

*The average windspeed over the region of the Antarctic Circumpolar Current is about  $10 \text{ ms}^{-1}$ .*

a. *Give an estimate of the mean wind-stress at the ocean-atmosphere interface in this region.*

From equation (2.1), we estimate that with  $V = 10 \text{ ms}^{-1}$ ,  $C_D = 10^{-3}$ ,  $\rho_a = 1.2 \text{ kg/m}^3$ ,

$$\tau = C_D \rho_a V^2 \approx 0.12 \text{ Pa}$$

b. *If a unidirectional wind blows over an initially motionless water column of 10 m thickness, then calculate the flow velocity in this layer after 3 hours.*

The wind stress  $\tau$  will transfer momentum to the water column of depth  $h$  according to the balance

$$\rho h \frac{du}{dt} = \tau$$

where  $u$  is the (uniform) velocity of the layer. From this equation we estimate

$$u(t) \approx u(0) + \frac{\tau}{\rho h} t$$

and find with  $t_* = 3 \text{ hours}$  that  $u(t_*) = 0.13 \text{ ms}^{-1}$ .