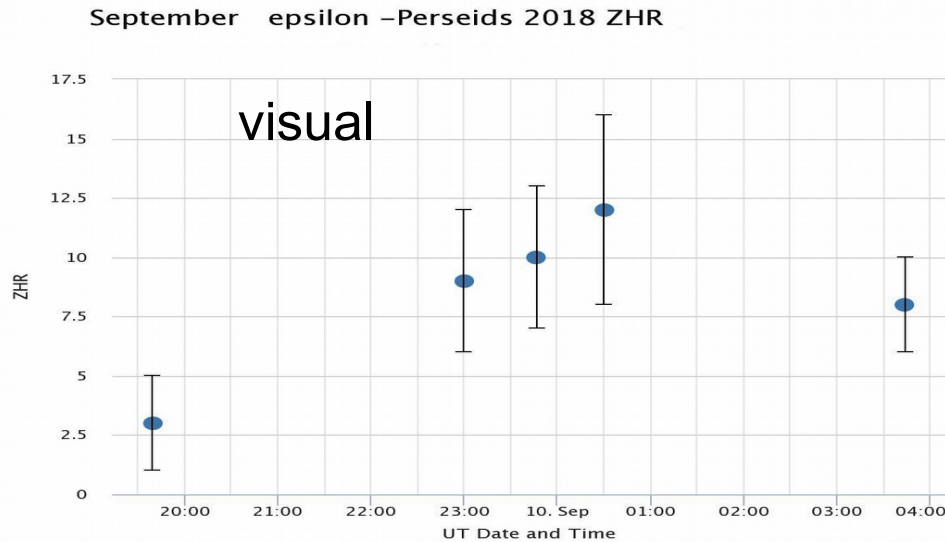
- long period cometary object
- events 2008+2013 related to one dust trail
- 2013 closest to potential parent (for timing)
- activity 2018 Sep 9, 19:12 UT (166.801°)

Lyytinen: next impressive SPE „not before 2040“

SPE 2019 Sep 10, 04:18UT
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September ϵ -Perseids

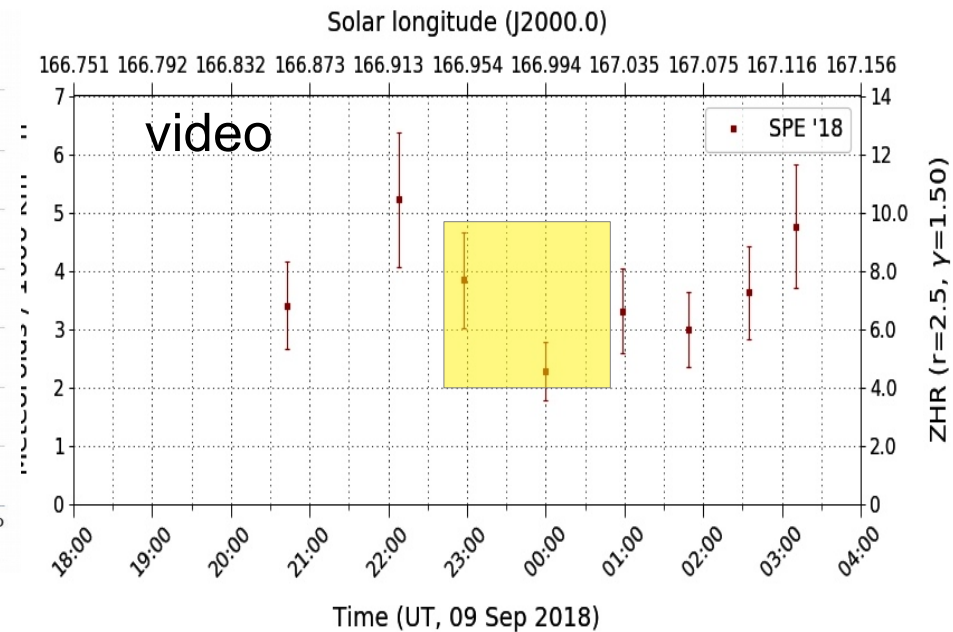
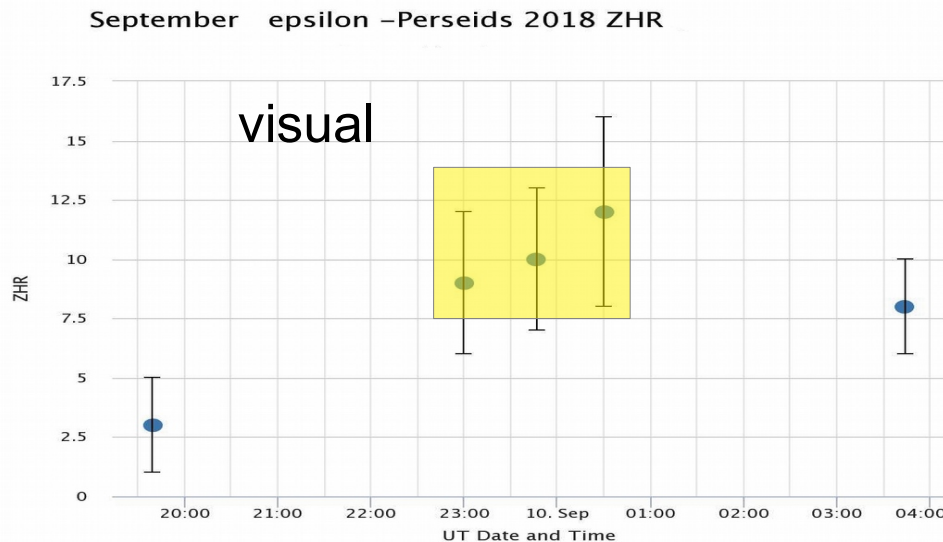
Check period around 166.7° – 166.8° (2018 Sep 9, 16–19 UT)



11 observers (northern radiant!), only 45 SPE
 16 UT no data; 19 UT low ZHR, apparent max. ~00-01 UT (centered 167.0°)

September ϵ -Perseids

Check period around 166.7° – 166.8° (2018 Sep 9, 16–19 UT)

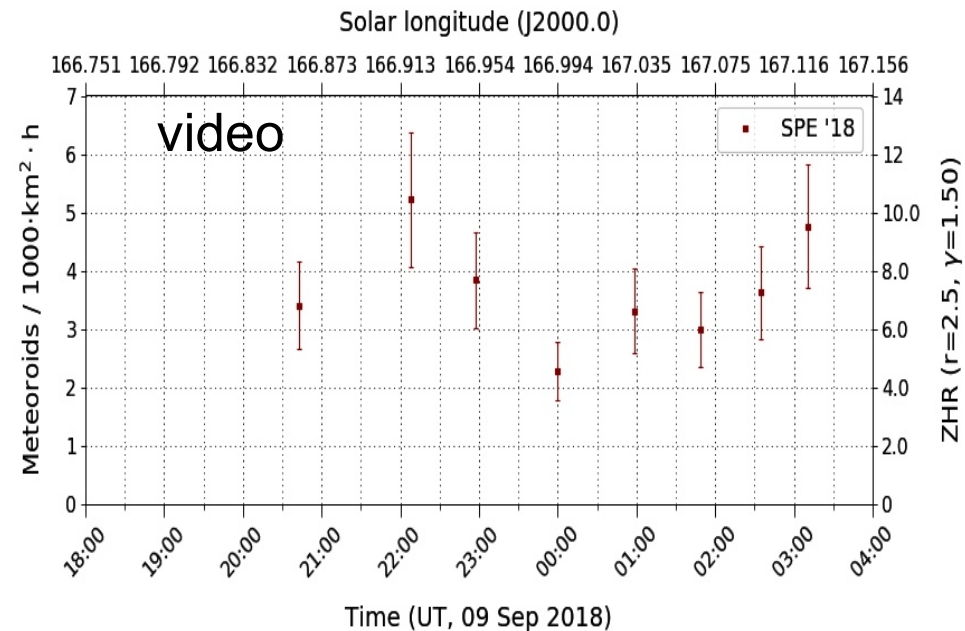
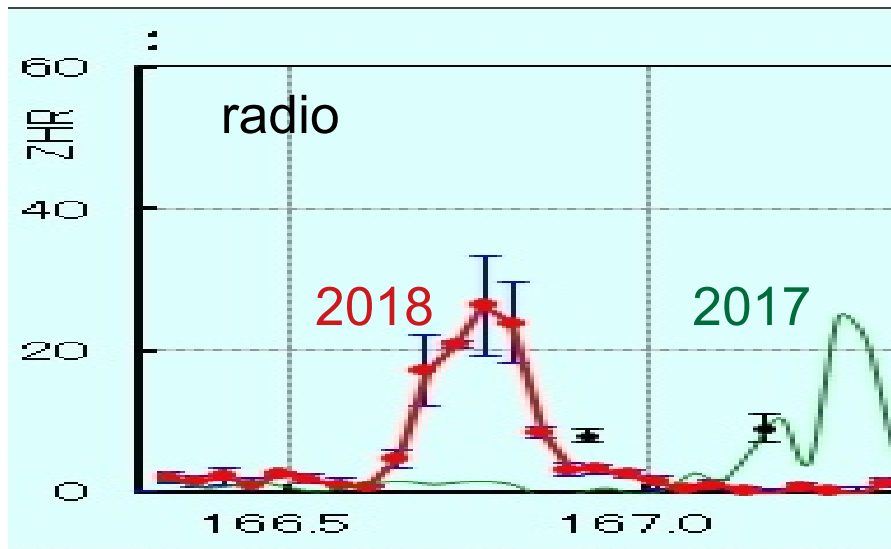


video data: similar situation

16-20 UT no data; apparent max. ~22 UT (166.9°) and 03 UT (167.1°) - last point

September ϵ -Perseids

Check period around 166.7° – 166.8° (2018 Sep 9, 16–19 UT)



Conclusion:

radio single maximum 166.8° (19 UT) \leftrightarrow optical higher activity 166.9° – 167.0°
 no significant peak confirmed independently
 „just normal return“ according to available data

December φ -Cassiopeids

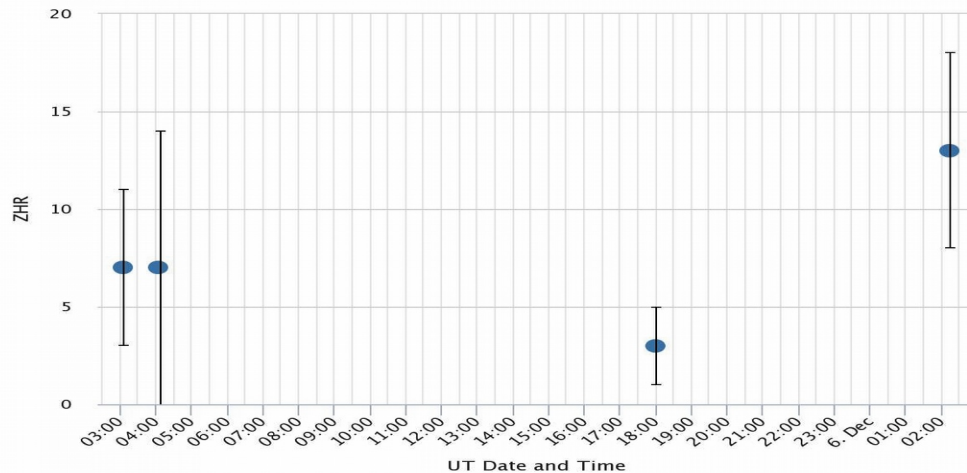
Wiegert et al., 2013: Return of the Andromedids (AJ **145**:70)
return 2011 Dec 3–5 (CMOR radar), dust from 1649 perihelion
„weak to moderate activity“ 2018 early December
centered at $254^\circ \rightarrow$ ca. Dec 6, 10 UT
radiant $24^\circ +50^\circ$ (Cas)
observers encouraged to monitor first week of December 2018
further possible returns: 2023, 2027, ...

December ϕ -Cassiopeids

centered at $254^\circ \rightarrow$ ca. Dec 6, 10 UT
 radiant $24^\circ +50^\circ$ (Cas)

visual: 6 observers, total 15 DPC, 12 in 4 intervals shown

December ϕ -Cassiopeids 2018 ZHR



very weak indication of DPC on Dec 5/6
 last data point: 2 observers (0 and 6 DPC)
 no video data (yet); Sugimoto no analysis of radio data

December φ -Cassiopeids

centered at $254^\circ \rightarrow$ ca. Dec 6, 10 UT

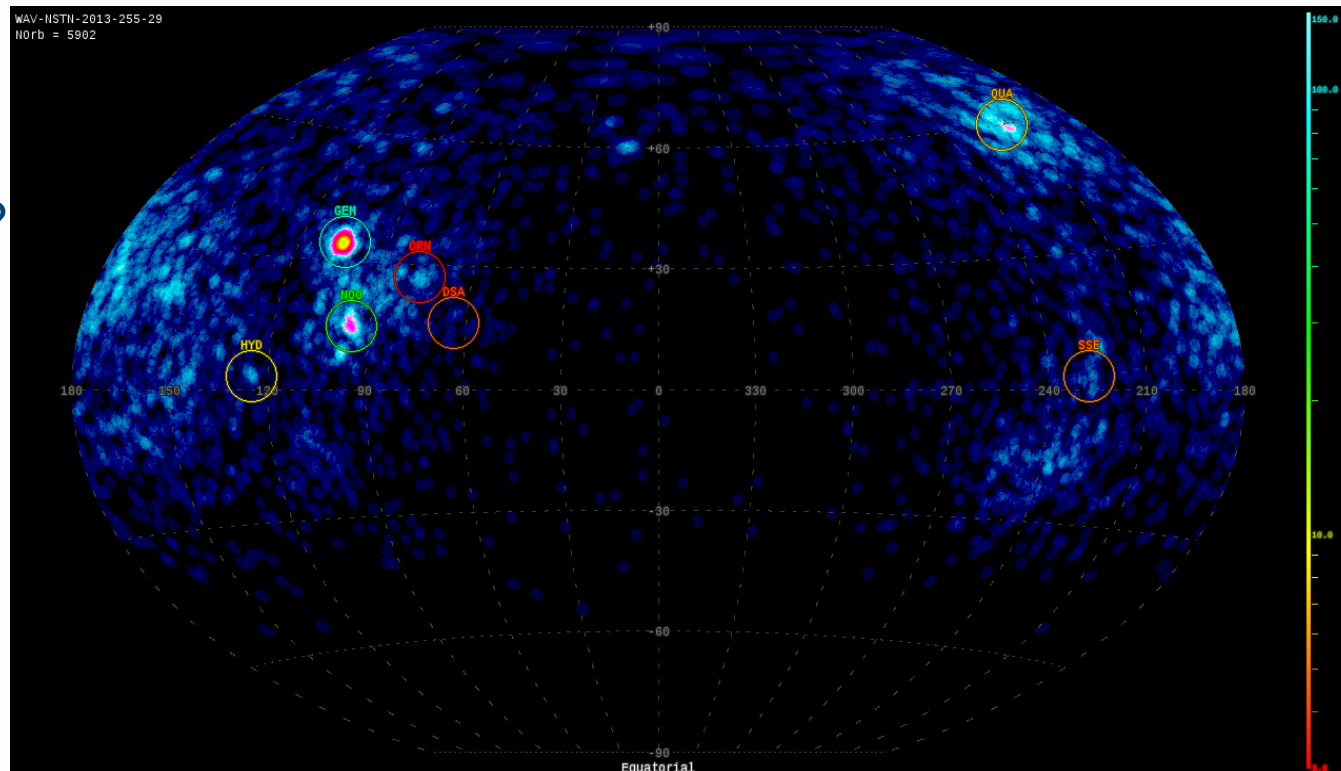
radiant $24^\circ +50^\circ$ (Cas)

wavelet analysis of CMOR data from **2013** (with activity at 255°)

half of 2011

nothing in 2018

perhaps periodic?
(Brown, pers. comm.)



Finally something positive ...

Shown examples seem not exciting

Before the summary and conclusions something encouraging!

Draconids 2018

21P/Giacobini-Zinner perihelion 2018 Sep 10

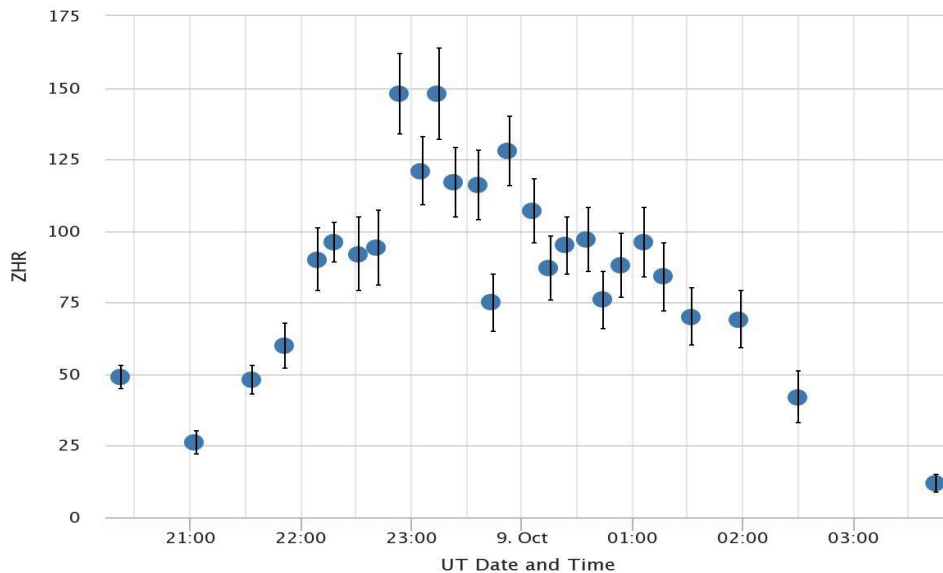
Predicted trail encounters for DRA 2018:

Time	ZHR	Author and remarks
Oct 8, 2331UT	15	Vaubaillon (recent comet ephemerides)
Oct 8, 2334UT	10-15	Maslov (1953 trail, reduced density)
Oct 9, 0014UT	20-50	Sato (1953 trail, comparison with 2011 DRA)

Draconids 2018

Visual: 40 observers, 2016 DRA, 372 intervals, N=50

Draconids 2018 ZHR

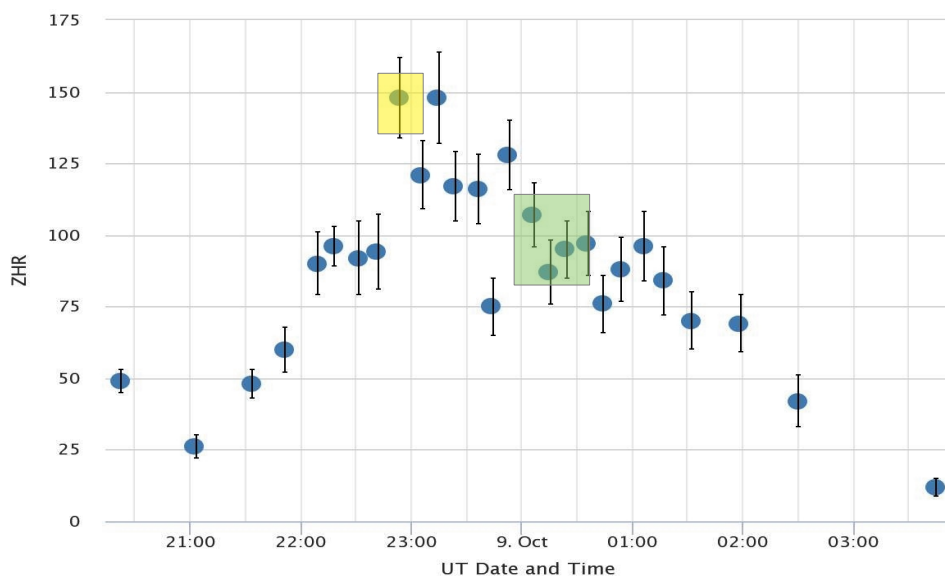


Draconids 2018

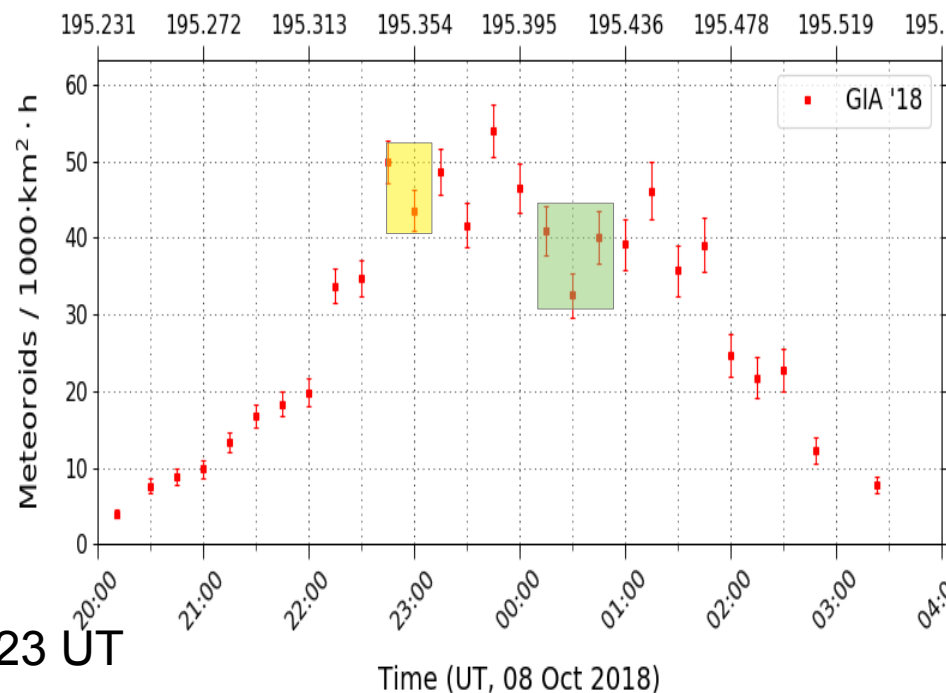
Visual: 40 observers, 2016 DRA, 372 intervals, N=50

Video: N=50, 15min binning

Draconids 2018 ZHR



Solar longitude (J2000.0)

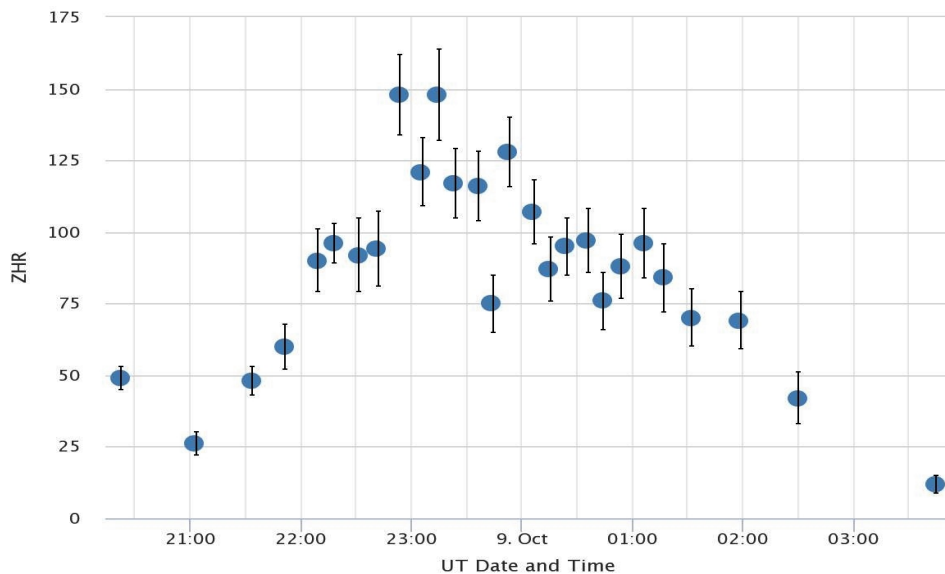


Similar profile: first peak shortly before 23 UT
dip at 0030 UT
slow decrease after 02:30 UT

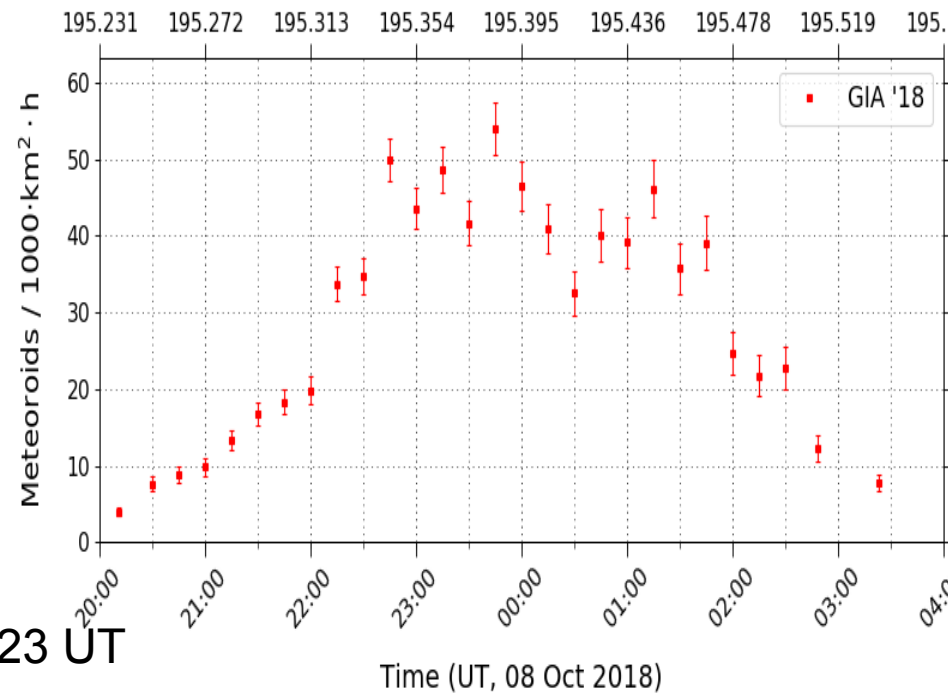
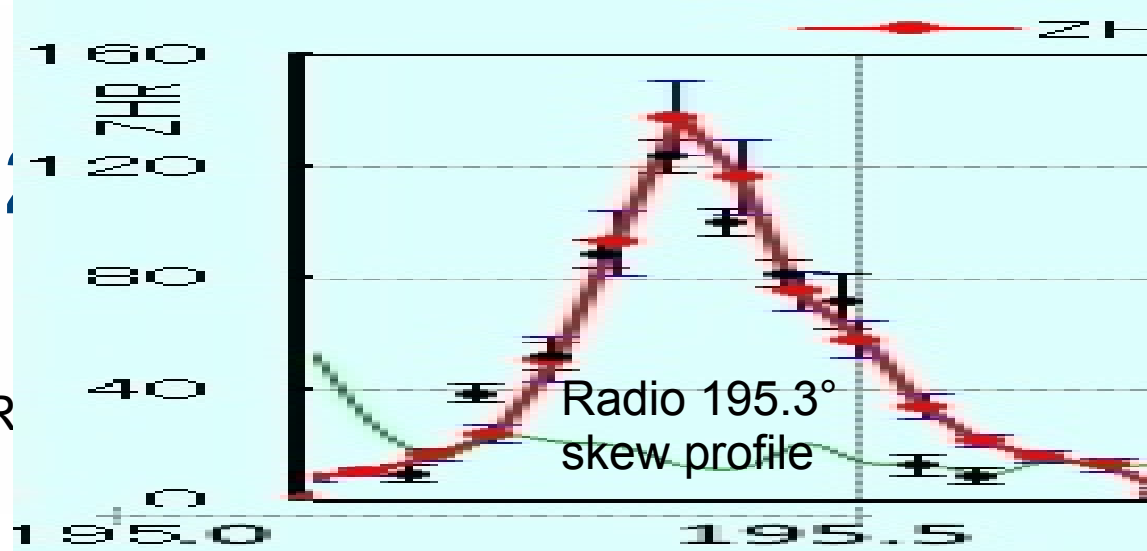
Draconids

Visual: 40 observers, 2016 DR
Video: N=50, 15min binning

Draconids 2018 ZHR



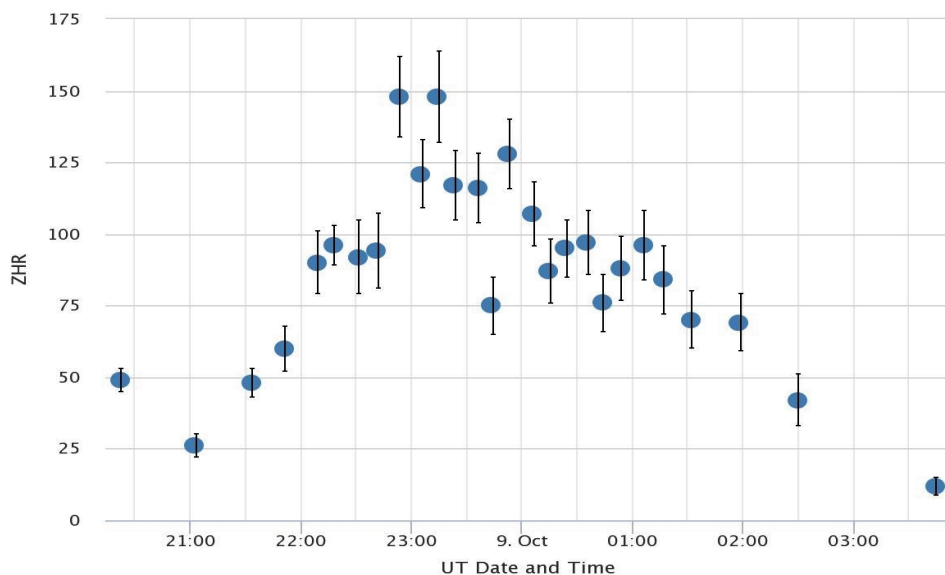
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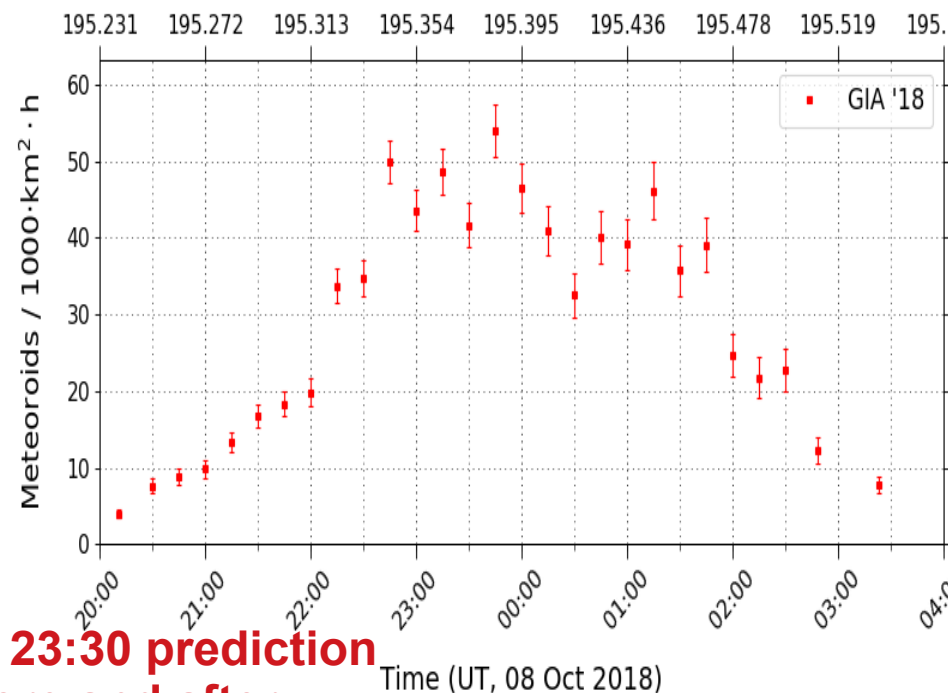
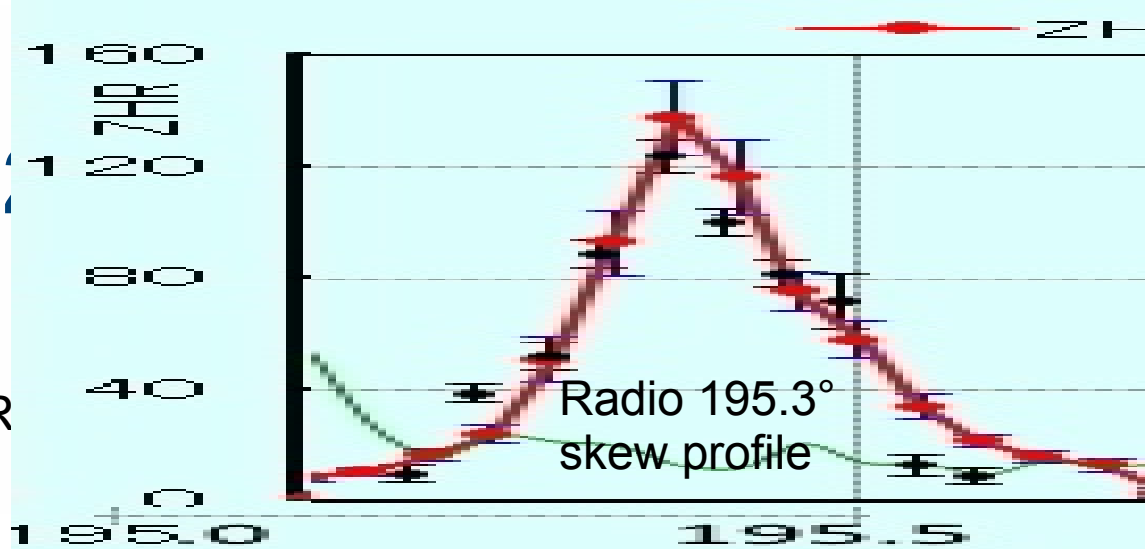
Draconids

Visual: 40 observers, 2016 DR
Video: N=50, 15min binning

Draconids 2018 ZHR



first peak before 23 UT – earlier than 23:30 prediction
00:14 UT → dip, observed peaks before and after
complex maximum, at least 2 peaks



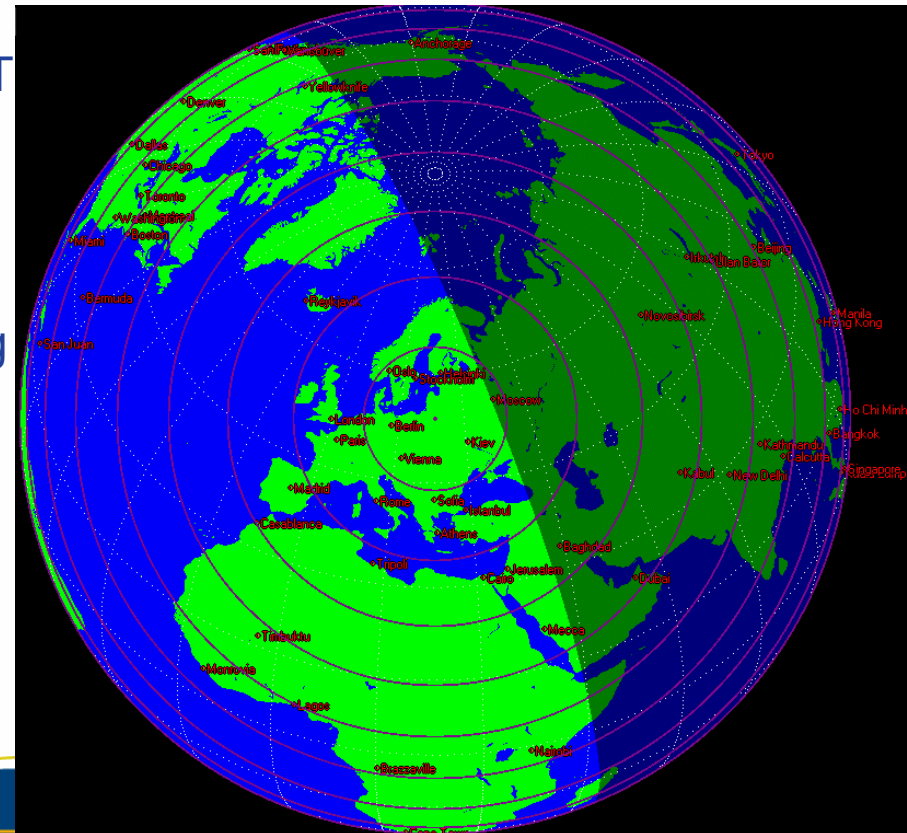
Draconids 2018⁹

Last minute addition – from Mikhail Maslov – be alert!

mail Oct 1: in 2019 the Draconids could again show activity [...] encounter of the 1959 trail [...] quite similar to 1999

expected ZHR $\approx 10-15$ on Oct 8, 14:44 UT
(considering 50 yr trail,
fast ejection, i.e. faint meteors)

best position: Asia
European observers check in the evening
(time differences in 2018: up to 1 hr)

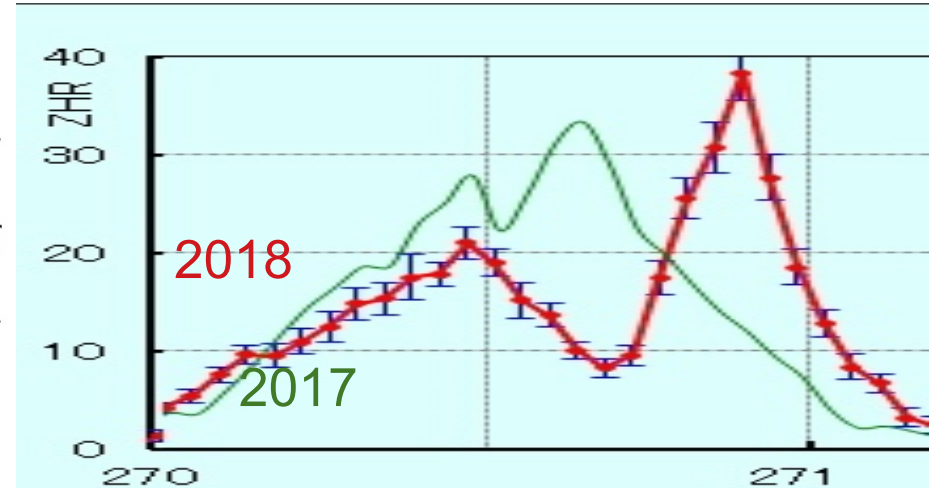
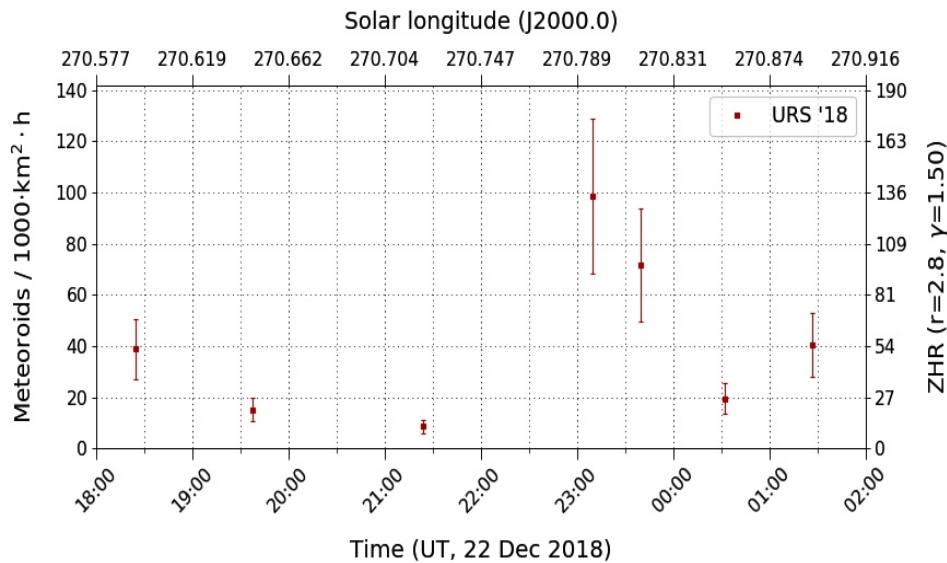


Ursids

Filament encounter Dec 22, 19–20 UT [270.62°-270.66°]

(Jenniskens 2006)

bright moonlight – no visual data, scarce video data, radio data



video flux density higher than average, radio about average

video: flux density max. slightly later at 270.8° (23 UT)

radio: two peaks 270.45°/270.85° (15:00/0030 UT)

data seem to be inconsistent, detailed analysis required

Summary & Conclusions

- May 06 ETA „Maya-peaks“ - some (additional?) activity, but **no clear sign**
- Sep 09 SPE **weak activity**, but not at the predicted position
- Oct 09 DRA **high ZHR (150 vs. 20-50), close to the predicted positions**
- Dec 06 DPC **below the detection limit** for optical and radar observations
- Dec 22 URS **weak signs of filament** encounter in video and radio data

Evidence of modelled encounters found in several cases, comparing models
Curiosity! Are the postulated parent objects out there?
Fascination of detecting interplanetary matter along the Earth's orbit, feel the Earth
crossing a stream
Alert many observers (for good coverage)
Shower calendar has now an overview of possible minor events

A circular astronomical image showing a dense field of stars. A bright, white comet streak is visible in the upper left quadrant. The text "Thank you" is centered in the image.

Thank you

photo Peter van Leuteren, Dec 2018