

General comments:

This paper proposed a high spatial resolution (500 meters) snow depth estimation method based on AMSR-2 brightness temperature data and automated machine learning (AutoML), significantly improving the accuracy of snow depth monitoring in the complex terrain areas of the Tibetan Plateau.

Through the Pearson correlation coefficient, 19 key influencing factors were selected, including AMSR-2 brightness temperature, slope, and surface roughness. The method comprehensively considers the impact of various geographic and topographic factors on snow depth, enhancing the model's robustness and accuracy. But the authors ignore influence of the snow properties. How to assess the influence?

However, the paper still needs to improve the writing style and enhance the readability and standardization of the charts, and the details need to be checked carefully. In conclusion, we suggest a major revision.

Specific comments:

1 Line 20 "Compared with Landsat-8, the estimated SD spatial distribution is consistent with the snow cover extent on optical images, which can provide reliable data for monitoring snow cover changes in mountainous regions". SD consistent with SCE, and the logic is not proper.

2 Line 27 "Roof of the World,"

Please remove “,”. It would be better to use “” instead of “,”, which is the Chinese usage. Please check the whole manuscript.

3 Line 62 Support Vector Machine (SVR), SVM would be better than SVR.

4 In the last part of Introduction, the author needs to add the objectives of your work and the contribution or potential usage to this field.

5 The art-to-state progress of SD estimation is not enough, and the author needs to improve it.

6 What is the amount of SD measurement from climate stations and line measurement? Line measurement is not a proper name. The site is mainly distributed in the middle and the east part and rarely distributed in the west part. What is the influence of limited materials on the remote sensing inversion.

7 Lin 109 Table 1 application: usage. Please separate the usage of auxiliary data.

8 Line 114-116 Please separate the long sentence.

9 How to deal with the different spatial resolution between different data sources.

10 The width of flow line is not consistent.

11 This study marks the introduction of the PyCaret automated machine learning framework into snow depth estimation. It automates data processing and model selection, reducing human intervention while enhancing the efficiency of model selection and parameter optimization. Figure 3 is too simple and needs to improve. How to solve the overfitting?

12 Line 235-240: The introduction of SD estimation in the past should move the Introduction.

Figure 4 the color of meteorological stations and downscaled snow depth sample are too close, which are hard to tell from each other.

13 The discussion lack the comparison of your work and others and please cite more reference.

14 The conclusion needs the quantitative data to support the conclusion.

15 Please check the reference to meet the requirements of magazine.