Reply to the Comment by T. López-Arias on "Clausius-Clapeyron equation and saturation vapour pressure: simple theory reconciled with practice"

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In her Comment, López-Arias [1] discusses my statement in [2] which reads "*...the saturation vapour pressure, also known as equilibrium vapour pressure, is an upper limit of the quantity of vapour that the atmosphere can hold*" and asserts that it may contribute to a *"very common misconception regarding the behaviour of water vapour and the role of air (which is none) in the process of reaching saturation*".

I wish to thank her for the attentiveness, for her kind Comment with the nice clarifications, and for being "*absolutely sure* [that] *the author does not have this image* [i.e. the misconception] *in his mind*". I agree that the choice of the word "hold" in my formulation was infelicitous. It should be replaced by "contain". I also agree with her explanations that the presence or absence of air should be irrelevant to reaching saturation. Actually, nowhere in my detailed calculations do I involve the presence or absence of air, or imply that the air could be considered as a sort of "*sponge*" holding water vapour—to repeat López-Arias's metaphor. Rather, I used the expression "*the atmosphere* [and not the air or the dry air] *can hold*" because of the much smaller quantity of water vapour in the atmosphere, in comparison to the bulk of other constituents (which, in addition, do not involve phase transitions). It is like we say that the dog wiggles its tail, although indeed the tail is part of the dog. Nevertheless, reformulating it and saying that the atmosphere *contains* the water vapour makes it more accurate.

I also agree when she modifies her initial assertion that the role of the air is none, subsequently assigning it the role of "*being the means by which water vapour cools or warms up*". Perhaps, it is even more than this, as several researchers and practitioners distinguish the saturation of pure water vapour from that of moist air and to estimate the saturation pressure of the latter they involve the air pressure (with a minor weight, though) in addition to temperature (e.g. [3]). However, this is beyond the scope of my paper and I mention it here just as an indication of the complexity of the phenomena.

Overall, I think there is no essential disagreement and I regard this discussion as very useful.

References

[1] López-Arias T 2012 Comment on "Clausius-Clapeyron equation and saturation vapour pressure: simple theory reconciled with practice", *European Journal of Physics* (this issue).

[2] Koutsoyiannis D 2012 Clausius-Clapeyron equation and saturation vapour pressure: simple theory reconciled with practice, *European Journal of Physics*, 33 (2), 295–305.

[3] Buck AL 1981 New equations for computing vapor pressure and enhancement factor, *Journal of Applied Meteorology* 20 (12) 1527-1532.