Responses to Comments on the Manuscript:

"Water vapor isotopes indicating rapid shift among multiple moisture sources for the 2018/2019 winter extreme precipitation events in Southeast China"

(MS No.: hess-2021-269)

Many thanks for the reviewer's constructive comments. Below are our point-to-point responses to the comments. The comments are in black, and our responses are in blue.

The authors presented an continuous observation of near surface vapor isotope ($\delta^{18}O$ and d-excess) for 5 winter raining events in Nanjing, China. Although precipitation isotopes have been used to diagnose different moisture sources, the vapor isotopes are less observed and more rare for moisture source identification of winter precipitation. This manuscript presented the vapor isotopes abrupt shifts during the 5 raining events and related them to the moisture transportation and moisture shifts.

My concern about this work is that the measurement is the near surface vapor, not the free atmosphere vapor that formed the precipitation observed. In fact, the vapor isotope shifts are caused by the re-evaporation of precipitation, which is much lower than the normal vapor isotope without precipitation events. Even slight precipitation can produce the lower $\delta^{18}O$ and d-excess in the observed near surface vapor. Therefore, to trace the vapor source, we usually remove the period apparently influenced by rainfall events. This have been found by previous publications in comparing the concurrent vapor and rainfall $\delta^{18}O$ and d-excess.

I suggested the author to compare the vapor isotopes data with parallel precipitation isotopes and you can find the trick. I also suggest the authors to refer more references for similar observations.

Response: We highly appreciate the reviewer's comment. Limited by the existing conditions, free atmphosphere vapor samples are difficult to collect. Therefore, observation of near-surface water vapor isotopes is the main means to achieve high-frequency and continuous isotopic data in water vapor. We agree with the reviewer that the raindrop re-evaporation could contribute to changes in stable isotopes in precipitation and surface water vapor.

As suggested, we compared the observed water vapor isotopic ratios ($\delta^{18}O_v$) with the theoretical isotopic composition of the water vapor in equilibrium with that of the precipitation at local temperature ($\delta^{18}O_e$) for the five typical precipitation events (Fig. R1). In most cases, the observed values are close to the equilibrium values, suggesting little raindrop re-evaporation. The $\delta^{18}O_e$ values are slightly larger than the

observed $\delta^{18}O_v$ values in some days during precipitation events d and e, indicating the re-evaporation of falling raindrops. We found that the relative large fluctuations of $\delta^{18}O_v$ and d_v (especially lower $\delta^{18}O_v$ and higher d_v) in stages 2 and 3 of precipitation event d and in stage 1 of precipitation event e may be caused by the effect of re-evaporation of precipitation. These analyses, discussions and a new figure **(Fig. 4)** have been added to the revised manuscript.
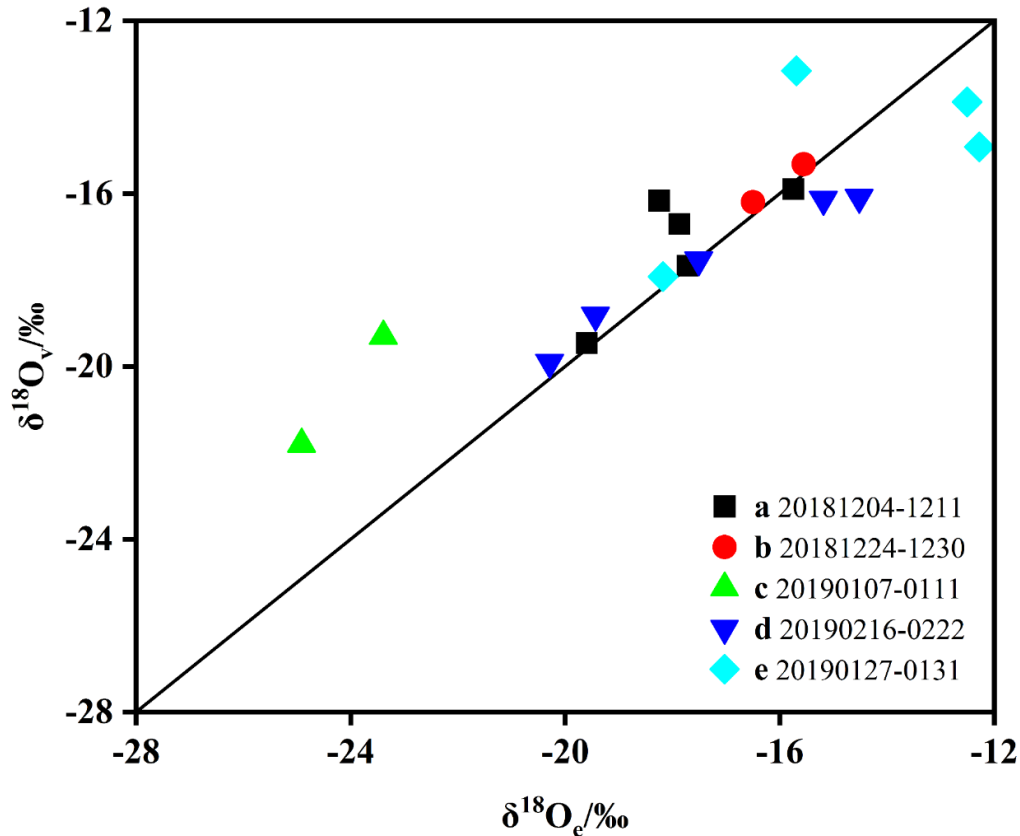
Figure R1. Relationship between observed ($\delta^{18}O_v$) and equilibrium ($\delta^{18}O_e$) vapor isotopic ratios in the five typical precipitation events. The isotopic composition of the water vapor theoretically in equilibrium with that of the precipitation ($\delta^{18}O_e$) is calculated by $\delta_e = (\delta_p - \varepsilon) / \alpha$, where ε is the equilibrium enrichment factor, and α is the liquid-to-vapor equilibrium fractionation factor (Mercer et al., 2020).The solid black line is the line of equilibrium.

References

Mercer, J. J., Liefert, D. T., and Williams, D. G.: Atmospheric vapour and precipitation are not in isotopic equilibrium in a continental mountain environment, Hydrol. Process., 34, 3078–3101, https://doi.org/10.1002/hyp.13775, 2020.