Future simulations of permafrost by the JULES land surface model

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Permafrost covers approximately 25% of the exposed land surface and contains large quantities of stored organic carbon, which may be released to the atmosphere when permafrost thaws, amplifying the global warming effect. It is therefore important to assess the fate of permafrost under future climate warming using global models.

Here we show the rate of permafrost degradation in JULES, which is the land surface model used in the Hadley Centre climate models, using future simulations under two different climate scenarios. The model shows both permafrost area loss and active layer deepening.

We compare the standard version of JULES with an improved model version that includes important high-latitude processes. In particular, including the effects of mosses and organic soils reduces the rate of permafrost loss and active layer deepening. We show that simulating a deep soil column is important for determining the future permafrost dynamics, confirming previous work. We also show that the resolution of the soil column is very important for realistically simulating permafrost.