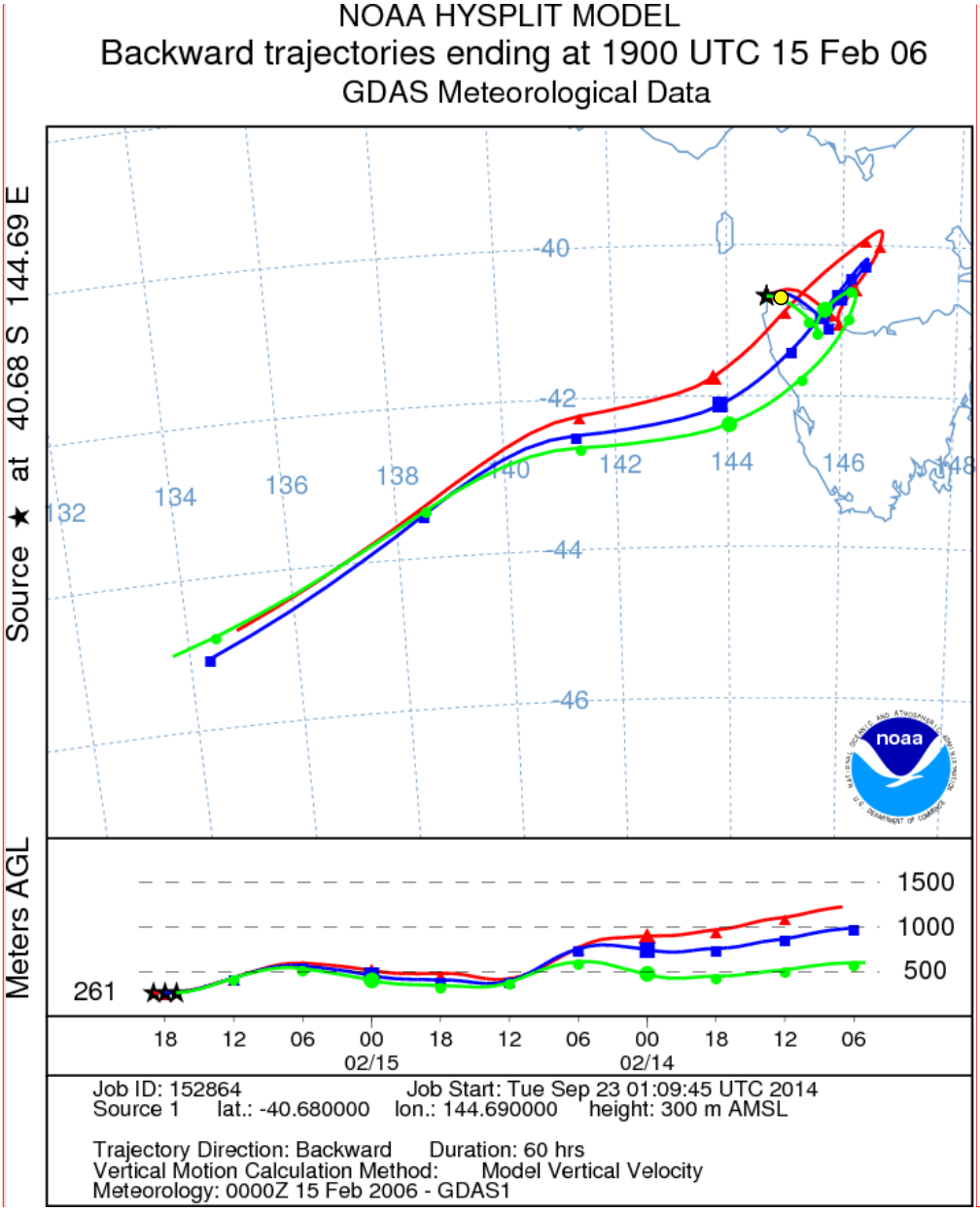

Fig 1a. Air mass back trajectory corresponding to BB1 Period A, fresh BB plume. Three back trajectories have been run and finish at 3:00, 4:00 and 5:00 on 16th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

Comment [law208 1]: Fire location has been added to all figures and the location of Melbourne has also been labelled where it is visible in the figure.

Comment [law208 2]: The times that the back trajectories correspond to have been added for all figures

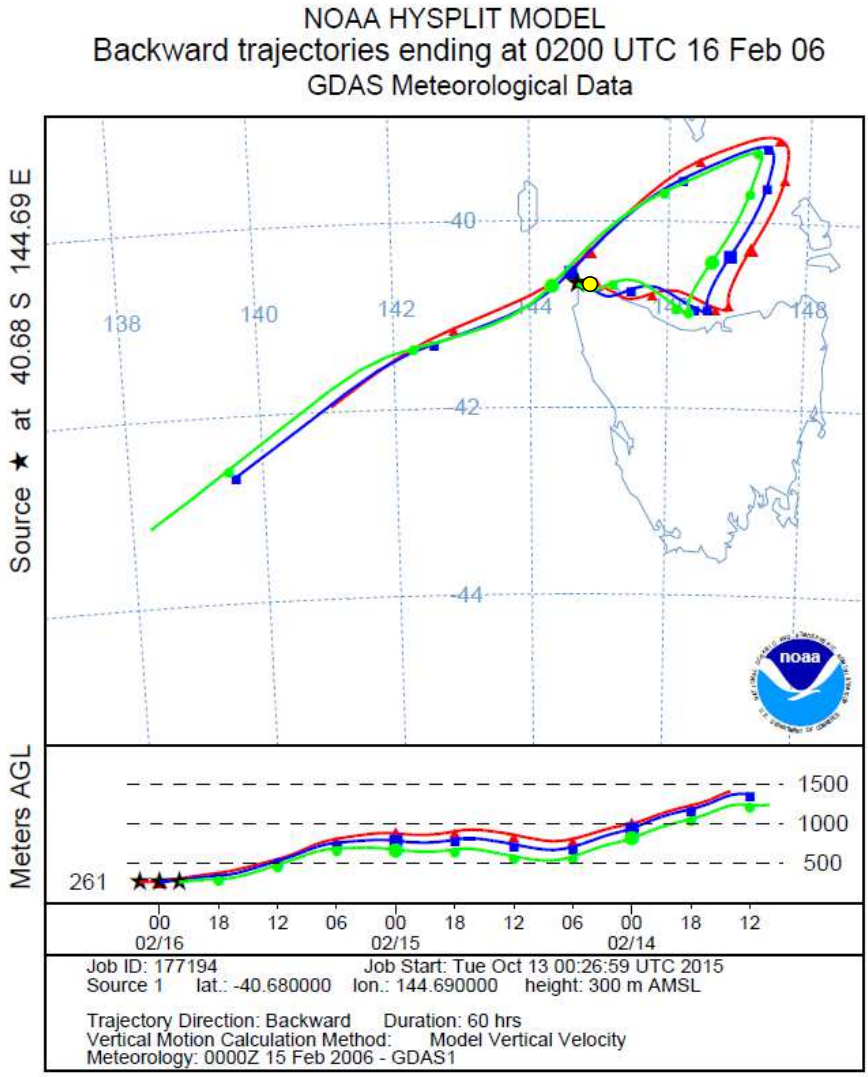

Fig 1b. Air mass back trajectory corresponding to BB1 Period B, particle growth event. Three back trajectories have been run and finish at 8:00, 10:00 and 12:00 on 16th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

Comment [law208 3]: These back trajectories have been rerun

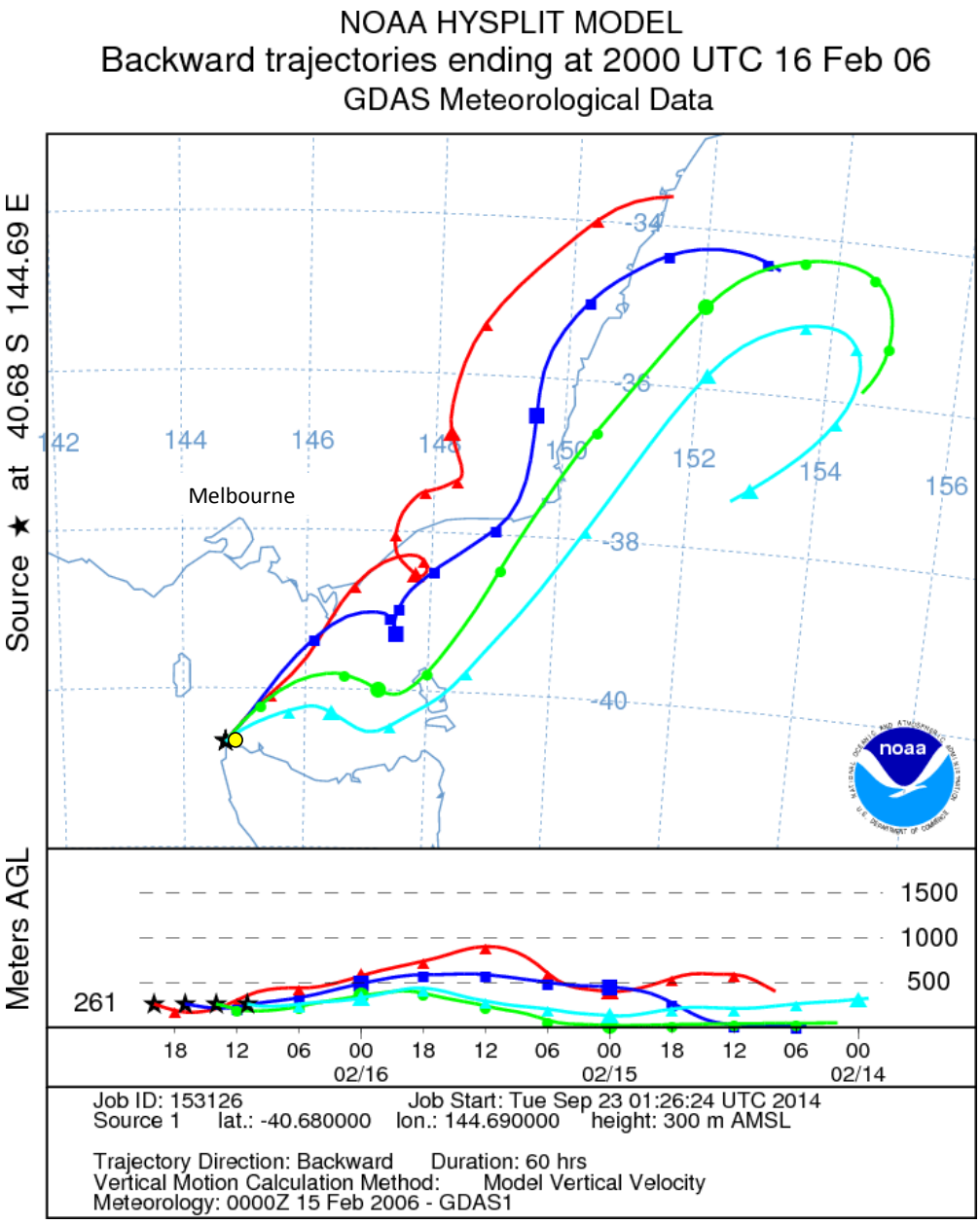

Fig 1c. Air mass back trajectory corresponding to BB1 Period C, mainland influence (background). Four back trajectories have been run and finish at 21:00 on the 16 February, 0:00, 3:00 and 6:00 on 17th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

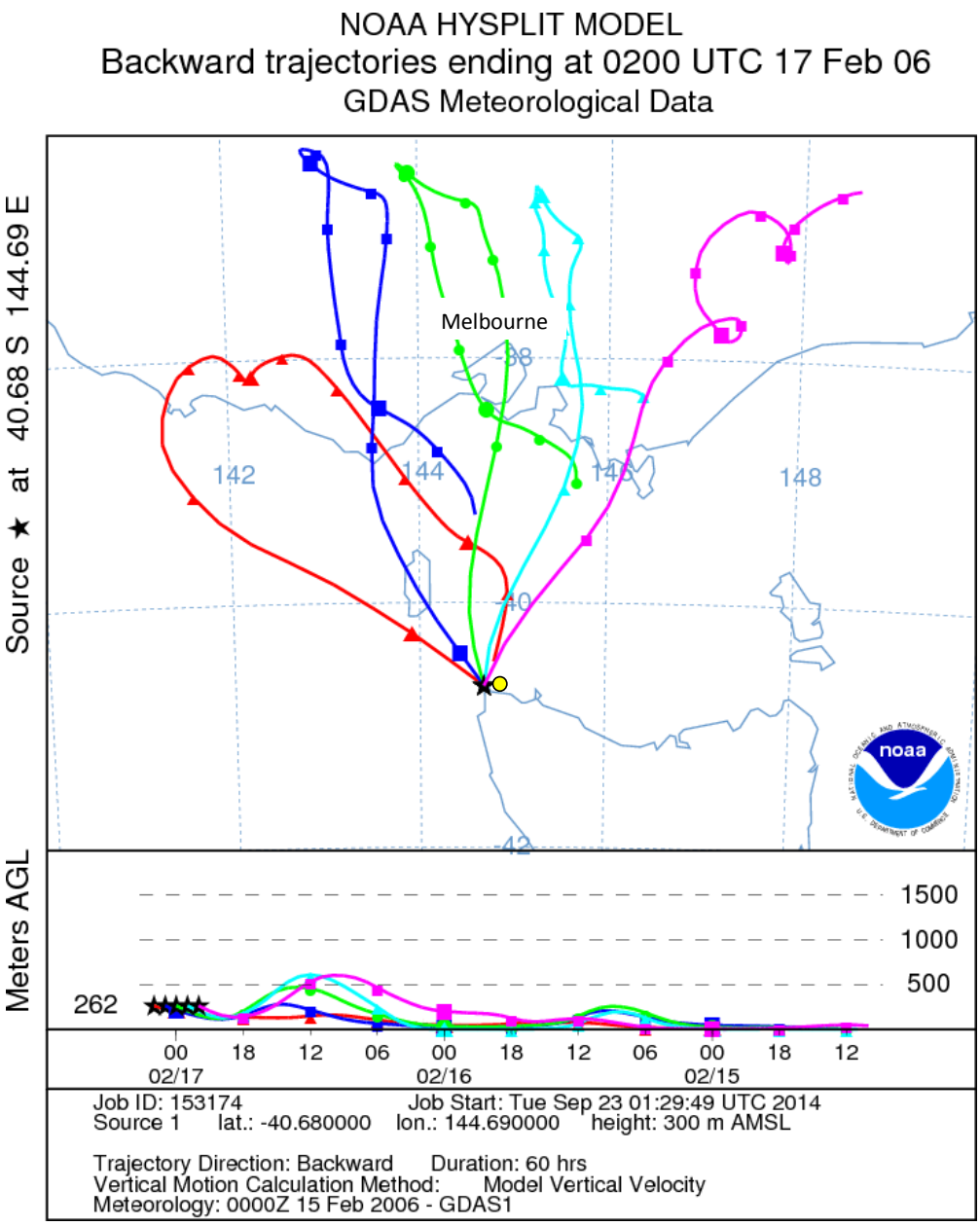

Fig 1d. Air mass back trajectory corresponding to BB1 Period D, mainland influence (urban). Five back trajectories have been run and finish at 8:00, 9:00, 10:00, 11:00 and 12:00 on 17th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

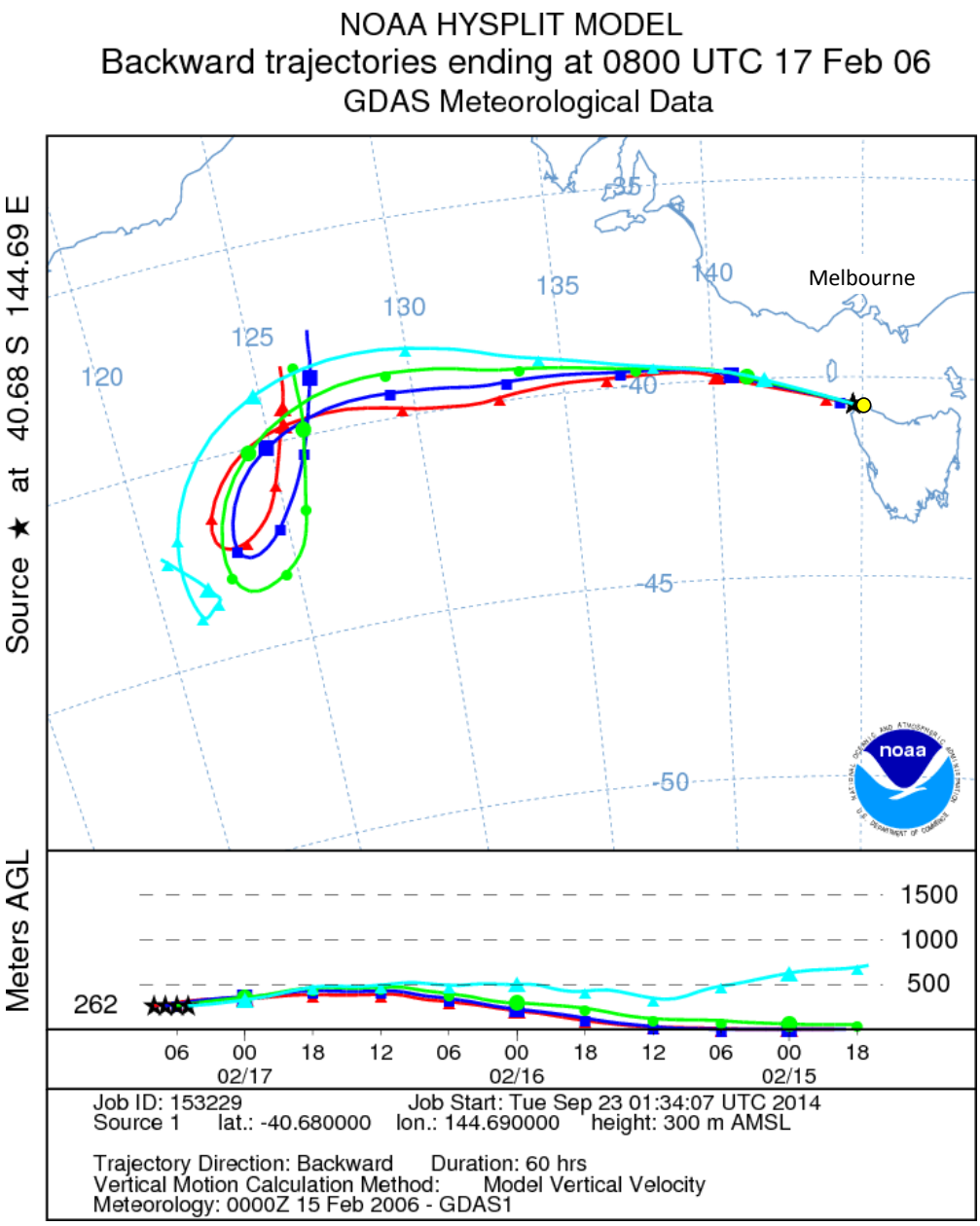

Fig 1e. Air mass back trajectory corresponding to BB1 Period E, clean marine air. Four back trajectories have been run and finish at 15:00, 16:00, 17:00 and 18:00 on 17th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

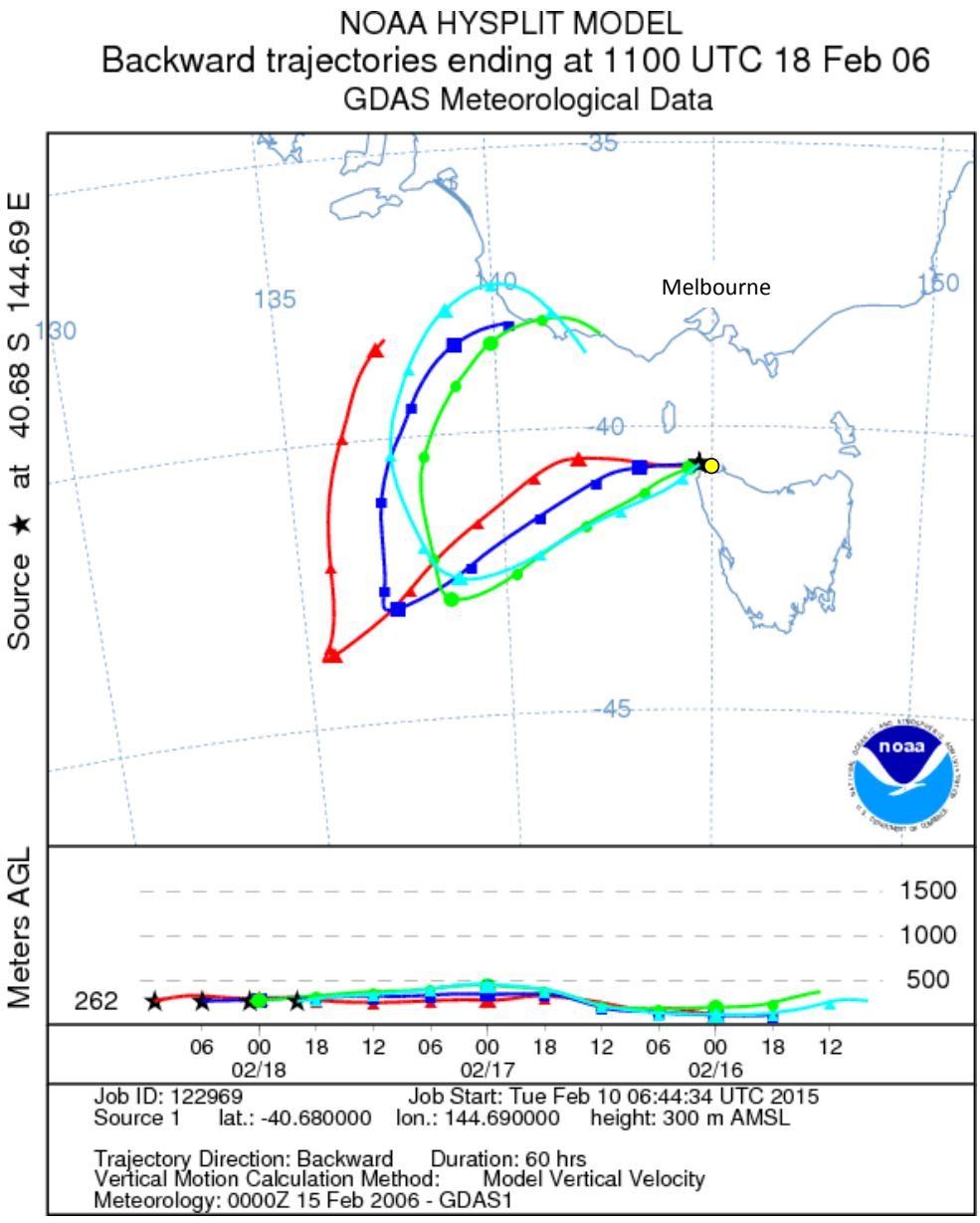

Fig 1 f. Air mass back trajectory corresponding to BB1 Period F, marine air with minor terrestrial influence. Four back trajectories have been run and finish at 6:00, 11:00, 16:00 and 21:00 on 18th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

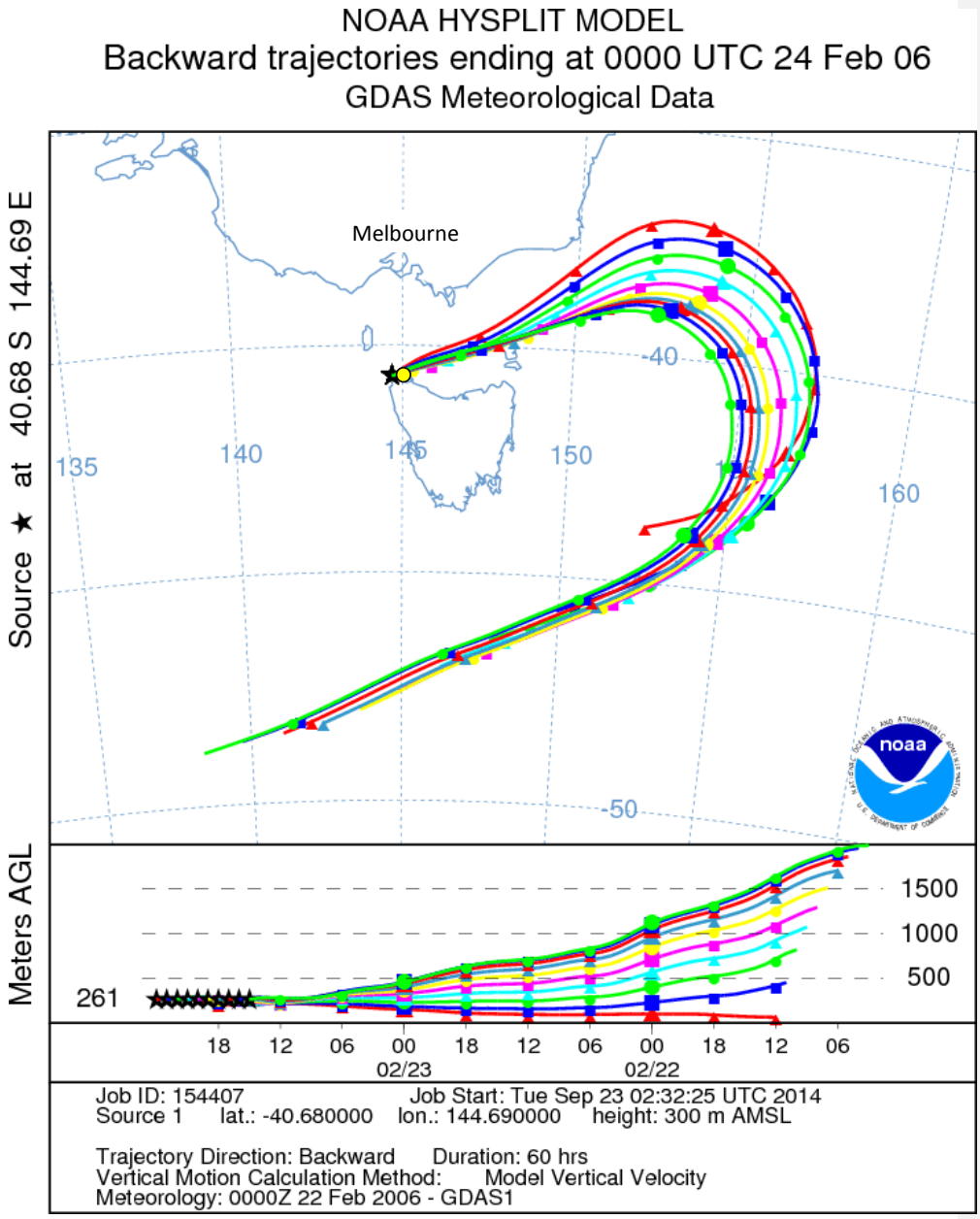

Fig 2a. Air mass back trajectory corresponding to BB2 Period A, fresh BB plume. Ten back trajectories have been run and finish at 1:00, 2:00. 3:00, 4:00, 5:00, 6:00, 7:00, 8:00, 9:00 and 10:00 on 24th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

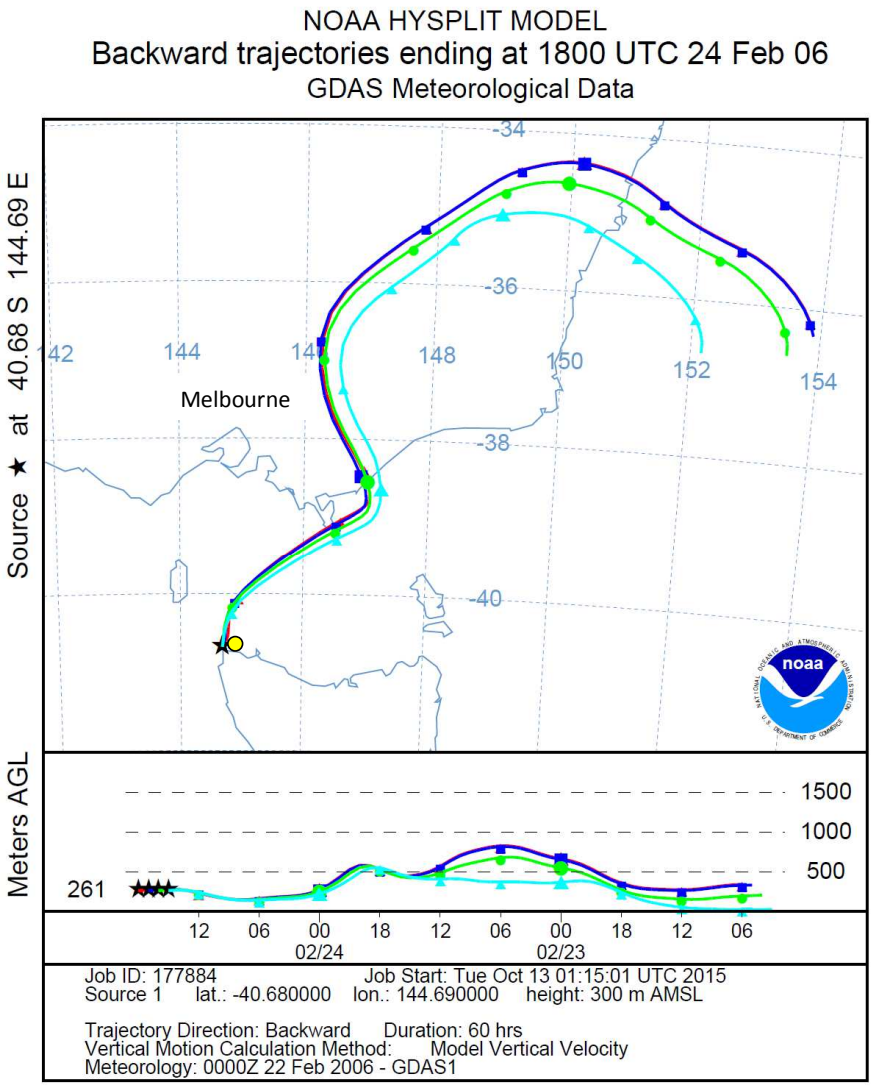

Fig 2b. Air mass back trajectory corresponding to BB2 Period B, mainland influence (background). . Four back trajectories have been run and finish at 1:00, 2:00. 3:00, 4:00 on 25th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

Comment [law208 4]: Back traj been rerun for this figure

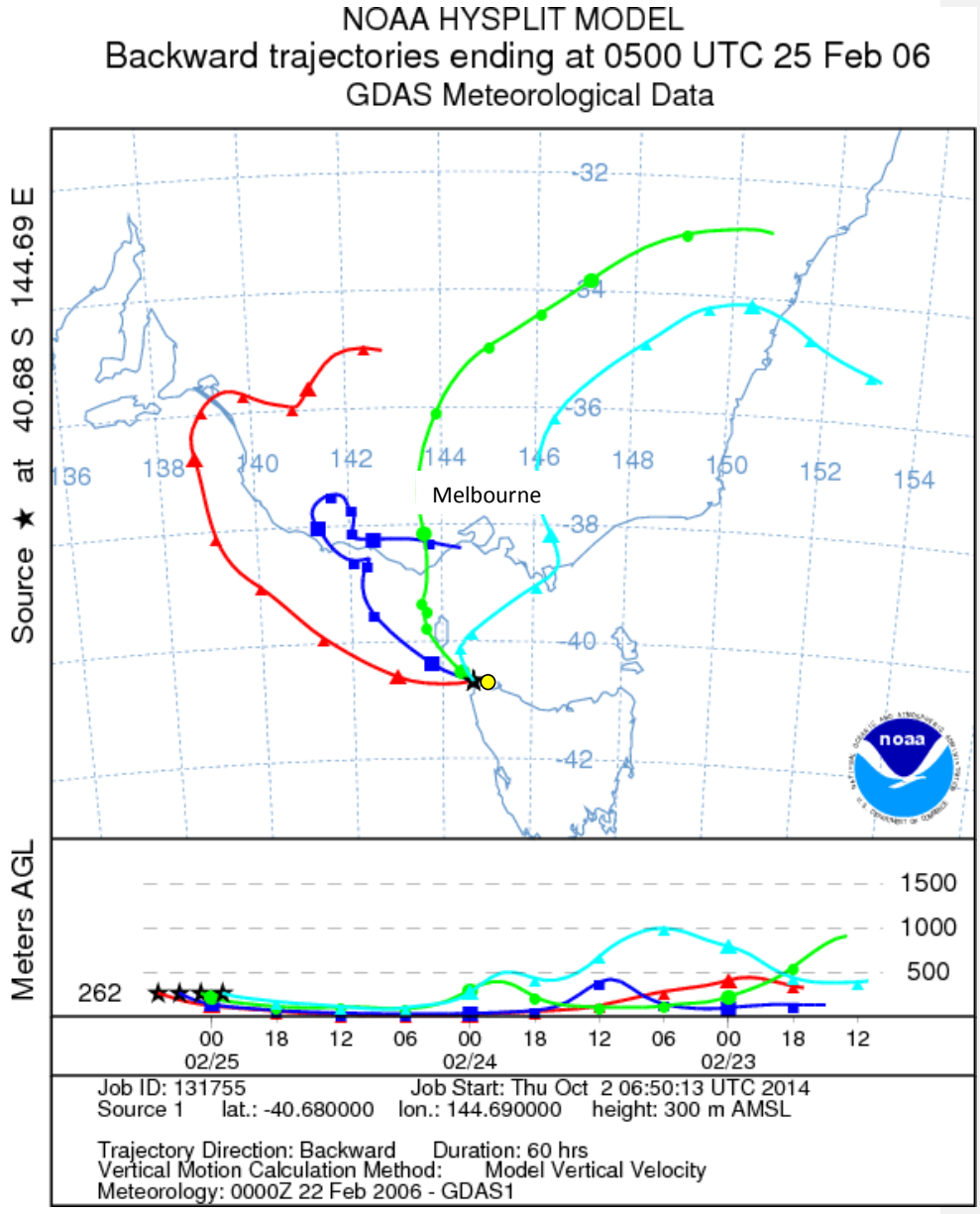

Fig 2c. Air mass back trajectory corresponding to BB2 Period C, mainland influence (urban). Four back trajectories have been run and finish at 9:00, 11:00, 13:00 and 15:00 on 25th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

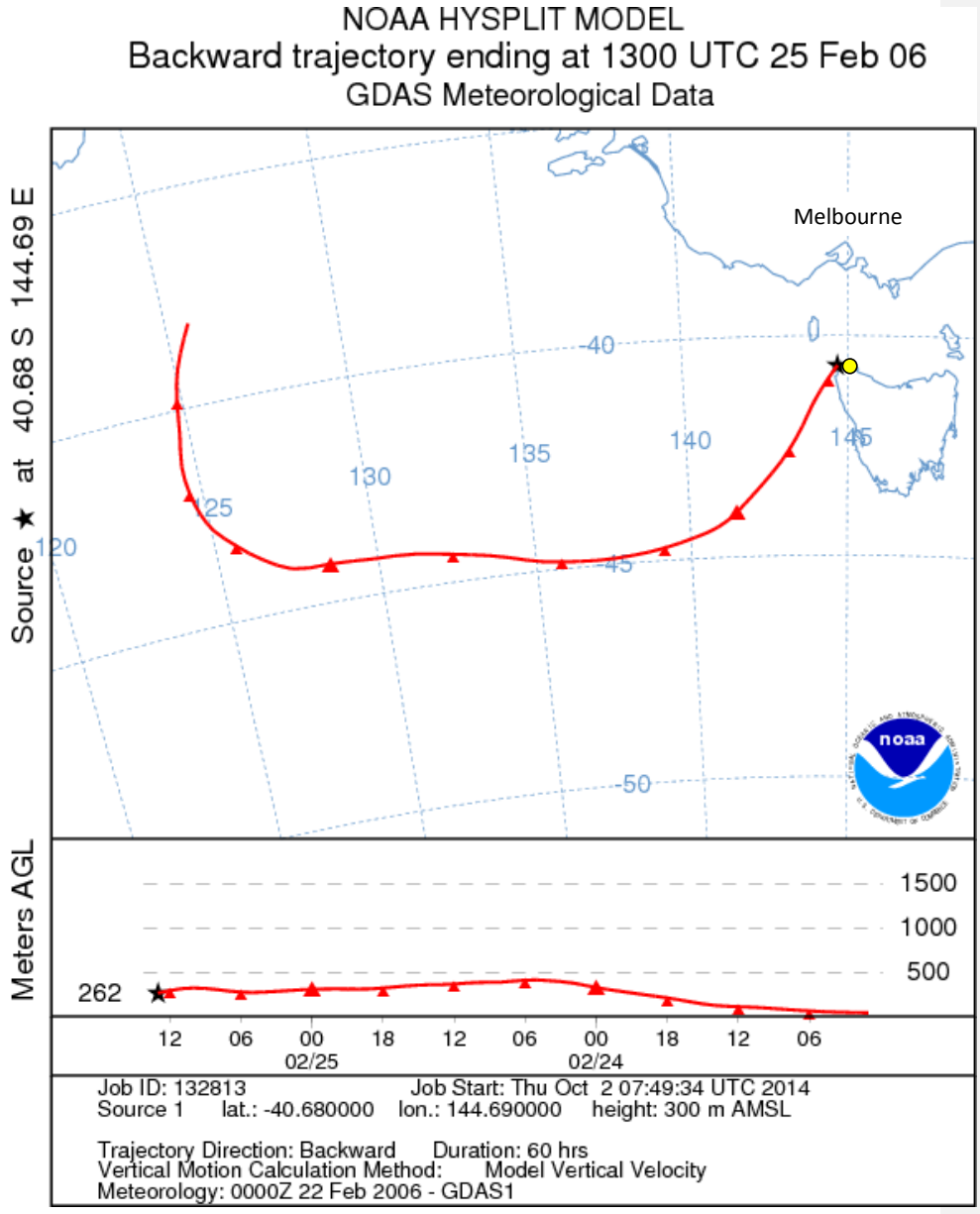

Fig 2d. Air mass back trajectory corresponding to BB2 Period D, clean marine air. Back trajectory ends at 23:00 on the 25th February 2006 Australian Eastern Standard Time (AEST). Yellow circle indicates approximate fire location.

Compound	formula	EF (g kg -1)[a]	EF (g kg $^{-1}$)[b]
methane	CH_4	3.8	2.5
hydrogen	H_2	0.93	0.64
ethane	C_2H_6	0.41	0.30
hydrogen cyanide (m/z 28)	HCN	0.73	0.49
methanol (m/z 33)	CH_3OH	2.07	1.4
acetonitrile (m/z 42)	C_2H_3N	0.32	0.17
acetaldehyde (m/z 45)	CH_3CHO	0.92	0.62
acetone/propanal (m/z 59)	C_3H_6O	0.54	0.36
acetic acid (m/z 61)	CH_3COOH	0.75	0.52
furan/isoprene (m/z 69)	C_4H_4O	1.69	1.15
MVK/MAK (m/z 71)	C_4H6O	0.38	0.26
methylglyoxal/methyl ethyl ketone (m/z 73)	C_4H_8O	0.35	0.24
benzene (m/z 79)	C_6H_6	0.69	0.47
unknown (m/z 85)	unknown	0.57	0.39
unknown (m/z 87)	$C_4H_6O_2$	0.39	0.27
toluene (m/z 93)	C_7H_8	0.30	0.20
phenol (m/z 95)	C_6H_5OH	0.35	0.24
xylenes (m/z 107)	C_8H_{10}	0.26	0.18
unknown (m/z 113)	unknown	0.25	0.17
C_3-benzenes (m/z 121)	C_9H_{12}	0.27	0.18
monoterpenes (m/z 137)	$C_{10}H_{16}$	0.11	0.08
methyl chloride	CH_3Cl	0.28	0.21
methyl bromide	CH_3Br	0.019	0.015
methyl iodide	CH_3I	0.0025	0.0019
black carbon	n/a	0.16	0.22

emission factors for selected species calculated using [a]carbon mass balance method and [b] ER to CO method. EF for CO taken from temperate forest (Akagi et al 2011)

EFs (g/kg fuel) were calculated using the equation detailed in Andreae et al., (2001), using CO as the reference gas:

$$EF(X) = ER(X/CO) \times \frac{MW(X)}{MW(CO)} \times EF(CO) \quad (1)$$

Where EF (X) is the calculated emission factor in g/kg fuel, ER (X/CO) is the molar emission ratio with respect to CO, MW(X) is the molecular weight of the trace species, MW (CO) is the molecular weight of CO, and EF(CO) is the emission factor of CO. The EF (CO) used was the temperate average EF from Akagi et al., (2011) (original publication) of 89 ±32 g CO kg $^{-1}$ fuel, which corresponds to MCE of 0.92.