Heating rate due to surface flux of 100 W/m² into a 100-m deep BL?

$$\frac{\partial \bar{\theta}}{\partial t} = -\frac{\partial}{\partial z}\overline{w'\theta'} = -\frac{\partial F}{\partial z}$$

Integrate over layer:

$$\frac{1}{h}\int_0^h \frac{\partial \bar{\theta}}{\partial t}\,dz = -\frac{1}{h}\int_0^h \frac{\partial F}{\partial z}\,dz$$

$$\frac{\partial [\bar{\theta}]}{\partial t} = -\frac{(F(h) - F(0))}{h}$$

$$= \frac{F(0)}{h} \quad \text{if } F(h) = 0.$$

$\overline{w'\theta'}$: $K\ m\ s^{-1}$

$\rho C_p \overline{w'\theta'}$: $\frac{kg}{m^3}\frac{J}{kg\text{-}K}\ \frac{K\,m}{s} = \frac{J}{s\text{-}m^2} = \frac{W}{m^2}$

$$\frac{\partial [\bar{\theta}]}{\partial t} = \frac{\rho C_p F(0)}{\rho c_p h} = \frac{\rho C_p F(0)}{C}$$

$C = \rho C_p h$: heat capacity of layer (of air)

$$= \frac{100\ W/m^2}{1 \times 1000 \times 100} = \frac{100}{10^5} = 10^{-3}\,\frac{K}{s}$$

$$= 3.6\,\frac{K}{h}$$