



GEMINIDS 2012
A spectacular show
from Oman

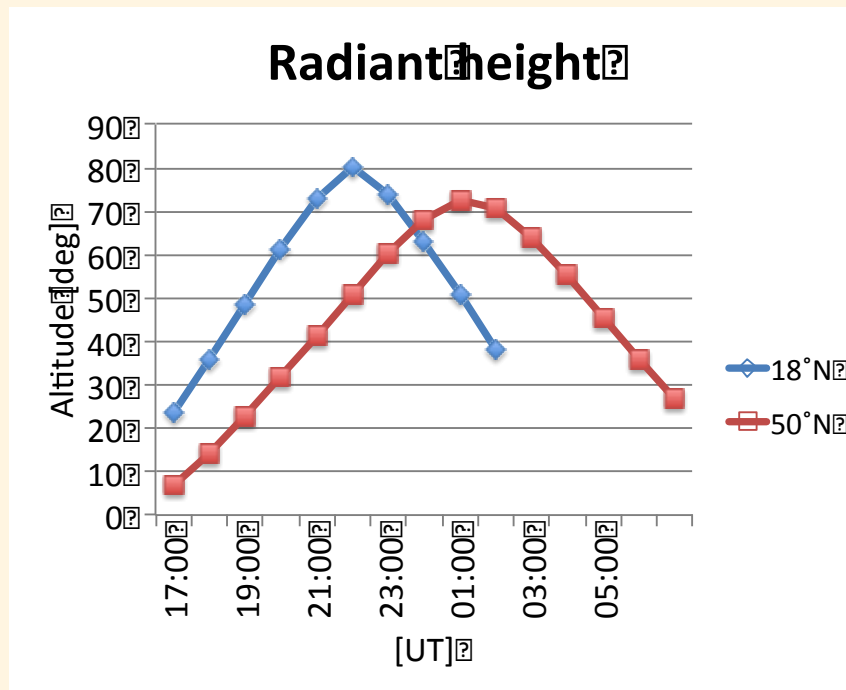
Thomas Weiland - Felix Bettonvil

CONTENT

- Why observing the Geminids from Oman?
- Oman
- Observing campaign 2012
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Why observing the Geminids from Oman?

- Similar radiant heights in Central Europe and Oman
- Chance of clear skies in Oman up to 85 %, dark desert areas
- Oman is a well developed and safe country



Oman



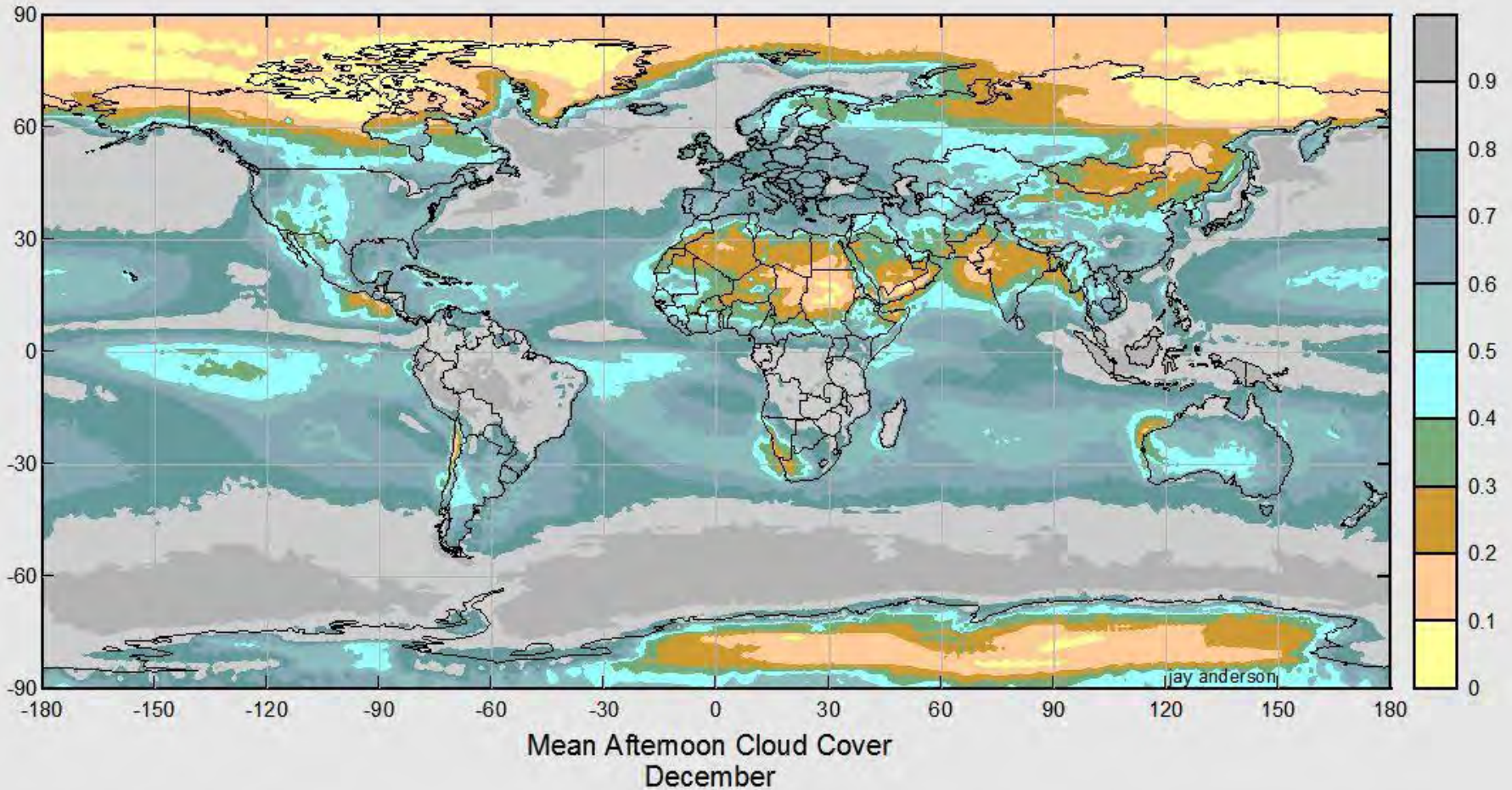
Political map of the Arabian Peninsula



Physical maps of Oman

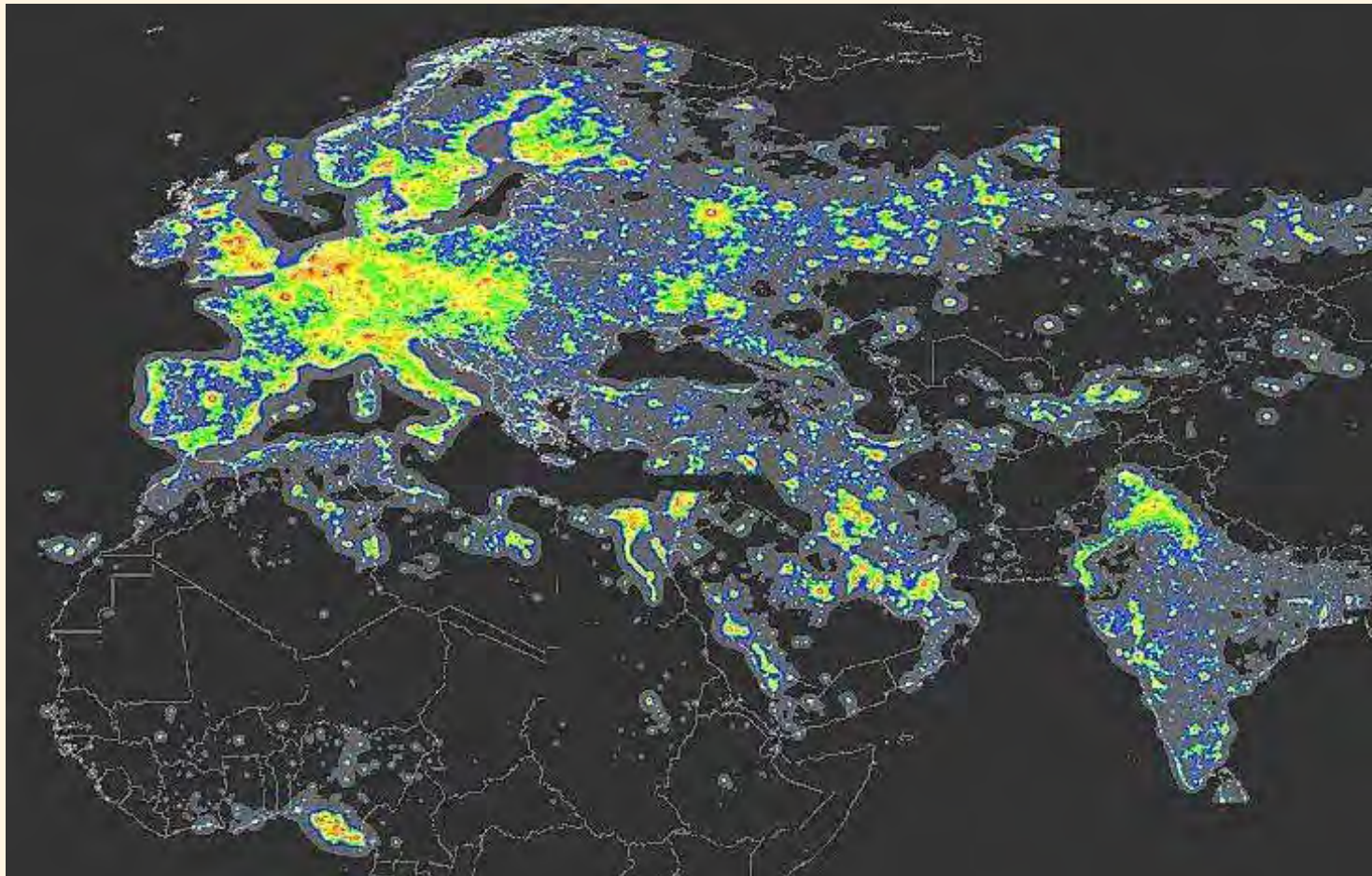


Oman



Mean afternoon cloud cover in December © Jay Anderson

Oman



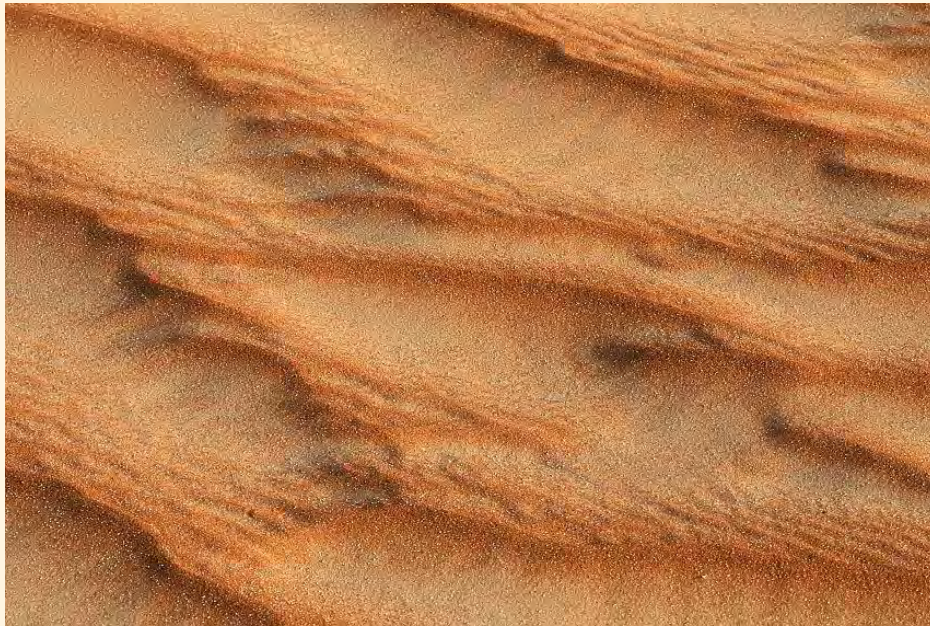
Light pollution in Europe, Northern Africa and Western Asia

Oman



Rub al-Khali Desert

Oman



Rub al-Khali Desert



2012 Observing campaign

- December 10/11 - 15/16
- New Moon December 13
- Observers: WEITH, BETFE
- Visual
- 6 nights, 43.81 hrs effective observing time
- Lm on average 6.06 - 6.50
- 1811 GEM in total

Results – Statistics

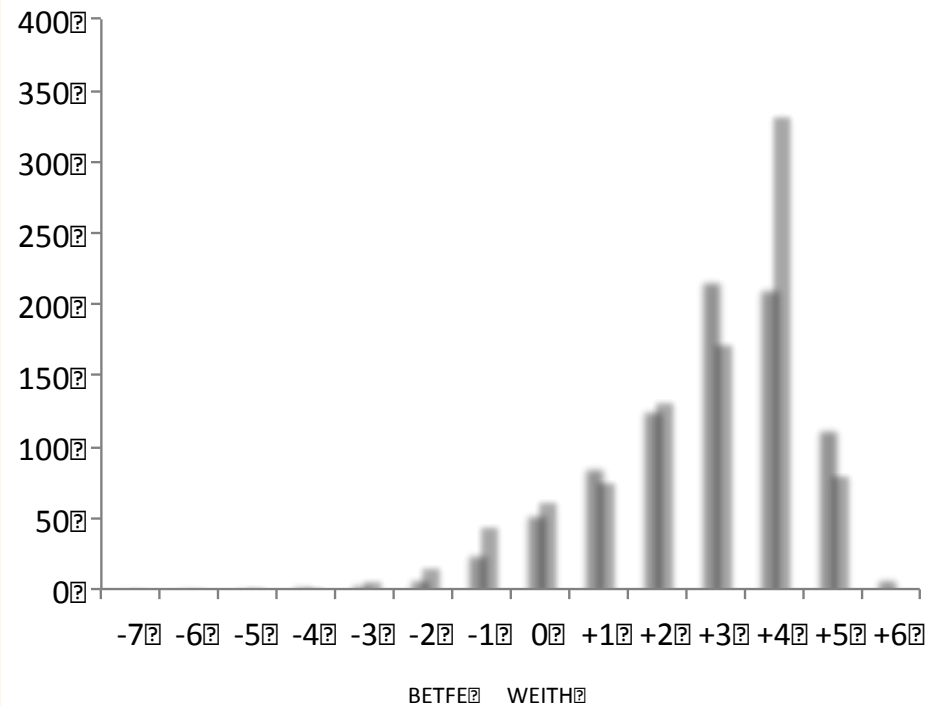
Date	Start	End	Teff	Lm	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	TOT	obs
10-dec-12	20:55	00:00	3,17	6,06	0	0	0	0	0	0	0	0	2	4	8	2	3	0	19	BETF
10-dec-12	20:30	23:30	2,90	6,10	0	0	0	0	0	0	1	2	1	5	8	21	7	0	19	WEITH
11-dec-12	21:01	00:00	2,83	6,35	0	0	0	0	0	0	1	1	7	5	15	19	10	3	61	BETF
11-dec-12	20:30	23:30	3,19	6,50	0	0	0	0	0	0	1	7	22	23	34	91	27	0	45	WEITH
12-dec-12	20:55	01:10	3,33	6,25	0	0	0	0	1	2	0	4	13	14	38	46	21	3	142	BETF
12-dec-12	21:00	01:00	3,98	6,45	0	0	0	0	1	2	1	7	22	23	34	91	27	0	208	WEITH
13-dec-12	17:05	01:45	7,77	6,28	0	1	2	3	4	7	24	45	62	97	142	115	61	2	565	BETF
13-dec-12	16:45	01:45	8,06	6,48	1	2	3	2	6	15	42	51	49	93	117	184	39	0	604	WEITH
14-dec-12	21:08	01:00	3,72	6,13	0	0	0	1	0	0	1	3	2	7	12	29	14	1	70	BETF
14-dec-12	21:30	00:30	3,00	6,50	0	0	0	1	1	0	2	2	2	8	8	31	5	0	60	WEITH
15-dec-12	22:35	23:52	1,87	6,10	0	0	0	0	0	0	0	1	1	0	3	1	5	0	11	BETF
15-dec-12	22:15	23:15	0,97	6,35	0	0	0	0	0	0	0	0	1	0	0	3	3	0	7	WEITH

43,81 observing hours

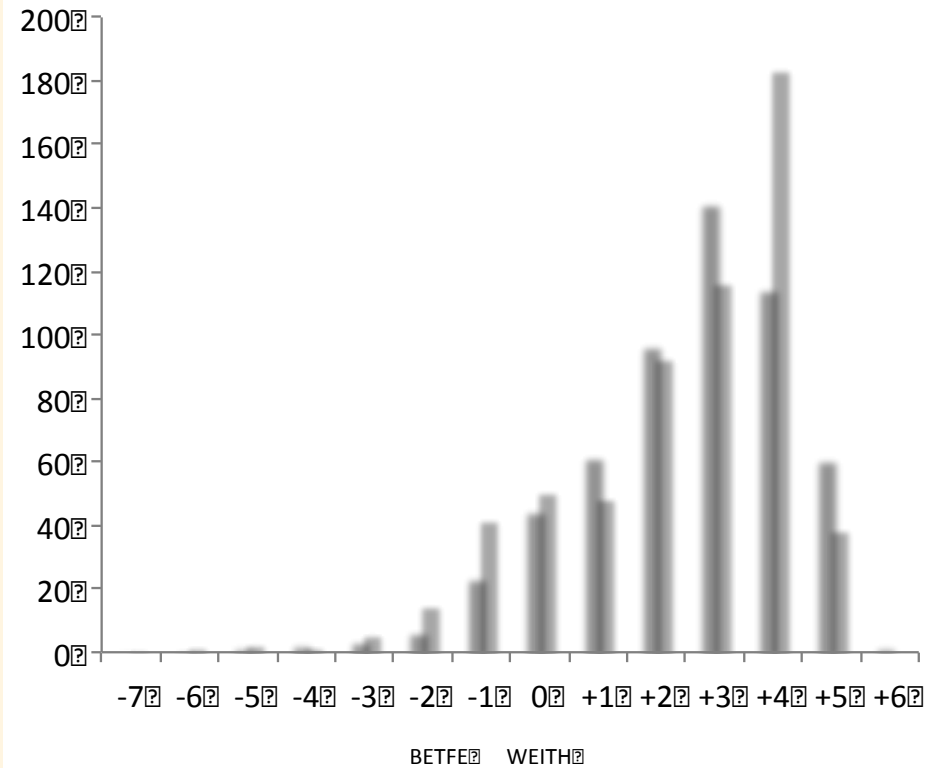
1811 SUM

Results – GEM magnitude distribution

Magnitude Distribution GEM all nights

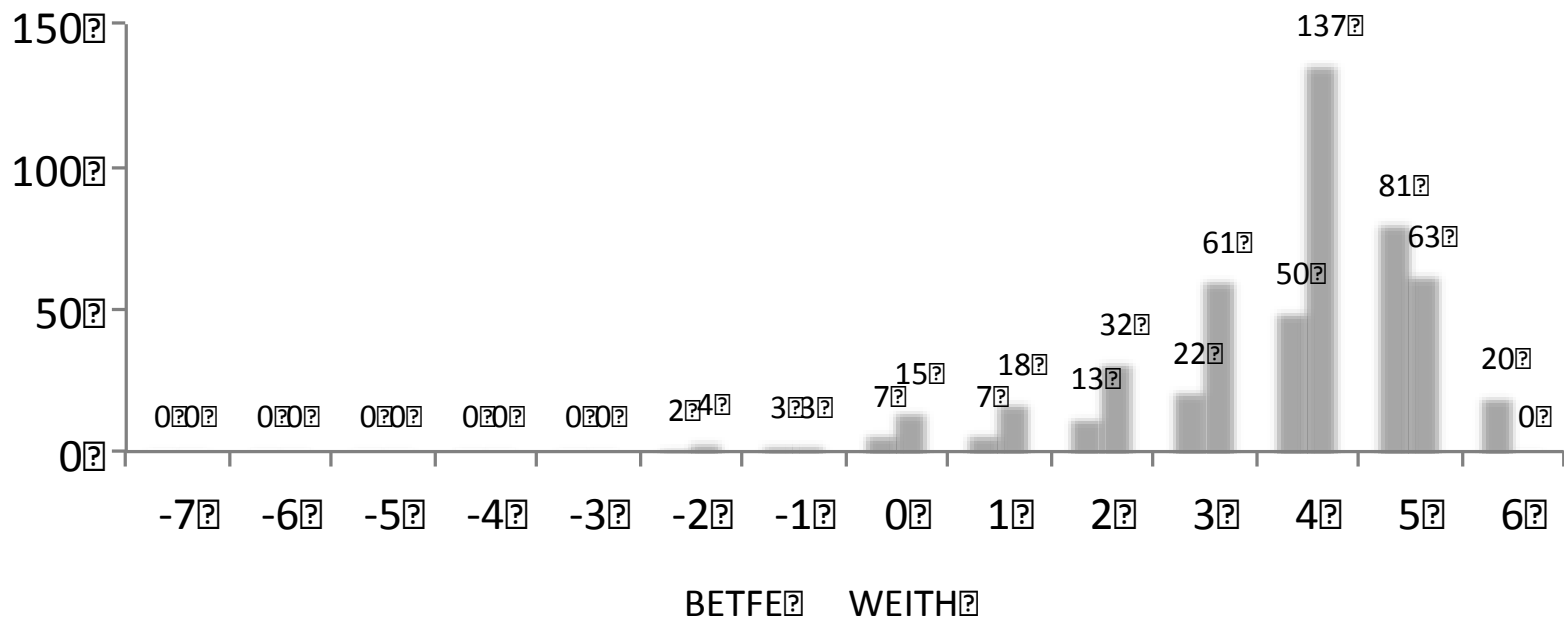


Magnitude Distribution Dec 13/14



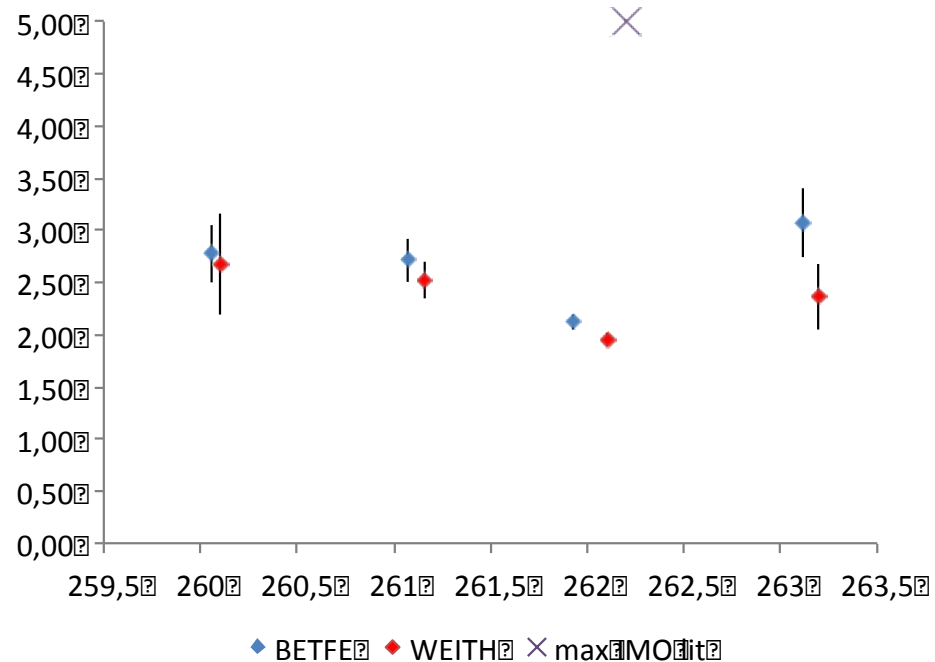
Results – SPO magnitude distribution

Magnitude distribution SPO

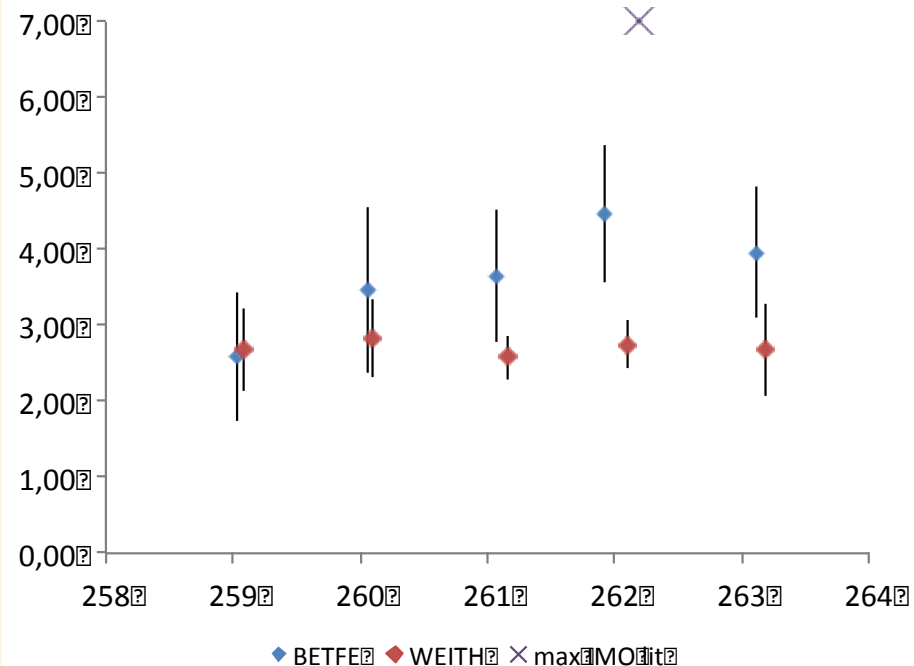


Results – GEM, SPO population index

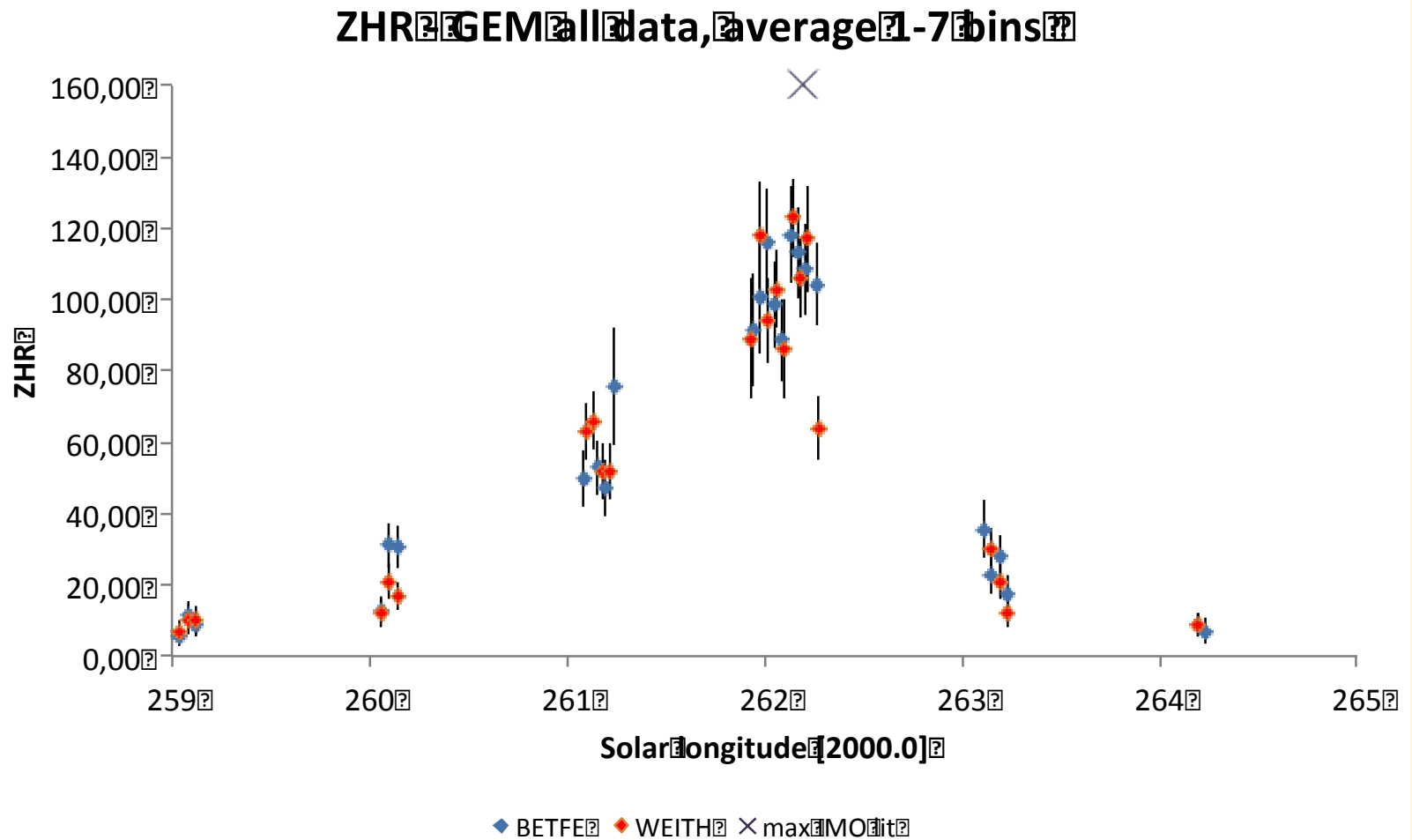
r² GEM avg of all data per night
error bars



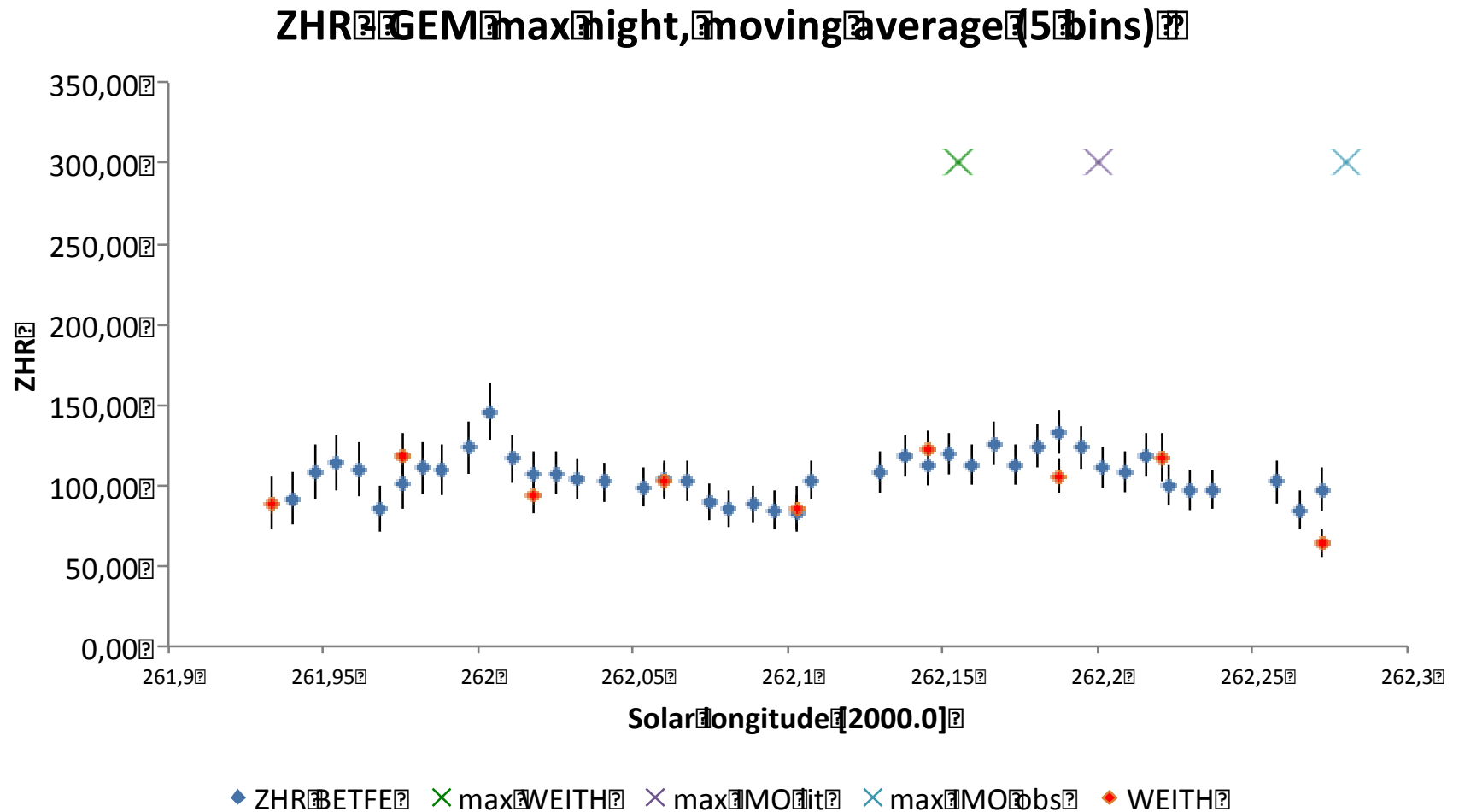
r² SPO avg of all data per night
error bars



Results – ZHR



Results – ZHR – maximum night



Results – General Appearance

□ Trains:

2 % left a train (-7 to +3 magnitude class),

9 % a short train (-6 to +4 magnitude class)

□ Colours:

yellow: 62 %

white: 21 %

blue: 9 %

orange: 7 %

green: 1 %

Results – Photography



Results – Fireballs

- Spectacular fireball array during maximum night (Dec 13/14)
- 15 (combined BETFE / WEITH) fireballs counted; magnitudes ranging from -3 to -7
- Times / magnitudes (WEITH):

19:25:15 UT: -4 23:22:05 UT: -3

19:32:00 UT: -3 23:22:20 UT: -4

20:48:50 UT: -5 23:33:00 UT: -3

20:55:20 UT: -3 23:38:05 UT: -5

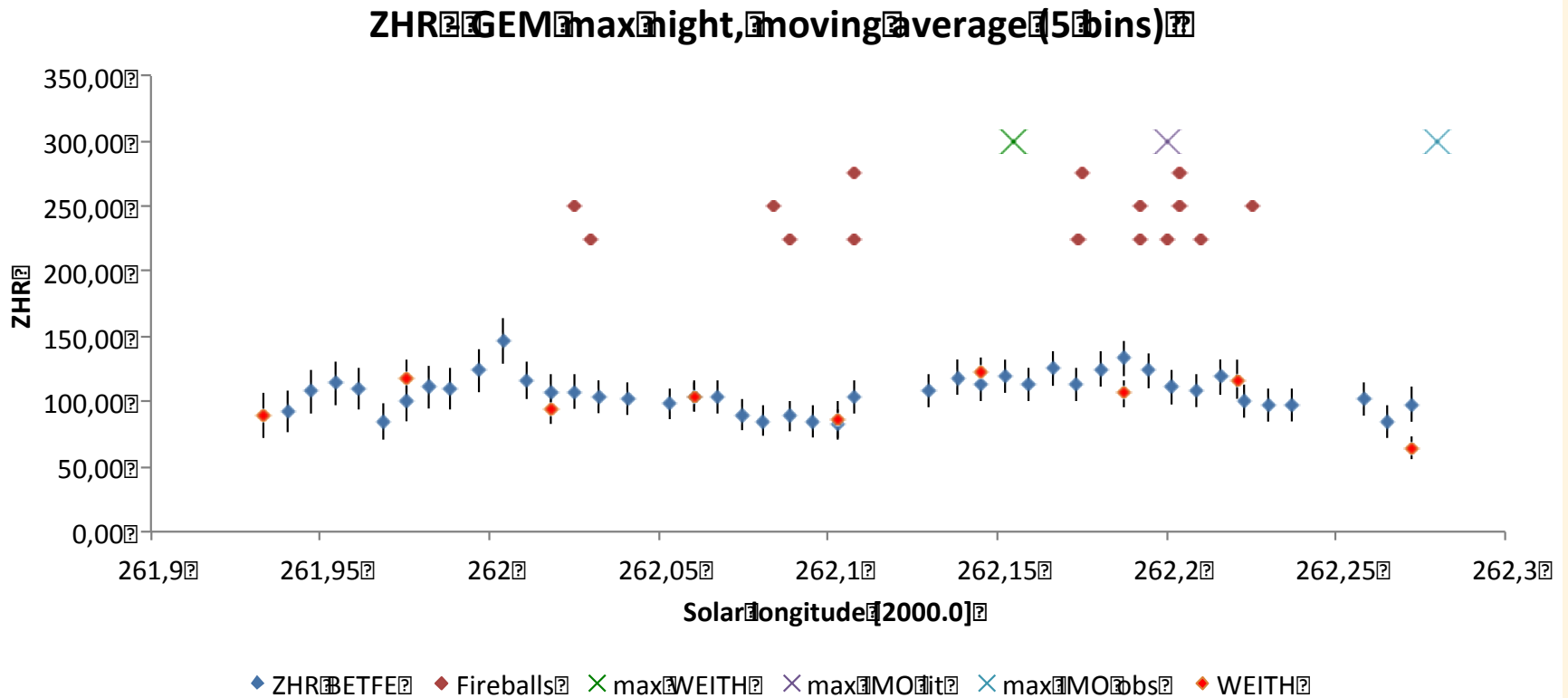
21:22:00 UT: -3 23:38:40 UT: -6

21:22:35 UT: -6 23:47:15 UT: -3

22:56:05 UT: -3 00:08:15 UT: -5

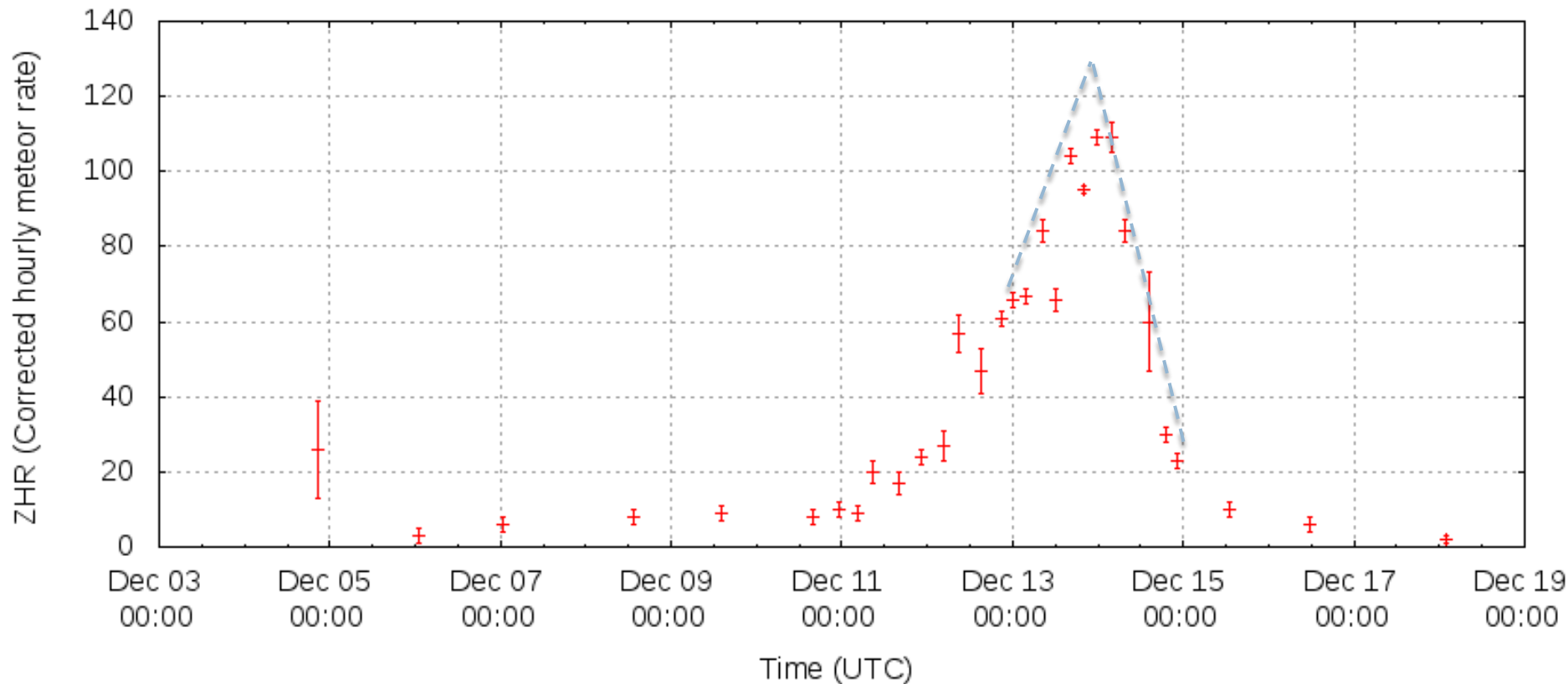
22:57:25 UT: -7

Results – Fireballs vs. GEM maximum



Results – Comparison

- IMO Live ZHR Graph with added trendline BETFE/WEITH



Conclusion

- **r-values** comparable to previous returns, dip around maximum
- **ZHRs** definitely lower than in 2004 (last moonless return within equal time window)
- **Maximum time** in line with prediction (less than 1^h earlier)
- Unusual concentration of **fireballs** within a short time span (4,7^h), centered around maximum (untypical)
- Probably no correlation between occurrence of fireballs and distance **(3200) Phaethon** – earth, Dec 14, 0^h UT (2012: 1,712 AE; near maximum value)
- Yellow meteors dominating over blue ones in 2012 – an indication of various **Na-depletion** for different meteoroids?

Future work

In comparison with previous returns the 2012 observational results may give rise to questions about the **evolution** of the stream:

- Have the GEM maximum rates already peaked at the turn of the century (*Miskotte et. al., 2011*) or will they steadily increase until 2050 (*Jones and Hawkes, 1986*)?
 - Is the percentage of bright GEM still on the rise (peaking together with highest rates; *Jones and Hawkes, 1986; Williams and Wu, 1993*)?
- Moonless returns in **2015, 2017** and **2020** offer excellent opportunities to prove this!

Thank you for your attention!

