Profiles in a stratocumulus-capped mixed layer

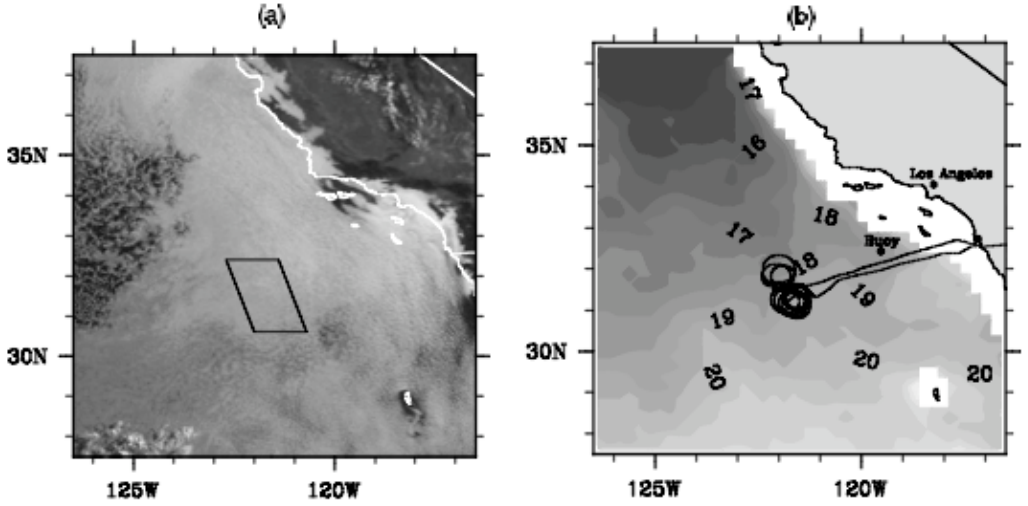
'Well-mixed': Moist-conserved variables

$s_l = c_pT + gz - Lq_l$,

$q_t = q_v + q_l$

$h = c_pT + gz + Lq_t$

are nearly uniform with height within the MBL.



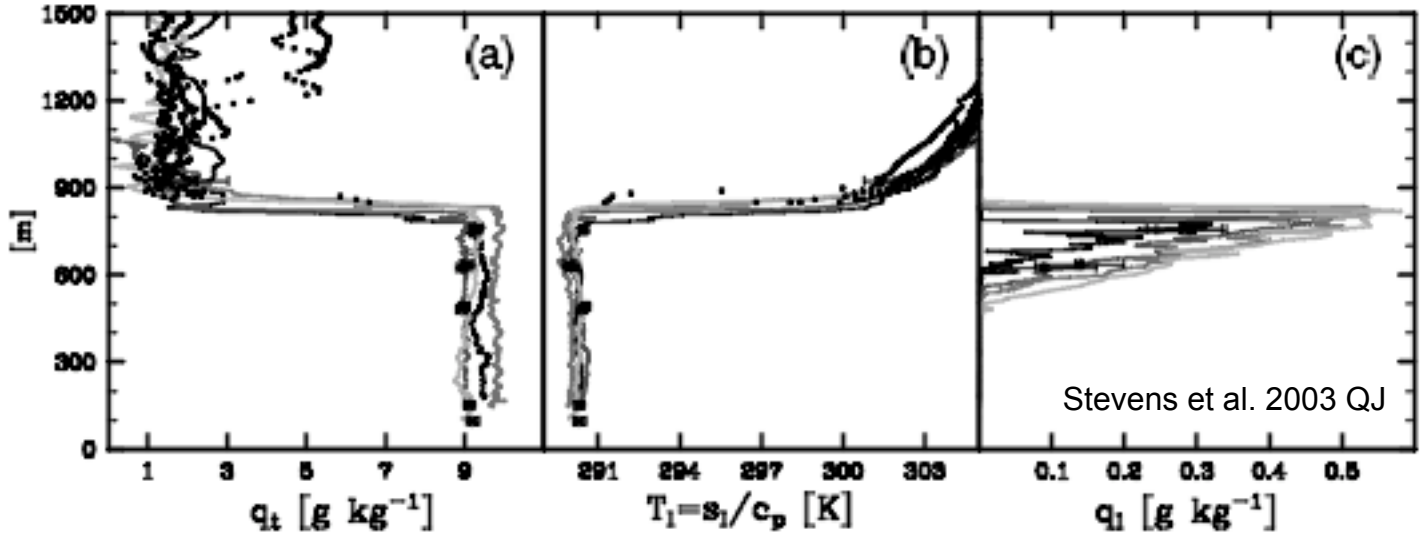


Figure 1. Cloud-layer state as observed during RF01: (a) total-water specific humidity q_t, (b) liquid-water static energy temperature s_l/c_p, and (c) liquid-water specific humidity q_l. Lines are from soundings, darker indicating earlier, filled circles and bars denote level-leg means and standard deviations, and dots denote dropsonde data from the above-cloud portion of the descent.

$\Rightarrow q_l$ increases linearly with z above cloud base

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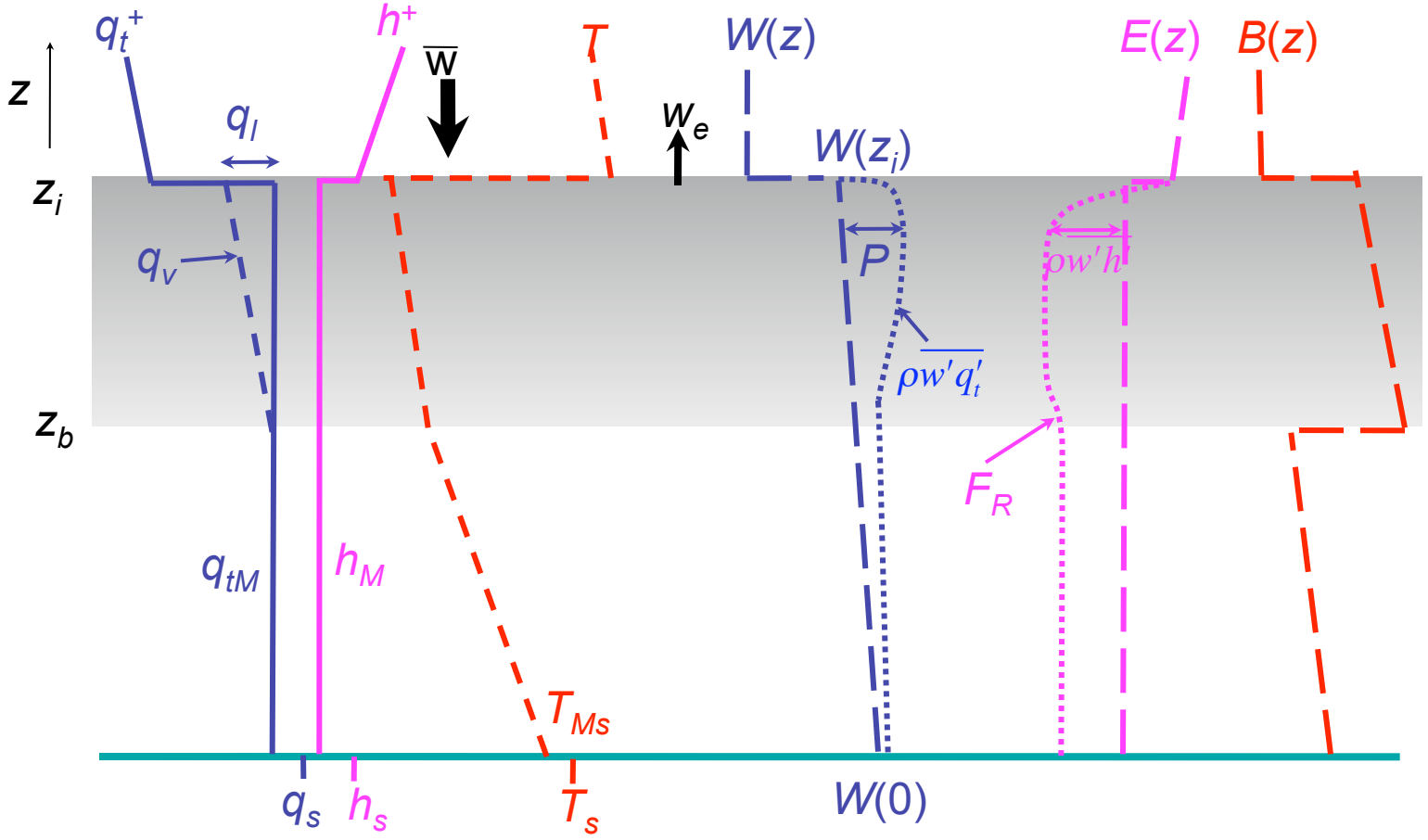


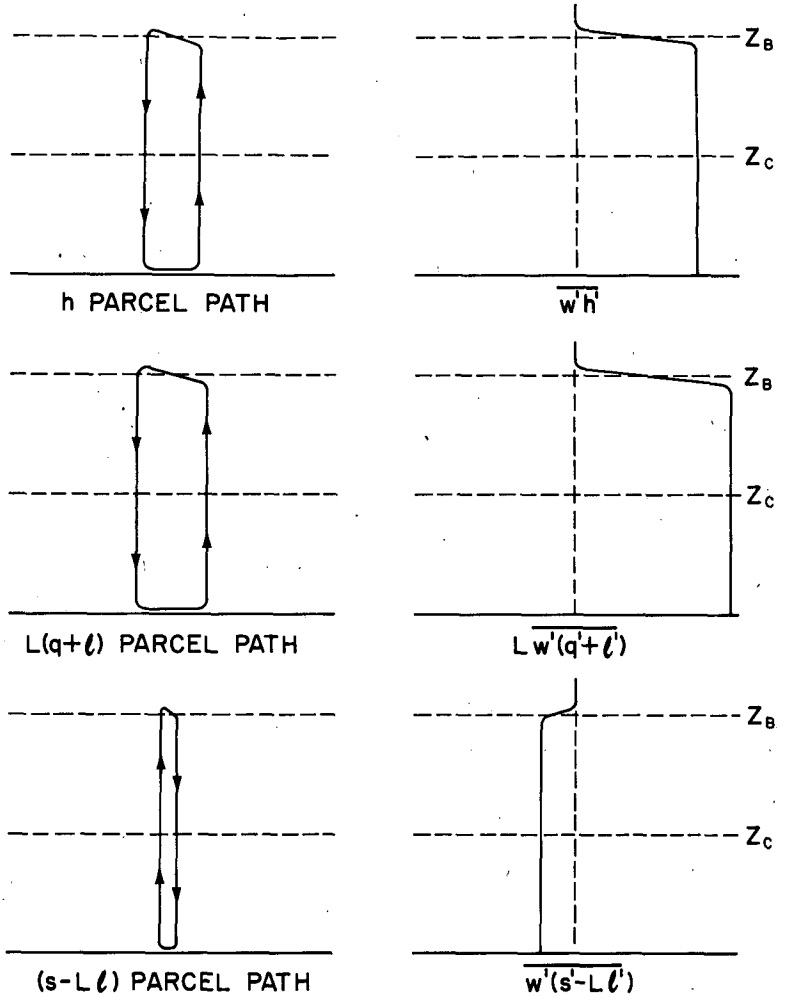


FIG. 14. Typical parcel paths of the conservative quantities h, $L(q + l)$ and $s - Ll$ and the resulting fluxes $\overline{w'h'}$, $L\overline{w'(q' + l')}$ and $\overline{w'(s' - Ll')}$.

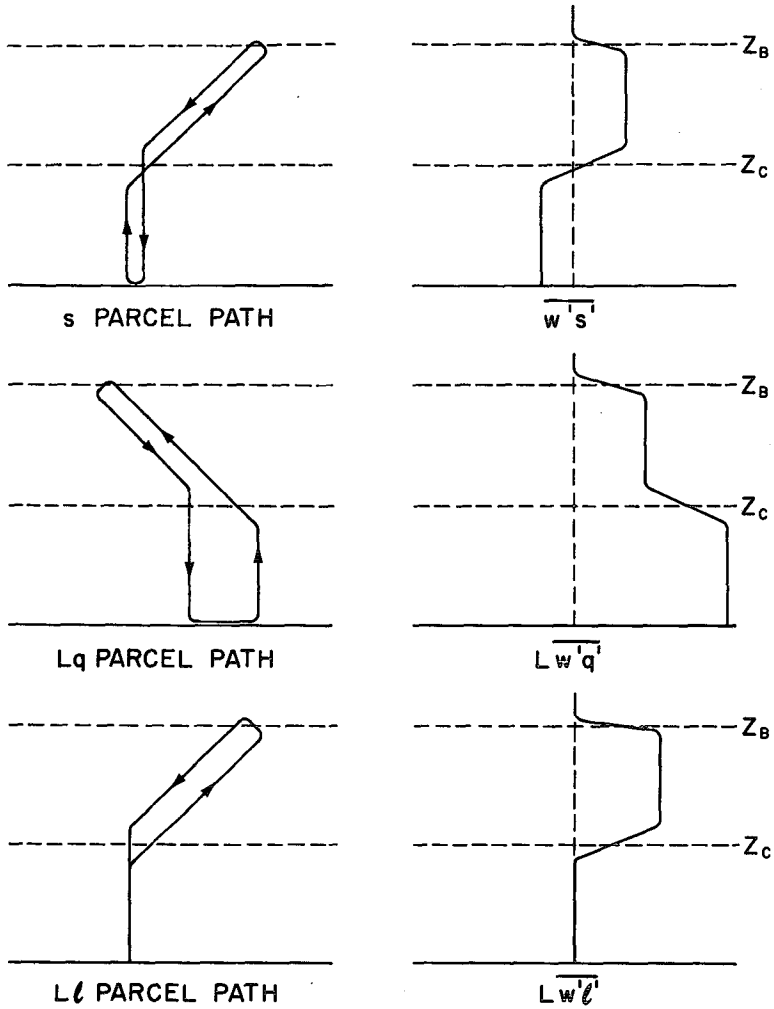
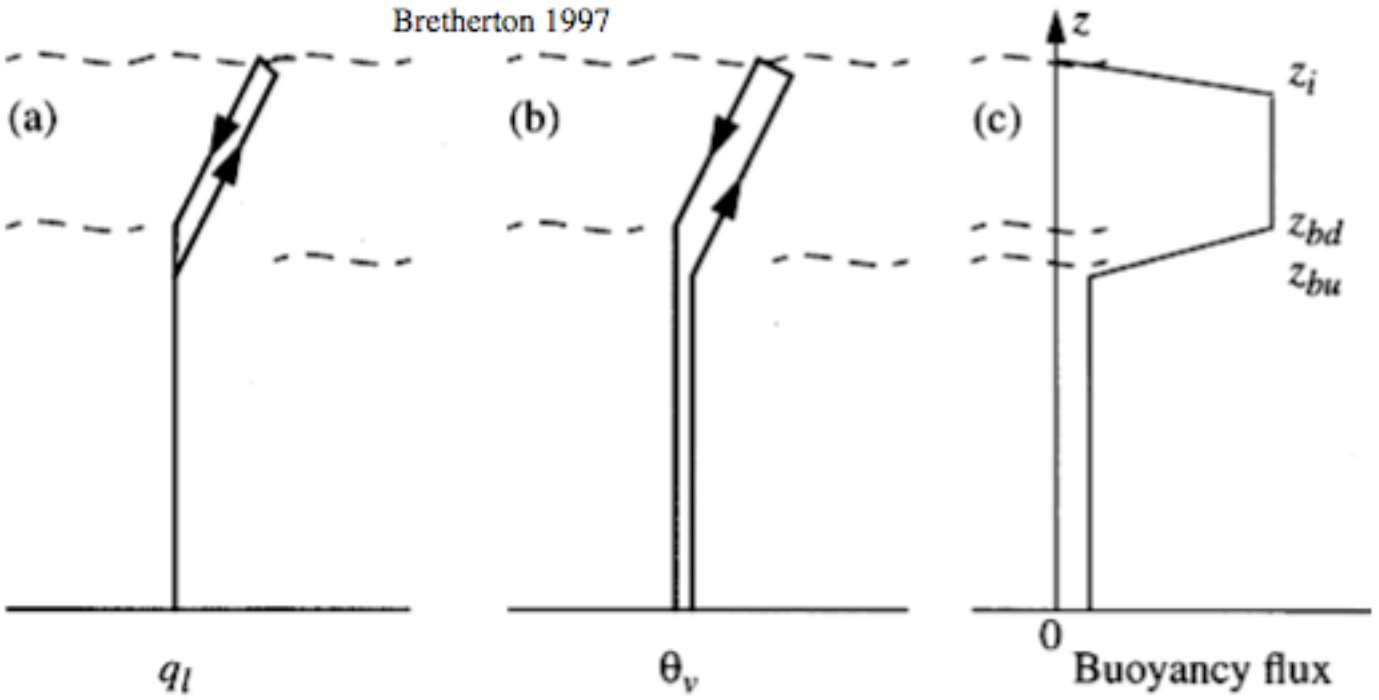


FIG. 15. Typical parcel paths of the nonconservative quantities s, Lq and Ll and resulting fluxes $\overline{w's'}$, $\overline{Lw'q'}$ and $\overline{Lw'l'}$. Note that in the major portion of the cloud there is no net condensation and $\overline{Lw'l'}$ is constant with height. The net condensation at cloud base is balanced by the net evaporation at cloud top.

Parcel circuits in a Sc-capped mixed layer



- Note implied discontinuous increase in liquid water and buoyancy fluxes at cloud base ⇒ turbulence driven from cloud, unlike dry CBL.
- Convective velocity w_* ~ 1 m s^{-1}:

$$w_*^3 = 2.5\int_0^{z_i} \overline{w'b'}dz$$

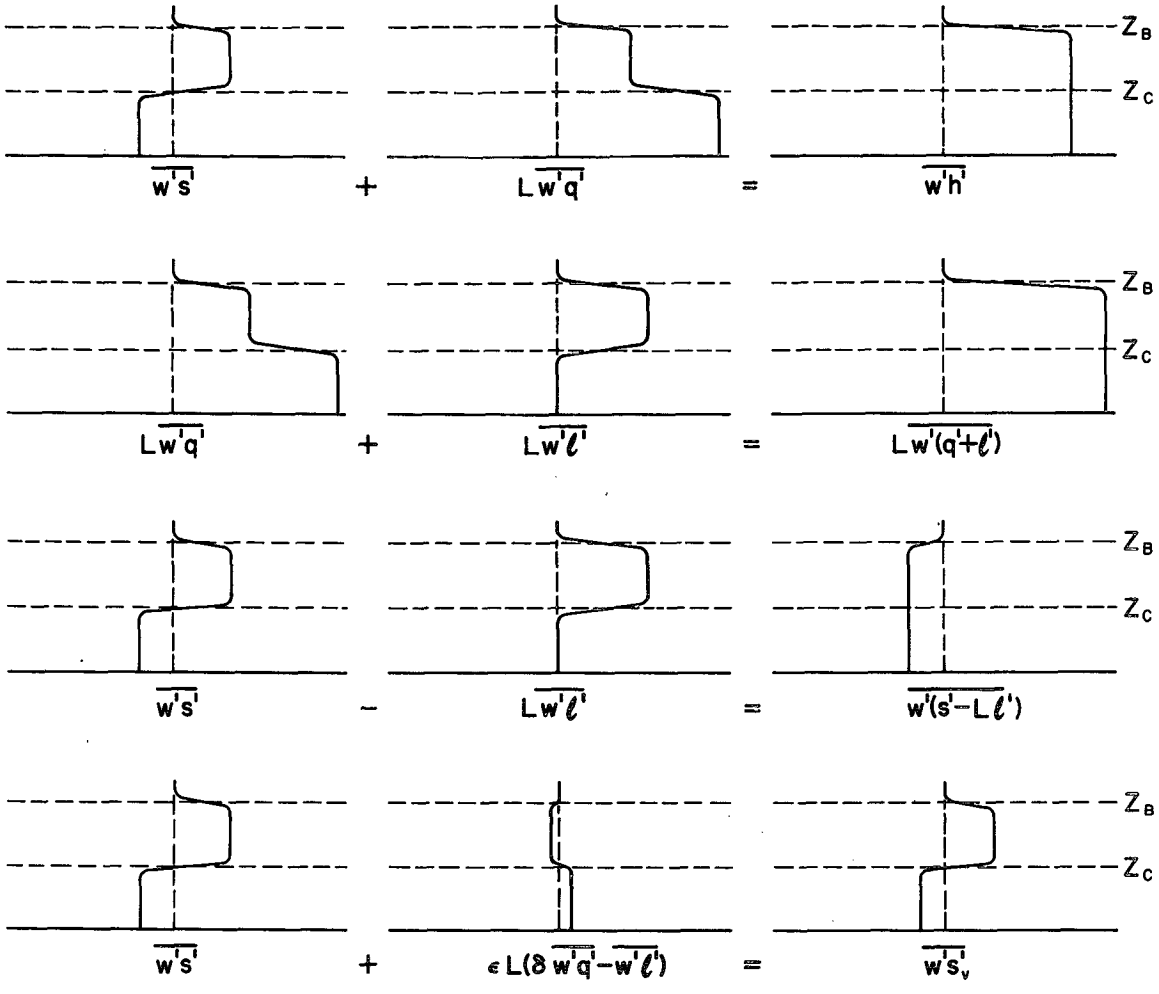


FIG. 13. Profiles of the three basic fluxes $\overline{w's'}$, $L\overline{w'q'}$ and $L\overline{w'l'}$ and their combinations to form $\overline{w'h'}$, $L\overline{w'(q' + l')}$ and $\overline{w'(s' - Ll')}$. These profiles are typical of steady-state horizontally homogeneous conditions when $\mu = \mu' = 0$.