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A recent compilation of measurements of soil organic carbon (SOC) stocks in the American Arctic shows that cryosols store much more SOC than assumed so far, on average 35 kgC/m2 but 40 to 50 kgC/m2 in lowlands and uplands (Ping et al., 2008). Several mechanisms are responsible for such high carbon concentration in arctic soils, such as slow decomposition in an unfavorable environment and the fast downward transport of organic matter due to cryoturbation. A quantitative understanding of such processes is required to assess the future carbon balance with higher validity. Pan-arctic simulations of carbon pools and fluxes by a permafrost-enhanced version of the Lund-Potsdam-Jena Dynamic Global Vegetation Model (LPJ) which includes explicit representation of the seasonal thawing and freezing of the active layer on top of the permafrost shows that high SOC stocks as measured in the field can be partly explained by soil thermal dynamics which impact microbial activity directly or indirectly via soil moisture. The permafrost-enhanced version of LPJ simulates SOC stocks of about 30 to 50 kgC/m2 which are higher than the standard LPJ version despite a reduced productivity of the vegetation. The difference follows a latitudinal trend. These results demonstrate that soil thermal dynamics but also more processes such as SOC transport need to be represented by global ecosystem models and climate model's land surface schemes for more reliable projection of the future carbon balance and climate.

