Responses to the reviewer's comments

Response to Reviewer #1

First of all, we are truly grateful for your feedback. It means a great deal to us that you are willing to review and support our research. We genuinely appreciate the time and effort you have dedicated to evaluating our work.

We have carefully considered each of your comments and fully understand your concerns about the quality of the previous version. Your insights, along with those from another reviewer, have guided us to make significant improvements to this manuscript.

We believe that research based on field observations should be robust and withstand thorough scrutiny. We are committed to addressing all of your questions with sincerity and diligence. We respectfully ask for another opportunity to present this study, and we eagerly look forward to your continued guidance.

The red words, sentences, and subsections represent our editing changes.

Responses to the general comments

Question 1

(The manuscript is very weakly written. The structure is unclear and the English is poor. This results in sometimes incorrect statements, which is a major concern. Examples include calling plants "buffer zone" or stating that the growth of vegetation results from "the synergistic stimulation from increased water and nutrient supply under global warming.")

Response: Thank you very much for your valuable feedback. We truly appreciate your insights, and we have made significant revisions in response to your comments in two key areas.

First, we understand your concerns regarding the manuscript's language. We recognize how language issues can affect the overall perception of our work. To address this, we have carefully revised the entire manuscript. Since we're currently in a position to respond only to your comments, we'd like to share some portions of the revised abstract and introduction for your review.

Second, we acknowledge that there were inaccuracies in the abstract, introduction, and results sections. To correct these errors, we took the time to identify the sources of the problematic statements and carefully reviewed the relevant literature. We have removed any sentences that lacked clarity and have reorganized the references to ensure accuracy.

Below, we present the modifications we made to the abstract and introduction:

"**Abstract.** While the impact of vegetation on global climate has been confirmed, the feedback mechanisms between vegetation and precipitation at local scales remain unknown. This study selects oasis as relatively independent geographical units and analyzes stable isotopes in precipitation, soil water, and xylem water across four vegetation cover types. Results show that in oasis areas, tree-covered regions have the highest recycled vapor ratio (fre), averaging 53%, and the lowest raindrop re-evaporation rate (fre-ev) at 38%. Cropland, grassland, and shrub-covered areas have lower fre (39%)

and higher average fre-ev (60 – 70%). In addition, sub-cloud re-evaporation loss of raindrops lead to higher relative humidity around grasslands and shrubs. This implies that vegetation suppresses precipitation evaporation losses through transpiration, thereby maintaining water vapor balance in the lower atmosphere. This study provides new insights into how local vegetation influences precipitation changes, and suggests that the potential effects of large-scale ecosystem restoration in arid regions on water resource availability warrant re-examination.

1 Introduction

Globally, species that are better adapted to warmer environments are gaining an advantage. In recent decades, many temperate forests have experienced a continuous expansion of greening areas and a gradual increase in tree biomass, resulting in a canopy closure effect that buffers the impact of atmospheric warming on understory vegetation (De Frenne et al., 2013). Since the last glacial period, numerous terrestrial sediment records have shown evidence of rapid climate change (Peteet, 2000), including severe extreme climate events that have left irreversible traces on Earth's ecosystems. To mitigate the effects of climate change, plants have increased their productivity and ecosystem stability, and enhanced the stability of temperature and precipitation by acting as a buffer zone (Huang et al., 2024). Evaporation and cooling are key factors driven by vegetation that link surface energy redistribution with terrestrial water and carbon cycling processes (Wang and Zeng, 2024). In terms of the relationship between vegetation and the water cycle, as well as various hydrological elements, climate warming may reduce the amount of available surface water by promoting vegetation growth and enhancing ecosystem evapotranspiration. Recent studies have indicated that plants have increased their productivity and ecosystem stability, thereby stabilizing temperature and precipitation by acting as a buffer zone (Huang et al., 2023). Stable isotopes of hydrogen (δ^2H) and oxygen (δ^{18}O) in water bodies undergo fractionation during different processes in the water cycle, leading to changes in their isotopic compositions (Dansgaard et al., 1964). This implies that the stable isotopic composition varies among different water bodies, making hydrogen and oxygen valuable tracers for investigating the sources of water and the movement pathways of evaporated water vapor (Walker and Brunel, 1990; Gibson and Edwards, 2002). Oasis, characterized by a stable water supply and vegetation cover, form distinct geographical units within arid desert environments. Given the abundant precipitation in oasis areas and the ambiguous relationship between different vegetation types and precipitation, isotopes of hydrogen and oxygen present in precipitation, plant xylem water, and soil water serve as valuable tools for elucidating the relationship between functional changes in ecosystems and climate variability, in accordance with the principles of water balance and isotopic mass balance.

Prolonged water scarcity can determine the sensitivity of biological communities to drought, leading to rapid vegetation responses to adapt to changing water resource mechanisms in short-term drought scenarios (Li et al., 2023). Transpiration from vegetation is a major component of terrestrial evapotranspiration (ET), serving as a crucial link between the water and carbon cycles at the land surface and the atmosphere. Given the dominant role of transpiration in land evapotranspiration, it possesses the capacity to influence regional precipitation and surface temperature by altering latent heat flux (Jasechko et al., 2013). Existing research has demonstrated that the recirculated water vapor formed by surface evapotranspiration can generate rainfall as a key source of moisture transport, thereby bridging the atmospheric moisture gap and alleviating regional drought conditions (Gimeno-Sotelo et al., 2024). Changes in evapotranspiration may also impact cloud formation and subsequent rainfall events (Zhang et al., 2023). During the process of raindrops descending from clouds to the ground, continuous exchange of water molecules occurs with the ambient water vapor, resulting in partial or complete evaporative losses in unsaturated air. This water vapor exchange process, primarily driven by secondary evaporation beneath the clouds, is closely related to the lifting condensation level (LCL) of the raindrops and directly affects the amount of precipitation reaching the surface. Furthermore, it influences boundary layer temperature and relative humidity through evaporative cooling (Graf et al., 2019). This also implies that changes in the near-surface thermodynamic state (temperature and humidity) induced by vegetation regulate the lifting condensation level (LCL) and the re-evaporation rate of raindrops, potentially creating a feedback loop that affects precipitation intensity and isotopic characteristics. Currently, research on this process remains relatively unclear, particularly regarding the influence of different vegetation types on rainfall.

As a relatively humid enclave at the desert margin, the oasis's special geographical location not only has important ecological service value but also greatly promotes the social and economic development of the region. Oasis vegetation has typical drought-tolerant and salt-resistant abilities, which can be mainly divided into three categories: trees, shrubs, and grasses. Moreover, the relatively abundant water resources provide favorable conditions for the development of irrigated agriculture in the region. In this study, we use stable isotopes of water to determine the sensitivity of precipitation to changes in evapotranspiration of different vegetation types and to address the following issues: 1) Quantifying the evapotranspiration ratios of forest, farmland, grassland, and shrub ecosystems in arid oasis areas; 2) Assessing the impact of local water vapor recycling on precipitation. This study focuses on the contribution of vegetation evapotranspiration to precipitation and examines how water vapor is transported. By looking into the relationship between vegetation evapotranspiration and precipitation, the results are helpful for identifying the possible reasons for changes in water availability in oasis areas."

Question 2

(The introduction of the research aim is too weak. Apparently the authors aim at "solving the problem of precipitation distribution patterns", but what problem this is exactly is unclear. ***The isotopes*** *appear out of nowhere, and introduction section does not include any introduction of the* ***study area****, leaving the reader guessing what is meant by "the oasis" or "the region". This is illustrative of the unjustifiably generic claims that the manuscript makes, leading to overpromises of the results. It is sometimes hard to judge the merits of the work, because of blurriness between findings and interpretations (example: lines 169-172), but surely generic claims such as in the title and abstract, but also in the following sentences, are not justified:*

"The research results will help fully elucidate the impact of vegetation evapotranspiration on precipitation and consider the regulatory effect of vegetation on precipitation and atmospheric water vapor from the perspective of heat transfer."

"This study, using stable isotope analysis, found that the water consumption capacity of crop transpiration far exceeds soil evaporation.")

Response: Your concerns are crucial, and we will take each of your questions and suggestions very seriously.

1. In the abstract, we have added an explanation of the principles of isotopes in water bodies and introduced the concept of oasis areas. The details are as follows:

Stable isotopes of hydrogen (δ^2H) and oxygen ($\delta^{18}O$) in water bodies undergo fractionation during different processes in the water cycle, leading to changes in their isotopic compositions (Dansgaard et al., 1964). This implies that the stable isotopic composition varies among different water bodies, making hydrogen and oxygen valuable tracers for investigating the sources of water and the movement pathways of evaporated water vapor (Walker and Brunel, 1990; Gibson and Edwards, 2002). Oasis, characterized by a stable water supply and vegetation cover, form distinct geographical units within arid desert environments. Given the abundant precipitation in oasis areas and the ambiguous relationship between different vegetation types and precipitation, isotopes of hydrogen and oxygen present in precipitation, plant xylem water, and soil water serve as valuable tools for elucidating the relationship between functional changes in ecosystems and climate variability, in accordance with the principles of water balance and isotopic mass balance.

2. We have removed vague and unreasonable sentences from the abstract, introduction, and results

sections. For example: “ The research results will help fully elucidate the impact of vegetation evapotranspiration on precipitation and consider the regulatory effect of vegetation on precipitation and atmospheric water vapor from the perspective of heat transfer. ” “ This study, using stable isotope analysis, found that the water consumption capacity of crop transpiration far exceeds soil evaporation.”

3.We are genuinely concerned about whether the title is appropriate and how it might be improved. We find ourselves at a bit of a loss in this regard, so we would like to humbly and sincerely seek your advice. We are committed to making the necessary modifications to the title to enhance its relevance and clarity.

Question 3

Beyond the quality of writing, sloppy mistakes in the text and figures make it difficult to trust the carefulness of the work. The authors need to carefully consider what to show and how, and take the reader along in the message, which is not the case now. For example, three new figures are presented in the Discussion, including a "calibration of different models" as the final figure. Section 5 is headed "4: Discussion", but also section 6 is headed "Discussion".

Response: We feel sincerely embarrassed about the issues and errors present in our manuscript. Nevertheless, we genuinely hope you might consider a second review of our work and give it another chance. We are committed to thoroughly checking for all errors in the manuscript and actively correcting them.

We sincerely request the reviewer #1 to re-evaluate the revised manuscript. Once again, thank you for your valuable feedback; we will ensure that the changes significantly enhance the clarity, credibility, and scientific quality of the paper.