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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Technical note: rectifying systematic underestimation of the specific energy required to evaporate water into the atmosphere" *by* Andrew S. Kowalski

G. Petty

gwpetty@wisc.edu

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It appears that underlying the author's premise is the notion that pressure-volume work due to expansion against *atmospheric* pressure must be accounted for (e.g., line 37, "Environmental evaporation is not a case of equilibrium thermodynamics, but performs work against atmospheric pressure."). But bulk mechanical expansion of evaporating water against full atmospheric pressure occurs only with actual boiling, at which point atmospheric and vapor pressures are by definition the same.

For sub-boiling temperatures, evaporation is necessarily a diffusive process rather than a bulk mechanical expansion. In molecular diffusive processes, I believe it is widely

accepted that, in the absence of attractive forces between air molecules and vapor molecules, the presence or absence of passive air molecules plays no role in the thermodynamic equilibrium between the liquid and vapor phases of water or in the energy of the phase change. Thus, both the saturation vapor pressure $e_s(T)$ and the latent heat (or enthalpy) of vaporization L are the same whether or not air molecules are present, and the pressure-volume component of L is always the volume change (due to vapor alone) times the saturation vapor pressure at that temperature.

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