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Discussions

Interactive comment on "Experimental evidence of condensation-driven airflow" *by* P. Bunyard et al.

Anonymous Referee #2

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The BPT (biotic pump theory) claims a driving force for atmospheric convection which is caused by condensation of rising moist air. The physical foundation of the BPT remains obviously contentious in the scientific community. That is why the authors attempt to study the underlying physics in laboratory scale, investigating the impact of condensation on airflow. The presented experimental results were gained in a set up of two columns (height 4.8 m) connected by two channels. The condensation of water vapour, i.e. the reduction of water partial pressure in the circulating moist air is realized by external cooling via refrigerator coils. In a series of experiments it is shown that condensation causes airflow. (This is a well known phenomenon in Engineering Thermodynamics and so far not really surprising.) But in my opinion this experiment is in principle not suited to verify or to falsify the BPT. There are two major reasons for that: 1. In nature the rise of moist air can be described in a first approach as an isentropic (adiabatic) expansion. That means temperature and pressure drop with increasing

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height. If the dew point of the moist air is exceeded condensation (cloud formation) takes place and the evaporation enthalpy is released leading to a temperature rise of the surrounding moist air. But it has to be emphasized that during this condensation process the total energy of the system (= air column) as well as the total mass remain constant. In contrast to this natural process in the described experimental set up energy (= heat) is withdrawn from the system (airflow) and the temperature after condensation is lower than before condensation). Thus in the experiment a rather different process in comparision to the natural process takes place. 2. The experimental set up is a thermodynamically closed ("airtight") system in which the total pressure drops during condensation. In contrast to this the atmosphere is an open system in which the total pressure at a fixed height remains constant during condensation.

Futhermore, the definitions of the properties r and q in eqns. 4 and 5 are not correct. r must be the mass fraction (= kg water vapour per kg moist air (not dry air !!). q must be the absolute humidity: kg of water vapour per kg dry air (not moist air!!). Using this correct definitions eqns. 4 and 5 are correct. But eqn. 6 is definitely wrong. The correct relationship between r and q is: r= q/(1+q) Consequently, the following quantitative analysis of the experiments which is based on eqns. 4 - 6 is more or less wrong.

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