

Supporting Information for ”Conductance Model for Extreme Events : Impact of Auroral Conductance on Space Weather Forecasts”

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1. Tables S1 to S15

Introduction This supporting information provides performance metrics calculated for multiple dB/dt and ΔB thresholds using the Conductance Model for Extreme Events. The metrics used has been listed in Table 2 of the main article. The format of these tables are similar to Tables 4 and 5 of the main article; for more details about those tables, please refer to Sections 3.2 and 3.3 of the main paper. For convenience, the tables have been coloured differently: In the tables, ***italicized-bolded text*** is used to denote best performance while *italicized-underlined text* is used to denote worst. Usage of the auroral oval and CMEE amounts to an increase in False Negatives (F) in both ΔB and dB/dt

predictions, while improving the rest of the quantities (H, M, N). Due to this reason, the FAR values are higher for oval runs, which results in less predictive score using the TSS metric. The new model (without the oval) has more misses (M) than the older model (without the oval), when predicting ΔB . For dB/dt predictions, the amount of skill lost during quieter activity, when simulating using CMEE, is more than regained with massive improvements for extreme driving, as is seen by Tables S3 to S7.

Table S1. Performance metrics for predicted dB/dt at Threshold = 0.1 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.7776</u>	0.7801	0.8436	0.8114	<u>0.8342</u>	0.8555	0.8976	0.8973
<i>POFD</i>	0.0631	0.0615	<u>0.0903</u>	0.0744	0.0938	0.0892	0.1687	<u>0.1697</u>
<i>FAR</i>	0.0431	0.0419	<u>0.0560</u>	0.0484	0.0587	0.0547	0.0944	<u>0.0950</u>
<i>MR</i>	<u>0.2997</u>	0.2970	0.2367	0.2686	<u>0.2481</u>	0.2224	0.1817	0.1823
<i>TS</i>	<u>0.7513</u>	0.7544	0.8034	0.7793	<u>0.7929</u>	0.8152	0.8208	0.8201
<i>F1</i>	<u>0.8580</u>	0.8600	0.8910	0.8760	<u>0.8845</u>	0.8982	0.9016	0.9012
<i>TSS</i>	<u>0.6572</u>	0.6611	0.7073	0.6830	<u>0.6932</u>	0.7229	0.7239	0.7227
<i>HSS</i>	<u>0.6645</u>	0.6687	0.7225	0.6959	<u>0.7080</u>	0.7381	0.7263	0.7251

Table S2. Performance metrics for predicted dB/dt at Threshold = 0.3 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	0.5814	<u>0.5628</u>	0.6782	0.6638	<u>0.6444</u>	0.6829	0.7970	0.7979
<i>POFD</i>	0.0416	0.0345	<u>0.0597</u>	0.0477	0.0426	0.0613	0.1038	<u>0.1164</u>
<i>FAR</i>	0.0858	0.0744	<u>0.1034</u>	0.0861	0.0797	0.1053	0.1459	<u>0.1606</u>
<i>MR</i>	0.2499	<u>0.2567</u>	0.2070	0.2121	<u>0.2207</u>	0.2049	0.1473	0.1485
<i>TS</i>	0.5513	<u>0.5384</u>	0.6290	0.6248	<u>0.6103</u>	0.6321	0.7015	0.6922
<i>F1</i>	0.7108	<u>0.7000</u>	0.7723	0.7690	<u>0.7580</u>	0.7746	0.8246	0.8181
<i>TSS</i>	<u>0.6644</u>	0.6689	0.6896	0.7017	0.6996	<u>0.6899</u>	0.7068	0.6909
<i>HSS</i>	0.5642	<u>0.5541</u>	0.6370	0.6368	<u>0.6240</u>	0.6396	0.6987	0.6855

Table S3. Performance metrics for predicted dB/dt at Threshold = 0.5 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.4812</u>	0.4840	0.5636	0.5922	<u>0.5496</u>	0.5989	0.7244	0.7451
<i>POFD</i>	0.0331	0.0302	<u>0.0497</u>	0.0435	0.0378	0.0543	0.0926	<u>0.1076</u>
<i>FAR</i>	0.1244	0.1138	<u>0.1539</u>	0.1315	0.1241	0.1576	0.2087	<u>0.2294</u>
<i>MR</i>	<u>0.2065</u>	0.2051	0.1821	0.1713	<u>0.1850</u>	0.1706	0.1284	0.1217
<i>TS</i>	<u>0.4504</u>	0.4557	0.5112	0.5434	<u>0.5099</u>	0.5385	0.6082	0.6098
<i>F1</i>	<u>0.6211</u>	0.6261	0.6765	0.7042	<u>0.6754</u>	0.7001	0.7564	0.7576
<i>TSS</i>	<u>0.6692</u>	0.6811	0.6640	0.6972	0.6909	0.6718	0.6629	<u>0.6489</u>
<i>HSS</i>	<u>0.5069</u>	0.5139	0.5622	0.5977	<u>0.5661</u>	0.5883	0.6458	0.6430

Table S4. Performance metrics for predicted dB/dt at Threshold = 0.7 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.3949</u>	0.4278	0.4661	0.5305	<u>0.4812</u>	0.5441	0.6537	0.7057
<i>POFD</i>	0.0255	0.0260	0.0365	<u>0.0387</u>	0.0285	0.0442	0.0801	<u>0.0936</u>
<i>FAR</i>	0.1502	0.1427	<u>0.1765</u>	0.1667	0.1395	0.1821	0.2516	<u>0.2667</u>
<i>MR</i>	<u>0.1847</u>	0.1765	<u>0.1681</u>	0.1512	<u>0.1630</u>	0.1482	0.1208	0.1059
<i>TS</i>	<u>0.3692</u>	0.3994	0.4238	0.4796	<u>0.4463</u>	0.4853	0.5359	0.5615
<i>F1</i>	<u>0.5393</u>	0.5708	0.5953	0.6483	<u>0.6172</u>	0.6535	0.6978	0.7192
<i>TSS</i>	<u>0.6651</u>	0.6809	0.6553	0.6821	0.6974	0.6697	0.6277	<u>0.6274</u>
<i>HSS</i>	<u>0.4451</u>	0.4779	0.4983	0.5559	<u>0.5264</u>	0.5594	0.5975	0.6195

Table S5. Performance metrics for predicted dB/dt at Threshold = 1.1 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.2920</u>	0.3310	0.3520	0.4380	<u>0.3770</u>	0.4440	0.5300	0.6230
<i>POFD</i>	0.0222	0.0235	0.0284	<u>0.0372</u>	0.0273	0.0434	0.0687	<u>0.0914</u>
<i>FAR</i>	0.2532	0.2408	0.2651	<u>0.2748</u>	0.2445	0.3041	0.3668	<u>0.3957</u>
<i>MR</i>	<u>0.1395</u>	0.1330	0.1299	0.1156	<u>0.1254</u>	0.1152	0.1015	0.0850
<i>TS</i>	<u>0.2657</u>	0.2995	0.3123	0.3756	<u>0.3360</u>	0.3719	0.4055	0.4425
<i>F1</i>	<u>0.4198</u>	0.4610	0.4760	0.5461	<u>0.5030</u>	0.5421	0.5770	0.6135
<i>TSS</i>	<u>0.6073</u>	0.6262	<u>0.6049</u>	0.6096	0.6301	0.5808	0.5317	<u>0.5193</u>
<i>HSS</i>	<u>0.3533</u>	0.3936	0.4056	0.4736	<u>0.4341</u>	0.4660	0.4924	0.5253

Table S6. Performance metrics for predicted dB/dt at Threshold = 1.5 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.2216</u>	0.2490	0.2668	0.3557	<u>0.2791</u>	0.3406	0.4309	0.5554
<i>POFD</i>	0.0169	0.0194	0.0253	<u>0.0319</u>	0.0262	0.0378	0.0566	<u>0.0784</u>
<i>FAR</i>	0.3306	0.3358	<u>0.3810</u>	0.3674	0.3780	0.4182	0.4597	<u>0.4775</u>
<i>MR</i>	<u>0.1089</u>	0.1057	0.1041	0.0932	<u>0.1026</u>	0.0957	0.0852	0.0693
<i>TS</i>	<u>0.1998</u>	0.2211	0.2291	0.2948	<u>0.2386</u>	0.2736	0.3153	0.3684
<i>F1</i>	<u>0.3330</u>	0.3622	0.3728	0.4553	<u>0.3853</u>	0.4297	0.4795	0.5385
<i>TSS</i>	0.5605	0.5585	<u>0.5150</u>	0.5394	0.5194	0.4861	0.4551	<u>0.4532</u>
<i>HSS</i>	<u>0.2855</u>	0.3120	0.3179	0.3973	<u>0.3297</u>	0.3672	0.4094	0.4647

Table S7. Performance metrics for predicted dB/dt at Threshold = 1.7 nT/s.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.1975</u>	0.2070	0.2389	0.3264	<u>0.2452</u>	0.3153	0.3838	0.5207
<i>POFD</i>	0.0161	0.0155	0.0238	<u>0.0287</u>	0.0246	0.0356	0.0529	<u>0.0754</u>
<i>FAR</i>	0.3861	0.3659	<u>0.4340</u>	0.4041	0.4359	0.4649	0.5151	<u>0.5275</u>
<i>MR</i>	<u>0.0957</u>	0.0947	0.0919	0.0826	<u>0.0913</u>	0.0844	0.0779	0.0630
<i>TS</i>	<u>0.1756</u>	0.1849	0.2019	0.2673	<u>0.2062</u>	0.2475	0.2726	0.3293
<i>F1</i>	<u>0.2988</u>	0.3121	0.3359	0.4218	<u>0.3418</u>	0.3968	0.4284	0.4955
<i>TSS</i>	0.5181	0.5395	<u>0.4741</u>	0.5133	0.4728	0.4508	<u>0.4070</u>	0.4095
<i>HSS</i>	<u>0.2573</u>	0.2709	0.2874	0.3706	<u>0.2926</u>	0.3406	0.3639	0.4264

Table S8. Performance metrics for predicted ΔB at Threshold = 100 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.7293</u>	0.7918	0.8099	0.7879	0.8603	<u>0.8373</u>	0.8882	0.8740
<i>POF</i>	0.1882	0.2296	<u>0.3074</u>	0.2836	0.3388	0.3199	<u>0.4442</u>	0.4003
<i>FAR</i>	0.1013	0.1124	<u>0.1422</u>	0.1358	0.1467	0.1430	<u>0.1792</u>	0.1667
<i>MR</i>	<u>0.4330</u>	0.3823	<u>0.3860</u>	0.4040	0.3261	<u>0.3540</u>	0.3153	0.3249
<i>TS</i>	<u>0.6739</u>	0.7196	0.7140	0.7011	0.7494	<u>0.7346</u>	0.7439	0.7439
<i>F1</i>	<u>0.8052</u>	0.8370	0.8331	0.8243	0.8568	<u>0.8470</u>	0.8532	0.8532
<i>TSS</i>	0.4658	0.5053	0.4718	<u>0.4602</u>	0.5272	<u>0.5030</u>	0.5055	0.5085
<i>HSS</i>	0.4825	0.5256	0.4850	<u>0.4772</u>	0.5243	0.5097	<u>0.4689</u>	0.4891

Table S9. Performance metrics for predicted ΔB at Threshold = 150 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.6803</u>	0.7440	0.7534	0.7460	0.8184	<u>0.7842</u>	0.8599	0.8432
<i>POF</i>	0.1186	0.1460	<u>0.2487</u>	0.2186	0.2743	0.2469	<u>0.3823</u>	0.3354
<i>FAR</i>	0.1166	0.1294	<u>0.2000</u>	0.1816	0.2025	0.1925	<u>0.2519</u>	0.2315
<i>MR</i>	<u>0.3238</u>	0.2836	0.3024	0.3003	0.2484	<u>0.2745</u>	0.2304	0.2376
<i>TS</i>	<u>0.6242</u>	0.6699	0.6340	0.6400	0.6776	<u>0.6606</u>	0.6668	0.6724
<i>F1</i>	<u>0.7686</u>	0.8023	0.7760	0.7805	0.8078	<u>0.7956</u>	0.8001	0.8041
<i>TSS</i>	<u>0.5595</u>	0.5870	<u>0.4976</u>	0.5181	0.5491	0.5329	<u>0.5177</u>	0.5309
<i>HSS</i>	0.5418	0.5843	<u>0.5000</u>	0.5200	0.5463	0.5348	<u>0.4893</u>	0.5158

Table S10. Performance metrics for predicted ΔB at Threshold = 200 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.6331</u>	0.6846	0.7241	0.7128	0.7812	<u>0.7466</u>	0.8142	0.8045
<i>POF</i>	0.0711	0.1117	<u>0.1697</u>	0.1523	0.2059	0.1929	<u>0.3183</u>	0.2683
<i>FAR</i>	0.1107	0.1532	<u>0.2063</u>	0.1916	0.2263	0.2228	<u>0.3025</u>	0.2701
<i>MR</i>	<u>0.2625</u>	0.2424	0.2305	0.2339	0.1990	<u>0.2206</u>	0.1973	0.1941
<i>TS</i>	<u>0.5869</u>	0.6092	0.6093	0.6098	0.6359	0.6150	<u>0.6017</u>	0.6200
<i>F1</i>	<u>0.7397</u>	0.7571	0.7573	0.7576	0.7774	0.7616	<u>0.7513</u>	0.7654
<i>TSS</i>	0.6267	0.6043	<u>0.5631</u>	0.5744	0.5747	0.5566	<u>0.5002</u>	0.5358
<i>HSS</i>	0.5702	0.5784	<u>0.5568</u>	0.5638	0.5750	0.5548	<u>0.4918</u>	0.5335

Table S11. Performance metrics for predicted ΔB at Threshold = 250 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.5774</u>	0.6071	0.6998	0.6692	0.7686	<u>0.7180</u>	0.7830	0.7887
<i>POF</i>	0.0527	0.0799	<u>0.1231</u>	0.1129	0.1504	0.1504	<u>0.2621</u>	0.2265
<i>FAR</i>	0.1208	0.1656	<u>0.2095</u>	0.2027	0.2277	0.2399	<u>0.3352</u>	0.3020
<i>MR</i>	<u>0.2284</u>	0.2208	0.1851	0.1984	0.1531	<u>0.1805</u>	0.1633	0.1535
<i>TS</i>	<u>0.5350</u>	0.5418	0.5903	0.5719	0.6267	0.5853	<u>0.5613</u>	0.5880
<i>F1</i>	<u>0.6971</u>	0.7028	0.7424	0.7277	0.7705	0.7384	<u>0.7191</u>	0.7406
<i>TSS</i>	0.6508	0.6136	<u>0.6054</u>	0.5989	0.6193	0.5796	<u>0.5015</u>	0.5445
<i>HSS</i>	0.5569	<u>0.5524</u>	0.5881	0.5717	0.6188	0.5729	<u>0.5058</u>	0.5502

Table S12. Performance metrics for predicted ΔB at Threshold = 300 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	0.5553	<u>0.5422</u>	0.6254	0.6145	0.7021	<u>0.6703</u>	0.7393	0.7426
<i>POF</i>	0.0456	0.0562	<u>0.0960</u>	0.0866	0.1194	0.1229	<u>0.2054</u>	0.1949
<i>FAR</i>	0.1333	0.1624	<u>0.2231</u>	0.2087	0.2414	0.2555	<u>0.3421</u>	0.3294
<i>MR</i>	0.1993	<u>0.2058</u>	0.1812	0.1840	0.1531	<u>0.1672</u>	<u>0.1491</u>	0.1459
<i>TS</i>	0.5116	<u>0.4906</u>	0.5302	0.5287	0.5739	0.5450	<u>0.5340</u>	0.5441
<i>F1</i>	0.6769	<u>0.6582</u>	0.6930	0.6917	0.7292	0.7055	<u>0.6962</u>	0.7048
<i>TSS</i>	0.6674	0.6318	<u>0.5956</u>	0.6073	0.6055	0.5773	<u>0.5088</u>	0.5248
<i>HSS</i>	0.5562	<u>0.5295</u>	0.5546	0.5568	0.5930	0.5604	<u>0.5190</u>	0.5344

Table S13. Performance metrics for predicted ΔB at Threshold = 350 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	0.5076	<u>0.4810</u>	0.5711	0.5698	0.6345	<u>0.6193</u>	0.6904	0.6967
<i>POF</i>	0.0529	0.0507	<u>0.0752</u>	0.0725	0.1041	0.1052	<u>0.1750</u>	0.1696
<i>FAR</i>	0.1952	0.1970	<u>0.2347</u>	0.2285	0.2764	0.2834	<u>0.3711</u>	0.3616
<i>MR</i>	0.1826	<u>0.1902</u>	0.1662	0.1662	0.1491	<u>0.1546</u>	0.1389	0.1356
<i>TS</i>	0.4520	<u>0.4302</u>	0.4860	0.4875	0.5107	0.4975	<u>0.4905</u>	0.4995
<i>F1</i>	0.6226	<u>0.6016</u>	0.6541	0.6555	0.6761	0.6644	<u>0.6582</u>	0.6663
<i>TSS</i>	0.6222	0.6127	<u>0.5991</u>	0.6053	0.5744	0.5620	<u>0.4900</u>	0.5027
<i>HSS</i>	0.5082	<u>0.4858</u>	0.5345	0.5373	0.5497	0.5348	<u>0.5014</u>	0.5137

Table S14. Performance metrics for predicted ΔB at Threshold = 400 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	0.4602	<u>0.4385</u>	0.5123	0.5224	0.5687	<u>0.5485</u>	0.6440	0.6671
<i>POF</i>	0.0575	0.0523	0.0616	<u>0.0658</u>	0.0865	0.0901	0.1393	<u>0.1429</u>
<i>FAR</i>	0.2587	0.2500	0.2516	<u>0.2602</u>	0.2982	0.3146	<u>0.3768</u>	0.3745
<i>MR</i>	0.1701	<u>0.1749</u>	0.1568	0.1546	0.1445	<u>0.1508</u>	0.1289	0.1220
<i>TS</i>	0.3965	<u>0.3826</u>	0.4370	0.4413	0.4580	<u>0.4382</u>	0.4635	0.4767
<i>F1</i>	0.5679	<u>0.5534</u>	0.6082	0.6124	0.6283	<u>0.6093</u>	0.6335	0.6457
<i>TSS</i>	<u>0.5712</u>	0.5751	0.5916	0.5851	0.5573	0.5346	<u>0.4943</u>	0.5035
<i>HSS</i>	<u>0.4585</u>	<u>0.4456</u>	0.5015	0.5042	0.5135	<u>0.4898</u>	0.4994	0.5132

Table S15. Performance metrics for predicted ΔB at Threshold = 450 nT.

<i>Metric</i>	<i>SETA</i>	<i>SETB</i>	<i>SETC</i>	<i>SETD</i>	<i>SETE</i>	<i>SETF</i>	<i>SETG</i>	<i>SETH</i>
<i>POD</i>	<u>0.4211</u>	0.4243	0.4589	0.4803	0.5230	<u>0.4901</u>	0.5855	0.6184
<i>POF</i>	<u>0.0487</u>	0.0482	0.0536	<u>0.0601</u>	0.0715	0.0690	0.1127	<u>0.1246</u>
<i>FAR</i>	0.2768	0.2732	0.2791	<u>0.2930</u>	0.3117	0.3181	0.3894	<u>0.4003</u>
<i>MR</i>	<u>0.1552</u>	0.1544	0.1472	0.1431	0.1343	<u>0.1419</u>	0.1236	0.1163
<i>TS</i>	<u>0.3626</u>	0.3660	0.3897	0.4005	<u>0.4229</u>	0.3989	0.4263	0.4377
<i>F1</i>	<u>0.5322</u>	0.5358	0.5608	0.5720	<u>0.5944</u>	<u>0.5703</u>	0.5978	0.6089
<i>TSS</i>	0.5680	0.5724	0.5737	<u>0.5640</u>	0.5541	0.5400	0.4870	<u>0.4834</u>
<i>HSS</i>	<u>0.4360</u>	0.4401	0.4641	0.4732	0.4928	<u>0.4670</u>	0.4797	0.4885