# Global Oceanic Heat Flow

Relating seafloor depth to local heat loss

# Basic Model

- Energy conservation
- Thermal contraction
- Isostasy
- Independent of heat transfer models

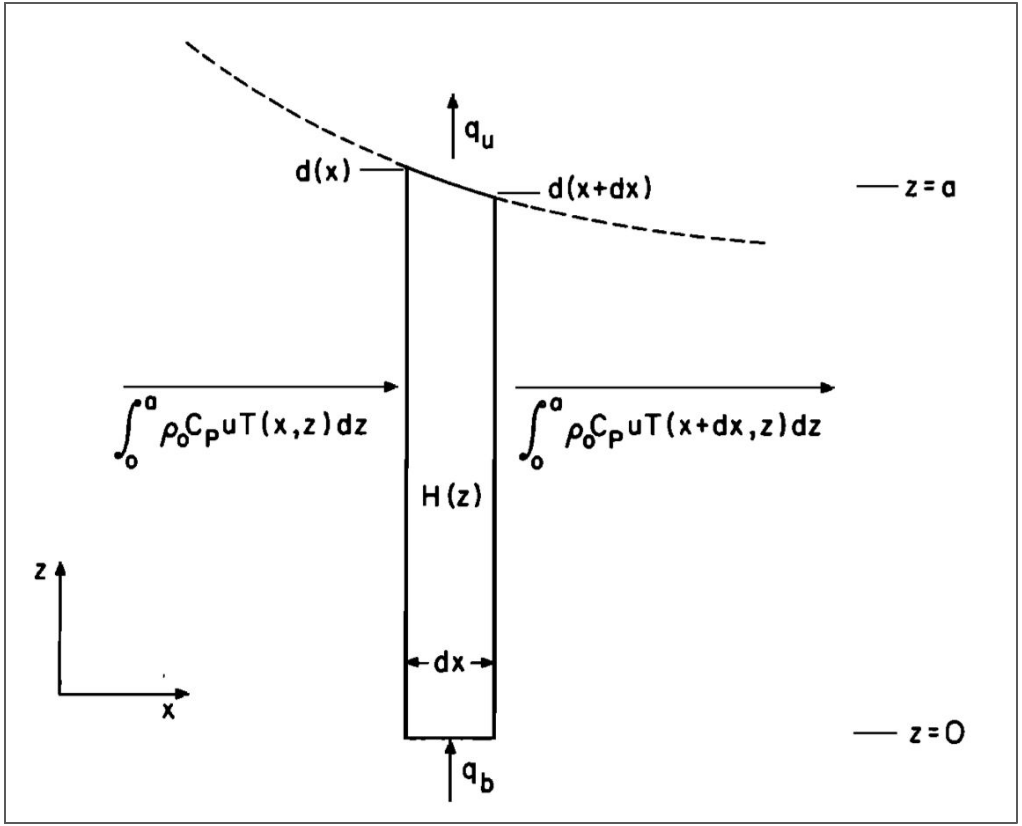
# 1-D Solution

Parsons and McKenzie (1978)

$$\rho_0 C_p v \int_0^a [T(x+dx,z) - T(x,z)]\,dz + (q_u - q_b)\,dx = 0$$

$$d(x+dx) - d(x) = -\frac{\alpha\rho_0}{(\rho_0 - \rho_w)} \cdot \int_0^a [T(x+dx,z) - T(x,z)]\,dz$$

$$q_u = \frac{(\rho_0 - \rho_w)C_p}{\alpha}\frac{d}{dx}d(x)v + q_b$$



# 2-D Solution

Wei and Sandwell (2006)

$$\rho_0 C_p \mathbf{v} \cdot \nabla T = \nabla \cdot \mathbf{q}$$

$$d(t) = \frac{-\alpha\rho_0}{(\rho_0 - \rho_w)} \int_0^a (T - T_m)\, dz$$

$$\rho(T) = \rho_0[1 - \alpha(T - T_m)]$$

$$\mathbf{v} \cdot \nabla d(t) = \frac{-\alpha\rho_0}{(\rho_0 - \rho_w)} \int_0^a \mathbf{v} \cdot \nabla T\, dz$$

$$= \frac{-\alpha}{(\rho_0 - \rho_w)C_p} \int_0^a \nabla \cdot \mathbf{q}\, dz$$

$$\mathbf{v} \cdot \nabla d = \frac{-\alpha}{(\rho_0 - \rho_w)C_p}(q_b - q_u)$$

$$\mathbf{v} = \frac{\nabla A}{\nabla A \cdot \nabla A}$$

$$q_u = \frac{(\rho_0 - \rho_w)C_p}{\alpha} \frac{\nabla A \cdot \nabla d}{\nabla A \cdot \nabla A} + q_b$$