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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

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Although I will withdraw the manuscript based on Professor Petty's first comment (hess-2018-195-SC2), I must push back somewhat regarding this second comment (hess-2018-195-SC3), with which I partially disagree.

First let me note where we agree. Boiling does indeed represent a case of pure bulk mechanical expansion, which I might have termed "non-diffusive" transport (Kowalski, 2017). Since the atmospheric and vapor pressures are the same, according to Dalton's law there is no other gas species present near the boiling surface, and therefore no diffusion.

However, for sub-boiling temperatures the relevance of diffusion does not put a stop to bulk mechanical expansion. Rather, according to equations (7) and (8) of Kowalski (2017), the water vapor mass fraction (or specific humidity, q) represents the non-diffusive fraction of vapor transport, while the balance (1- q) is the diffusive fraction. Thus, instead of "evaporation is necessarily a diffusive process rather than a bulk mechanical expansion", I would say that "evaporation is a diffusive process *in addition to* a bulk mechanical expansion", where the two processes' degrees of relevance depend on q.

This difference of opinion regards transport alone, and does not apply to Dr. Petty's conclusion regarding thermodynamics. I accept that neither the saturation vapour pressure nor the latent heat of vaporization depend on the pressure of dry air.

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