The Cryosphere

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Discussions

# Interactive comment on "Simulating the role of gravel on the dynamics of permafrost on the Qinghai-Tibetan Plateau" *by* S. Yi et al.

S. Yi et al.

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We would like to thank referee 3 for the very helpful suggestions. We made point-by-point responses to the comments in the following part.

General Comment Natural land in cold regions usually contains gravels, especially in deeper ground. The commonly used algorithms to define soil thermal and hydraulic properties were developed based on agricultural soils, which contain little gravel. This study simulated the role of gravel on permafrost conditions based on three model schemes. The results show the significant effects of gravel on soil thermal and hydraulic properties, and the results from the three model schemes are different. This work identified an important knowledge and data gap about gravel for quantifying thermal and hydrological dynamics in natural land. Although it is not conclusive about which

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scheme is better, I agree with the author that more laboratory work is needed and compiling data about gravel distribution is important for quantifying thermal/hydrological dynamics of the natural land, especially for permafrost.

Specific comments 1. It would be useful to provide more description of the three schemes in section 2.4 so that readers can have a better idea about them. Such information is useful for understanding their simulated differences as well.

Reply: We will provide more descriptions about the three schemes as suggested in new version of the manuscript.

2. The paper described a study site and indicated observations of soil temperature and moisture. It would be informative to compare the model results with your observations when they are available.

Reply: We will add the comparison between measurements and simulations with three schemes. Please see the attached figure for comparisons of soil temperatures at three depths (20 cm, 100 cm, and 200 cm).

Minor points 1. Organic matter has been mentioned in Line 6 section 2.2, but it is not very clear if organic matter is considered or not in the schemes.

Reply: The site tested is poorly vegetated and the amount of organic matter is small. We did not consider the effects of organic matter on soil properties in this study. We will make this point clear in new version.

2. Section 2.2, Line 6: you may revise it to "Soil is a mixture of porous organic material and minerals of various grain sizes." The following sentence "Soil texture classifications do not consider gravel and models usually neglect gravel" is more suitable in introduction section than here.

Reply: We will make changes as suggested.

3. Section 3.1, Line 8-9. You may use the word "significant" rather than "striking". The

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difference in diameter is not considered in Figs 4 and 5. The following sentence should be moved to section 3.3.

Reply: We will make changes as suggested.

4. Table 3: adding a raw about the meaning of the columns.

5. Fig.3. adding the title of the Y-axis and X-axis. The white areas are is for no data?

6. Fig.6-10: adding the title of the Y-axis and X-axis.

Reply to point 4-6: We will improve figures and tables as suggested.
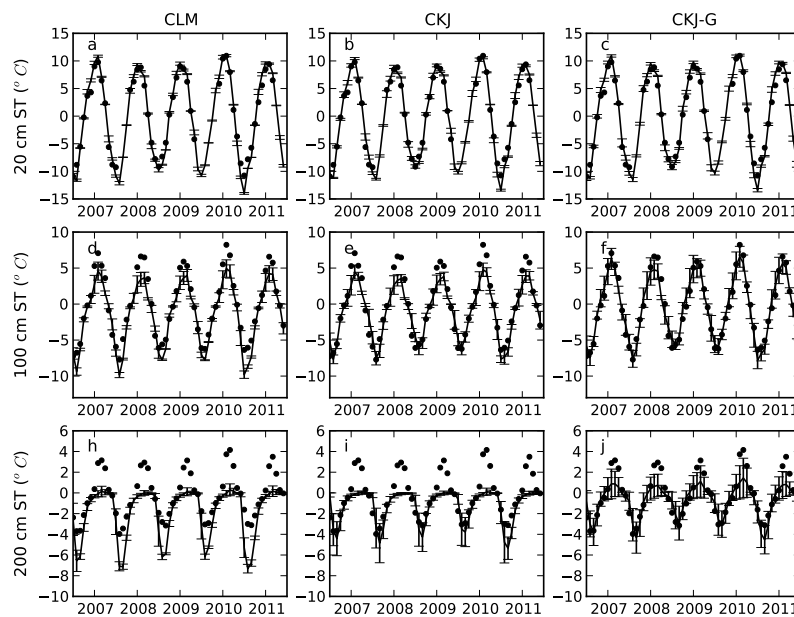
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**Fig. 1.** Comparisons of measured (dot) and simulated soil temperatures (line) with three different schemes (CLM, CKJ, and CKJ-G) at 20 cm, 100 cm and 200 cm.

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