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Research article

A multiscale statistical analysis of the relationship between climate variability and dengue incidence in Mexico

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Supplementary

Table S1. Ranking of fitted national levels models according to predictive and information criteria (from better to worst fit).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
GLM	1	Poisson	Municipality	3.0247	0.468	0.4518	149280.05	1070630.16	NA	NA	1	50	1	1	53
GLM	1	Poisson	Municipality + Year	3.12	0.4482	0.394	166014.81	992849.57	NA	NA	6	46	10	5	67
GLM	2	Poisson	Municipality	3.1967	0.4808	0.3815	149563.46	1058404.79	NA	NA	19	59	12	2	92
GLM	4	Poisson	Year	3.1253	0.4723	0.4244	197566.29	1444329.24	NA	NA	7	54	3	30	94
GLM	3	Poisson	Year	3.1283	0.4723	0.4232	198019.57	1449407.05	NA	NA	8	55	5	31	99
GLM	4	Poisson	None	3.1034	0.4869	0.4246	191260.31	1532514.34	NA	NA	2	73	2	24	101
GLM	3	Poisson	None	3.1064	0.4871	0.4234	191667.54	1537528.60	NA	NA	3	74	4	25	106
GLM	2	Poisson	Year	3.1339	0.4739	0.4192	198641.04	1455258.11	NA	NA	9	56	7	34	106
GLM	1	ZIP	Municipality	3.1957	0.4712	0.3568	181140.07	842023.23	NA	NA	17	52	22	16	107
GLM	2	NegBin	Year	3.138	0.4861	0.3822	184961.46	733595.58	NA	NA	11	66	11	22	110
GLM	2	Poisson	None	3.1113	0.4886	0.4204	192257.86	1543272.00	NA	NA	4	76	6	26	112
GLM	1	Poisson	Year	3.1408	0.4758	0.4139	199763.81	1461491.92	NA	NA	12	58	9	35	114
GLM	3	NegBin	Year	3.1472	0.4861	0.3798	184199.32	732831.29	NA	NA	13	68	15	21	117
GLM	2	ZIP	Municipality	3.2132	0.4749	0.3221	178894.49	836363.49	NA	NA	21	57	29	11	118
GLM	4	NegBin	Year	3.1513	0.4865	0.3799	183659.48	732327.92	NA	NA	14	70	14	20	118
GLM	1	NegBin	Year	3.1359	0.4868	0.3811	186537.41	734439.24	NA	NA	10	72	13	23	118
GLM	2	Poisson	Municipality + Year	3.2957	0.4624	0.315	166765.82	980018.23	NA	NA	33	48	31	7	119
GLM	1	Poisson	None	3.1185	0.4907	0.4152	193376.41	1549342.82	NA	NA	5	78	8	28	119
GLM	2	NegBin	None	3.1763	0.5073	0.3777	180464.38	744881.69	NA	NA	16	81	16	14	127
GLM	1	NegBin	None	3.1652	0.5078	0.3765	181872.37	745619.76	NA	NA	15	82	17	17	131
GLM	3	NegBin	None	3.1964	0.5079	0.3748	179878.26	744194.95	NA	NA	18	83	19	13	133
GLM	4	NegBin	None	3.2051	0.5086	0.3754	179480.89	743763.43	NA	NA	20	84	18	12	134
GLM	1	ZIP	Municipality + Year	3.2377	0.459	0.3193	200347.94	803479.41	NA	NA	22	47	30	36	135
GLM	3	ZIP	Municipality	3.2781	0.4827	0.278	178001.16	829647.13	NA	NA	32	63	34	9	138
GLM	2	ZIP	Municipality + Year	3.2556	0.4629	0.2841	198203.17	797517.61	NA	NA	28	49	33	32	142
GLM	4	ZIP	None	3.2412	0.4854	0.3619	234179.24	1180906.58	NA	NA	23	65	20	39	147
GLM	3	ZIP	None	3.2436	0.4861	0.3584	234878.76	1183651.75	NA	NA	24	67	21	40	152
GLM	3	ZIP	Municipality + Year	3.3194	0.4709	0.2427	197431.53	790558.84	NA	NA	34	51	39	29	153
GLM	4	ZIP	Year	3.2554	0.481	0.354	241258.46	1136395.84	NA	NA	27	60	23	45	155
GLM	2	ZIP	None	3.2464	0.4868	0.3534	235617.50	1186210.55	NA	NA	25	71	24	41	161
GLM	3	ZIP	Year	3.2577	0.4817	0.3502	242009.76	1139033.63	NA	NA	29	61	25	46	161
GLM	2	ZIP	Year	3.2603	0.4824	0.3449	242768.94	1141569.25	NA	NA	30	62	27	47	166
GLM	1	ZIP	None	3.2495	0.488	0.3479	236622.27	1188557.34	NA	NA	26	75	26	43	170
GLM	1	ZIP	Year	3.2632	0.4835	0.3393	243802.99	1144004.57	NA	NA	31	64	28	48	171
INLA with BYM2	4	NegBin	None	3.4113	0.4118	0.2161	1312124.76	NA	673852.96	674351.88	48	1	62	64	175
INLA with BYM2	4	NegBin	Municipality	3.4113	0.4118	0.2161	1312120.27	NA	673853.44	674349.64	49	2	63	63	177
INLA with BYM2	3	NegBin	Municipality	3.4114	0.4118	0.2186	1314004.70	NA	675318.71	675897.46	50	3	60	66	179

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Table S1. Ranking of fitted models according to predictive and information criteria (continued from previous page).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
INLA with BYM2	3	NegBin	None	3.4114	0.4118	0.2185	1313997.98	NA	675317.72	675891.85	51	4	61	65	181
INLA with BYM2	2	NegBin	Municipality	3.4114	0.4118	0.222	1316173.40	NA	677128.83	677604.17	54	6	59	67	186
INLA with BYM2	2	NegBin	None	3.4114	0.4118	0.2221	1316192.75	NA	677128.38	677609.69	55	5	58	68	186
INLA with BYM2	4	Poisson	Year	3.4114	0.4118	0.2439	1322682.48	NA	1109911.57	4622595.49	62	16	35	77	190
INLA with BYM2	4	Poisson	Municipality + Year	3.4114	0.4118	0.2439	1322371.61	NA	1109911.53	4622597.91	61	19	36	76	192
GLM	3	Poisson	Municipality	3.6749	0.5055	0.3019	153293.00	1045259.12	NA	NA	83	80	32	3	198
INLA with BYM2	1	NegBin	None	3.4114	0.4118	0.2242	1319395.79	NA	679003.15	679463.30	58	13	55	73	199
INLA with BYM2	4	Poisson	None	3.4114	0.4118	0.2428	1325736.83	NA	1216126.42	4360402.14	66	10	38	85	199
INLA with BYM2	4	Poisson	Municipality	3.4114	0.4118	0.2428	1325736.99	NA	1216126.27	4360403.01	67	9	37	86	199
INLA with BYM2	4	NegBin	Year	3.4114	0.4118	0.2035	1317192.19	NA	661364.92	661965.52	52	8	71	69	200
INLA with BYM2	1	NegBin	Municipality	3.4114	0.4118	0.2239	1319287.88	NA	678977.07	679412.02	59	15	56	71	201
INLA with BYM2	4	NegBin	Municipality + Year	3.4114	0.4118	0.2034	1317784.03	NA	661365.52	661963.57	53	7	72	70	202
INLA with BYM2	3	Poisson	Year	3.4114	0.4118	0.2391	1324201.59	NA	1116551.93	5502408.38	64	22	41	79	206
INLA with BYM2	4	ZIP	None	3.4113	0.4118	0.1138	1239475.65	NA	956111.09	2816976.60	36	39	82	51	208
INLA with BYM2	3	Poisson	Municipality + Year	3.4114	0.4118	0.2391	1324219.07	NA	1116552.06	5502405.13	65	21	42	80	208
GLM	3	Poisson	Municipality + Year	3.8021	0.4899	0.2406	171431.11	966257.81	NA	NA	84	77	40	8	209
INLA with BYM2	3	NegBin	Year	3.4114	0.4118	0.2059	1319369.06	NA	662864.63	663956.15	56	12	69	72	209
INLA with BYM2	3	NegBin	Municipality + Year	3.4114	0.4118	0.2058	1319696.20	NA	662868.36	663908.73	57	11	70	74	212
INLA with BYM2	3	ZIP	Municipality	3.4113	0.4118	0.1088	1239848.82	NA	960510.61	3283594.96	37	40	85	52	214
INLA with BYM2	4	ZIP	Year	3.4113	0.4118	0.1166	1250686.13	NA	902192.55	2991287.10	43	33	81	58	215
GLM	4	ZIP	Municipality	3.4501	0.4973	0.2343	178610.77	822655.05	NA	NA	81	79	46	10	216
INLA with BYM2	4	ZIP	Municipality + Year	3.4113	0.4118	0.1128	1250223.40	NA	902417.46	2988012.28	42	36	83	57	218
GLM	4	Poisson	Municipality	4.6727	0.5451	0.2386	160765.23	1033022.06	NA	NA	86	87	43	4	220
INLA with BYM2	2	ZIP	None	3.4113	0.4118	0.1055	1240307.94	NA	965678.07	3603353.64	38	42	88	53	221

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Table S1. Ranking of fitted models according to predictive and information criteria (continued from previous page).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
INLA with BYM2	3	ZIP	Municipality + Year	3.4113	0.4118	0.1118	1252984.13	NA	906579.71	3353060.56	44	35	84	59	222
INLA with BYM2	2	NegBin	Year	3.4114	0.4118	0.2091	1323809.59	NA	664786.96	665307.24	63	14	67	78	222
INLA with BYM2	3	Poisson	None	3.4114	0.4118	0.2383	1327074.31	NA	1224409.57	4897195.90	72	18	45	87	222
INLA with BYM2	3	Poisson	Municipality	3.4114	0.4118	0.2383	1327074.48	NA	1224409.46	4897196.42	73	17	44	88	222
INLA with BYM2	3	ZIP	None	3.4113	0.4118	0.1007	1237982.91	NA	961417.85	3281010.44	35	45	93	50	223
INLA with BYM2	2	ZIP	Municipality	3.4113	0.4118	0.1053	1240357	NA	964811.27	3603194.52	39	41	89	54	223
INLA with BYM2	2	NegBin	Municipality + Year	3.4114	0.4118	0.209	1322145.06	NA	664783.98	665306.43	60	20	68	75	223
INLA with BYM2	2	Poisson	Municipality + Year	3.4114	0.4118	0.2341	1325027.79	NA	1124530.45	6093916.53	70	28	47	81	226
INLA with BYM2	2	ZIP	Municipality + Year	3.4113	0.4118	0.1071	1257335.03	NA	908955.50	3554212.38	47	34	87	62	230
INLA with BYM2	2	Poisson	Year	3.4114	0.4118	0.2341	1325686.53	NA	1124530.54	6093911.83	71	27	48	84	230
INLA with BYM2	1	ZIP	Municipality	3.4113	0.4118	0.101	1241275.17	NA	970402.87	3563128.53	41	43	92	56	232
INLA with BYM2	1	ZIP	None	3.4113	0.4118	0.09981	1241083.22	NA	970522.37	3561484.84	40	44	94	55	233
INLA with BYM2	1	ZIP	Municipality + Year	3.4113	0.4118	0.1014	1254660.65	NA	913224.75	3559705.92	45	38	90	60	233
INLA with BYM2	1	ZIP	Year	3.4113	0.4118	0.1014	1254838.24	NA	913220.48	3559689.81	46	37	91	61	235
GLM	1	NegBin	Municipality	5.2048	0.5623	0.2222	166754.30	575212.69	NA	NA	88	88	57	6	239
INLA with BYM2	2	Poisson	None	3.4114	0.4118	0.2337	1328549.20	NA	1234071.58	5353045.19	75	24	50	91	240
INLA with BYM2	2	Poisson	Municipality	3.4114	0.4118	0.2337	1328549.38	NA	1234071.40	5353045.48	76	23	49	92	240
INLA with BYM2	1	NegBin	Municipality + Year	3.4114	0.4118	0.2104	1325582.54	NA	666714.33	667166.81	68	26	66	82	242
INLA with BYM2	1	NegBin	Year	3.4114	0.4118	0.2105	1325591.22	NA	666716.54	667169.69	69	25	65	83	242
INLA with BYM2	1	Poisson	Municipality + Year	3.4114	0.4118	0.228	1327593.31	NA	1135284.37	6672080.68	74	32	52	89	247
INLA with BYM2	1	Poisson	Year	3.4114	0.4118	0.228	1327930.75	NA	1135284.37	6672080.09	77	31	51	90	249
GLM	1	NegBin	Municipality + Year	4.3459	0.5113	0.2108	181950.12	563302.37	NA	NA	85	85	64	18	252
INLA with BYM2	1	Poisson	None	3.4114	0.4118	0.2276	1330727.23	NA	1245506.15	5945615.09	78	29	54	93	254

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Table S1. Ranking of fitted models according to predictive and information criteria (continued from previous page).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
INLA with BYM2	1	Poisson	Municipality	3.4114	0.4118	0.2276	1330727.37	NA	1245506.00	5945614.44	79	30	53	94	256
GLM	4	ZIP	Municipality + Year	3.4951	0.4863	0.2031	198335.02	783479.23	NA	NA	82	69	73	33	257
GLM	4	Poisson	Municipality + Year	4.909	0.5347	0.1883	180532.83	953452.87	NA	NA	87	86	74	15	262
GLM	2	NegBin	Municipality	8.1027	0.6417	0.1692	183379.38	573093.23	NA	NA	90	90	75	19	274
GLM	2	NegBin	Municipality + Year	6.2799	0.5684	0.1608	193247.26	561082.36	NA	NA	89	89	76	27	281
GLM	3	NegBin	Municipality	12.2651	0.7459	0.1405	207485.65	570972.78	NA	NA	92	92	77	37	298
GLM	3	NegBin	Municipality + Year	9.2857	0.6476	0.1335	211256.09	558841.99	NA	NA	91	91	78	38	298
GLM	4	NegBin	Municipality + Year	13.4915	0.7525	0.1181	235936.67	556760.73	NA	NA	93	93	80	42	308
GLM	4	NegBin	Municipality	17.9171	0.8826	0.1238	240139.99	569000.01	NA	NA	94	94	79	44	311
INLA with BYM2	4	ZIP	Municipality	3.414	0.4715	-0.05886	1205483.03	NA	7783384.23	9.797e+08	80	53	143	49	325
INLA with BYM2	2	ZIP	Year	2.6e+12	1.27e+12	0.1076	3.27e+17	NA	908821.25	3536450.04	96	96	86	96	374
INLA with BYM2+RW2	2	NegBin	Year	7.73e+22	5.61e+21	-0.006085	1.44e+27	NA	639126.14	639997.31	97	97	125	97	416
INLA with BYM2+RW2	2	NegBin	Municipality + Year	1.52e+23	1.1e+22	-0.006073	2.83e+27	NA	639122.33	639999.99	98	98	123	98	417
INLA with BYM2+RW2	3	NegBin	Municipality + Year	2.06e+23	1.49e+22	-0.006084	3.84e+27	NA	638923.11	639800.13	99	99	124	99	421
INLA with BYM2+RW2	4	NegBin	Municipality + Year	3.65e+23	2.65e+22	-0.006056	6.82e+27	NA	638708.20	639529.34	101	101	121	101	424
INLA with BYM2+RW2	3	NegBin	Year	3.06e+23	2.21e+22	-0.006085	5.7e+27	NA	638921.09	639803.25	100	100	126	100	426
INLA with BYM2+RW2	4	NegBin	Year	4.71e+23	3.42e+22	-0.006057	8.8e+27	NA	638710.42	639534.57	102	102	122	102	428
INLA with BYM2	3	ZIP	Year	1.2e+10	6223792611	-0.07085	1.6e+15	NA	8343623.79	7.728e+08	95	95	144	95	429
INLA with BYM2+RW2	1	NegBin	Year	2.57e+24	1.86e+23	-0.006052	4.78e+28	NA	639201.28	640071.18	103	103	120	103	429
INLA with BYM2+RW2	4	NegBin	None	7.66e+27	5.46e+26	-0.005997	1.41e+32	NA	638766.56	639601.39	105	105	114	105	429
INLA with BYM2+RW2	1	NegBin	Municipality + Year	2.78e+24	2.01e+23	-0.006048	5.17e+28	NA	639203.61	640070.73	104	104	119	104	431
INLA with BYM2+RW2	3	NegBin	None	1.63e+28	1.15e+27	-0.006018	2.97e+32	NA	638979.38	639861.30	106	106	118	106	436
INLA with BYM2+RW2	3	NegBin	Municipality	1.69e+28	1.2e+27	-0.006015	3.09e+32	NA	638974.16	639856.41	107	107	117	107	438
INLA with BYM2+RW2	4	NegBin	Municipality	3.2e+28	2.28e+27	-0.005985	5.86e+32	NA	638761.24	639592.61	109	109	111	109	438
INLA with BYM2+RW2	2	NegBin	None	3.19e+28	2.27e+27	-0.006002	5.84e+32	NA	639174.31	640057.28	108	108	116	108	440

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Table S1. Ranking of fitted models according to predictive and information criteria (continued from previous page).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
INLA with BYM2+RW2	2	NegBin	Municipality	3.23e+28	2.29e+27	-0.006002	5.9e+32	NA	639173.21	640055.90	110	110	115	110	445
INLA with BYM2+RW2	1	NegBin	None	8.81e+28	6.26e+27	-0.005995	1.61e+33	NA	639259.81	640147.35	111	111	113	111	446
INLA with BYM2+RW2	1	NegBin	Municipality	1.26e+29	8.98e+27	-0.005993	2.31e+33	NA	639257.53	640145.52	112	112	112	112	448
INLA with BYM2+RW2	2	Poisson	Year	3.05e+32	2.03e+31	-0.005802	5.23e+36	NA	923535.11	1977947.65	118	118	107	118	461
INLA with BYM2+RW2	2	Poisson	Municipality + Year	3.12e+32	2.08e+31	-0.005802	5.35e+36	NA	923550.18	1978600.12	119	119	108	119	465
INLA with BYM2+RW2	3	Poisson	Municipality + Year	4.04e+32	2.68e+31	-0.005815	6.9e+36	NA	922795.56	1906208.23	120	120	110	120	470
INLA with BYM2+RW2	3	Poisson	Year	4.31e+32	2.86e+31	-0.005814	7.37e+36	NA	922746.41	1906140.84	121	121	109	121	472
INLA with BYM2+RW2	1	Poisson	Municipality + Year	8.3e+32	5.54e+31	-0.005797	1.43e+37	NA	923290.62	1989817.26	122	122	106	122	472
INLA with BYM2+RW2	1	Poisson	Year	8.41e+32	5.61e+31	-0.005796	1.44e+37	NA	923311.48	1988778.42	123	123	105	123	474
INLA with BYM2+RW2	4	Poisson	Year	1.31e+33	8.77e+31	-0.005792	2.26e+37	NA	922664.07	1847396.00	125	125	104	125	479
INLA with BYM2+RW2	1	ZIP	Municipality + Year	2.61e+30	1.84e+29	-0.006898	4.75e+34	NA	790905.49	1340529.35	113	113	141	113	480
INLA with BYM2+RW2	4	Poisson	Municipality + Year	1.41e+33	9.43e+31	-0.005792	2.43e+37	NA	922644.88	1845060.15	126	126	103	126	481
INLA with BYM2+RW2	2	ZIP	Year	2.08e+31	1.47e+30	-0.006896	3.77e+35	NA	790240.49	1310631.93	114	114	140	114	482
INLA with BYM2+RW2	4	ZIP	Municipality + Year	4.78e+31	3.36e+30	-0.006873	8.64e+35	NA	790776.32	1288731.43	115	115	137	115	482
INLA with BYM2+RW2	2	ZIP	Municipality + Year	9.93e+31	7e+30	-0.006896	1.8e+36	NA	790098.28	1309549.61	116	116	139	116	487
INLA with BYM2+RW2	3	ZIP	Year	2.15e+32	1.51e+31	-0.006893	3.89e+36	NA	790346.55	1306834.86	117	117	138	117	489
INLA with BYM2+RW2	2	Poisson	None	1.77e+37	1.16e+36	-0.005761	3e+41	NA	921668.91	1988578.11	135	135	99	135	504
INLA with BYM2+RW2	3	ZIP	Municipality + Year	1.09e+33	7.66e+31	-0.00687	1.97e+37	NA	789864.28	1289395.74	124	124	136	124	508
INLA with BYM2+RW2	2	Poisson	Municipality	1.77e+37	1.17e+36	-0.005761	3e+41	NA	921648.30	1990547.18	136	136	100	136	508
INLA with BYM2+RW2	3	Poisson	Municipality	2.38e+37	1.57e+36	-0.005774	4.03e+41	NA	921338.28	1901345.36	137	137	102	137	513
INLA with BYM2+RW2	3	Poisson	None	2.41e+37	1.59e+36	-0.005774	4.09e+41	NA	921344.46	1901513.79	138	138	101	138	515
INLA with BYM2+RW2	1	Poisson	None	5.41e+37	3.57e+36	-0.005757	9.2e+41	NA	921920.70	1974805.30	139	139	98	139	515

Continued on next page

Table S1. Ranking of fitted models according to predictive and information criteria (continued from previous page).

Model type	Lag	Distribution	Random effect	RMSE	MAE	Correlation	Poisson Deviance	AIC	DIC	WAIC	rank RMSE	rank MAE	rank Cor	rank Dev	Rank Global
INLA with BYM2+RW2	1	ZIP	Year	2.05e+33	1.44e+32	-0.006865	3.71e+37	NA	790559.80	1332559.80	127	127	135	127	516
INLA with BYM2+RW2	1	Poisson	Municipality	5.5e+37	3.63e+36	-0.005757	9.36e+41	NA	921908.63	1974786.86	140	140	97	140	517
INLA with BYM2+RW2	3	ZIP	Municipality	4.19e+34	2.93e+33	-0.006864	7.55e+38	NA	789574.24	1285284.78	128	128	134	128	518
INLA with BYM2+RW2	1	ZIP	Municipality	4.79e+34	3.36e+33	-0.006857	8.64e+38	NA	790220.52	1321707.86	129	129	131	129	518
INLA with BYM2+RW2	4	Poisson	None	8.32e+37	5.5e+36	-0.005751	1.42e+42	NA	921496.43	1849545.53	141	141	96	141	519
INLA with BYM2+RW2	4	Poisson	Municipality	8.92e+37	5.89e+36	-0.005751	1.52e+42	NA	921510.54	1849099.56	142	142	95	142	521
INLA with BYM2+RW2	1	ZIP	None	4.9e+34	3.44e+33	-0.006858	8.85e+38	NA	790256.66	1322970.80	130	130	132	130	522
INLA with BYM2+RW2	4	ZIP	None	8.37e+34	5.84e+33	-0.006837	1.5e+39	NA	790126.58	1278205.58	132	132	128	132	524
INLA with BYM2+RW2	2	ZIP	None	5.15e+34	3.61e+33	-0.006858	9.29e+38	NA	789435.63	1293176.45	131	131	133	131	526
INLA with BYM2+RW2	2	ZIP	Municipality	1.2e+35	8.38e+33	-0.006853	2.16e+39	NA	789283.37	1286158.78	133	133	130	133	529
INLA with BYM2+RW2	3	ZIP	None	3.09e+35	2.15e+34	-0.006852	5.55e+39	NA	789463.08	1281754.00	134	134	129	134	531
INLA with BYM2+RW2	4	ZIP	Year	1.12e+45	7.7e+43	-0.00677	1.98e+49	NA	790661.99	1280223.53	143	143	127	143	556
INLA with BYM2+RW2	4	ZIP	Municipality	4.64e+73	3.29e+72	-0.007387	8.47e+77	NA	815249.14	1263074.17	144	144	142	144	574



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