Reply to Anonymous Referee #1' comments and suggestions

The manuscript provides a new valuable method for recognizing geochemical anomalies from high-dimensional geochemical survey datasets. It can be considered for publication after moderate revisions.

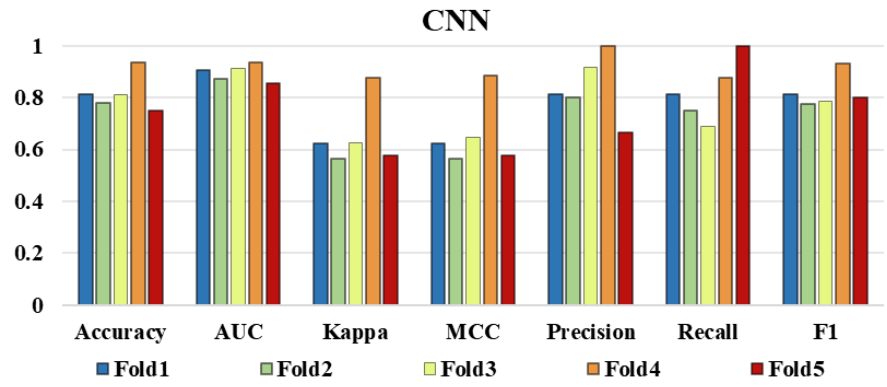
Re: Thank you for your interest. We have addressed all your comments and suggestions. I hope you are satisfied with this revision.

Please further polish the English of the manuscript.

Re: The manuscript has been comprehensively edited for clarity and precision, with a focus on simplifying complex sentences and ensuring accurate terminology.

The training patches are only 134. It is too few for training the deep learning models used in geochemical anomaly recognition. This needs to further explanations.

Re: Yes, we agree. At the early stage of this work, we had the same concern. Therefore, to further verify whether the available data are sufficient for training the proposed model, we conducted 5-fold cross-validation. The results show that the predictive performance of the model on the validation set remains consistently high across all folds, with minimal fluctuations. This indicates that the model is well-trained without overfitting, demonstrating that the data are effective and sufficient for model training (Fig. 1).



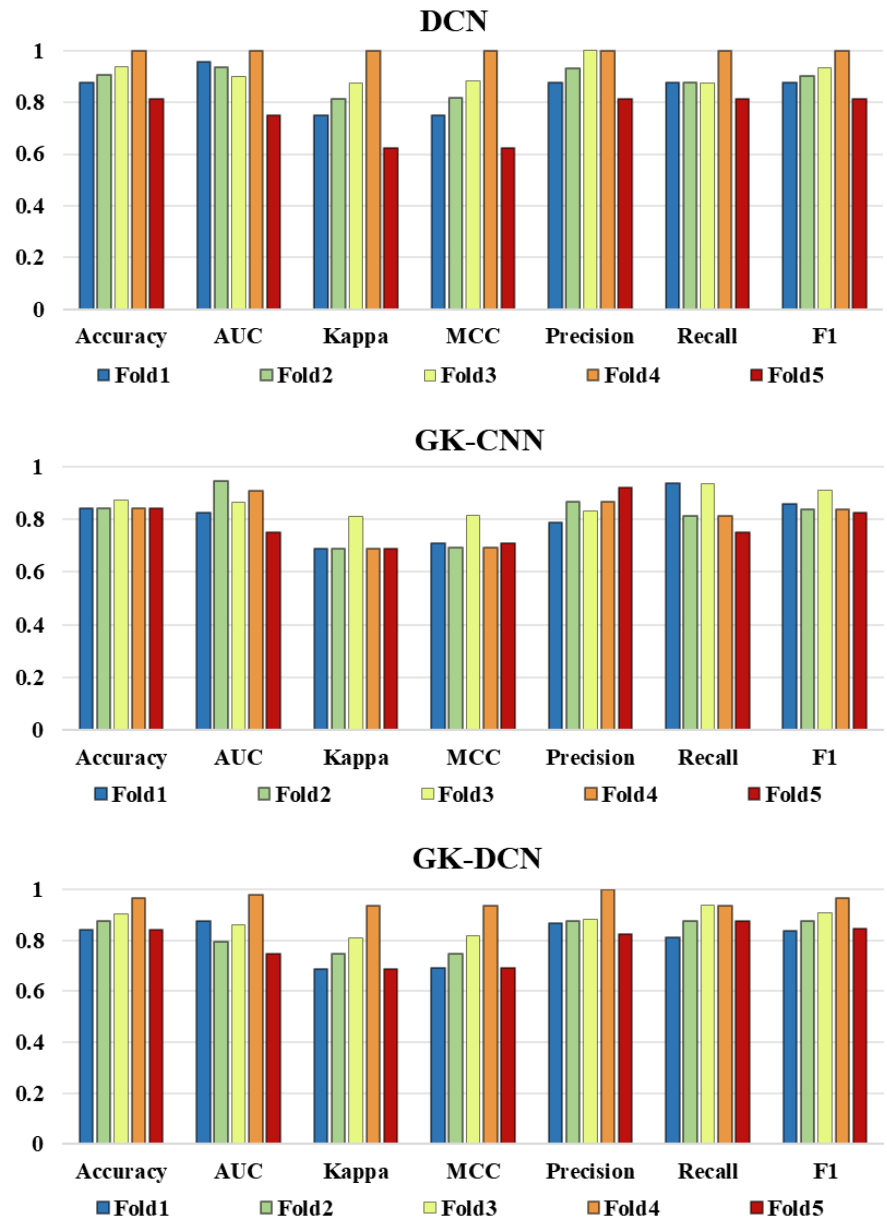


Figure 1. Results of 5-fold cross-validation for models CNN, DCN, GK-CNN, and GK-DCN across different performance metrics

The limitations of the new method should be discussed in the Results and Discussion Section.

Re: The limitations of the new method have been added.

A primary limitation of this work lies in the interpretability and completeness of the incorporated geological knowledge. The current model leverages observed ore-controlling faults as a geological constraint within the loss function. This approach, while enhancing the model's focus on anomalies related to observable structures, inherently introduces a significant bias. It assumes the spatial patterns of geochemical anomalies are predominantly controlled by these mapped features. Consequently, in exploration scenarios for covered areas or deep-seated mineral deposits—such as

in southern Tianshan Au-Cu polymetallic ore district—the model's performance is constrained. It may suppress or fail to recognize valid geochemical anomalies that are spatially associated with blind or concealed faults, which are not observable at the surface but are equally crucial ore-controlling factors. This limits the model's generalizability and predictive power in covered regions where observed structures are not fully indicative of subsurface controls.

All the suggestions have been marked on the attached pdf file.

Re: All the suggestions in the attached file have been revised.