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Modelling uncertainty of carbon stocks changes in peats.

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Global warming might change the hydrology of upland blanket peats in Scotland with increased risk of release of the stored carbon. It is therefore important to model the loss of carbon in peat areas with estimation of the damage potential. The presented approach has the potential to provide important information for the assessment of carbon stocks over large areas, but also in case of changes of land use, such as construction of wind farms. The provided spatial uncertainty is important for including the results in further environmental and climate-change models and for decision making in order to provide alternatives and prioritisation.
In this study, main peat properties (i.e. depth, water content, bulk density and carbon content) were modelled using a hybrid GAM-geostatistical 3D approach that allows full uncertainty propagation. The approach used involves 1) modelling the trend with full 3D spatial correlation, i.e. exploiting the values of the neighbouring pixels in 3D-space, and 2) 3D kriging as spatial component. The uncertainty of the approach is assessed with iterations in both steps of the process.
We studied the difference between local estimates obtained with the present method and local estimates obtained assuming the global average value across the test area for Carbon content and bulk density. To this end, virtual pits with a surface area of 30x30 m were excavated for the whole peat depth at randomly selected locations. Calculated uncertainty was used to estimate credible intervals of C loss.
In this case the estimates obtained with the proposed approach are higher that what would be obtained by assuming spatial homogeneity and using just average values across the area. This has implications for environmental decision making and planning as, in this case, it is likely that more carbon would be lost than estimated using traditional approaches.