Dear Editor:

Thank you for your letter and the reviewers' comments on our manuscript titled "Analysis of the Spatiotemporal Evolution, Key Control Features, and Driving Mechanisms of Carbon Emission/Absorption in the Continental Ecosystem of Shandong Province from 2001 to 2020" (manuscript number: ijgi-3687862). All comments are highly valuable and have been instrumental in helping us revise and improve the paper. We have carefully reviewed these comments and made the corresponding revisions in the original text, highlighting them in red. We hope you will find these revisions satisfactory.

Comments 1: Insufficient applicability of the heterotrophic respiration (Rh) model. Page 4 line 121, it is mentioned that the model for estimating Rh by Pei et al. is adopted. However, this model was established for the high-cold regions of the Tibetan Plate, while Shandong Province has a temperate monsoon humid climate. The author didnot make any adjustment about the model based on the characteristics of the region, and the of the model should be verified.

Response 1: Thank you for your valuable comments on our paper. We appreciate your thorough review and insightful suggestions. We are aware that the Rh estimation model proposed by Pei et al. was developed using the Qinghai-Tibet Plateau region as the study area, while the climatic conditions in Shandong Province are indeed different. In the Methods section of the paper, we have added relevant explanations and cited relevant literature to argue that the model is applicable to the entire Chinese terrestrial ecosystem (lines 119 – 125). Additionally, your suggestions are highly effective and practical. Future research should incorporate the specific climatic and geographical characteristics of the region to appropriately adjust and validate the model.

Once again, we sincerely thank you for your meticulous review and valuable suggestions. We believe these revisions will enhance the quality of the paper and look forward to your further feedback.

Comments 2: Lack of explanation for the contradiction of dominant driving factors at different scales. section 3.1 line 332, it is pointed out that land use change (LUCC) at the provincial scale is the dominant carbon sink driving factor (contributing 23.71%), but at the urban scale (such as Qingdao, line 378), precipitation and evapotranspiration are shown to be dominant driving factors. The article does not explain the difference in dominant driving factors at different spatial scales.

Response 2: Thank you for raising this issue. We also recognize the impact of differences in dominant driving factors at different scales on research results. In the revised paper, we have added an analysis of scale differences in the discussion section, explaining the reasons for the differences in dominant driving factors between the provincial and urban scales. We note that at the provincial scale, land use change (LUCC) may have a significant impact on carbon sources/sinks, while at the urban scale, the driving factors differ due to the rapid development of urbanization and distinct local climate characteristics (lines 413–416, 448–478). We hope this revision will help readers better understand the complexity of driving factors at different scales.

We hope these modifications effectively address your comments and enhance the

quality of the paper.

Comments 3: Incomplete explanation of driving mechanisms. The cloud model quantified factor contribution weights but did not explain the interaction between factors and derivative effects. It is suggested that an analysis of interactive effects be supplemented.

Response 3: Thank you for pointing out this issue. We recognize that quantifying the contribution weights of individual factors may not fully capture the interactions between factors and their derived effects. However, given that cloud models focus on spatial differentiation of expression, they have limited capacity for analyzing factor interactions. Therefore, we have added a discussion on the insufficient study of factor interactions in the discussion section and will conduct a thorough analysis of factor interactions in future research (lines 488–498).

Once again, thank you for your careful review of our paper and valuable suggestions. We believe these revisions will enhance the quality of the paper and look forward to your further feedback.

Comments 4: Inconsistent terminology. many places in the article, there are multiple expressions for the same concept, it is suggested that the terminology shoule be unified throughout the text.

Response 4: Thank you very much for your careful observation. We have standardized the terminology throughout the text to ensure consistent expression of the same concept. In the revised manuscript, the definitions and expressions of all terms have been adjusted and standardized, including carbon source/sink, GPP, NPP, NEP, Rh, Ra, Rs, Ex, En, and He, to ensure clearer and more consistent use of terminology in the paper. We have annotated the use of terminology within the text and provided detailed explanations in the appendix to ensure readers can accurately understand the terms (lines 544–545; all other revisions are highlighted in red).

We hope these revisions effectively address your feedback and enhance the quality of the paper.

We would like to express our sincere gratitude for your valuable comments.

We have made every effort to improve the manuscript and have made the necessary revisions. These revisions do not affect the conclusions or framework of the paper. We appreciate the helpful suggestions and comments from the editors and reviewers and hope that our revisions will be accepted.

Once again, thank you for your comments and suggestions.