Modified (consistent) total energy equation assuming variable latent heats

$$\frac{\partial}{\partial t}\int \overline{\rho}^{(d)}\left\{\underline{\left(1+\overline{m}^{(H_2O)}\right)\left(\overline{K}+\overline{\Phi}_s\right)+c_p^{(d)}T+\sum_{\ell\in\mathcal{L}_{H_2O}}\overline{m}^{(\ell)}c_p^{(\ell)}\left(\overline{T}-T_{00}\right)}+\overline{m}^{(wv)}L_{s,00}+\overline{m}^{(liq)}L_{f,00}\right\}dz$$

$$-\Delta\breve{\mathcal{I}}_{L(T)}-\Delta\hat{\mathcal{I}}_{L(T)}=-\sum_{\ell\in\mathcal{L}_{H_2O}}\underline{\overline{F}_{net}^{(\ell)}\left[c_p^{(\ell)}\left(\widetilde{\overline{T}}_s-T_{00}\right)+\widetilde{\overline{K}}_s\right]}+\overline{F}_{net}^{(wv)}L_{s,00}+\overline{F}_{net}^{(liq)}L_{f,00}+\overline{F}_{net}^{(turb,rad)}$$