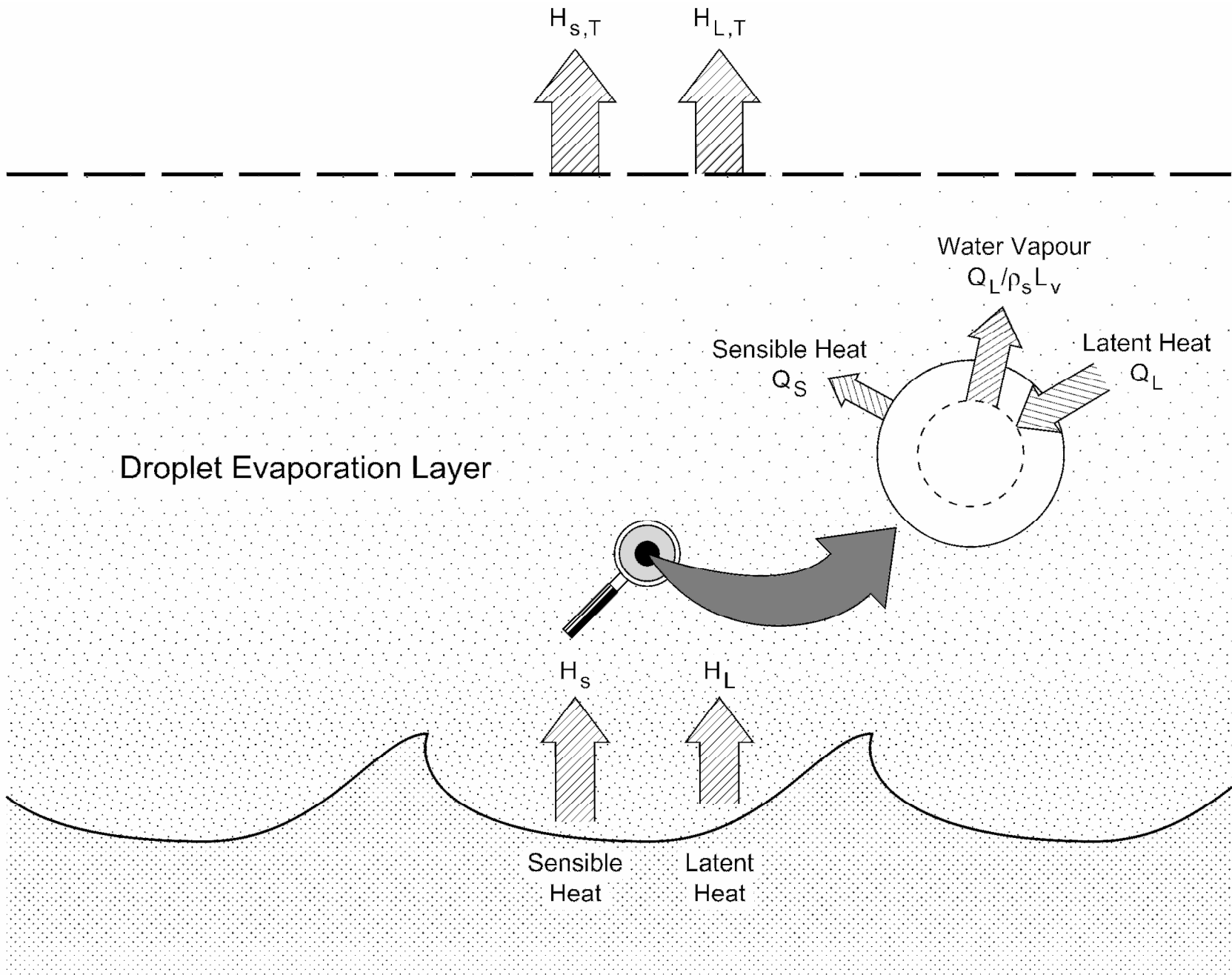


**Spray-Mediated Enthalpy Flux
to the Atmosphere
and Salt Flux to the Ocean
in High Winds**

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Lebanon, NH



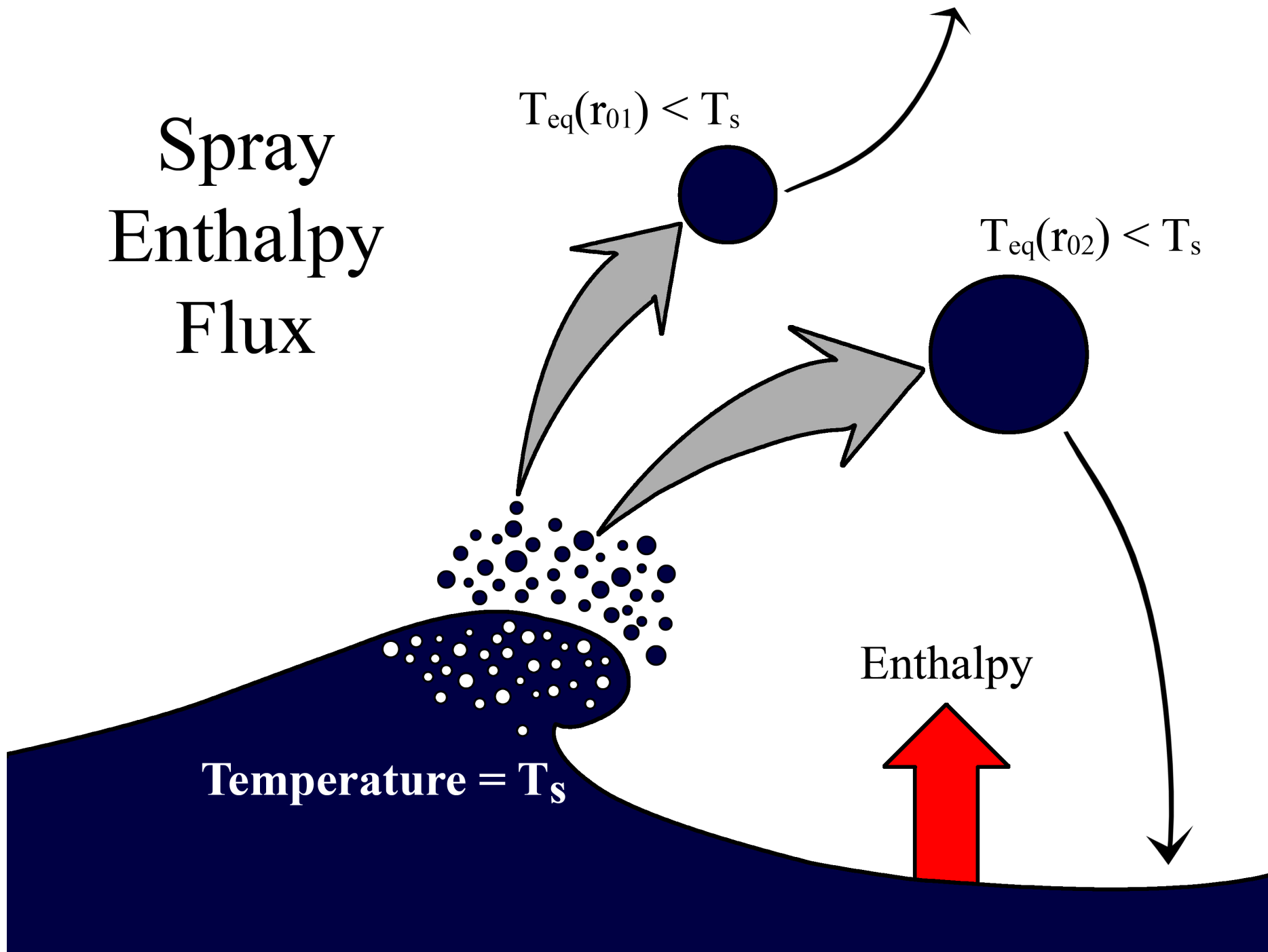
Spray
Enthalpy
Flux

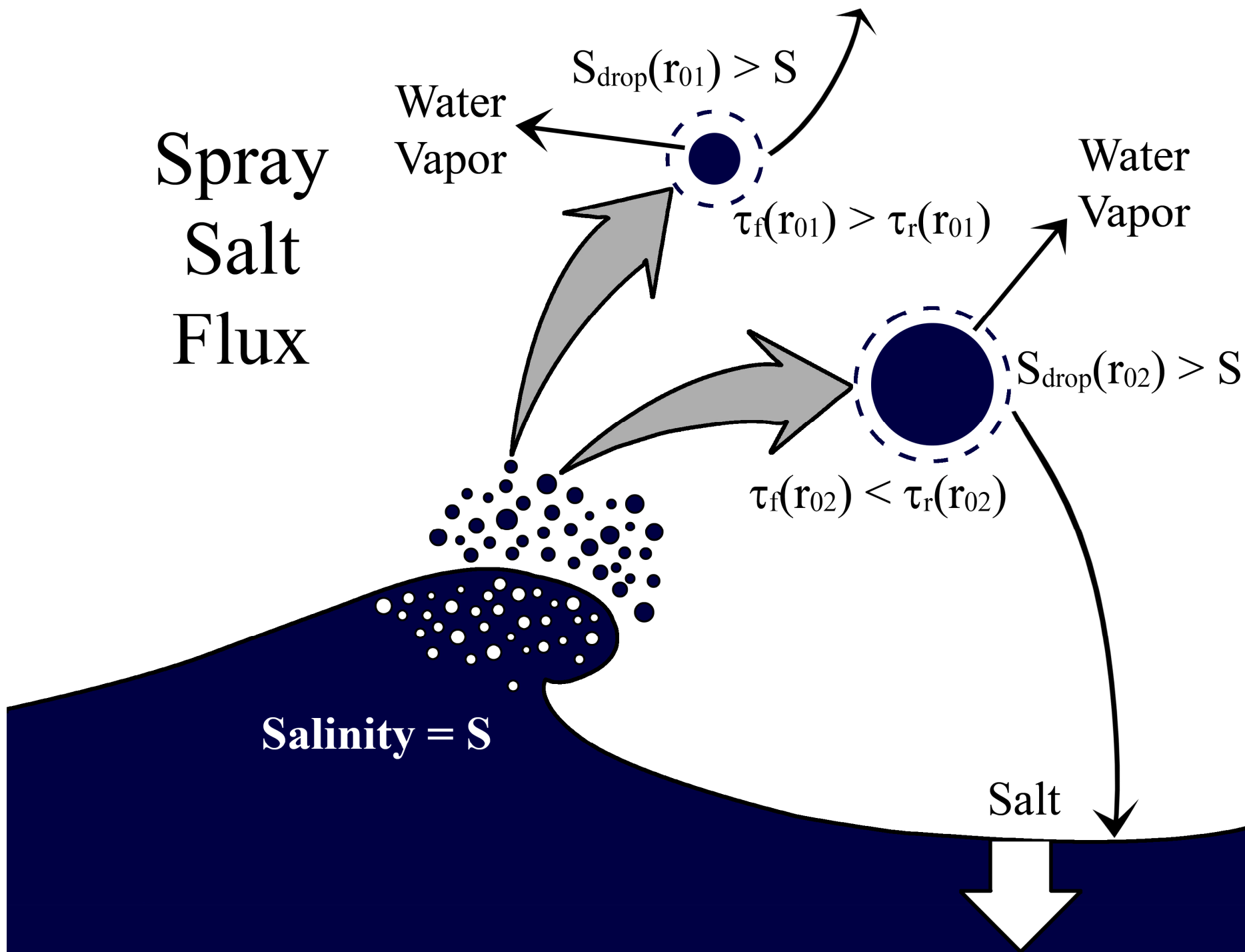
$$T_{\text{eq}}(r_{01}) < T_s$$

$$T_{\text{eq}}(r_{02}) < T_s$$

Enthalpy

$$\text{Temperature} = T_s$$





Data from HEXOS and FASTEX



Total Enthalpy Flux

My **Microphysical Model** predicts

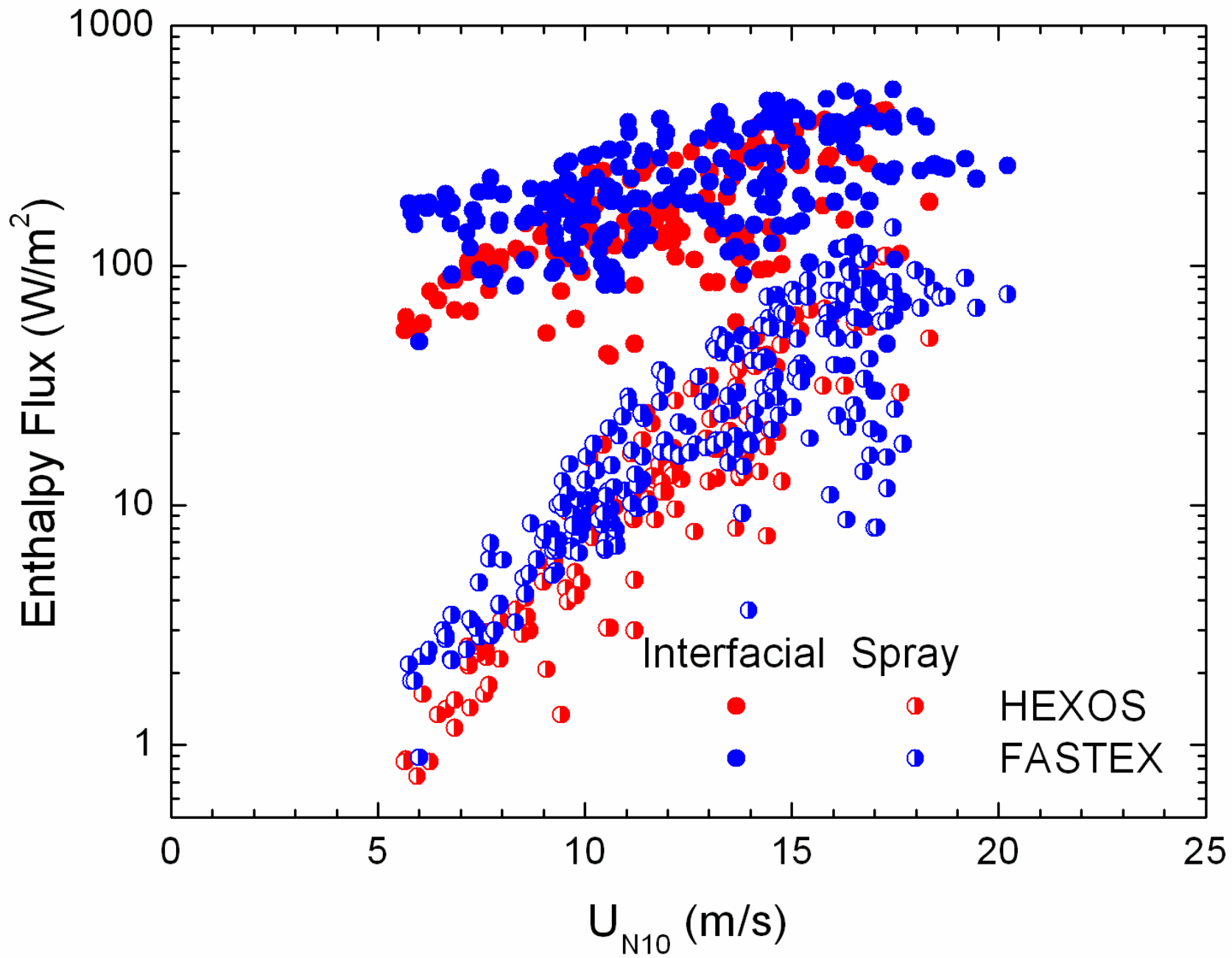
$$H_{L,T} = H_L + \alpha \bar{Q}_L$$

$$H_{s,T} = H_s + \beta \bar{Q}_s + (\gamma - \alpha) \bar{Q}_L$$

Then, the **Total Enthalpy Flux** is

$$Q_{en,T} = H_{L,T} + H_{s,T} = \underbrace{H_L + H_s}_{\text{Interfacial}} + \underbrace{\beta \bar{Q}_s + \gamma \bar{Q}_L}_{\text{Spray}}$$

where $\alpha = 1.5$, $\beta = 10.5$, $\gamma = 0.2$.



Interfacial Salt Flux

Model Interfacial Latent Heat Flux:

$$H_L = \rho_a L_v C_{Er} U_r (Q_r - Q_s)$$

Model Interfacial Salt Flux:

$$F_{\text{salt}} = \frac{s H_L}{L_v (1 - s)}$$

where s is the fractional salinity.

Spray Salt Flux

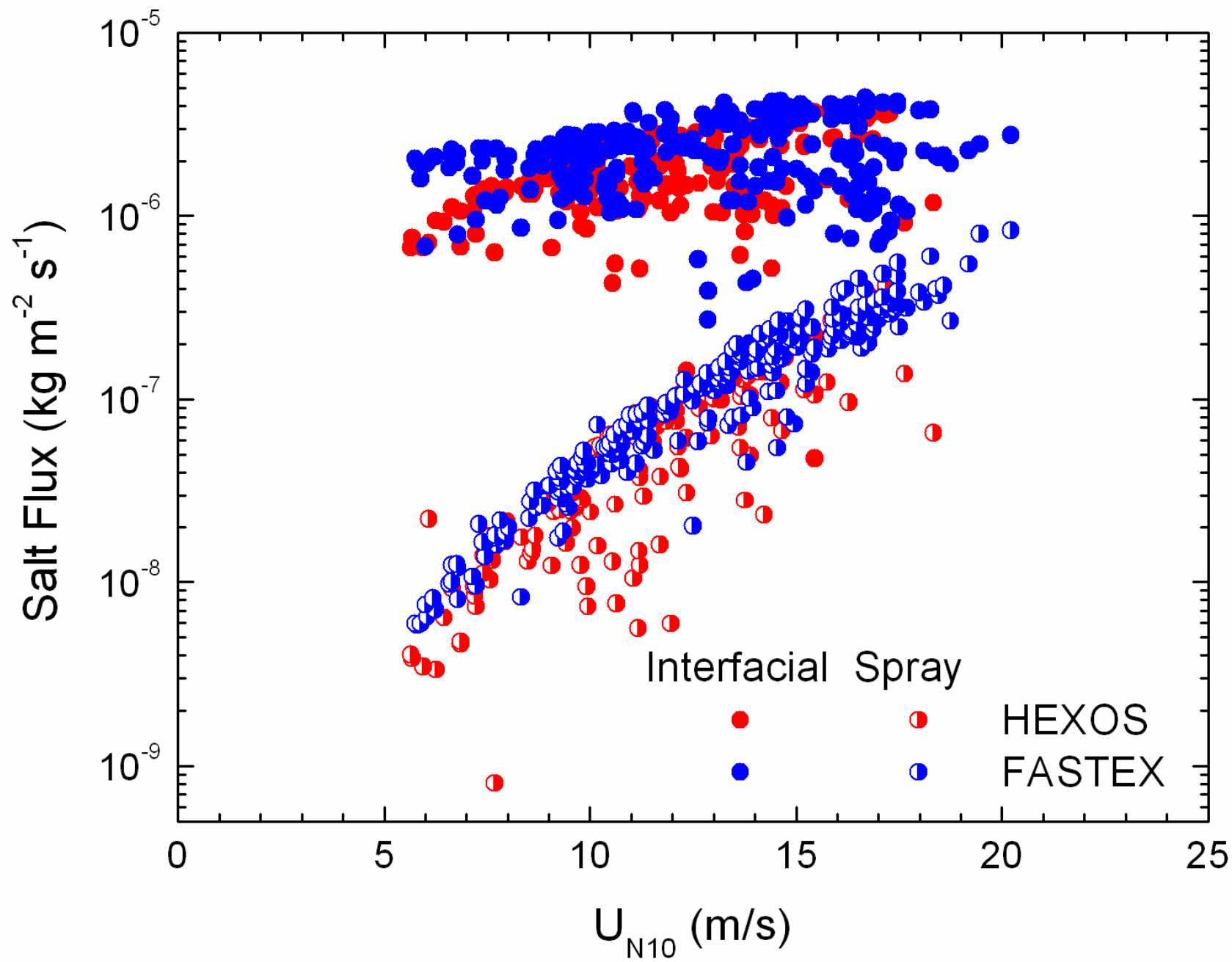
Assume droplets for $\tau_f(r_0) \leq \tau_r(r_0)$ are re-entrant:

$$Q_{\text{salt}}(r_0) = \frac{\rho_w s}{1-s} \left\{ 1 - \left[\frac{r(\tau_f)}{r_0} \right]^3 \right\} \left(\frac{4\pi r_0^3}{3} \frac{dF}{dr_0} \right)$$

Then in analogy with Spray Latent Heat Flux, model **Spray Salt Flux**:

$$Q_{\text{salt,sp}} = \alpha \int_{r_{\text{min}}}^{500} Q_{\text{salt}}(r_0) dr_0$$

where $\alpha = 1.50$.



Conclusions

- Re-entrant spray droplets constitute both an enthalpy and a salt flux.
- Spray effects on the air-sea fluxes become significant at modest wind speeds, ~ 12 m/s.
- Spray enthalpy and salt fluxes are comparable to the corresponding interfacial fluxes for wind speed ~ 25 m/s.
- Perhaps measurements in the ocean (instead of in the atmosphere) might be a way to obtain fluxes in high winds.

