

**22nd
European
Cosmic Ray
Symposium in
Turku, Finland**



FORBUSH-EFFECTS WITH SUDDEN AND GRADUAL ONSET

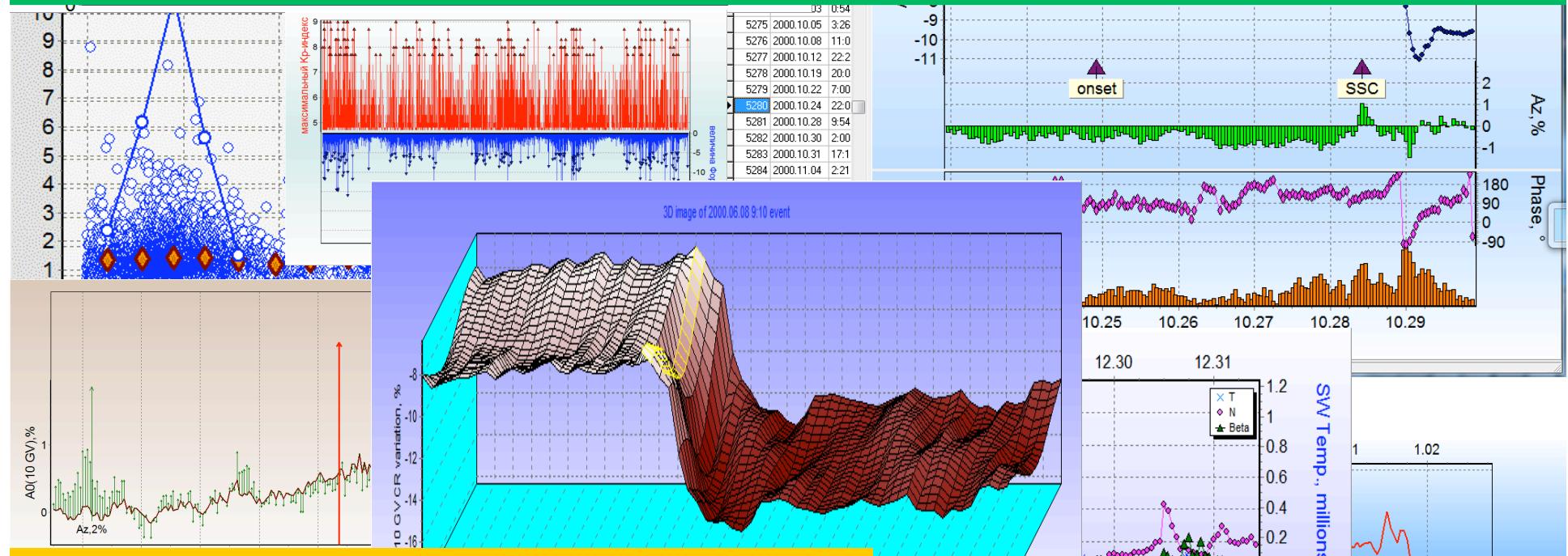


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Eroshenko,
V. Oleneva, V. Yanke**

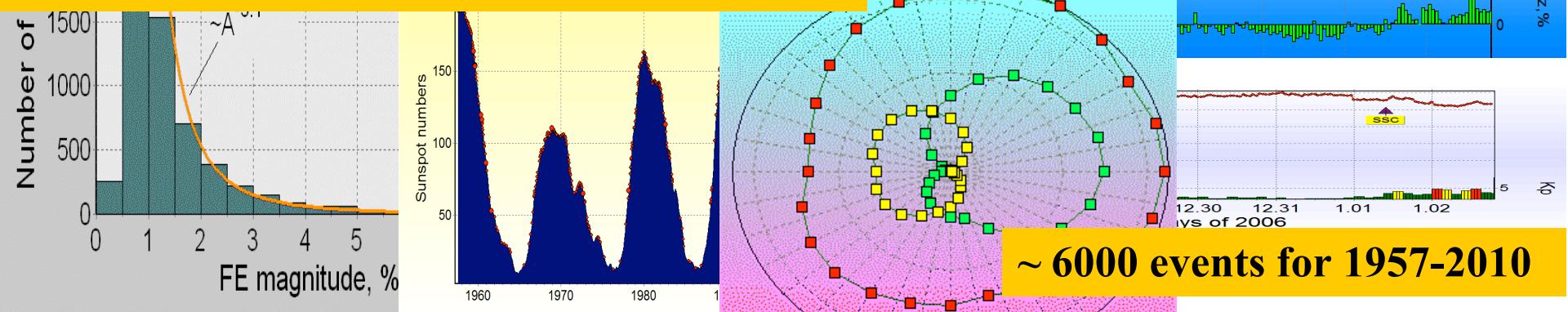
Content

1. Database of Forbush-effects and interplanetary disturbances
2. Division of the Forbush-effects:
 - a) *Events with the SSC*
 - b) *Events without the SSC*
3. Relation of the FE magnitude to the interplanetary environment characteristics
4. Relation of the FE magnitude to the Ap-index of geomagnetic activity

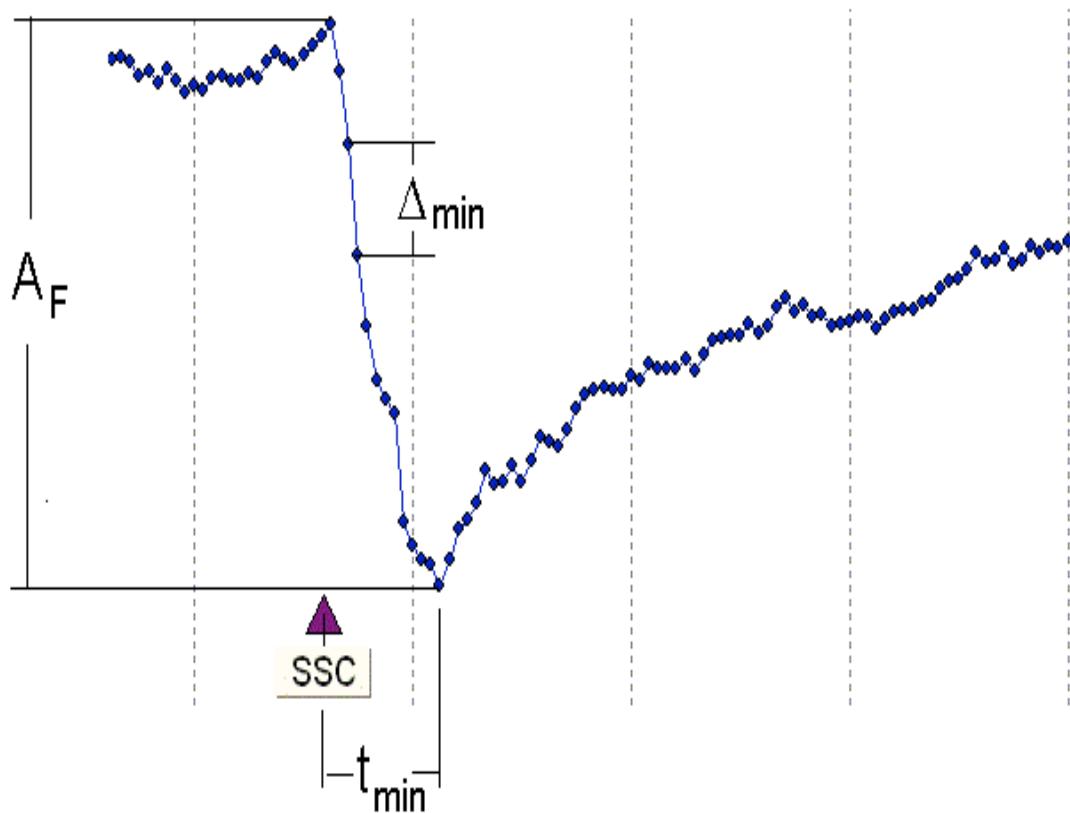
Database of Forbush-effects and interplanetary disturbances



Cosmic ray characteristics (10 GV rigidity),
from world network of neutron monitors



What is Forbush-Effects?



A_F — Forbush-effect magnitude

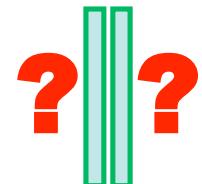
Δ_{\min} — maximum hourly decrease of the CR density

t_{\min} — time of decrease

Division of Forbush-Effects

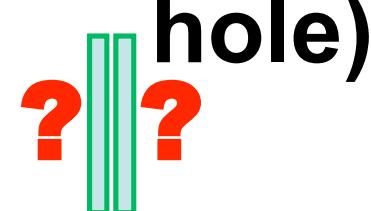
Let's check up this relationship!

sporadic
(CME)



SSC

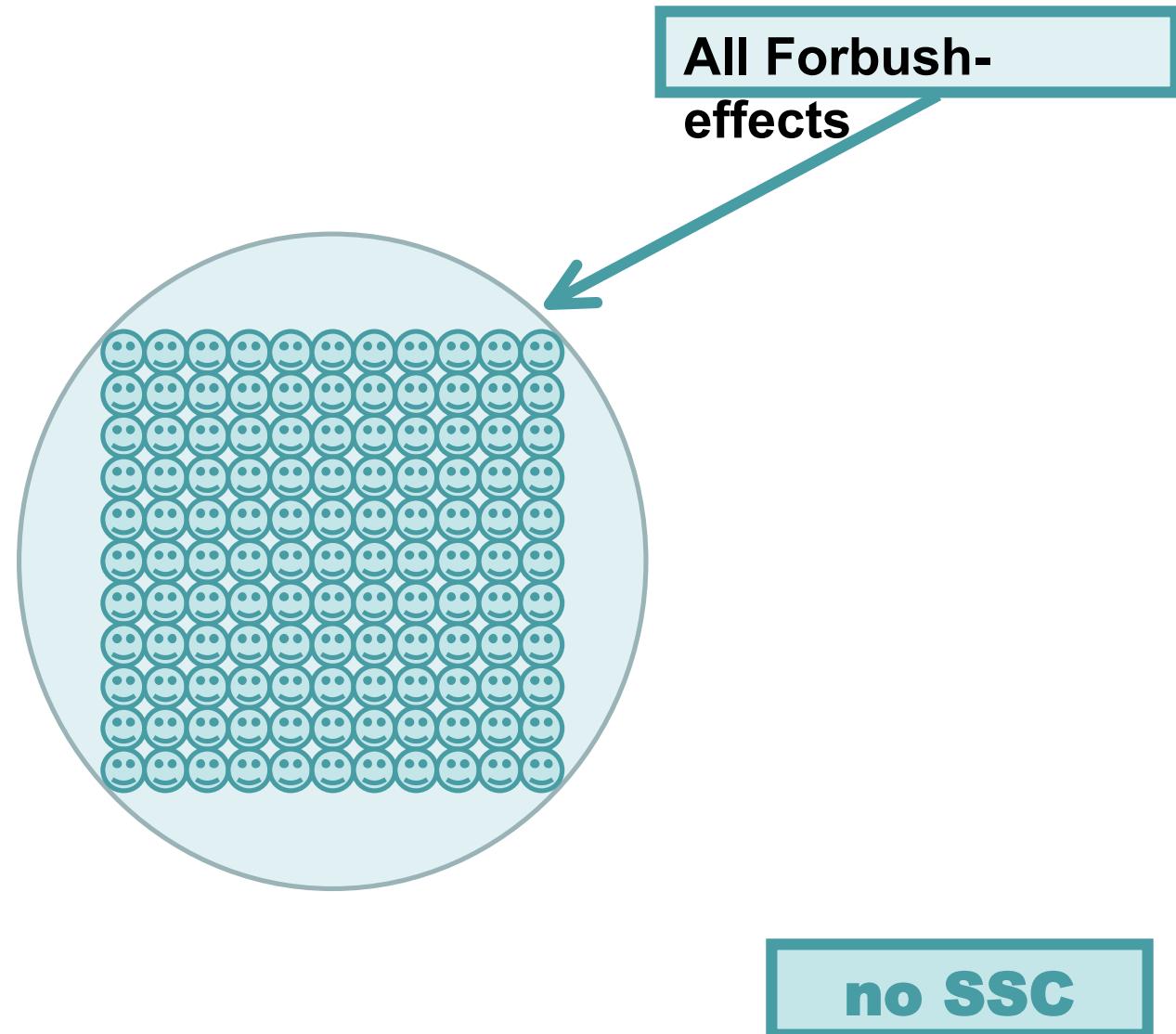
recurrent
(Coronal
hole)



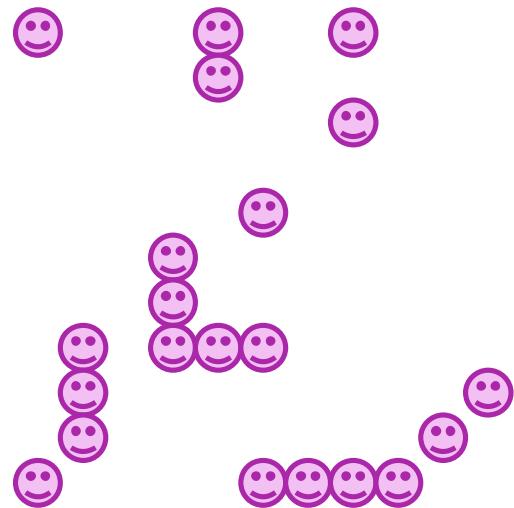
no SSC



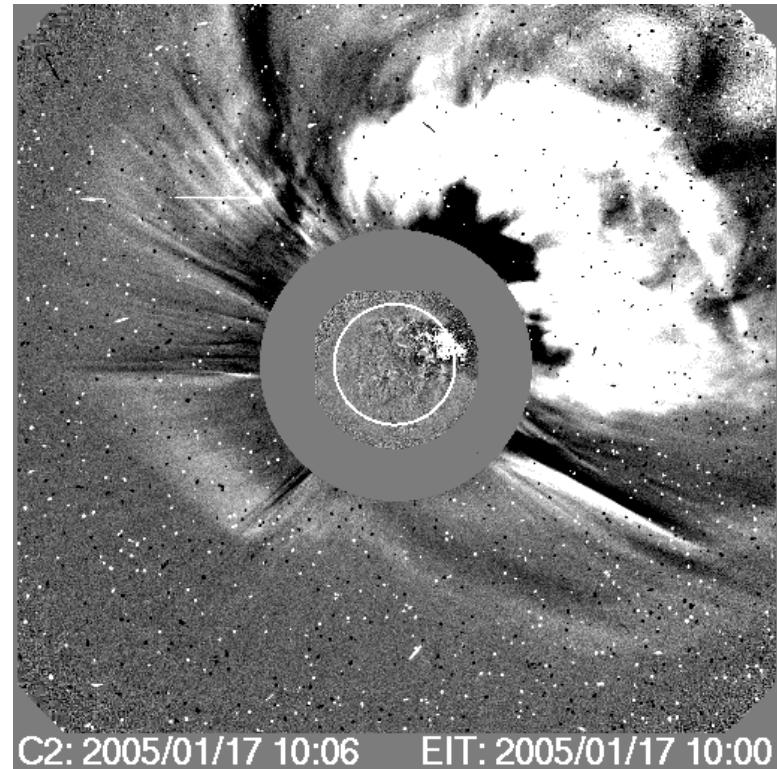
Division of Forbush-Effects



Division of Forbush-Effects



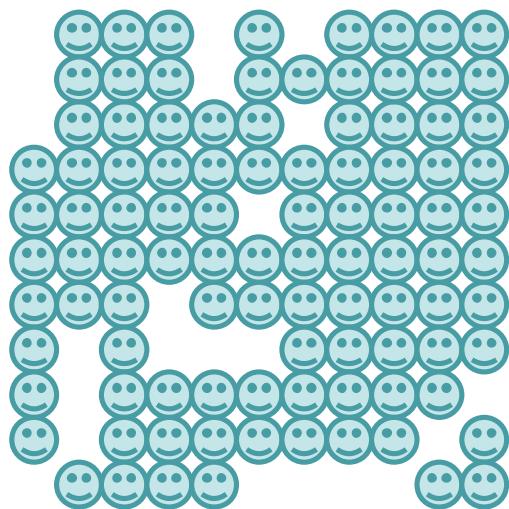
?≈?



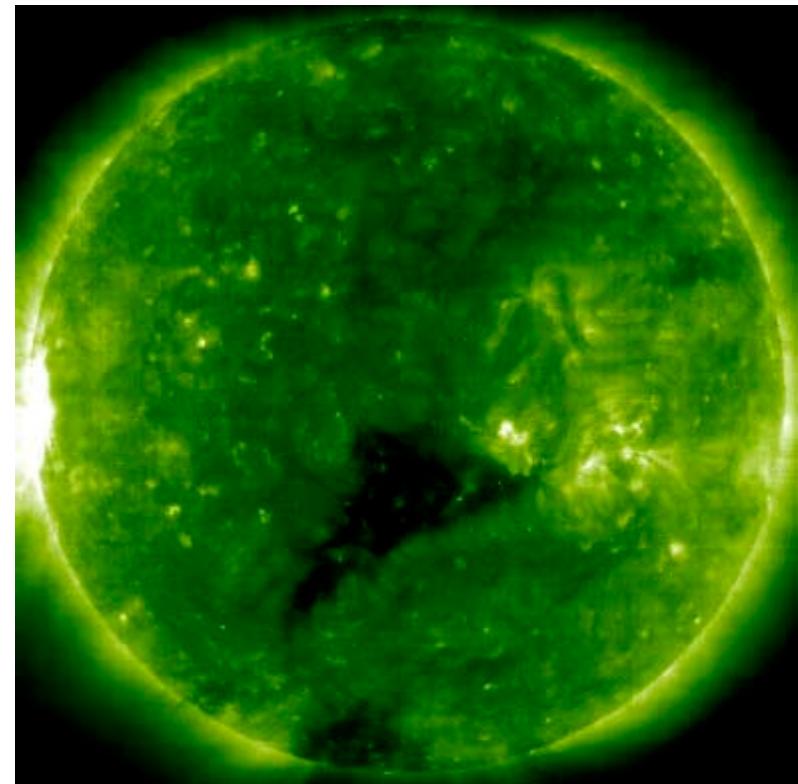
SSC

CME

Division of Forbush-Effects



?≈?



no SSC

Coronal hole

Division of Forbush-Effects

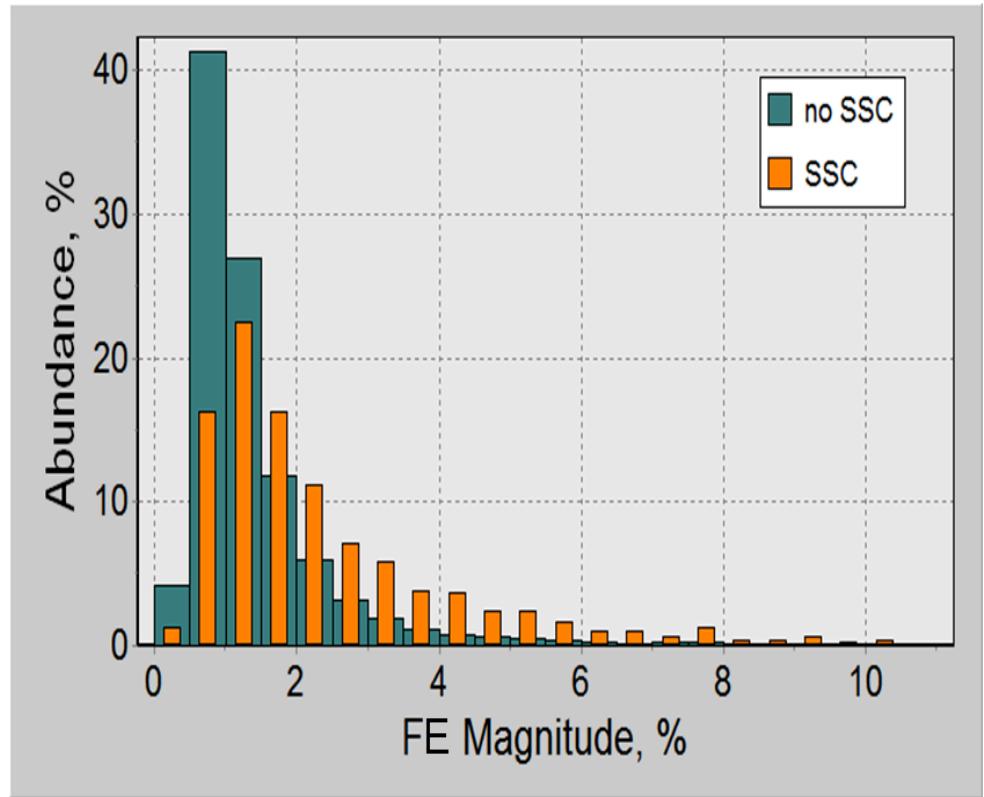
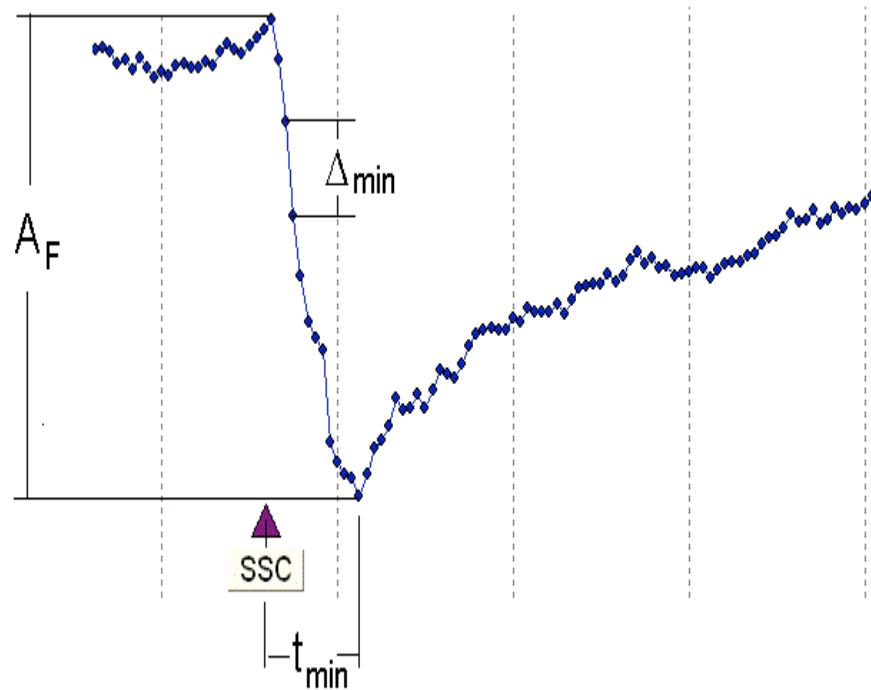
Forbush-effect sources

What are properties at these groups of FEs?

SSC

no SSC

Division of Forbush-Effects



A_F — Forbush-effect magnitude

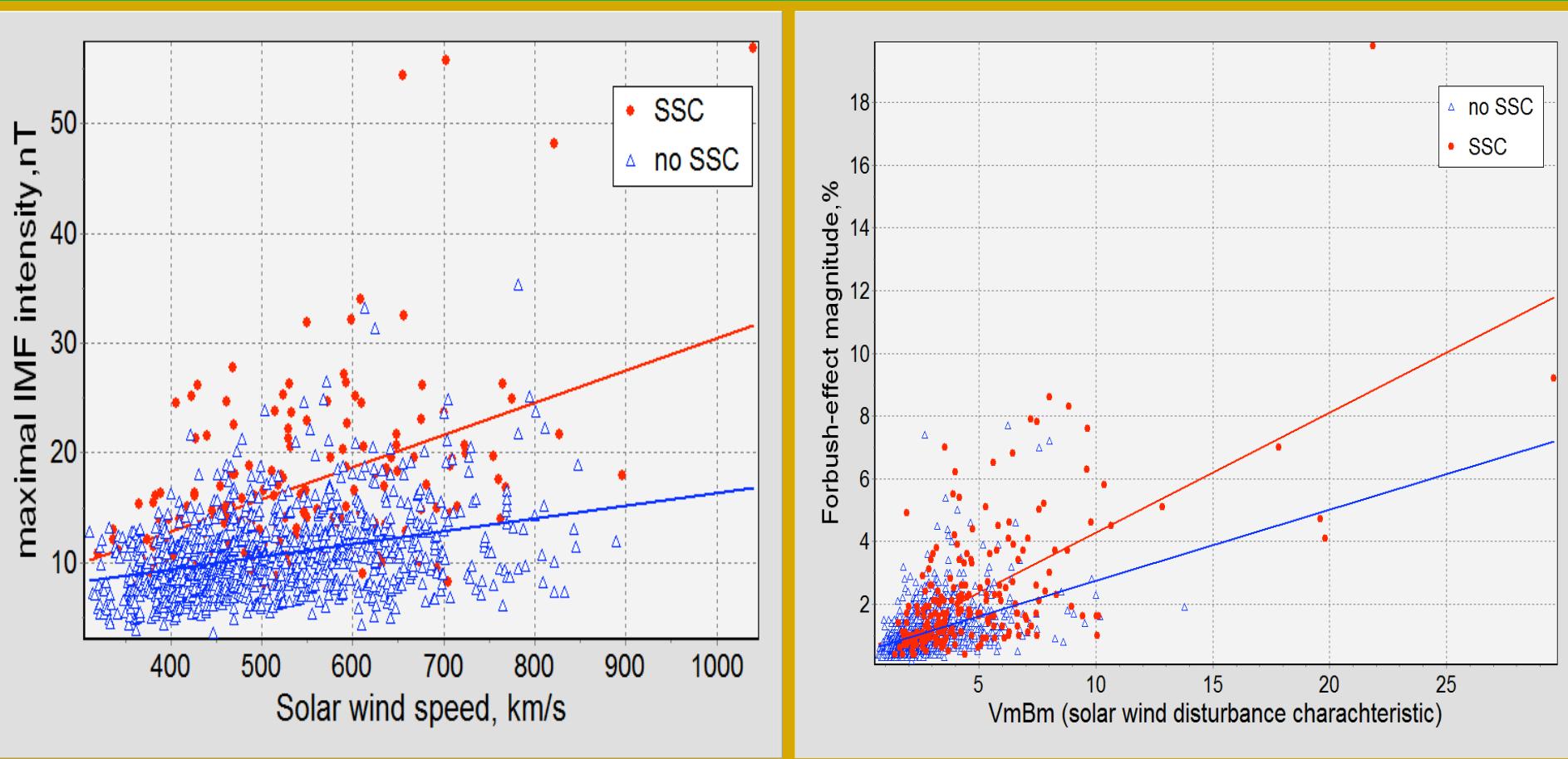
Δ_{\min} — maximum hourly decrease of the CR density

t_{\min} — time of decline

Division of Forbush-Effects

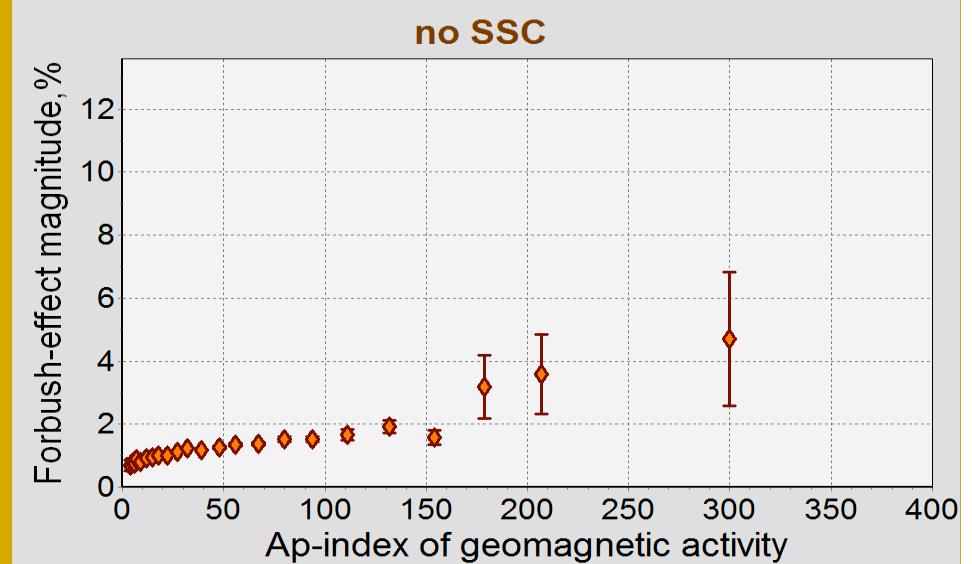
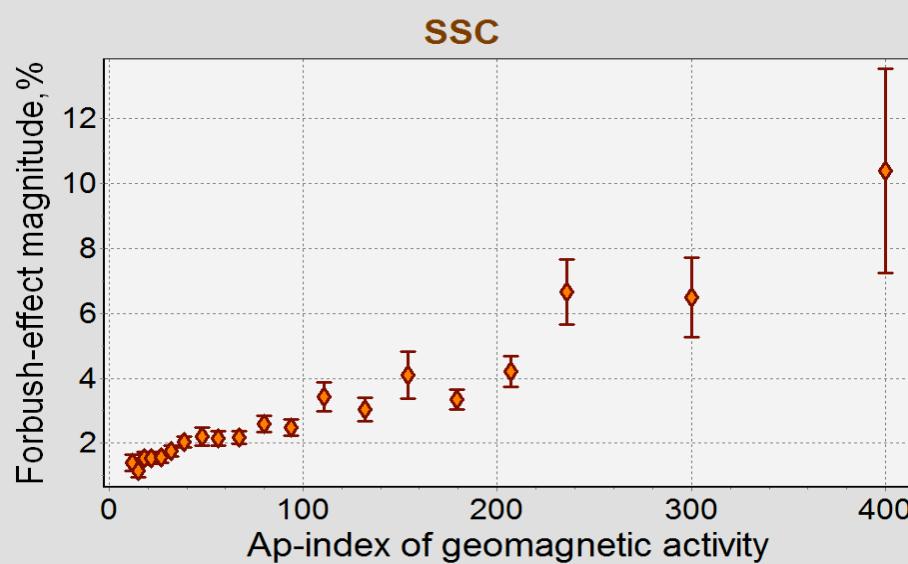
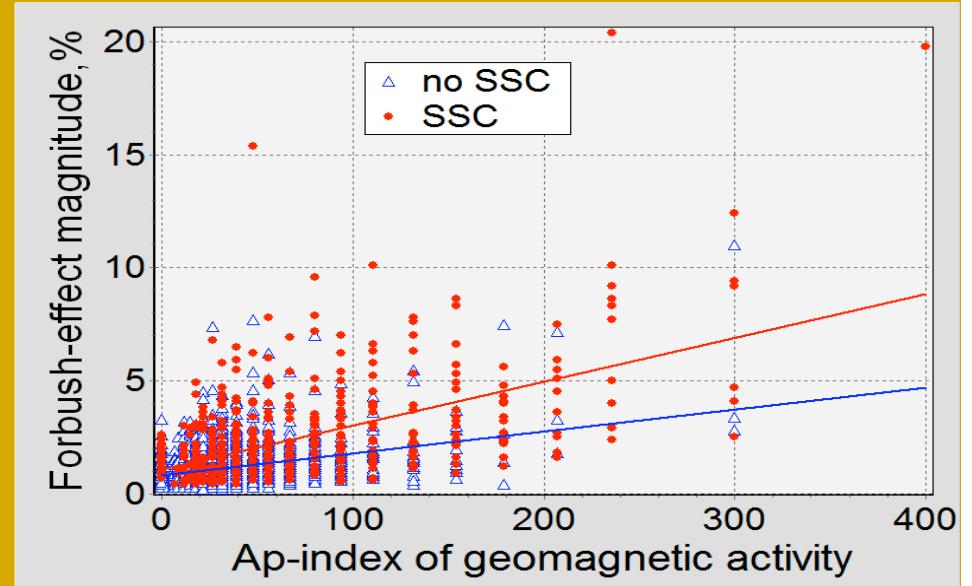
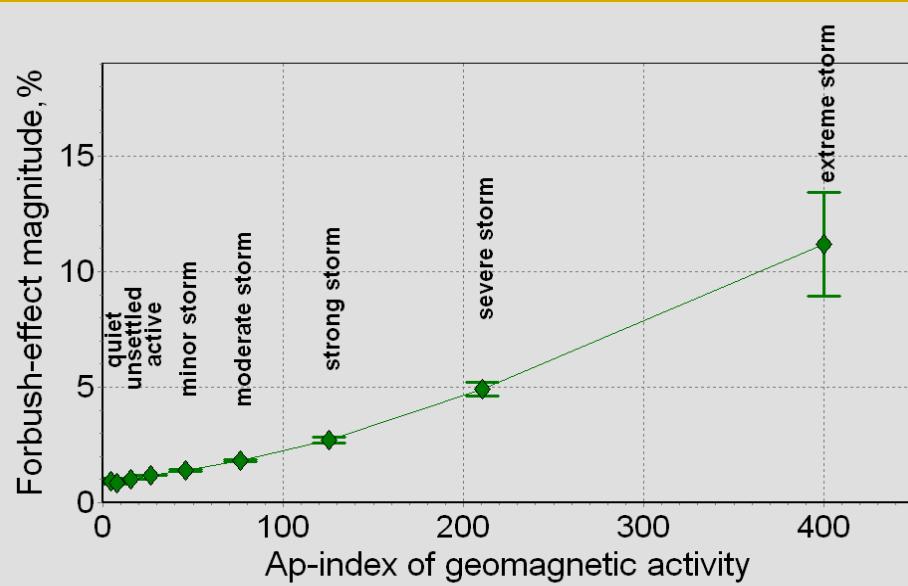
	SSC				no SSC			
	Mean	Max	Min	Number	Mean	Max	Min	Number
AF(magn)	2.27 ± 0.08	19.80	0.30	571	1.12 ± 0.01	11.00	0.20	2446
Axy_max	1.64 ± 0.03	5.78	0.24	571	1.24 ± 0.01	6.87	0.11	2446
Az_range	1.90 ± 0.04	10.18	-4.99	571	1.43 ± 0.01	5.60	0.47	2445
Dmin	0.50 ± 0.07	-0.13	0.53	534	-0.32 ± 0.00	-0.11	-1.84	2276
Dmax	-0.52 ± 0.02	27.13	0.05	534	0.32 ± 0.00	5.45	0.02	2276
Kpmax	5.25 ± 0.0	9.00	1.33	571	4.14 ± 0.02	8.67	1.00	2446
Apmax	66.97 ± 2.4	400.0	0.00	571	33.60 ± 0.55	300.0	0.00	2446
Dst_min	-60.2 ± 2.2	3.0	-472.0	571	-33.7 ± 0.5	9.0	-327.0	2446
Bmax	5.85 ± 0.35	56.90	0.00	403	10.58 ± 0.09	35.30	3.60	1704
Vmax	551.5 ± 6.1	1040.0	306.0	391	509.8 ± 2.7	890.0	311.0	1692
VmBm	4.60 ± 0.16	29.59	0.92	366	2.76 ± 0.03	13.80	0.69	1571
HCStilt	48.73 ± 1.03	75.10	7.60	319	42.83 ± 0.53	75.10	5.20	1423
tmin	23.54 ± 0.91	120.0	-37.0	534	19.97 ± 0.48	116.00	-13.00	2276
tmax	10.78 ± 1.03	79.0	-76.00	534	20.38 ± 0.52	86.00	-18.00	2276
tdmin	3.47 ± 0.73	141.0	-58.0	534	18.03 ± 0.39	93.00	-18.00	2276
Aftob	0.144 ± 0.006	0.82	0.03	378	0.108 ± 0.001	0.69	0.01	1621
HLon	-0.499 ± 1.247	90.0	-94.0	459	0.10 ± 0.087	81.00	-52.00	2014
VMean	625.18 ± 15.4	1343	258	223	583.46 ± 52.11	821.0	317.0	1300
Ayb	0.662 ± 0.01	2.55	-1.42	571	0.369 ± 0.009	3.33	-2.24	2446
Axyb	0.397 ± 0.022	2.7	0.00	571	0.577 ± 0.008	4.61	0.00	2446

Forbush-effect and solar wind disturbance

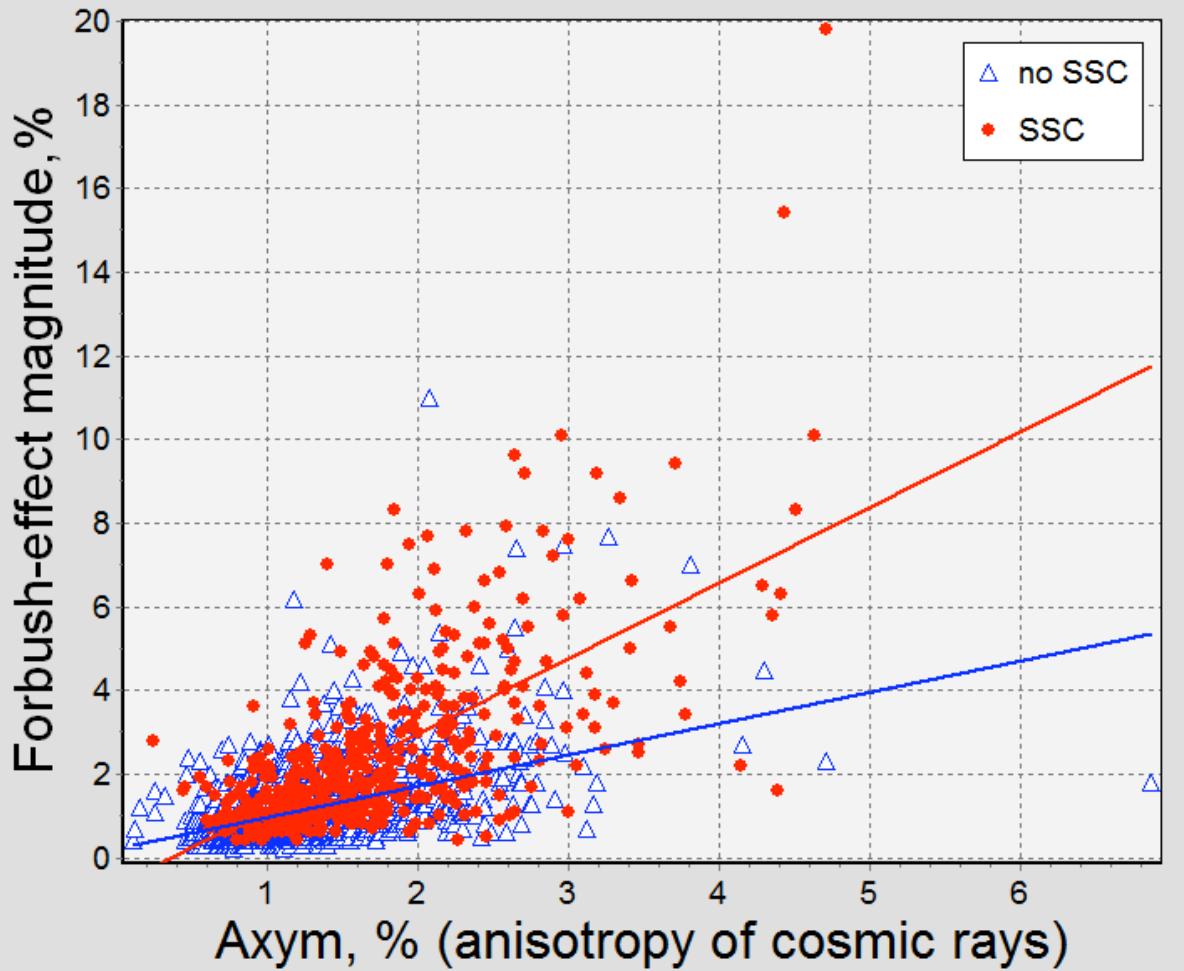


$$B_{\max} V_{\max} = \frac{B_{\max}}{5nT} \frac{V_{\max}}{400 \text{ km/s}}$$

Relation of the FE magnitude to the Ap-index of geomagnetic activity



Relation of the FEs magnitude to the anisotropy of cosmic rays



Axym(SSC) <

CONCLUSIONS:

1. For the events with Storm Sudden Commencement and without SSC – relations essentially differ.
2. Groups with SSC and without SSC divides on magnitude of FE and on the modulation mechanism.
3. Interrelation exists between different characteristics of the FE and interplanetary disturbance, and indexes of geomagnetic activity as well.
4. Collected data on the events allow us to reveal and study various relations both between internal parameters of the FEs and between characteristics of the FEs and parameters of the interplanetary space as well.



Thank you
for attention!!!