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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Vapor plumes in a tropical wet forest: spotting the invisible evaporation" *by* César Dionisio Jiménez–Rodríguez et al.

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Comments to authors

General comments

This paper deals with an interesting phenomenon, visible vapor plumes from wet forest. It is commonly seen in Japan at the time of rainfall and/or just after the cessation of rainfall. It is often observed from my office, and one of my colleagues and I have tried to make a plan to observe it. Even so, we could not come up with the idea and approach to clarify the conditions or mechanisms. Though authors used conventional

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instrumentation, the results are clear and reasonable. Now that authors have shown the methodology, we realize how apparent it really is. Anyway, authors succeeded in clarifying the conditions and the mechanism that the plumes are formed, though there are still many unknown processes to elucidate. I appreciate the smart way of observations and analyses. This manuscript is well written and is worth publishing in this journal with minor revision.

Specific comments

1) Page 1, Introduction

There are some researches that show evaporation from forest works as a moisture pump that transports water vapor from the ocean to the inland on a continental scale (Makarieva and Gorshkov, 2007; Makarieva et al., 2013a). Those studies claim that the amount of precipitation in the inland of the continent covered with forest is almost the same with that at the coastal area because of the biotic pump mechanism. Please cite those papers.

2) Page 6, line 5

"The parameters ΨS and ΨL were determined using the vapor pressure deficit of the air on each height (Stull, 2016)". ΨS is calculated using the vapor pressure deficit (even if it is zero), but how is ΨL estimated? Under the condition of visible vapor plumes the relative humidity (RH) is 100% or more and the vapor pressure deficit is zero. I tried to find the method in Stull (2017; the 2016 version has been revised and seems to be unavailable), but could not.

3) Results and Discussion

RH in the visible vapor plumes is 100% or more, i.e. saturation or supersaturation. However, the plumes continue to grow and evaporation does not stop, because plumes are not stagnant but are moving upward; water vapor along with visible vapor plumes are removed toward the higher altitude due probably to the mechanism proposed by

Makarieva et al. (2013b), i.e. condensation in clouds with drastic reduction in volume of vapor caused by the phase change. At the same time some part of the ambient air is unsaturated, and I think splash droplets keep evaporating because of this unsaturated air. The negative temperature gradient may be caused by the latent heat of vaporization of splash droplet evaporation in the canopy, but it is difficult to know if it is the result of the evaporation or originated from other causes. Authors described visible water vapor plumes only from phenomenological point of view, but the above-mentioned inferred mechanisms that plumes are maintained is worth describing.

4) Page 7, line 19

"because of its timing"; this expression is ambiguous and difficult to follow what it meas. Please add a sentence to explain the detail, like "i.e. mist might be formed early in the morning 201-03-21 and 2018-03-22 but the time lapse video did not work at those times (Table B1)."

5) Page 8, line 28

"there are two sources of aerosols at LSBS". Please add one more source of aerosols. Recent studies proved that a numerous number of bioaerosols are released from forests upon rainfall. For example, Huffman et al. (2013) mentioned in Conclusions, "Our observations indicate that rainfall can trigger intense bursts of bioparticle emission within the forest canopy and massive enhancements of atmospheric bioaerosol concentrations by an order of magnitude or more, from the onset of precipitation through extended periods of high surface wetness after the rainfall (up to one day)." Bioaerosols are integral source of aerosols relevant to rainfall in forest, and please cite paper(s) dealing with this issue at least Huffman et al. (2013).

Technical corrections

6) Page 1, line 10

$\Delta\Theta/\Delta z$ -> $\Delta\theta/\Delta z$

7) Page 1, line 10

Zlcl,43; "Z" is notated in capital letter, but it is in small letter on page 6, line 15 and equation 7. It holds true throughout the manuscript. Please unify the notation.

8) Page 2, line 2

Pease insert "is" between "This" and "because".

9) Page 4, line 9

"TS.5"; I think "TS.0" is correct. Please confirm.

10) Page 4, line 11

"TSS"; There is no description on the definition of TSS. Please clarify.

11) Page 5, Equation 1

"zS"; There is no description on the definition of zS. Please clarify.

12) Page 6, line 2

Please insert "C" between "°" and ")".

13) Page 6, line 4

moist -> saturated

14) Page 7, line 13

Please insert "mm" between "0.2" and "d-1".

15) Page 7, line 18

identify -> identified

16) Page 10, line 16

Spellman (2010) -> (Spellman, 2012)

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17) Page 11, line 10

-0.5 °C m-1 -> -1 °C m-1

References

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