Supplementary Materials:

Table S1 Australian PyroCb Register

Id	Event	Year	Date	State	Location	Longitude	Latitude	Level of confidence
1983a	1983 (16 Feb) SA: Adelaide Hills	1983	16/02/1983	SA	Adelaide Hills	137.5	-35	High
1983b	1983 (16 Feb) Vic: Lorne	1983	16/02/1983	Vic	Lorne	144	-38	High
1994a	1994 (23 Jan) WA: WSW Kalgoorlie	1994	23/01/1994	WA	WSW Kalgoorlie	120	-32	Moderate
1995a	1995 (25 Feb) Vic: Berringa	1995	25/02/1995	Vic	Berringa	143.7	-37.8	Very high
1998a	1998 (02 Feb) Vic: Caledonia River	1998	02/02/1998	Vic	Caledonia River	146.8	-37.5	Very high
2001a	2001 (18 Jan) WA: Splinter Rock	2001	18/01/2001	WA	Splinter Rock	122.9	-33.1	Very high
2002a	2002 (17 Dec) Vic: Big Desert	2002	17/12/2002	Vic	Big Desert	141	-35.7	Very high
2003a	2003 (10 Jan) WA: Mount Cooke	2003	10/01/2003	WA	Mount Cooke	116.3	-32.4	Very high
2003b	2003 (17 Jan) ACT: Stockyard Spur	2003	17/01/2003	ACT	Stockyard Spur	148.9	-35.5	Very high
2003c	2003 (17 Jan) NSW: Cabramurra	2003	17/01/2003	NSW	Cabramurra	148.5	-36	Very high
2003d	2003 (17 Jan) NSW: Thredbo	2003	17/01/2003	NSW	Thredbo	148.3	-36.5	Very high
2003e	2003 (18 Jan) NSW: Broken Cart Fire	2003	18/01/2003	NSW	Broken Cart Fire	148.6	-35.5	Very high
2003f	2003 (18 Jan) ACT: Stockyard Complex	2003	18/01/2003	ACT	Stockyard Complex	148.9	-35.6	Very high
2003g	2003 (18 Jan) ACT: Stockyard Complex	2003	18/01/2003	ACT	Stockyard Complex	148.8	-35.5	Very high
2003h	2003 (18 Jan) NSW: McIntyres Hut Fire	2003	18/01/2003	NSW	McIntyres Hut Fire	148.8	-35.3	Very high
2003i	2003 (18 Jan) NSW: Tumut River	2003	18/01/2003	NSW	Tumut River	148.4	-36	Very high
2003j	2003 (26 Jan) NSW: Alpine Complex	2003	26/01/2003	NSW	Alpine Complex	147	-37	Very high
2003k	2003 (30 Jan) NSW: Alpine Complex	2003	30/01/2003	NSW	Alpine Complex	148	-37	Very high
2006a	2006 (19 Jan) Vic: Grampians	2006	19/01/2006	Vic	Grampians	142.4	-37.3	Very high
2006b	2006 (22 Nov) NSW: Wollemi	2006	22/11/2006	NSW	Wollemi	150.3	-32.8	Very high
2006c	2006 (22 Nov) NSW: Grose Valley	2006	22/11/2006	NSW	Grose Valley	150.3	-33.6	Very high
2006d	2006 (29 Nov) NSW: Pilliga	2006	29/11/2006	NSW	Pilliga	149.2	-31	Very high

2006e	2006 (06 Dec) Vic: Dandongadale	2006	06/12/2006	Vic	Dandonga-dale	146.6	-36.8	Moderate
2006f	2006 (06 Dec) Vic: Basalt Knob #1	2006	06/12/2006	Vic	Basalt Knob #1	146.5	-37.4	Moderate
2006g	2006 (06 Dec) Vic: Licola	2006	06/12/2006	Vic	Licola	146.8	-37.6	Moderate
2006h	2006 (10 Dec) Vic: Black Range	2006	10/12/2006	Vic	Black Range	146.6	-37.8	Moderate
2006i	2006 (10 Dec) Vic: Basalt Knob #2	2006	10/12/2006	Vic	Basalt Knob #2	146.5	-37.4	Moderate
2006j	2006 (10 Dec) Vic: Turton river	2006	10/12/2006	Vic	Turton river	147	-37.7	Moderate
2006k	2006 (14 Dec) Vic: East Licola	2006	14/12/2006	Vic	East Licola	146.8	-37.6	Moderate
2006l	2006 (14 Dec) Vic: Thomson River	2006	14/12/2006	Vic	Thomson River	146.6	-38	Moderate
2006m	2006 (14 Dec) Vic: Gaffneys Creek	2006	14/12/2006	Vic	Gaffneys Creek	146.2	-37.5	Moderate
2007a	2007 (16 Jan) Vic: Mount Buller	2007	16/01/2007	Vic	Mount Buller	146.4	-37.1	Very high
2009a	2009 (07 Feb) Vic: Kilmore Gap	2009	07/02/2009	Vic	Kilmore Gap	145.1	-37.2	Very high
2009b	2009 (07 Feb) Vic: Murrundindi	2009	07/02/2009	Vic	Murrun-dindi	145.5	-37.4	Very high
2009c	2009 (07 Feb) Vic: Bunyip	2009	07/02/2009	Vic	Bunyip	145.7	-37.9	Very high
2009d	2009 (07 Feb) Vic: Dargo	2009	07/02/2009	Vic	Dargo	147.16	-37.24	Very high
2009e	2009 (07 Feb) Vic: Beechworth	2009	07/02/2009	Vic	Beechworth	146.7	-36.4	Very high
2010a	2010 (18 Feb) WA: Esperance	2010	18/02/2010	WA	Esperance	122.2	-33.1	Very high
2012a	2012 (18 Oct) WA: Deserts	2012	18/10/2012	WA	Deserts	125.1	-27.3	Very high
2012b	2012 (18 Oct) WA: Deserts	2012	18/10/2012	WA	Deserts	124.8	-26.5	Very high
2012c	2012 (18 Oct) WA: Deserts	2012	18/10/2012	WA	Deserts	126.7	-27.4	Very high
2012d	2012 (18 Oct) WA: Deserts	2012	18/10/2012	WA	Deserts	126	-27.6	Very high
2012e	2012 (18 Oct) WA: Deserts	2012	18/10/2012	WA	Deserts	126.7	-28.3	Very high
2012f	2012 (29 Oct) WA: Deserts	2012	29/10/2012	WA	Deserts	122.8	-28.5	Very high
2013a	2013 (04 Jan) Tas: Dunalley	2013	04/01/2013	Tas	Dunalley	147.7	-42.9	Very high
2013b	2013 (13 Jan) NSW: Wambelong	2013	13/01/2013	NSW	Wambelong	149	-31.3	Very high
2013c	2013 (21 Feb) Vic: Grampians	2013	21/02/2013	Vic	Grampians	142.3	-37.3	Very high

2014a	2014 (16 Jan) Vic: Grampians	2014	16/01/2014	Vic	Grampians	142.4	-37	Very high
2014b	2014 (17 Jan) Vic: Grampians	2014	17/01/2014	Vic	Grampians	142.3	-37.1	Very high
2014c	2014 (09 Feb) Vic: East Gippsland	2014	09/02/2014	Vic	East Gipps-land	148.5	-37.3	Very high
2015a	2015 (07 Jan) Vic: Black Range	2015	07/01/2015	Vic	Black Range	142.1	-37.1	Very high
2015b	2015 (07 Jan) Vic: Nhill	2015	07/01/2015	Vic	Nhill	141.4	-36.5	Moderate
2016a	2016 (06 Jan) WA: Wa-roona	2016	06/01/2016	WA	Waroona	116	-32.9	Very high
2016b	2016 (07 Jan) WA: Wa-roona	2016	07/01/2016	WA	Waroona	116	-32.9	Very high
2016c	2016 (07 Jan) WA: Wa-roona	2016	07/01/2016	WA	Waroona	116	-32.9	Very high
2016d	2016 (05 Dec) Qld: Cecil Plains	2016	05/12/2016	Qld	Cecil Plains	151	-28.2	Very high
2016e	2016 (06 Dec) Qld: Cecil Plains	2016	06/12/2016	Qld	Cecil Plains	151	-28.2	Very high
2016f	2016 (07 Dec) WA: Cocklebiddy	2016	07/12/2016	WA	Cockle-biddy	126	-32.1	Very high
2017a	2017 (12 Feb) NSW: Sir Ivan Fire	2017	12/02/2017	NSW	Sir Ivan Fire	149.55	-32.05	Very high
2017b	2017 (08 Nov) WA: Ta-ble Hill	2017	08/11/2017	WA	Table Hill	117.02	-34.65	Very high
2017c	2017 (08 Nov) WA: Ta-ble Hill	2017	08/11/2017	WA	Table Hill	117.16	-34.69	Very high
2018a	2018 (04 Nov) WA: Deserts	2018	04/11/2017	WA	Deserts	122.3	-21	High
2019a	2019 (25 Jan) Vic: Tim-barra	2019	25/01/2019	Vic	Timbarra	148.1	-37.1	Very high
2019b	2019 (03 Feb) Vic: Tim-barra	2019	03/02/2019	Vic	Timbarra	148.16	-36.97	Very high
2019c	2019 (03 Feb) Vic: Wal-halla	2019	03/02/2019	Vic	Walhalla	146.53	-37.96	Very high
2019d	2019 (27 Feb) WA: Goldfields	2019	27/02/2019	WA	Goldfields	120.7	-32.5	Very high
2019e	2019 (27 Feb) WA: Goldfields	2019	27/02/2019	WA	Goldfields	122.7	-33	Very high
2019f	2019 (27 Feb) WA: Goldfields	2019	27/02/2019	WA	Goldfields	122.7	-33	Very high
2019g	2019 (01 Mar) WA: Goldfields	2019	01/03/2019	WA	Goldfields	124.5	-24.5	Very high
2019h	2019 (01 Mar) WA: Goldfields	2019	01/03/2019	WA	Goldfields	124.3	-28.5	Very high
2019i	2019 (02 Mar) Vic: Licola	2019	02/03/2019	Vic	Licola	146.7	-37.6	Very high
2019j	2019 (02 Mar) Vic: Bunyip	2019	02/03/2019	Vic	Bunyip	145.7	-38	Very high

2019k	2019 (03 Mar) Vic: Licola	2019	03/03/2019	Vic	Licola	146.7	-37.65	Very high
2019l	2019 (03 Mar) Vic: Bunyip	2019	03/03/2019	Vic	Bunyip	146.9	-38.2	Very high
2019m	2019 (04 Mar) Vic: Licola	2019	04/03/2019	Vic	Licola	146.75	-37.7	Very high
2019n	2019 (04 Mar) Vic: High Plains	2019	04/03/2019	Vic	High Plains	147.2	-37.1	Very high
2019o	2019 (04 Mar) Vic: Dargo	2019	04/03/2019	Vic	Dargo	147.1	-37.4	Very high
2019p	2019 (04 Mar) Vic: Mt Wellington	2019	04/03/2019	Vic	Mt Welling-ton	146.8	-37.5	Very high
2019q	2019 (05 Mar) Vic: Tea TreeRange	2019	05/03/2019	Vic	Tea TreeRange	147	-37.3	Very high
2019r	2019 (05 Mar) Vic: Dargo	2019	05/03/2019	Vic	Dargo	147.27	-37.2	Very high
2019s	2019 (05 Mar) Vic: Licola	2019	05/03/2019	Vic	Licola	146.8	-37.7	Very high
2019t	2019 (05 Mar) Vic: Dargo	2019	05/03/2019	Vic	Dargo	147.3	-37.2	Very high
2019u	2019 (22 Nov) NSW: Grose Valley	2019	22/11/2019	NSW	Grose Val-ley	150.44	-33.6	Very high
2019v	2019 (10 Dec) Vic: Mt Skene	2019	10/12/2019	Vic	Mt Skene	146.4	-37.5	Moderate
2019w	2019 (10 Dec) NSW: Mt Werong	2019	10/12/2019	NSW	Mt Werong	149.98	-34.08	Very high
2019x	2019 (14 Dec) Vic: Grant Junction	2019	14/12/2019	Vic	Grant Junc-tion	147.2	-37.4	Moderate
2019y	2019 (18 Dec) WA: Es-perance	2019	18/12/2019	WA	Esperance	120	-32.6	Very high
2019z	2019 (19 Dec) NSW: West of Sydney	2019	19/12/2019	NSW	West of Sydney	149.79	-34.12	Very high
2019aa	2019 (20 Dec) Vic: Tambo Crossing	2019	20/12/2019	Vic	Tambo Crossing	147.85	-37.65	Very high
2019ab	2019 (21 Dec) NSW: Il-ford	2019	21/12/2019	NSW	Ilford	149.8	-33	Very high
2019ac	2019 (21 Dec) NSW: Ulladulla	2019	21/12/2019	NSW	Ulladulla	150.28	-35.19	Very high
2019ac	2019 (21 Dec) NSW: Mt Irvine	2019	21/12/2019	NSW	Mt Irvine	150.4	-33.6	Very high
2019ad	2019 (28 Dec) NSW: Tumut area	2019	28/12/2019	NSW	Tumut area	148.16	-35.42	Very high
2019ae	2019 (28 Dec) NSW: Badja area	2019	28/12/2019	NSW	Badja area	149.5	-36.17	Very high
2019af	2019 (28 Dec) NSW: Ulladulla area	2019	28/12/2019	NSW	Ulladulla area	149.97	-35.58	Very high
2019ag	2019 (28 Dec) NSW: Nowra area	2019	28/12/2019	NSW	Nowra area	150.43	-34.9	Very high
2019ag	2019 (28 Dec) NSW: Mt Tianjara	2019	28/12/2019	NSW	Mt Tianjara	150.2	-35	Very high

2019ah	2019 (29 Dec) NSW: Wombeyan Caves area	2019	29/12/2019	NSW	Wombeyan Caves area	150	-34.3	Very high
2019ah	2019 (29 Dec) Vic: Goonjerah	2019	29/12/2019	Vic	Goonjerah	148.7	-37.3	Very high
2019ai	2019 (29 Dec) Vic: Cann River	2019	29/12/2019	Vic	Cann River	149.4	-37.6	Very high
2019aj	2019 (30 Dec) Vic: Wulgulmerang	2019	30/12/2019	Vic	Wul-gulmerang	148.9	-37.3	Very high
2019ak	2019 (30 Dec) NSW: E of Cooma	2019	30/12/2019	NSW	E of Cooma	149.8	-36.1	Very high
2019al	2019 (30 Dec) Vic: Cann River	2019	30/12/2019	Vic	Cann River	149.4	-37.6	Very high
2019am	2019 (30 Dec) Vic: Cann River	2019	30/12/2019	Vic	Cann River	149.4	-37.6	Very high
2019an	2019 (30 Dec) Vic: Ensay	2019	30/12/2019	Vic	Ensay	147.8	-37.4	Very high
2019ao	2019 (30 Dec) Vic: Dig-gers Hole	2019	30/12/2019	Vic	Diggers Hole	148.13	-37.09	Very high
2019ap	2019 (30 Dec) Vic: Bul-lumwaal	2019	30/12/2019	Vic	Bullumwaal	147.63	-37.62	Very high
2019aq	2019 (31 Dec) NSW: Yarrangobilly	2019	31/12/2019	NSW	Yar-rangobilly	148.1	-35.7	Very high
2019ar	2019 (31 Dec) NSW: Nowra	2019	31/12/2019	NSW	Nowra	150.5	-35	Very high
2019as	2019 (30 Dec) Vic: Goonjerah	2019	30/12/2019	Vic	Goonjerah	148.44	-37.71	Very high
2019at	2019 (10 Dec) NSW: Gibraltar Range	2019	10/12/2019	NSW	Gibraltar Range	152.2	-29.5	Very high
2019au	2019 (10 Dec) NSW: Nullo Mtn	2019	10/12/2019	NSW	Nullo Mtn	150.3	-32.8	Very high
2019av	2019 (10 Dec) NSW: Cockatoo Hill	2019	10/12/2019	NSW	Cockatoo Hill	150.3	-33.4	Moderate
2019aw	2019 (10 Dec) NSW: Mt Carrington	2019	10/12/2019	NSW	Mt Carring-ton	151.8	-31.4	Very high
2019ax	2019 (10 Dec) NSW: Paddys flat	2019	10/12/2019	NSW	Paddys flat	152.4	-28.7	Very high
2020a	2020 (01 Jan) NSW: Nullo Mtn	2020	01/01/2020	NSW	Nullo Mtn	150.25	-32.72	Very high
2020b	2020 (04 Jan) NSW: Nowra	2020	04/01/2020	NSW	Nowra	150.4	-34.8	Very high
2020c	2020 (04 Jan) NSW: Cabramurra	2020	04/01/2020	NSW	Cabramurra	148.3	-35.5	Very high
2020d	2020 (04 Jan) NSW: W of Mt Kosciuszko	2020	04/01/2020	NSW	W of Mt Kosciuszko	148.1	-36.5	Very high
2020e	2020 (04 Jan) NSW: Cabramurra	2020	04/01/2020	NSW	Cabramurra	148.3	-35.5	Very high
2020f	2020 (08 Jan) WA: Bel-ladonia	2020	08/01/2020	WA	Belladonia	123.2	-32.7	Very high

2020g	2020 (08 Jan) WA: Belladonia	2020	08/01/2020	WA	Belladonia	123.9	-33.1	Very high
2020h	2020 (08 Jan) WA: Bald Rock Fire	2020	08/01/2020	WA	Bald Rock Fire	119.6	-32.5	Moderate
2020i	2020 (08 Jan) WA: Lake King Fire	2020	08/01/2020	WA	Lake King Fire	120	-33	Moderate
2020j	2020 (08 Jan) WA: Wingarnie	2020	08/01/2020	WA	Wingarnie	121.6	-31.9	Moderate
2021a	2021 (23 Jan) WA: Balladonia	2021	23/01/2021	WA	Balladonia	123.52	-32.05	Very high

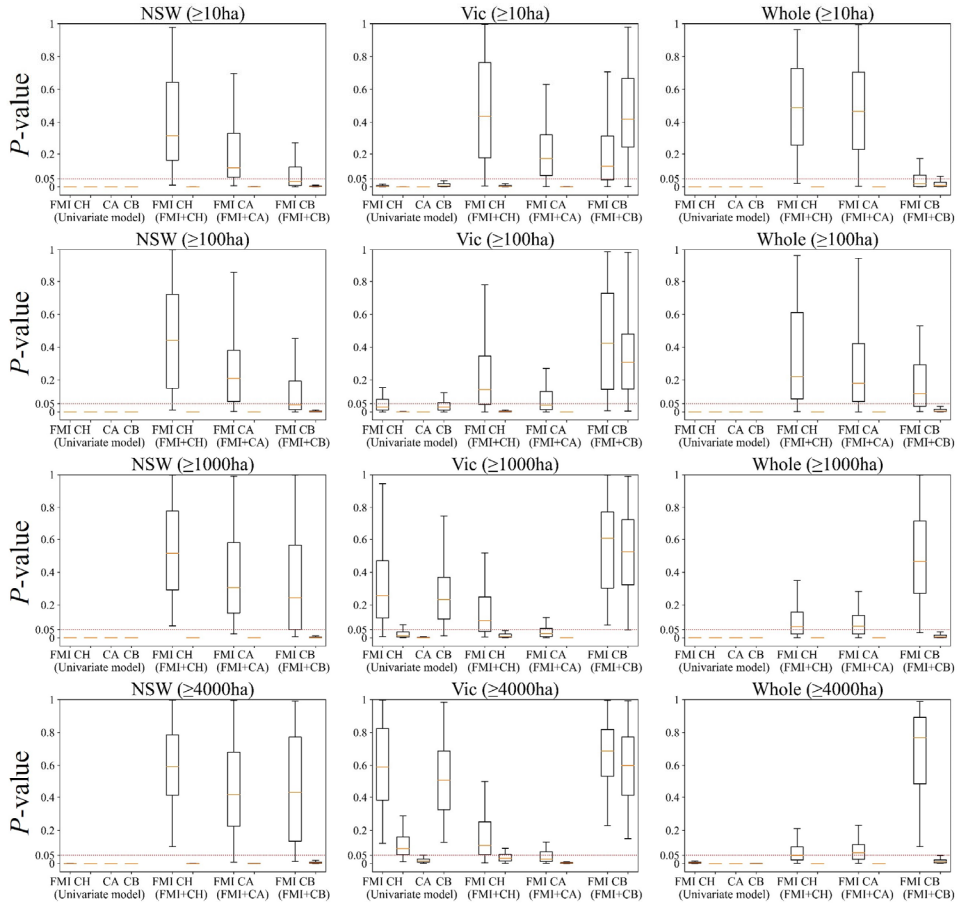

Figure S1 P value distribution of *FMI*, C-Haines (CH), *CA*, *CB* in univariate models and multivariate models at 0200UTC, the y-axis indicates the P value, the x-axis indicates variables, and the second line of the x-axis label in parentheses indicates the model type.

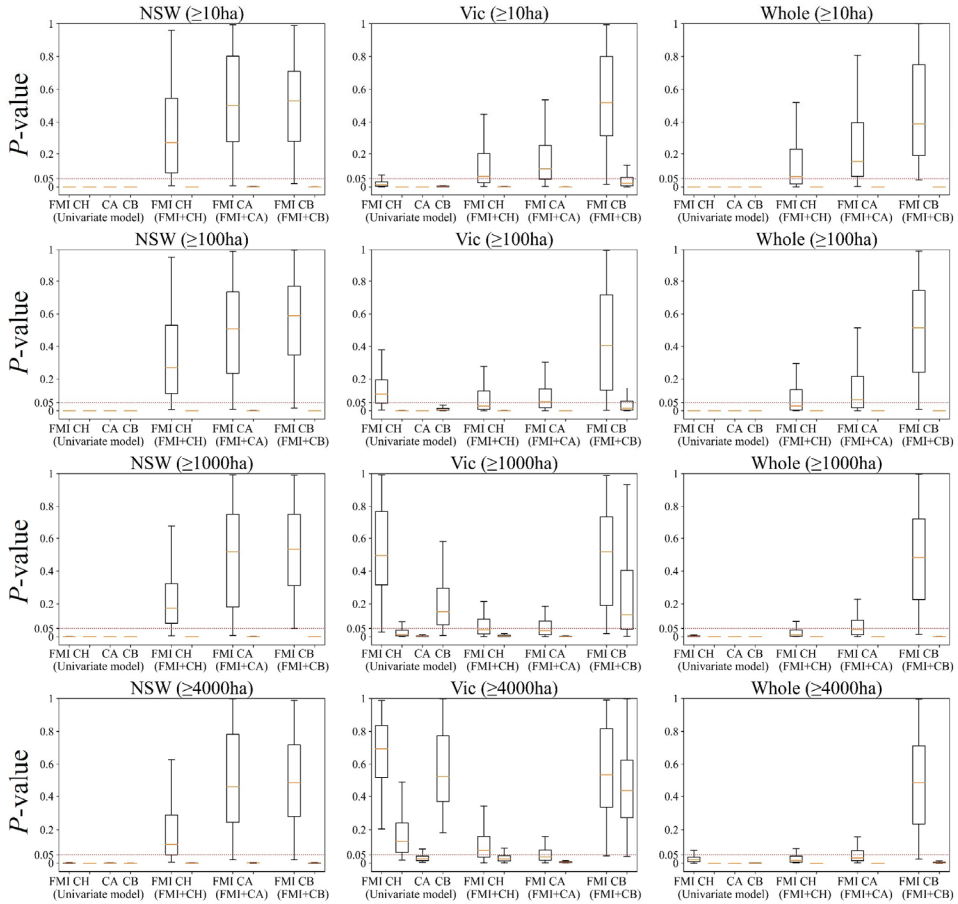

Figure S2 *P*-value distribution of *FMI*, C-Haines (CH), *CA*, *CB* in univariate models and multivariate models at 0400UTC, the y-axis indicates the *p*-value, the x-axis indicates variables, and the second line of the x-axis label in parentheses indicates the model type.

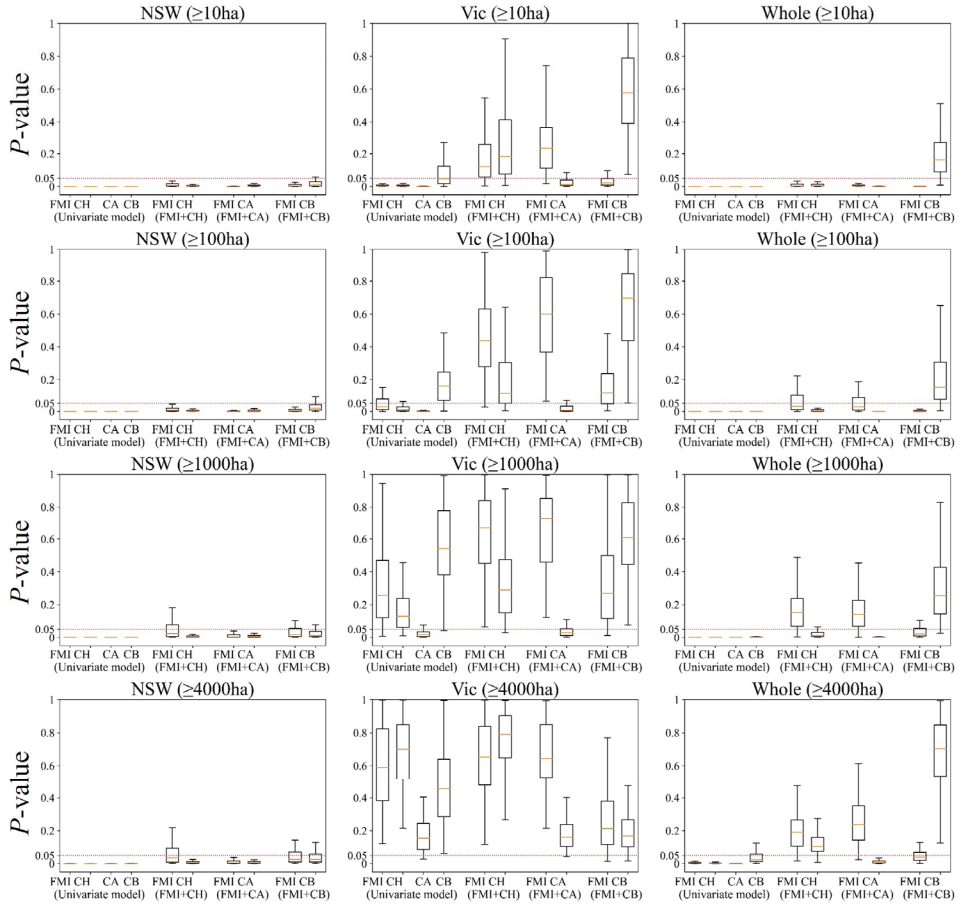

Figure S3 ***P*-value distribution of *FMI*, C-Haines (CH), *CA*, *CB* in univariate models and multivariate models at 0800UTC, the y-axis indicates the *p*-value, the x-axis indicates variables, and the second line of the x-axis label in parentheses indicates the model type.**

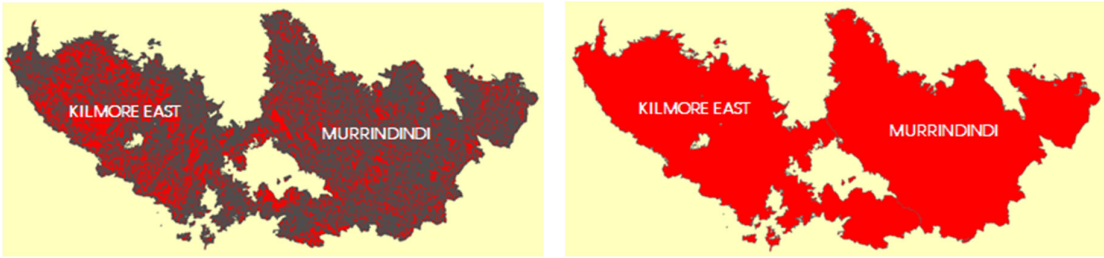

Figure S4 Two fires that occurred in 2009 recorded in Vic fire history dataset. On the left is the original data, with 98,103 polygons for these two fires. On the right is the merged fire polygons. The white letters are the names of the two fires.