

Role of the Lower Positive Charge Region (LPCR) in initiation of the Thunderstorm Ground Enhancements (TGEs)

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The objective of our study

- * ***Electric field disturbance***
- * ***Thunderstorm Ground Enhancement (TGE)***
- * ***Lower Positive Charge Region(LPCR)***
- * ***Lightning activity during TGE***

Monitors

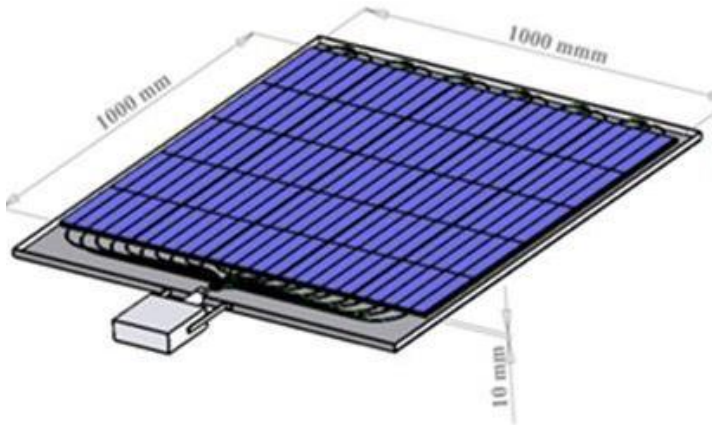


**Electric Filed Monitor
Boltek EFM-100**

**Lightning Detector
(Boltek StormTracker)**

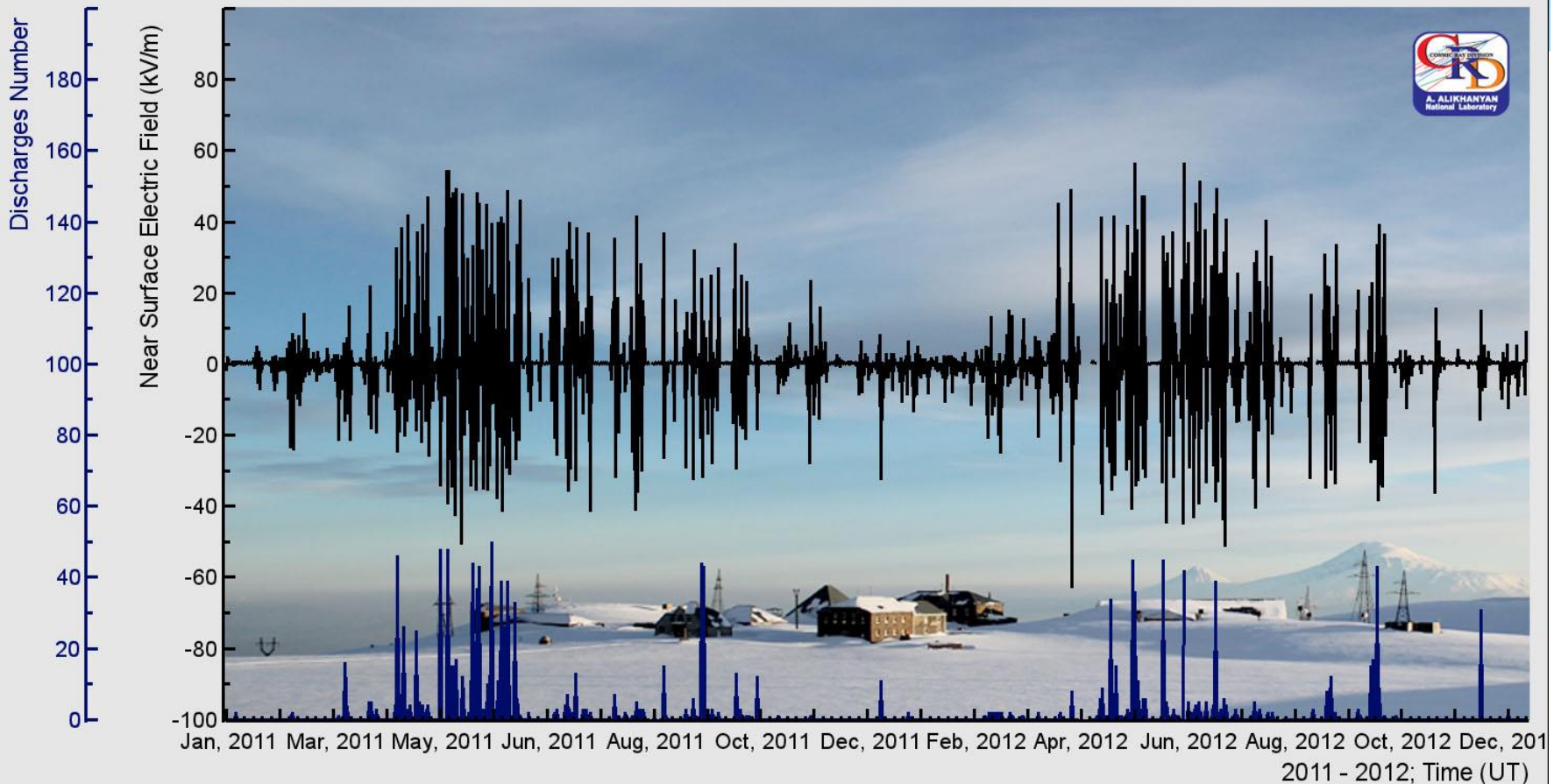


3cm Plastic Scintillator



- * **Outside 5 cm plastic scintillator detectors**

Annual pattern of electric field and IC-lightning occurrences within 3km



Lightning types

Intracloud (75%)

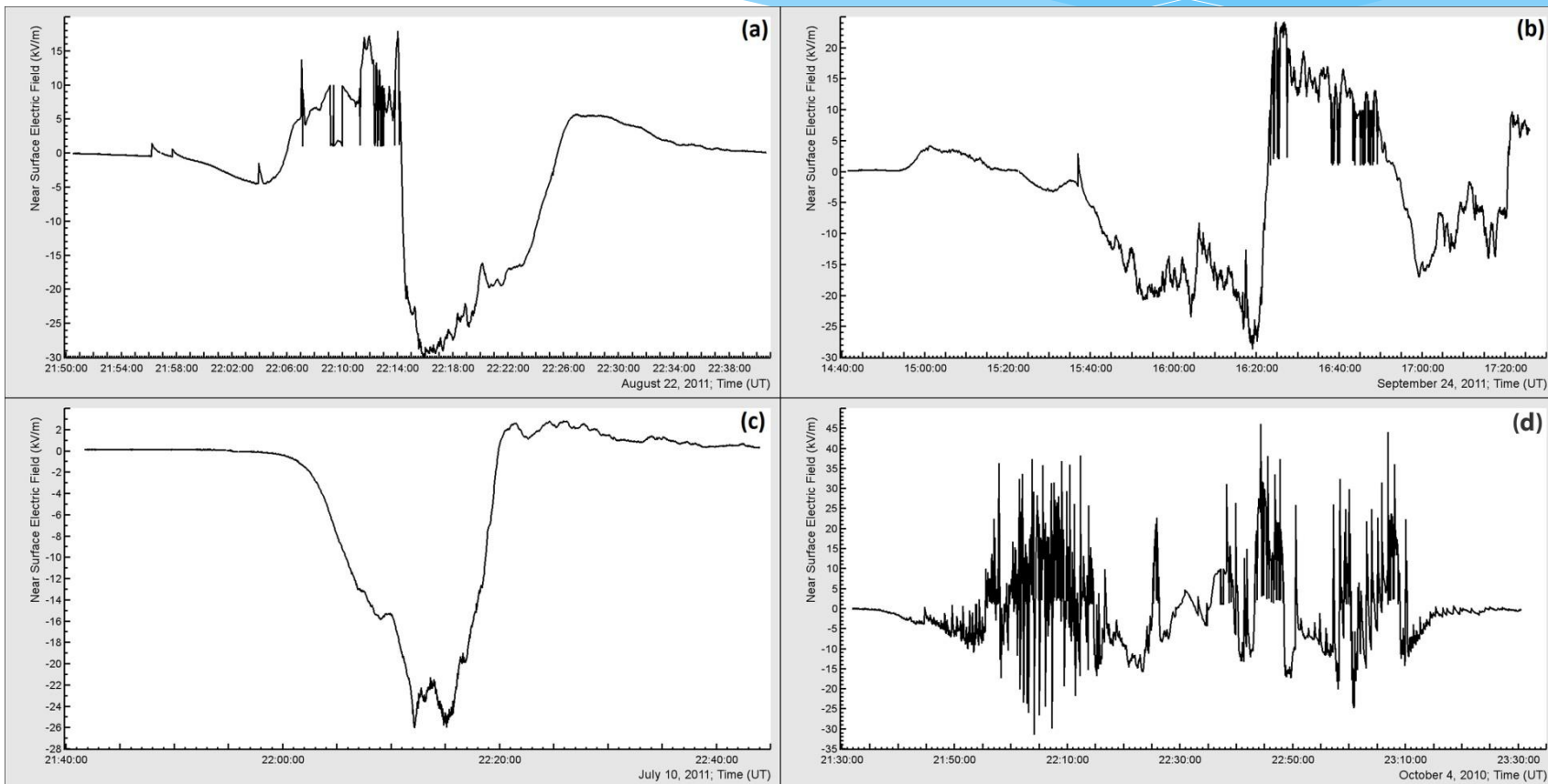
Cloud to ground (25 %)

IC - }
CG- } 95%

IC+ }
CG+ } 5%



The pattern of the electric field disturbance during TGE events on Aragats.



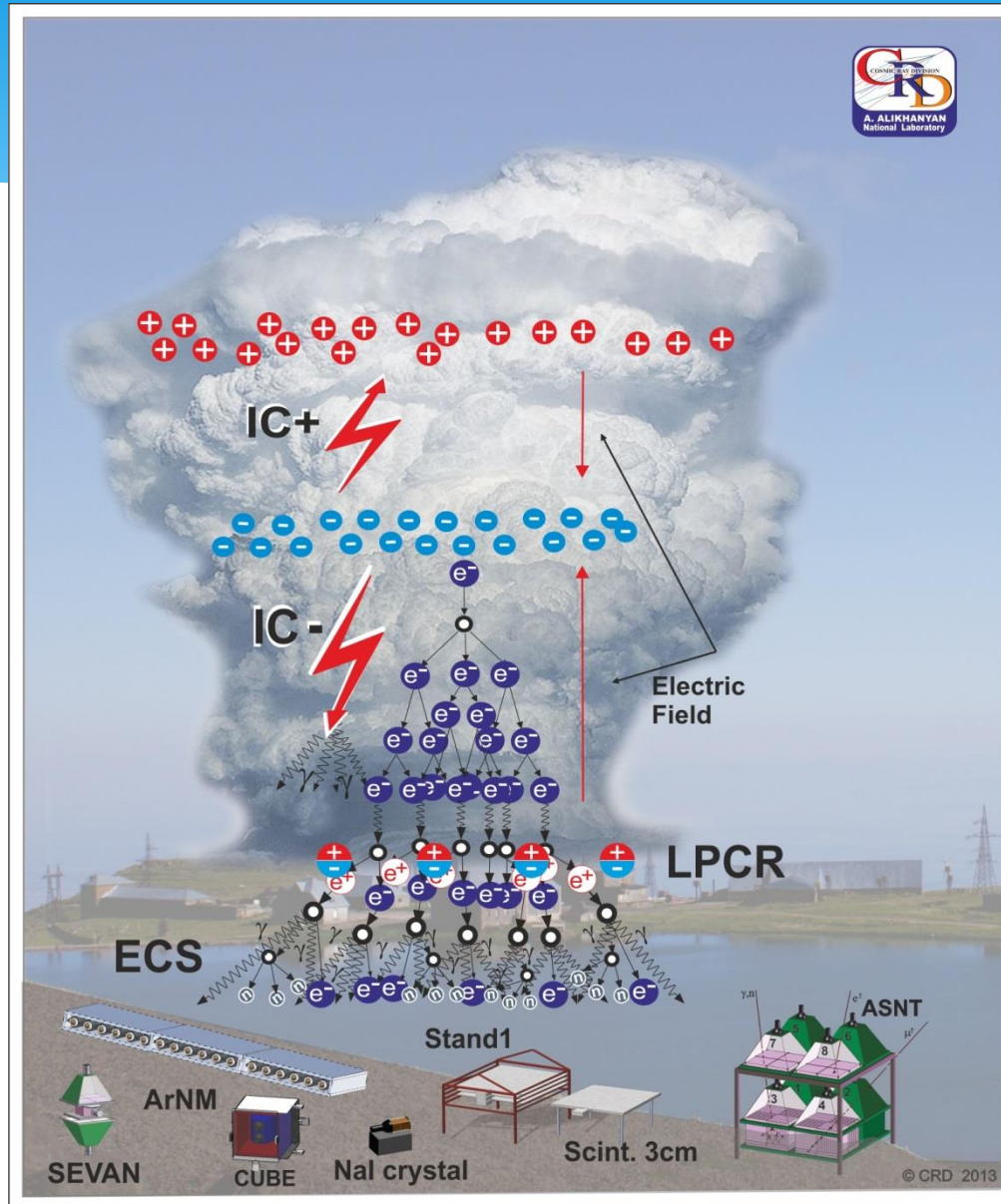


From October 2010 to May 2013

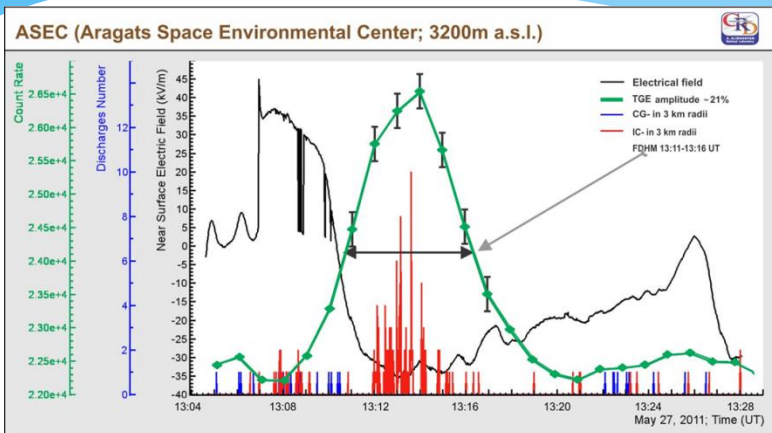
~150 TGE events

18 events

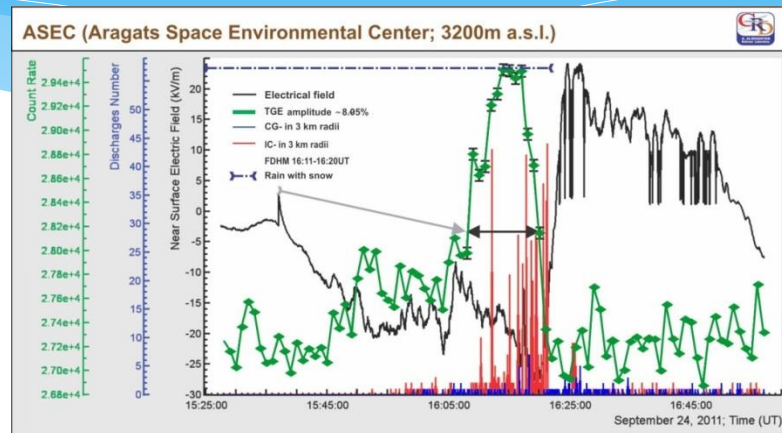
Lower Positive Charge Region(LPCR)



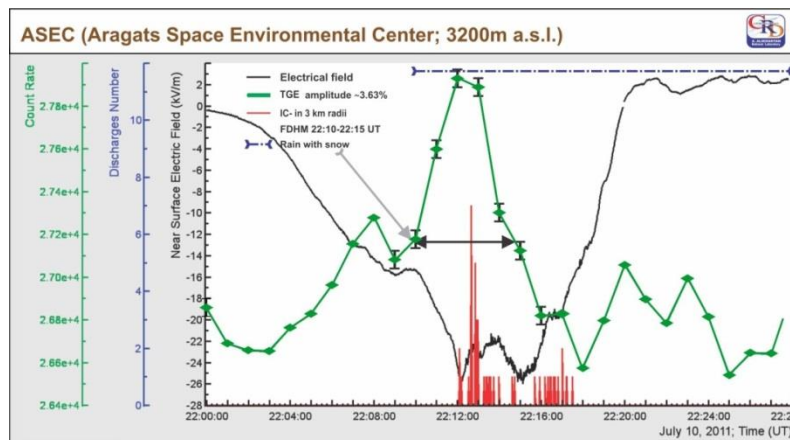
TGE Types



First type



Second type



Third type

First type

1st type

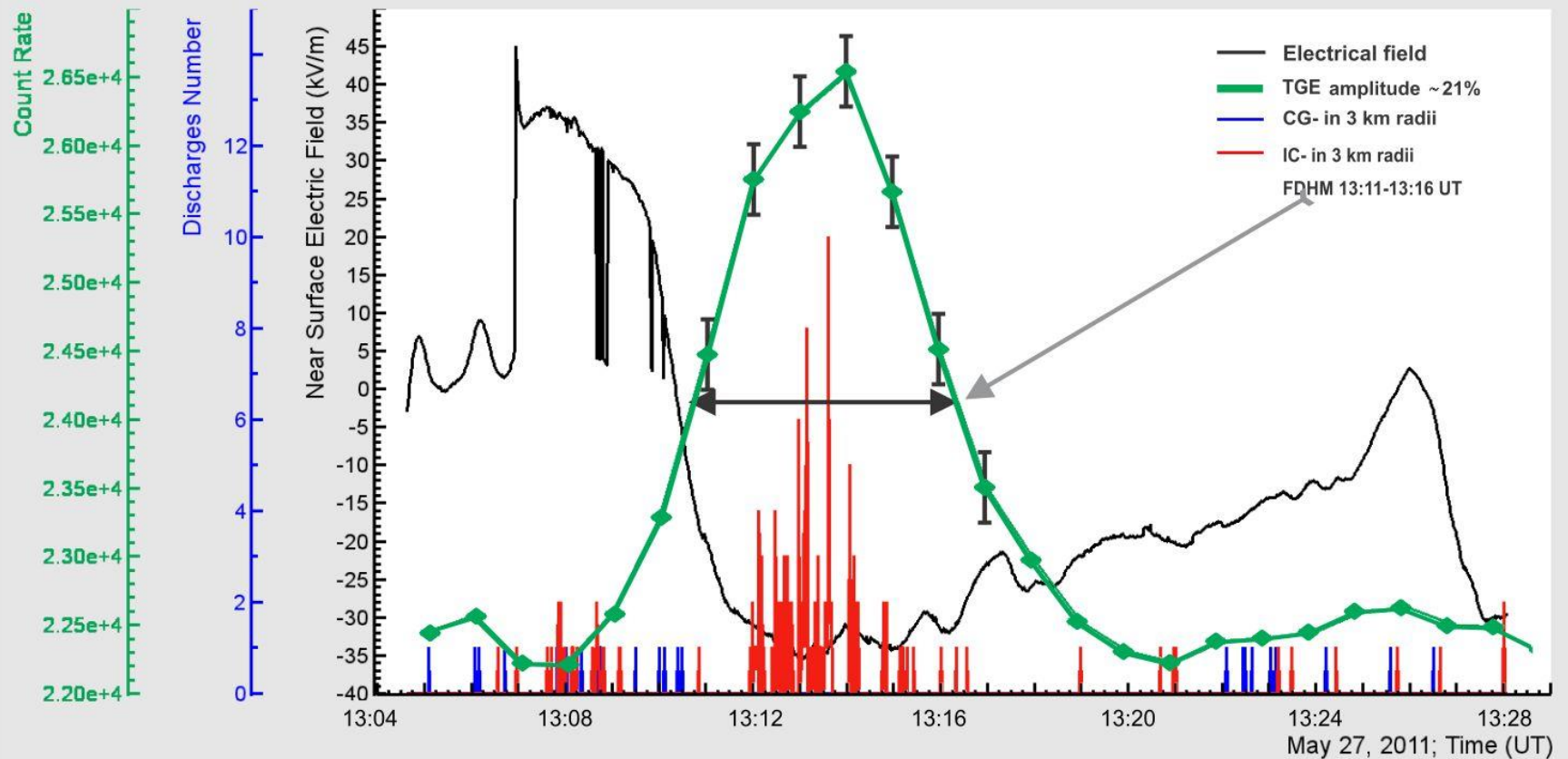
Date	Duration of positive field	Maximal value of electric field	Duration of negative field	Minimal value of electric field	FDHM of TGE	Flux increase (max flux minute)	Rain duration
04.10.2010	18:14-18:20	28,8 kV/m	18:20-18:25	-28,8 kV/m	18:22-18:23	76%	missing data
24.05.11	13:17-13:26	22,15 kV/m	13:26-13:40	-35,2 kV/m	13:29-13:38	3%	missing data
27.05.11	13:05-13:10	45 kV/m	13:10-13:25	-35,5 kV/m	13:11-13:16	21%	missing data
08.06.11	11:44-11:52	38,65 kV/m	11:54-12:18	-30,95 kV/m	11:53-11:59	1,7%	11:53-12:47
15.07.11	21:05-21:24	14,05kV/m	21:24-21:41	-29,3kV/m	21:26-21:35	2,44%	no rain
22.08.11	22:06-22:14	17,9 kV/m	22:14-22:25	-29,95 kV/m	22:14-22:20	8%	22:16-23:09
20.09.11	10:09-10:20	21,05 kV/m	10:20-10:40	-29,45 kV/m	10:22-10:28	2,55%	07:56-09:47

Date	Fraction of lightnings of different type within 1km					Fraction of lightnings of different type within 3km					Fraction of lightnings of different type within 5km				
	Flash rate	IC-	IC+	GC-	GC+	Flash rate	IC-	IC+	GC-	GC+	Flash rate	IC-	IC+	GC-	GC+
04.10.2010 Duration of positive field (18:14-18:20 UT)	0/min	0%	0%	0%	0%	0,17/min	0%	100%	0%	0%	0,5/min	66,7%	33,3%	0%	0%
04.10.2010 FDHM of TGE (18:22-18:23 UT)	1/min	100%	0%	0%	0%	2/min	100%	0%	0%	0%	9/min	100%	0%	0%	0%
27.05.2011 Duration of positive field (13:05-13:10 UT)	2,2/min	27%	55%	18%	0%	12,6/min	36%	40%	24%	0%	16,2/min	30%	39%	31%	0%
27.05.2011 FDHM of TGE (13:11-13:16 UT)	0,4/min	100%	0%	0%	0%	28,2/min	97%	3%	0%	0%	106,2/min	84%	15%	1%	0%
22.08.2011 Duration of positive field (22:06-22:14 UT)	0/min	0%	0%	0%	0%	0/min	0%	0%	0%	0%	0/min	0%	0%	0%	0%
22.08.2011 FDHM of TGE (22:14-22:20 UT)	15/min	100%	0%	0%	0%	20/min	100%	0%	0%	0%	22/min	100%	0%	0%	0%

First type

May 27, 2011

ASEC (Aragats Space Environmental Center; 3200m a.s.l.)

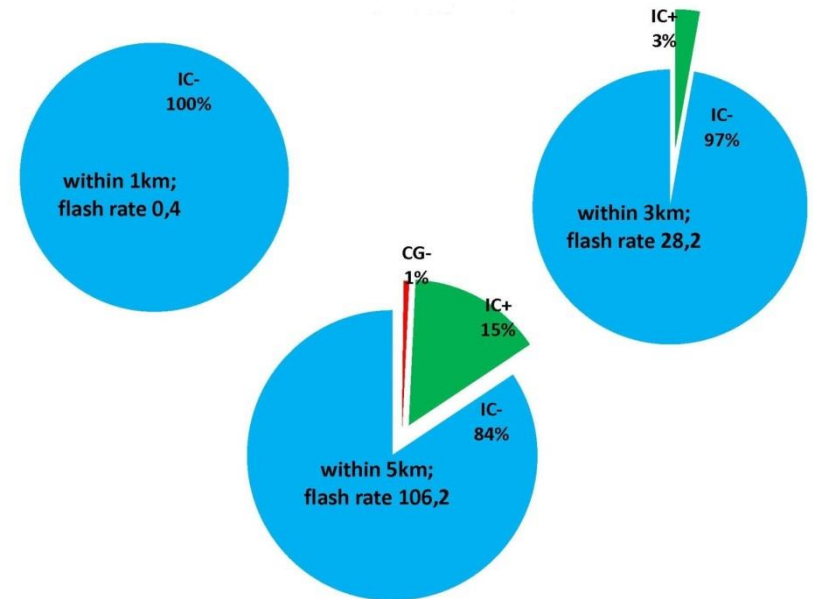
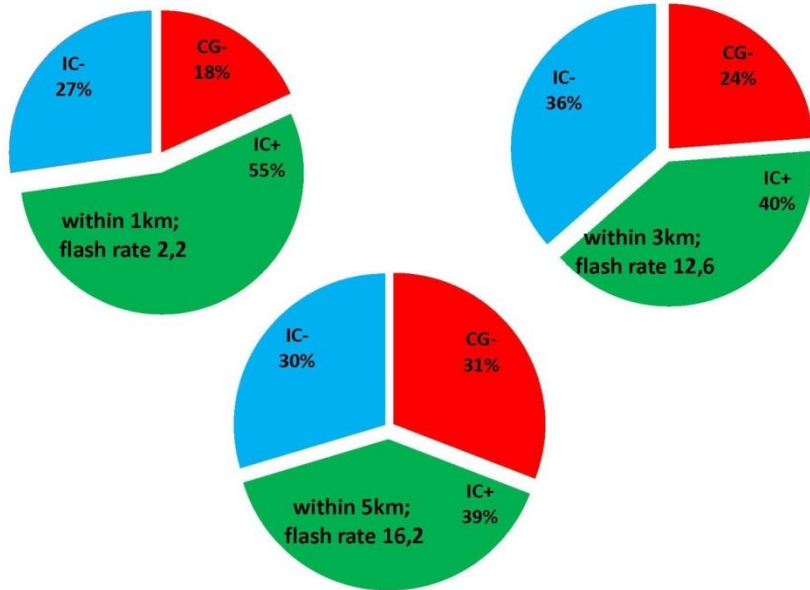


May 27, 2011

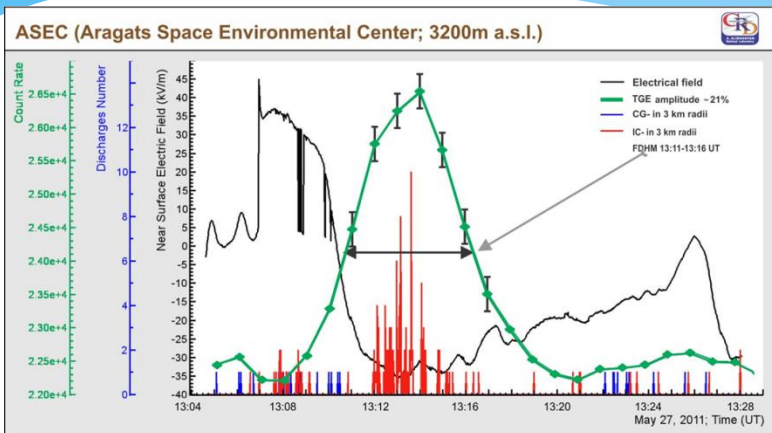


13:04-13:10 UT; positive field peaked 45.05kV/m at 13:06 UT.

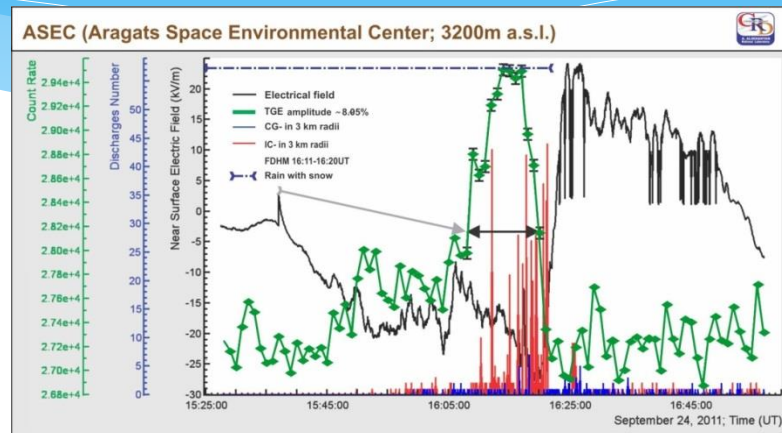
FDHM of TGE (13:12-13:16 UT); negative field peaked -35.5 kV/m at 13:13 UT.



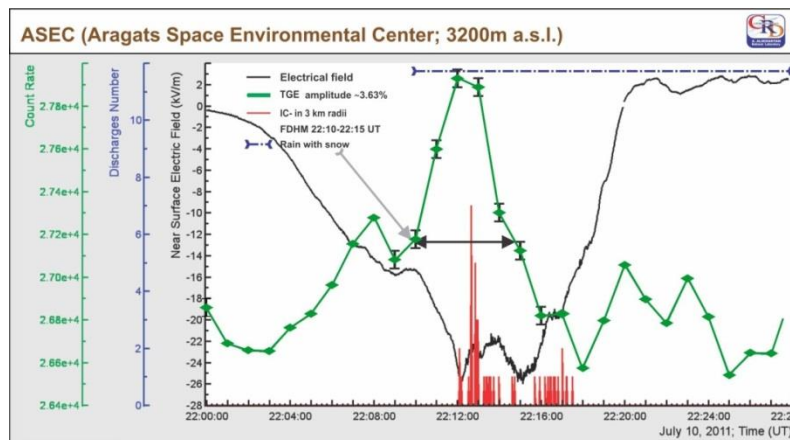
TGE Types



First type



Second type



Third type

3rd type of event

Date	Duration of negative field	Minimal value of electric field	FDHM of TGE	Flux increase (max flux minute)	Rain duration
07.05.11	20:35-21:30	-34,5 kV/m	21:11-21:15	4,36%	missing data
08.05.11	01:43-02:09	-32 kV/m	01:45-01:51	7,5%	missing data
10.07.11	21:56-22:20	-26,05 kV/m	22:10-22:15	4,36%	22:15-22:35
13.10.11	11:24-11:50	-29,5 kV/m	11:32-11:39	12%	no rain
25.10.11	23:08-23:37	-18,55kV/m	23:24-23:33	2,27%	no rain

Conclusion

- * **Electric field disturbance divided in 4 patterns**
- * **The creation of LPCR was proved.**
- * **CG- and IC- lightning activity**

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A. Chilingarian, H. Mkrtchyan, Physical Review D 86, 072003 (2012)



*Thank you
for
attention*