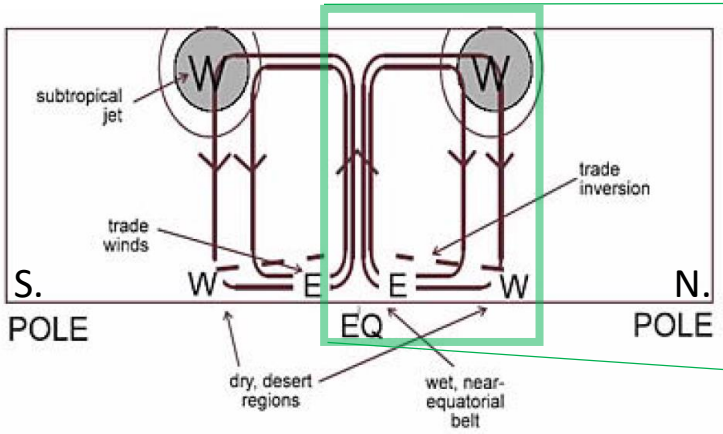
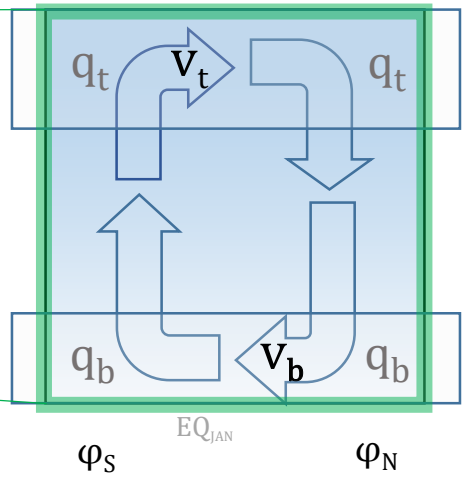
General circulation – Hadley cell



2-LAYER MODEL →

N. branch – [Jan. Mean]



$p_{Tropopause} \cong 100$ mb

$p_T + \Delta p$

$p_S - \Delta p$

$p_{Surface} \cong 1000$ mb

φ_S φ_N

Latent Heat Flux Contribution Eqn. 10 [pg. 9] If $q_t \cong 0$ then...

$$\mathcal{L} = \frac{L}{g} \times 2\pi a \cos\varphi \int_0^{p_s} \overline{vq}\, dp \simeq \frac{L}{g} \times 2\pi a \cos\varphi [\overline{v}]_b [\overline{q}]_b \Delta p.$$

Constants *(for atmospheric air)*

Latent heat of fusion

$L = 2.25 \times 10^6$ J/kg

$g = 9.8$ m/s^2

$a \cong 6.4 \times 10^6$ m

(^ Earth's radius)

Estimate values for:

[$\overline{v}$elocities]

$\overline{v}_t =$

$\overline{v}_b =$

Spec. humidity **q** is units of **g/kg**

Use MKS system for calculations.

[$\overline{q}$: specific humidity]

$\overline{q}_t =$

$\overline{q}_b =$

φ : latitude

$\varphi_{avg} =$

1 millibar =10^2 Pascals

p : pressure

$\Delta p =$

→ Express $\mathcal{L}$ in Petawatts, $\mathrm{PW} = 10^{15}$ W.

Total Heat Flux = $\mathcal{H} + \mathcal{L}$