

# The Sverdrup Balance

The steady, linear vorticity equation was found to be

$$fw_z = \beta v - \text{Curl}(\tau)/H_E \quad (2)$$

The Sverdrup balance  $\beta V = \text{Curl}(\tau)$ , where upper case symbols indicate depth-integrated velocities, is obtained by vertically integrating (2), assuming that  $w$  vanishes at the top and bottom.

Decomposing the meridional velocity into geostrophic and Ekman parts:

$$v_g = -p_x/f \quad \text{and} \quad V_E = -\tau^x/f$$

and noting that  $\text{Curl}(\tau/f) \equiv \text{Curl}(\tau)/f + \beta \tau^x/f^2$ , allows rewriting the Sverdrup balance as

$$\frac{\beta}{f} V_g = \text{Curl}(\tau/f) \quad (3)$$

In (3), the term on the left can be evaluated from the observed ocean data, and the term on the right from the observed wind.