This work systematically explores water vapor transport characteristics and their modulation effects on stable water isotopes associated with two rare once-in-a-century events over the Dongting Lake bnasin: the June 2017 extreme rainstorm and the January 2008 major freezing event. This thematic focus bears strong scientific relevance for unpacking regional hydrometeorological evolution and the driving mechanisms of extreme synoptic phenomena across the East Asian monsoon domain. Consequently, it offers meaningful implications for hydrological cycle diagnosis, severe weather forecasting, and paleoclimatic proxy interpretation. The authors combine in-situ monitoring records, reanalysis datasets, and isotope model outputs to build a multi-angle analytical framework featuring coherent and robust experimental design. Several core discoveries advance our mechanistic knowledge of subtropical monsoon basin extremes—for instance, analogous large-scale circulation patterns governing seasonally disparate disasters, low-latitude southwest oceans acting as the primary water vapor sources, and systematic isotopic fractionation along long-distance transport pathways.
Overall, the paper features clear organizational logic, reliable multi-source observational and simulated datasets, and interpretive conclusions that are largely supported by the quantitative analyses presented. Nevertheless, several aspects require refinement to strengthen the manuscript's scientific rigor, including standardized conceptual terminology, transparent data documentation, physically consistent inter-case comparisons, and uniform formatting across the text. Therefore, I recommend a Major Revision for this manuscript.

Detailed review comments are as follows:

1. Incorporate historical baseline comparisons in moisture flux analyses: In Section 3.2.1, the authors contrast the four-directional mean moisture flux of Event A against climatological June averages; however, comparisons against historical synoptic-period background values are absent. Drawing on Table 1 in the Discussion section, the manuscript should incorporate a supplementary comparison between Event A and corresponding historical-period water vapor transport metrics. The mean inflow and outflow vapor flux across the four basin boundaries during matching historical windows should also be quantified. Identical revisions are requested for Section 3.3.1 (Event B) to better highlight the anomalous water vapor circulation signatures characteristic of these extreme episodes.

2. Expand Figure 8 to include seasonal background isotopes: Figure 8 displays paired $\delta^{18}O$ and $\delta^{2}H$ scatter points covering the full observational dataset, alongside samples collected during the June 2017 rainstorm and the January 2008 freezing disaster. To enable direct comparison of isotopic signatures between extreme event intervals and typical background conditions, additional scatter panels illustrating multi-year January and June baseline precipitation isotopes should be added. The figure caption should be revised accordingly to reflect this expanded content.

3. Revise the "centennial extreme events" terminology for accurate description of extreme event return period: The manuscript employs "centennial extreme events" to describe the magnitude of the two studied extreme events. In climatological and paleoclimatic research, "centennial extreme events" specifically denotes the temporal resolution or time span of a study period, not the recurrence interval of individual synoptic events. For the 2017 rainstorm and 2008 freezing disaster that represent once-in-a-century extremes, please replace "centennial extreme events" and analogous expressions with accurate terms such as "Extreme rainstorm once-in-a-century" and "Major freezing disaster once-in-a-century" throughout the text to avoid conceptual confusion between research time scale and event recurrence property.

4. Address data gaps and ERA5 precipitation biases in Figure 2: A data gap is visible in the second half of 2019 in Figure 2b. The authors should explain the root cause of this missing interval (e.g., gaps in raw observational inputs or temporary breaks in model simulation runs). Furthermore, while Figure 2a shows that measured rainfall during the 2017 extreme rainstorm ranks highest across all recorded years, the ERA5 reanalysis dataset in Figure 2b fails to reproduce this record-breaking magnitude. It is necessary to evaluate whether this deviation affects the analysis of isotopic signatures under intense rainfall and discuss how this mismatch might influence the reliability of the core interpretations.

5. Clarify the motivation for comparing static vs. dynamic trajectories: Regarding Sections 3.2.3, 3.3.3, and 4.3, the vapor pathways derived in Sections 3.2 and 3.3 represent static long-term mean fields without temporal fluctuations, which differ fundamentally from the time-evolving airflow tracks generated by the HYSPLIT model. The manuscript should elaborate on the scientific merit of comparing these two distinct trajectory approaches and explain how this dual-pathway analysis enhances our understanding of moisture transport dynamics during severe weather events.

6. Revise the physical mechanism behind low-latitude vapor isotope stability: Revisions are needed for statements in Section 4.1 and the Abstract. The manuscript claims that the isotopic composition of oceanic vapor at low latitudes displays weak seasonal shifts due to stable large-scale atmospheric backgrounds. In reality, low-latitude regions are frequently disturbed by the Intertropical Convergence Zone (ITCZ), tropical cyclones, easterly waves, and other synoptic systems, leading to highly variable atmospheric states. The muted seasonal variability of primary marine vapor isotopes is primarily driven by subtle seasonal fluctuations in isotopic ratios over evaporative ocean surfaces. The text should be reworded to accurately reflect these tropical atmospheric dynamics.

7. Specify isoGSM grid coordinates for transparency: Section 3.1 mentions that 6-hourly $\delta^{18}O$ outputs from isoGSM at the Changsha matching grid cell are used, but the text fails to specify whether this grid corresponds to the QXY or MPL observation station (Figure 2 contains the same ambiguity). To ensure data transparency and reproducibility, the exact geographic coordinates (latitude and longitude) or the designated monitoring station corresponding to the target isoGSM grid cell must be clearly stated (Lines 270–282).

8. Add labels to Figure 4 and Figure 6: The red rectangular frames in Figures 4 and 6 lack textual labels. The authors should confirm whether these boxes delineate the Dongting Lake Basin domain and add corresponding explanatory notes in each figure caption.

9. Standardize geographic presentation in Figure 10:
(1) Remove national boundary lines where feasible.
(2) Adopt a uniform format for latitude and longitude notation throughout the manuscript.
(3) Align the geographic extent and central coordinates across all subplots to facilitate intuitive cross-comparison.
(4) Unify the line color and thickness for all trajectory curves to maintain visual consistency.

10. Standardize time references to Beijing Time: The manuscript alternates between UTC and Beijing Time (e.g., sampling timestamps in Section 2.2 versus radiosonde observation hours in Section 4.3). Given that the study domain is located in China, all time references should be uniformly converted to Beijing Time, with all relevant text updated accordingly.

11. Standardize coordinate formatting: Coordinate notation is inconsistent throughout the manuscript, switching between discrete points (e.g., “28.20°N, 113.01°E”) and zonal/meridional ranges (e.g., “24.63°N–30.42°N, 107.27°E–114.12°E”). A single, standardized format (with consistent decimal precision and punctuation separators) should be applied to all geographic coordinates to improve readability and presentation.

12. Include event-specific model evaluations: The manuscript infers high model confidence for extreme events based solely on good seasonal agreement between simulated and observed meteorological and isotopic data. To further validate the model's reliability during synoptic extremes, event-specific comparisons of these variables for the two studied disasters should be included as supplementary analysis.

13. Revise the inaccurate southwest transport statement and clarify water vapor transport direction and source regions: The expression referring to southwest transport as the primary water vapor source is conceptually imprecise. “Southwest” indicates the direction of water vapor transport rather than the geographic origin category of air masses. The water vapor supplied via the

southwest transport pathway essentially originates from low-latitude ocean surfaces including the Bay of Bengal and the Indian Ocean, and is transported to the basin under the control of southwesterly circulation. Please revise relevant descriptions in the main text to distinguish transport direction from air mass source attributes, and explicitly specify that water vapor is mainly delivered through the southwest pathway with source areas over the low-latitude Bay of Bengal and Indian Ocean.