

Analysis of the Influence of Space Weather Factors on the Telemetry Parameters of Small Spacecraft in Low Earth Orbit

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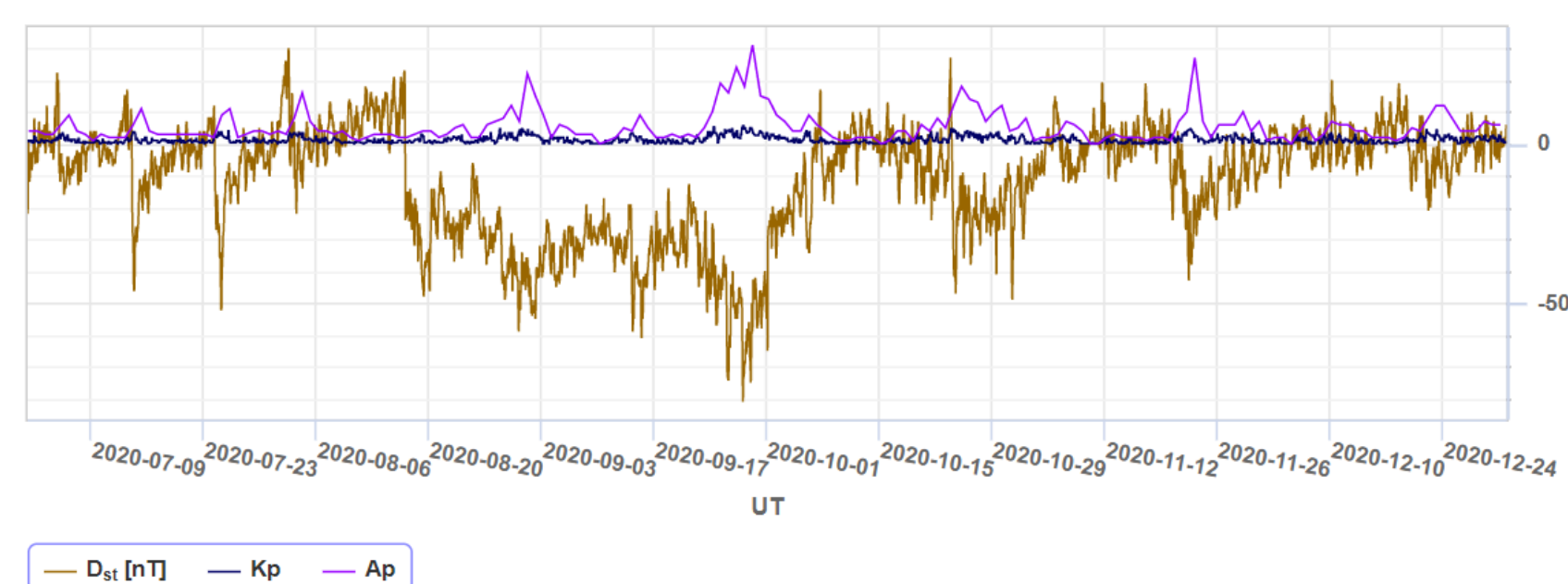
Abstract

The research shows that high solar activity and the associated increased geomagnetic disturbance have a significant impact on the functioning of small spacecraft (SSC) in low Earth orbit (LEO). An increase in the number of anomalies in the telemetry data of small satellites with an increase in the absolute value of the geomagnetic activity index Dst is studied. The influence exerted by space weather (SW) factors on the current state of the SSC systems is also studied. An increasing dependence between the spacecraft parameters and changes in geomagnetic activity is shown, which intensifies in the subpolar regions of the orbit.

Data sources



ID	Latitude	Frequency	Mode	Timestamp	Results	Observer	Status
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:45:00	OK	PHD Datasets	881 - CDMA2000
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:52:57	OK	PHD Datasets	88 - CDMA2000-01
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:02	OK	PHD Datasets	13 - WGS84
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:26	OK	PHD Datasets	801 - CDMA2000 - LMF
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:41	OK	PHD Datasets	1402 - ICDOT_LMF_LMF
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:50	OK	PHD Datasets	1887 - ICDOT_LMF_Phone
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:52	OK	PHD Datasets	1448 - ICDOT_LMF - Tracking with hostnet
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:53:51	OK	PHD Datasets	1440 - ICDOT_LMF
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 14:54:11	OK	PHD Datasets	480 - ICDOT_LMF
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:04:51	OK	PHD Datasets	488 - ICDOT
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:04:54	OK	PHD Datasets	1188 - ICDOT_LMF - Ground Station
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:05:21	OK	PHD Datasets	480 - ICDOT_LMF
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:05:33	OK	PHD Datasets	342 - CDMA2000 - Large
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:05:34	OK	PHD Datasets	342 - CDMA2000 - Large
ST1000-1	45.870742	QF95.4800	QF95.4800	2020-10-09 15:05:38	OK	PHD Datasets	342 - CDMA2000 - Large



Telemetry data from the network of receiving stations SatNOGS

Data from the «Space Weather» service of the Research Institute of Nuclear Physics, Moscow State University

Methodology

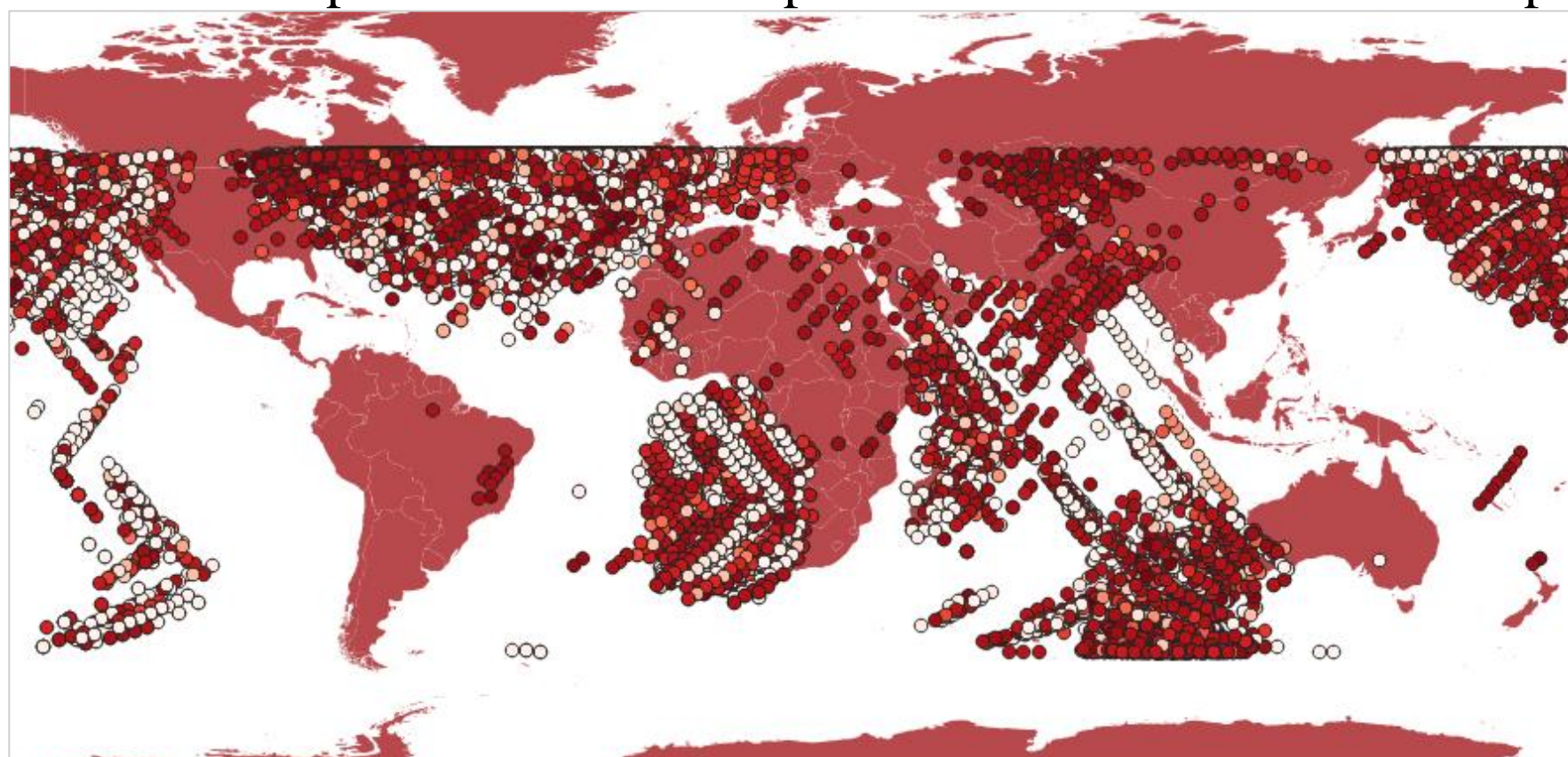
Correlation indices within the entire volume of data

	usb1	usb2	usb3	isb1	isb2	isb3	iab	
Dst	0,049461	0,025988	0,046718	0,030452	0,03348	0,008014	0,065051	
	ich1	ich2	ich3	ich4	t1_pw	t2_pw	t3_pw	t4_pw
Dst	-0,01282	-0,04068	0,007878	0,002001	-0,04787	-0,06059	-0,06999	-0,03873

Distribution of data frames across latitude ranges

Geographic latitude	Number of data frames
00–30.99	2210
31–40.99	2490
41–45.99	1909
46–49.99	2844
50–50.99	1666
51–51.49	1399
51.5–51.8	2180

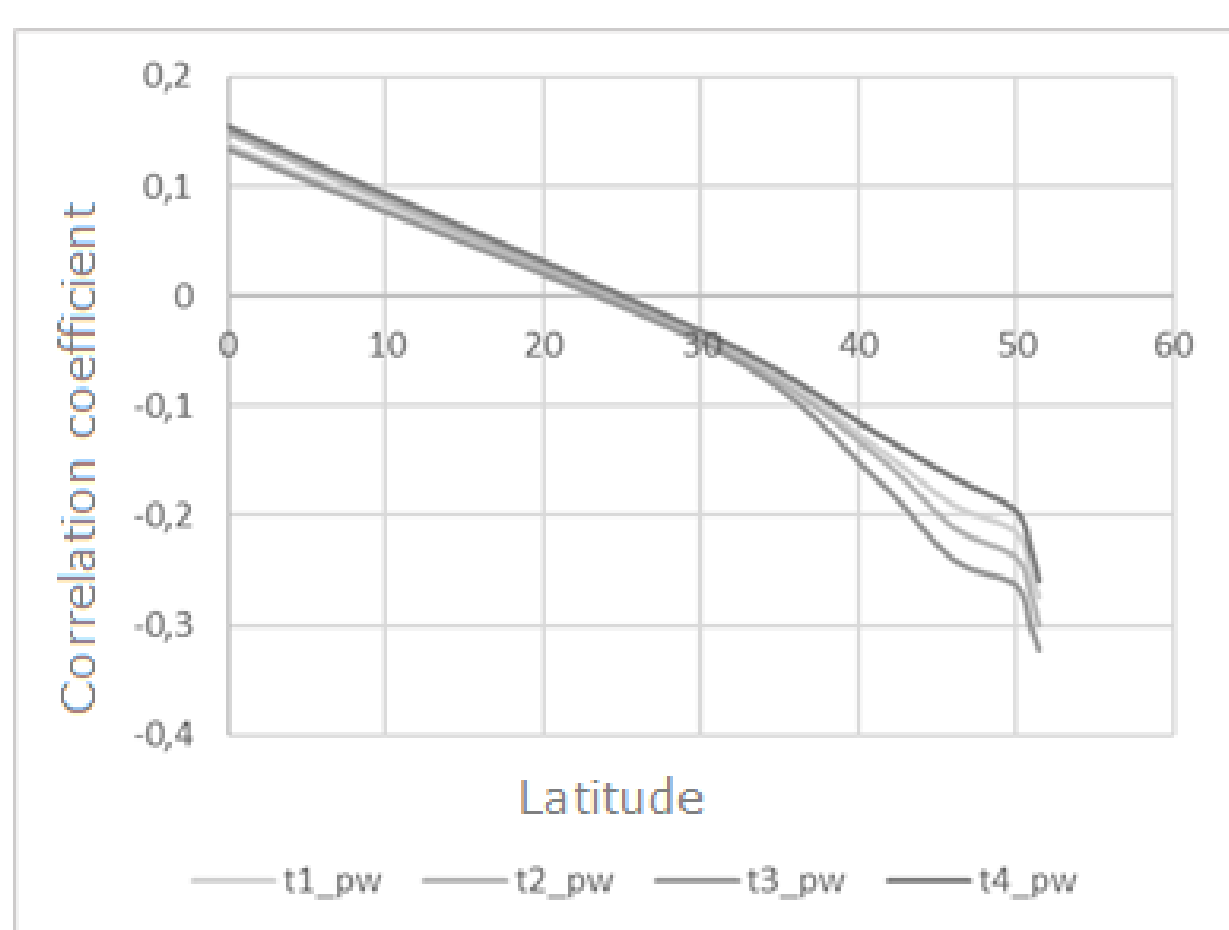
The location points of the small spacecraft at the time of data reception.



Summary Correlation Matrix

	latitude, °	t1_pw	t2_pw	t3_pw	t4_pw
Dst	00–30.99	0,138456	0,148133	0,134159	0,154412
	31–40.99	-0,04223	-0,0458	-0,04843	-0,03829
	41–45.99	-0,13606	-0,14338	-0,16366	-0,12336
	46–49.99	-0,19003	-0,20994	-0,23866	-0,16497
	50–50.99	-0,21494	-0,23792	-0,26261	-0,19546
	51–51.49	-0,25405	-0,27238	-0,30083	-0,23232
	51.5–51.8	-0,27466	-0,30003	-0,32145	-0,25934

Correlation Trend Line



Software prototype

