$$Q_s = \rho_a c_p C_D^* (1 + \alpha_s T_o') \|\mathbf{U}\| (T_o - T_a) \tag{1}$$
$$Q_L = \rho_a L_v C_D^* (1 + \alpha_L T_o') \|\mathbf{U}\| (q_o - q_a) \tag{2}$$

and the total flux is

$$F = Q_s + Q_L \tag{3}$$

sensible

$$\begin{aligned}
Q_s =& \rho_a c_p C_D^s (1 + \alpha_s T_o')(U + U')(T_o + T_o' - T_a - T_a') \\
\Delta T =& T_o - T_a \qquad \Delta T' = T_o' - T_a' \\
Q_s =& \rho_a c_p C_D^s (1 + \alpha_s T_o')(U + U')(\Delta T + \Delta T') \\
Q_s =& \rho_a c_p C_D^s (U + U' + \alpha_s T_o' U + \alpha_s T_o' U')(\Delta T + \Delta T') \\
Q_s =& \rho_a c_p C_D^s \Delta T (U + U' + \alpha_s T_o' U + \alpha_s T_o' U') + ... \\
& \rho_a c_p C_D^s \Delta T' (U + U' + \alpha_s T_o' U + \alpha_s T_o' U')
\end{aligned}$$

latent

$$\begin{aligned}
Q_L =& \rho_a L_v C_D^L (1 + \alpha_s T_o')(U + U')(q_o + q_o' - q_a - q_a') \\
\Delta q =& q_o - q_a \qquad \Delta q' = q_o' - q_a' \\
Q_L =& \rho_a L_v C_D^L (1 + \alpha_s T_o')(U + U')(\Delta q + \Delta q') \\
Q_L =& \rho_a L_v C_D^L (U + U' + \alpha_s T_o' U + \alpha_s T_o' U')(\Delta q + \Delta q') \\
Q_L =& \rho_a L_v C_D^L \Delta q (U + U' + \alpha_s T_o' U + \alpha_s T_o' U') + ... \\
& \rho_a L_v C_D^L \Delta q' (U + U' + \alpha_s T_o' U + \alpha_s T_o' U')
\end{aligned}$$

no eddy terms

$$\rho_a c_p C_D^s \Delta T U \qquad \rho_a L_v C_D^L \Delta q U$$

eddy terms

$$\begin{array}{ll}
\rho_a c_p C_D^s \Delta T \alpha_s T_o' U' & \rho_a L_v C_D^L \Delta q \alpha_L q_o' U' \\
\rho_a c_p C_D^s \Delta T' \alpha_s T_o' U' & \rho_a L_v C_D^s U \ \Delta q' \alpha_s q_o' U' \\
\rho_a c_p C_D^s U' \Delta T' & \rho_a L_v C_D^L U' \Delta q' \\
\rho_a c_p C_D^s \Delta T' \alpha_s T_o' U' & \rho_a L_v C_D^L \Delta q' \alpha_L q_o' U'
\end{array}$$

terms that are linear in primes

$$\begin{array}{ll}
\rho_a c_p C_D^s \Delta T U \ \alpha_s T_o' & \rho_a L_v C_D^L \Delta q U \ \alpha_L q_o' \\
\rho_a c_p C_D^s \Delta T U' & \rho_a L_v C_D^L \Delta q U' \\
\rho_a c_p C_D^s \Delta T' U & \rho_a L_v C_D^L \Delta q' U
\end{array}$$