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Neutron monitor altitude-dependent yield function and its application to an analysis of neutron-monitor data

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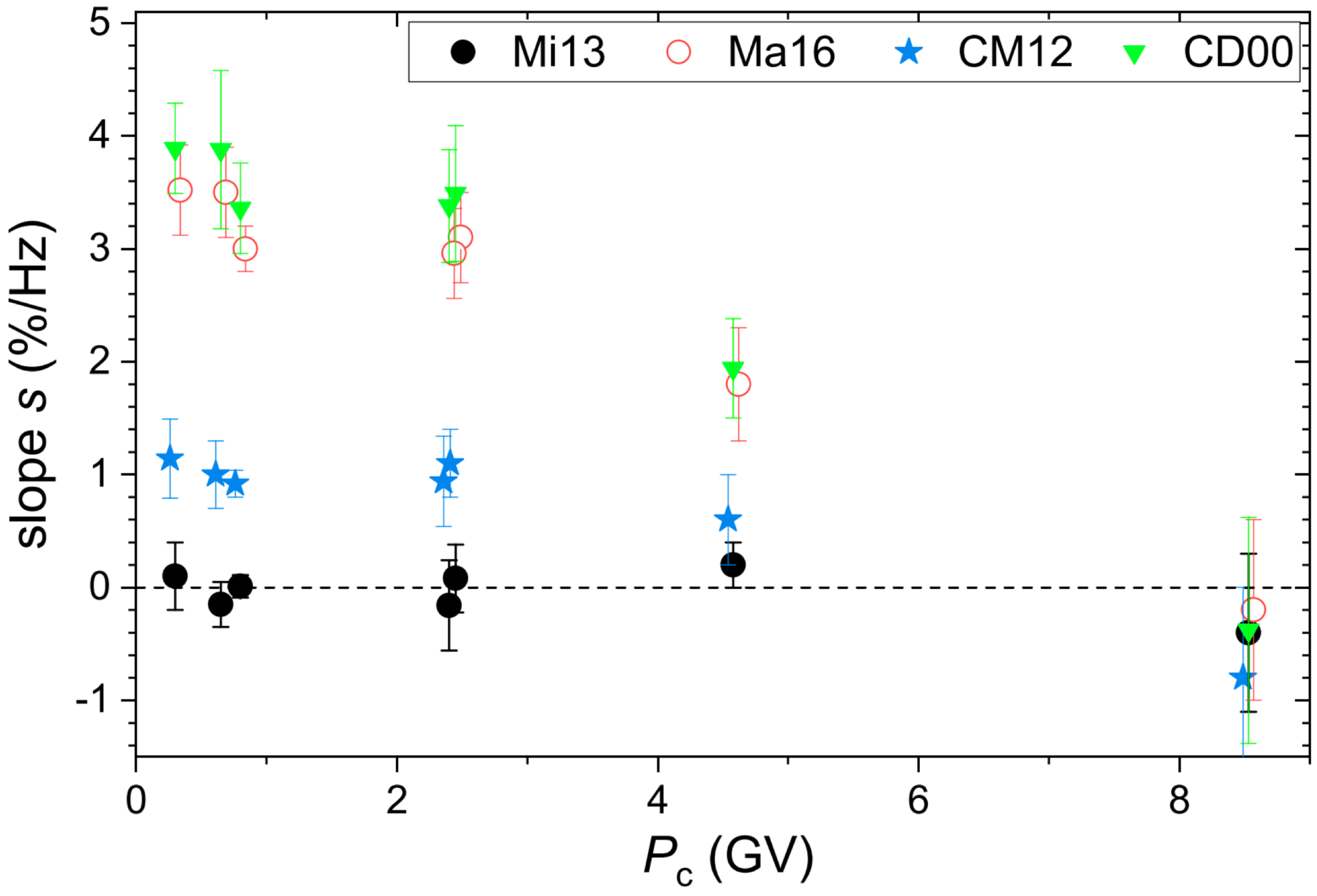
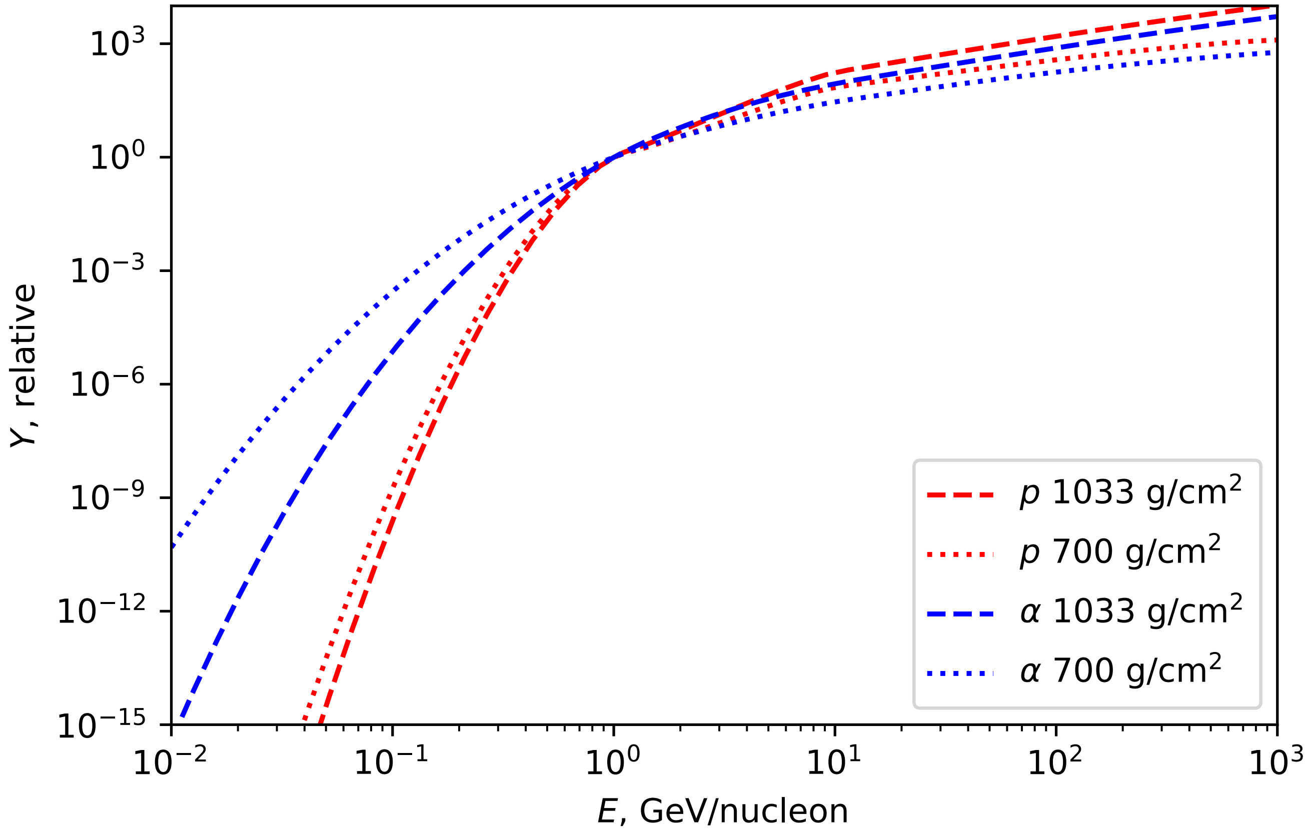
Neutron monitor yield function verification



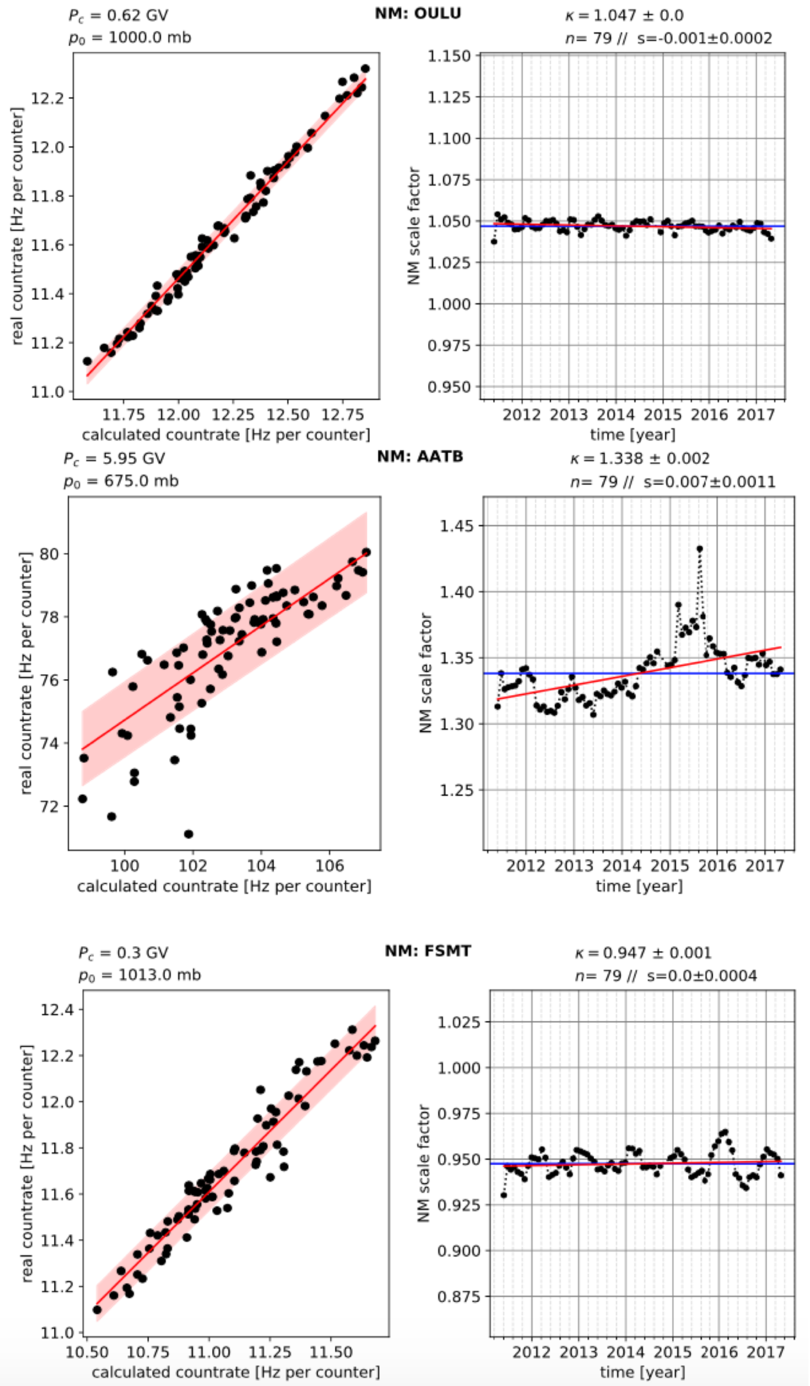
New computations of neutron monitor yield function



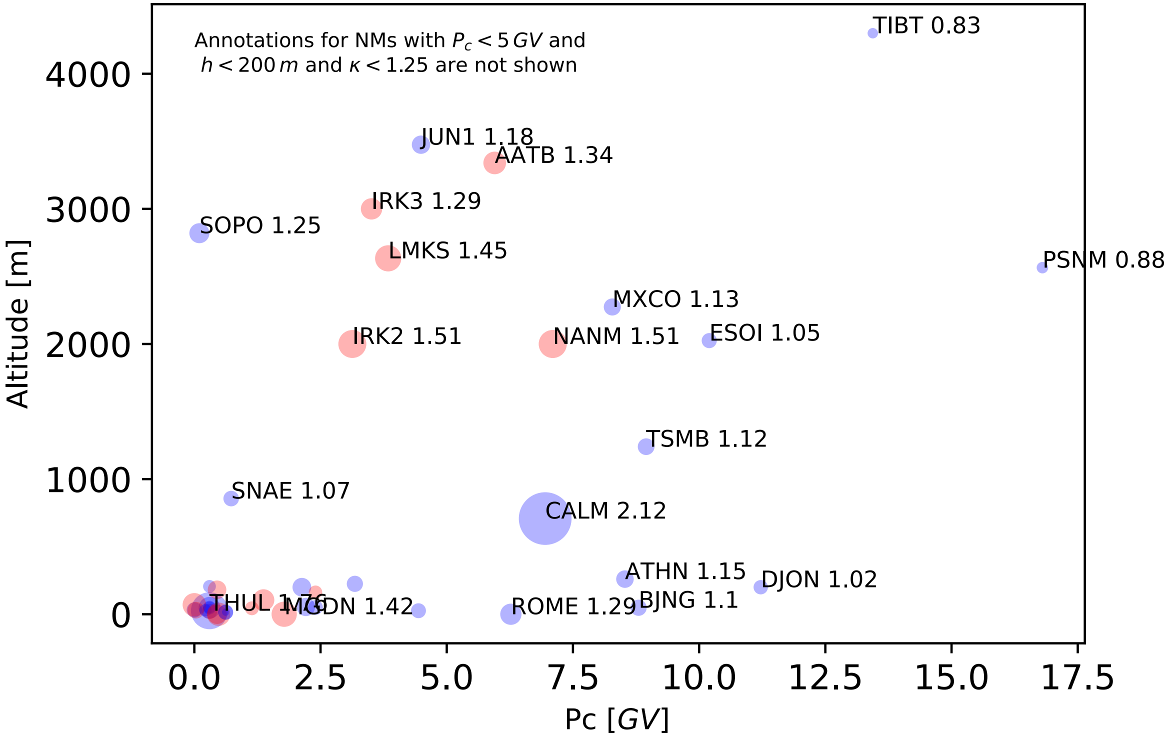
$$\ln\left(\frac{Y(h,E)}{Y(1{,}000,E)}\right) = A(R)\cdot(1{,}000-h)^2 + B(R)\cdot(1{,}000-h)$$

$$\ln(Y(1{,}000,E)) = \sum_{l=0}^{3} a_l(\ln(R))^l,$$

$$A(R)\ (\text{or } B(R)) = \sum_{l=0}^{5} b_l(\ln(R))^l,$$



Testing new yield function against the experimental results



Name	Source	P_c (GV)	p_0 (mb)	n	κ	Stability
AATB	1	5.95	675	79	1.338	J, T(0.7)
APTY[a]	3	0.45	1,010	79	1.193	Stable
ATHN	1	8.53	980	79	1.152	Stable
BJNG	2	8.8	1,000	46	1.098	T(−0.3)
BKSN	2	5.6	820	76	1.149	J
BRBG	2	0.0	1,000	79	1.365	T(−0.5)
CALM	1	6.95	1,000	64	2.124	Stable
DJON	1	11.22	1,001.3	68	1.019	Stable
DRBS	1	3.34	986.6	72	1.098	J
ESOI	2	10.2	800	75	1.053	S(>5%)
FSMT	1	0.3	1,013	79	0.947	Stable, S(2%)
HRMS	1	4.44	1,013.25	79	1.045	Stable
INVK	1	0.3	1,013	79	1.059	Stable
IRK2	2	3.13	800	75	1.508	J
IRK3	2	3.51	715	60	1.294	J
JUN1	1	4.49	642.614	79	1.184	J, S(10%)
KERG	1	1.14	1,000	77	0.998	Stable
KIEL[b]	1	2.21	1,006.7	79	1.184	J, T(−0.3)
LMKS	2	3.84	733.3	75	1.454	J, T(−0.5)
MCMD	1	0.3	973.25	75	1.304	Stable
MGDN	1	1.78	982.2	54	1.423	J, T(0.3)
MOSC	1	2.13	1,000	79	1.197	Stable
MRNY	2	0.03	1,013	79	1.118	T(0.3)
MWSN	2	0.22	990	78	0.921	Stable
MXCO	2	8.28	778.58	79	1.135	Stable
NAIN	1	0.3	1,013	79	0.952	Stable
NANM	1	7.1	802	76	1.512	J, T(1.0)
NRLK	2	0.45	1,005	66	1.227	J, T(0.3)
NVBK	2	2.4	995	79	0.977	T(−0.4)
NWRK	1	2.4	1,013.3	79	1.039	Stable
OULU	4	0.62	1,000	79	1.047	Stable
PSNM	2	16.8	750.479	79	0.883	Stable
PWNK	1	0.3	1,013.3	79	0.943	Stable
ROME	1	6.27	1,009.25	63	1.290	Stable
SNAE	1	0.73	880	79	1.072	Stable
SOPO	1	0.1	680	79	1.247	Stable
TERA	1	0.0	986.42	79	1.063	Stable
THUL	1	0.3	1,005	79	1.759	Stable
TIBT	1	13.44	607	66	0.828	Stable
TSMB	1	8.95	880	73	1.120	Stable
TXBY	2	0.48	1,000	79	1.360	S(3%), J
YKTK	2	1.37	1,000	75	1.303	T(−0.6)

Conclusion

- Yield function Mishev et al. 2013, verified with AMS-02 experimental data, was expanded to different atmospheric depths;
- Expected neutron monitor responses were calculated using this yield function for the period 2011 – 2017 and compared with real data for all neutron monitors having data for this period of time;
- About half of neutron monitors appear to be stable while the other part suffers instabilities in the data such as trends and sudden jumps;

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