Bias Correction of an Ensemble Mean Reanalysis-Based Permafrost Soil Temperature Product using Snow Cover and Vegetation

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ABSTRACT

Reanalysis products provide spatially homogeneous coverage for a variety of climate variables in regions where observational data are limited. However, soil temperature estimates in many reanalysis products are biased cold by 2-7 K across the Arctic, particularly in the cold season. In previous work we showed that a soil temperature product based on the ensemble mean of all available reanalysis products generally outperformed the individual soil temperature estimates of any individual product. Biases over permafrost regions, however, remained relatively large. Here we utilize mean bias subtraction, multiple linear regression, and a random forest regression technique to bias-correct an ensemble mean permafrost soil temperature product. In addition to the thermodynamic state of the land surface in the reanalysis, the random forest regressor also uses information relating to remotely sensed snow cover and vegetation. As part of this process, we develop a vegetation classification scheme that reflects the functional impacts of vegetation on snow cover and soil temperature in order to compare the vegetation cover assumed in the reanalysis products to European Space Agency Climate Change Initiative (ESA-CCI) vegetation cover. We train our models primarily on soil temperature data from Eurasia, as data from North America is sparse. The performance of the correction algorithm will be evaluated in different regions, with specific attention to data-poor regions in North America. The importance of different predictors, and in particular the role of snow biases and vegetation cover will be discussed.

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