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Interactive comment on "Pipes to Earth's subsurface: The role of atmospheric conditions in controlling air transport through boreholes and shafts" *by* Elad Levintal et al.

Anonymous Referee #3

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This paper, after a noteworthy revision, could be a useful contribution to the literature on air transport and borehole-atmosphere exchanges. This manuscript studies the air transport between three borehole types using temperature and pressure gradients and using the water vapor as tracer of air flow. Levintal et al. found that the main mechanism driven the air transport depend on the geometries, where changes in pressure induce more transport in narrow boreholes and temperature differences induce more transport in wide-diameter boreholes.

My mayor comment to this paper is that the authors are studying the air transport neglecting the air composition to estimate the air mass buoyancy. The virtual temperature

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Discussion paper

(Tv) is the temperature at which dry air would have the same density as the moist air, at a given pressure. In other words, two air samples with the same Tv have the same density, regardless of their actual temperature or relative humidity. Levintal et al are measuring the relative humidity in the external and internal air, therefore they would be estimate the virtual temperature to study the buoyancy.

The authors mention that they found around 2000 ppm of CO_2, however they don′t show the CO_2 pattern in any graph and the CO_2 sensors are not described in methodology. I suggest showing the data as supporting information and discuss the possible influence in the air composition and its buoyancy.

Minor comments (line/page):

1-5/3: How far are both sites? Could you include coordinates?

11/3: Edit "42".

30/3: It′s not clear how many sensors do you have and their positions? Please add more information and include this information in Fig 1b.

8/4: delete “An example of”

13/4: the number 6050 will be 6048 (6 measurements/h*24h/day*42day)

14-15/4: provide the % of relative humidity for 12 and 27 separately. In figure 1 and figure S1 I can see that during the whole period the relative humidity is always higher at 12m than at 27m, does that make sense?

9/7: Could it be because the max-min variation in temperature is higher in the shaft than in the borehole?

24/7: could you provide some analysis (as a simple Rˆ2) to prove that the correlation AH-Temperature is higher than AH-pressure?

3-5/8: I can see in Figure 7 that negative values on dPatm/dt increase the RH at 10m.

During the days 22-24 probably the atmospheric pressure was changing from low to high pressure and for this reason the negative values on dPatm/dt were much lower. Would be useful if you show the atmospheric pressure value in a second Y-axis in Fig7, panel 4.

5-end/11: In your conclusions, you would remark that these conclusions were carried out only with data during 42 days in the shaft, 4 days in the borehole and 7 days in the large-diameter borehole, therefore, in the future we need investigate during longer periods, . . .because for example in the case of the CO_2, you found 2000 ppm in spring, but commonly the maximum values of CO_2 are reached in summer/fall and therefore they could affect to the buoyancy.

Figure2: In the legend “cavity air” is the Lower boundary, isn't it?

2-3/17: delete “representative”

4/17: change from “black dashed line in 3” to “. . .in panel 3”

Figure 7: increase the scale on panel 1 because the air temperature during the day 25 is chopped, and also move the legend box.

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