Supplement:

Detailed Methodology

The buoyancy flux parameter (F_B) **Equation A1** is a function of the temperature difference between the air (T_A) and the fire (T_F), the vertical motion of air (v) and the size of the fire, d (here always measured at 1km^2 in this work).

$$F_B = gv\frac{d^2}{4}\left(\frac{T_F - T_A}{T_A}\right) \tag{A1}$$

The buoyancy flux parameter has been found empirically to demonstrate whether the plume rise is buoyancy or momentum dominated. Under stable atmospheric conditions [Stone and Carlson, 1979], where the atmospheric lapse rate is ($L_A = \frac{\Delta T}{\Delta Z} < -5$), for a buoyancy dominated plume, (defined as where the difference between T_A and T_F is given in **Equation A2b1**), the plume rise height (Δh) is given by **Equation A2b2**, where (U) is the horizontal wind magnitude.

$$(T_F - T_A) > 0.01958 T_F \sqrt{v} \tag{A2b1}$$

$$\Delta h = 2.4\left(\frac{F_B}{.02U}\right)^{1/3} \tag{A2b2}$$

Whereas, for a momentum dominated plume (where the difference between T_A and T_F is less than the right hand side of **Equation A2b1)**, the height rise is given by **Equation A2b3**.

$$\Delta h = 1.5\left(\frac{\frac{V^2 d^2}{4}\frac{T_A}{T_F}}{\sqrt{.02U}}\right)^{1/3} \tag{A2b3}$$

On the other hand, under unstable atmospheric conditions (where $L_A > -5$), and where the plume rise is buoyancy dominated, the plume rise height is given by either **Equation A2b4** when $F_B > 55$ or **Equations A2b5, A2b6** when $F_B < 55$ [Woodward, 2010].

$$X^* = 14{F_B}^{\frac{5}{8}} \tag{A2b4}$$

$$X^* = 34{F_B}^{\frac{2}{5}} \tag{A2b5}$$

$$\Delta h = 1.6\frac{{F_B}^{\frac{1}{3}}(3.5X^*)^{\frac{2}{3}}}{U} \tag{A2b6}$$