Universität Potsdam

Master Thesis

Forecasting Macroseismic Intensities: A Sensitivity Study of a Bayesian Approach

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Declaration of Authorship

I, Silvio Schwarz, declare that this thesis titled, 'Forecasting Macroseismic Intensities: A Sensitivity Study of a Bayesian Approach' and the work presented in it are my own. I confirm that:

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- I have acknowledged all main sources of help.
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" If I have seen further it is by standing on the shoulders of Giants."

Sir Isaac Newton

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Abstract

Faculty of Science
Institute of Earth and Environmental Science

Master of Science

Forecasting Macroseismic Intensities:
A Sensitivity Study of a Bayesian Approach

by Silvio Schwarz

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

Acknowledgements

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Abbreviations

I_0	Intensity at the epicentre
I_s	Intensity at site
PGA	**P**eak **G**round **A**cceleration
PSA	**P**eak **S**pectral **A**cceleration
PGV	**P**eak **G**round **V**elocity

For/Dedicated to/To my...

1 Introduction

2 Methodology

3 Sensitivity study

3.1 Synthetic Data

4 Case Study

4.1 Data

4.2 Handling uncertain data

5 Conclusions

A Data

	year	month	day	λ	θ	ϕ	I_{max}	depth	K	MLH	M_W	Length	F1.1	F1.2	F2.1	F2.2
1	1883	11	14	72.80	40.60	200	7	12	13.9	5.383	5.68	4.98	72.790	40.579	72.823	40.586
2	1885	8	2	74.10	42.70	250	9	15	15.6	6.182	6.20	11.43	74.034	42.682	74.155	42.668
3	1887	6	8	76.80	43.10	250	9	20	16.9	6.793	6.81	29.89	76.627	43.054	76.945	43.017
4	1889	7	11	78.40	43.20	250	9	40	18.5	7.545	7.55	97.54	77.837	43.049	78.872	42.929
5	1897	9	17	68.47	39.80	270	8	25	15.4	6.088	6.15	10.54	68.405	39.800	68.515	39.771
6	1902	12	16	72.30	40.80	270	9	9	15.6	6.182	6.20	11.43	72.232	40.800	72.353	40.768
7	1907	10	21	68.10	38.70	270	9	24	17.0	6.840	6.85	32.18	67.915	38.700	68.246	38.611
8	1911	1	3	76.90	42.90	250	10	25	17.8	7.216	7.22	58.14	76.566	42.810	77.180	42.739
9	1911	2	18	72.80	38.20	200	9	26	17.3	6.981	6.99	40.17	72.722	38.030	72.981	38.089
10	1924	7	12	73.20	40.60	270	8	14	15.6	6.182	6.20	11.43	73.132	40.600	73.253	40.568
11	1927	8	12	71.60	41.00	270	8	14	14.8	5.806	5.96	7.81	71.554	41.000	71.637	40.978
12	1932	12	24	78.20	42.80	250	6	23	14.0	5.430	5.71	5.23	78.170	42.792	78.225	42.786
13	1933	9	9	70.70	40.10	270	6	26	13.6	5.242	5.58	4.28	70.675	40.100	70.720	40.088
14	1937	12	18	70.90	42.10	270	7	25	15.6	6.182	6.20	11.43	70.831	42.100	70.955	42.068
15	1938	6	20	75.80	42.70	250	8	21	16.0	6.370	6.39	15.37	75.712	42.676	75.874	42.657
16	1941	4	20	70.50	39.20	270	9	8	15.6	6.182	6.20	11.43	70.434	39.200	70.552	39.168
17	1942	1	18	71.60	41.10	270	7	21	14.0	5.430	5.71	5.23	71.569	41.100	71.625	41.086
18	1946	11	2	72.00	41.90	270	9	25	17.0	6.840	6.85	32.18	71.806	41.900	72.153	41.811
19	1947	6	2	72.30	40.90	270	8	13	14.5	5.665	5.87	6.72	72.260	40.900	72.331	40.881
20	1948	7	28	75.40	41.40	250	7	6	13.6	5.242	5.58	4.28	75.376	41.393	75.420	41.388
21	1949	7	10	70.80	39.20	200	9	16	17.0	6.840	6.85	32.18	70.736	39.064	70.947	39.111
22	1954	12	3	74.80	41.40	250	7	15	14.0	5.430	5.71	5.23	74.771	41.392	74.825	41.386
23	1955	4	15	74.60	39.90	200	9	25	16.4	6.558	6.57	20.65	74.559	39.813	74.695	39.843
24	1957	5	8	74.60	41.60	250	6	7	13.0	4.960	5.39	3.17	74.582	41.595	74.615	41.591
25	1958	10	13	75.10	41.60	250	6	12	13.0	4.960	5.39	3.17	75.082	41.595	75.115	41.591
26	1959	7	12	72.80	41.70	270	6	14	12.9	4.913	5.36	3.02	72.782	41.700	72.814	41.692
27	1959	10	24	70.00	41.70	270	7	13	14.0	5.430	5.71	5.23	69.969	41.700	70.025	41.686
28	1960	12	18	78.40	42.30	250	6	17	12.8	4.866	5.33	2.87	78.384	42.296	78.414	42.292
29	1961	4	27	72.90	39.65	200	6	26	14.2	5.524	5.77	5.78	72.888	39.626	72.927	39.634
30	1962	9	3	73.10	40.93	270	7	20	14.0	5.430	5.71	5.23	73.069	40.933	73.125	40.919
31	1963	10	19	71.62	41.23	270	6	8	12.5	4.725	5.24	2.47	71.602	41.233	71.628	41.227
32	1965	3	17	69.37	40.80	270	7	12	13.0	4.960	5.39	3.17	69.348	40.800	69.381	40.791

	year	month	day	λ	θ	ϕ	I_{max}	depth	K	MLH	M_W	Length	F1.1	F1.2	F2.1	F2.2
33	1965	9	25	75.03	41.53	250	6	25	13.0	4.960	5.39	3.17	75.015	41.528	75.048	41.525
34	1965	10	18	77.55	41.97	250	6	15	13.0	4.960	5.39	3.17	77.532	41.962	77.565	41.958
35	1966	4	25	69.28	41.38	270	6	8	13.3	5.101	5.49	3.69	69.261	41.383	69.301	41.373
36	1966	4	30	71.80	41.10	270	6	20	13.6	5.242	5.58	4.28	71.774	41.100	71.820	41.088
37	1967	5	18	70.75	40.62	270	6	25	12.0	4.490	5.08	1.92	70.739	40.617	70.759	40.611
38	1967	9	28	79.70	42.10	250	6	18	13.5	5.195	5.55	4.07	79.677	42.094	79.719	42.089
39	1967	11	30	77.40	43.00	250	6	10	12.0	4.490	5.08	1.92	77.389	42.997	77.409	42.995
40	1968	3	20	75.07	41.15	250	6	17	12.6	4.772	5.27	2.60	75.052	41.146	75.079	41.143
41	1970	1	19	69.22	41.05	270	7	25	12.1	4.537	5.11	2.02	69.205	41.050	69.226	41.044
42	1970	6	5	78.73	42.52	250	8	15	15.6	6.182	6.20	11.43	78.668	42.499	78.788	42.485
43	1971	5	10	71.40	42.92	250	7	20	14.0	5.430	5.71	5.23	71.370	42.909	71.425	42.902
44	1971	10	28	72.25	41.95	270	6	17	14.0	5.430	5.71	5.23	72.218	41.950	72.275	41.936
45	1972	3	17	69.65	40.28	270	6	20	13.5	5.195	5.55	4.07	69.626	40.283	69.669	40.272
46	1974	1	22	71.90	40.20	270	7	24	12.7	4.819	5.30	2.73	71.884	40.200	71.913	40.192
47	1974	2	20	75.25	40.72	250	6	15	13.2	5.054	5.46	3.51	75.230	40.711	75.266	40.707
48	1974	7	2	75.32	42.23	250	6	15	12.9	4.913	5.36	3.02	75.299	42.229	75.331	42.225
49	1974	8	11	73.85	39.38	200	6	15	16.6	6.652	6.67	23.94	73.802	39.282	73.960	39.317
50	1975	2	12	78.80	43.30	250	6	10	13.0	4.960	5.39	3.17	78.782	43.295	78.815	43.291
51	1977	1	31	70.87	40.08	296	8	20	15.5	6.135	6.15	10.62	70.811	40.104	70.916	40.054
52	1977	6	3	71.82	40.00	128	6	15	14.2	5.524	5.77	5.78	71.843	39.984	71.843	39.984
53	1977	12	6	69.70	41.57	270	7	15	14.0	5.430	5.71	5.23	69.669	41.567	69.725	41.552
54	1978	3	24	78.58	42.88	270	8	22	15.6	6.182	6.20	11.43	78.513	42.883	78.639	42.852
55	1978	11	1	72.60	39.40	200	8	30	16.2	6.464	6.48	17.81	72.565	39.325	72.682	39.351
56	1979	4	6	77.43	41.97	121	6	25	13.5	5.195	5.55	4.07	77.454	41.957	77.453	41.955
57	1980	7	5	77.50	41.92	250	6	20	13.8	5.336	5.65	4.73	77.473	41.909	77.523	41.904
58	1980	12	11	69.05	41.33	270	7	10	13.5	5.195	5.55	4.07	69.026	41.333	69.069	41.322
59	1982	5	6	71.50	40.17	112	8	20	14.4	5.618	5.83	6.39	71.535	40.156	71.530	40.149
60	1982	12	31	77.37	42.87	274	6	15	13.6	5.242	5.58	4.28	77.340	42.868	77.387	42.855
61	1983	12	16	72.90	39.40	228	7	15	14.6	5.712	5.90	7.06	72.870	39.379	72.932	39.380
62	1983	12	21	77.25	42.07	250	6	20	12.5	4.725	5.24	2.47	77.236	42.063	77.262	42.060
63	1984	2	2	71.40	42.87	250	6	15	12.6	4.772	5.27	2.60	71.385	42.863	71.413	42.859
64	1984	2	17	71.02	40.85	240	8	10	14.1	5.477	5.74	5.50	70.988	40.838	71.042	40.835
65	1984	10	26	71.23	39.20	37	8	15	14.8	5.806	5.96	7.81	71.261	39.228	71.269	39.178
66	1985	4	27	71.12	40.85	103	8	15	12.8	4.866	5.33	2.87	71.133	40.847	71.130	40.842
67	1985	8	23	75.48	39.43	308	7	20	16.5	6.605	6.62	22.24	75.381	39.495	75.585	39.372
68	1985	10	13	69.80	40.30	48	8	10	14.8	5.806	5.96	7.81	69.834	40.323	69.836	40.278
69	1987	3	26	69.95	41.82	203	6	5	13.1	5.007	5.42	3.33	69.942	41.803	69.966	41.807
70	1988	3	13	75.47	42.10	250	6	7	12.6	4.772	5.27	2.60	75.452	42.096	75.479	42.093
71	1988	6	17	77.40	42.93	29	6	21	12.9	4.913	5.36	3.02	77.409	42.945	77.415	42.925
72	1988	12	21	72.32	41.23	270	6	10	12.9	4.913	5.36	3.02	72.299	41.233	72.331	41.225
73	1990	11	12	77.93	42.93	211	8	15	15.3	6.041	6.12	10.02	77.902	42.895	77.982	42.906
74	1992	5	15	72.42	41.10	270	8	10	15.3	6.041	6.12	10.02	72.357	41.100	72.464	41.072

	year	month	day	λ	θ	ϕ	I_{max}	depth	K	MLH	M_W	Length	F1.1	F1.2	F2.1	F2.2
75	1992	8	19	73.63	42.07	250	10	25	17.0	6.840	6.85	32.18	73.451	42.017	73.787	41.978

TABLE 1: Data (Dziewonski et al., 1981) (Ekström et al., 2012)

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