



## **Fine-scaled spatiotemporal variability of surface elevation change in a northern peatland: Interactions with hydrology and vegetation**

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The depth of the groundwater table below the surface (GWT) is a major control on biogeochemical processes in northern peatlands. In these wetlands, the fluctuations in GWT are stabilized by expansion and compression of the organic soil (peat) matrix (peat volume change;  $\Delta PV$ ). It is unclear at which spatial scale this feedback occurs and which processes control its spatial variability.

We explored the fine-scale (0.5 m resolution) spatial structure of  $\Delta PV$  and its relationship to vegetation and hydrology using spatially continuous data of surface elevation and point measurements on plant species composition, geohydrological, and positional factors along a transect in a northern peatland throughout a growing season.

We found that  $\Delta PV$  ranged between -6 cm and +1.2 cm over the growing season, showing large spatial variation. Spatial patterns of  $\Delta PV$  over the whole season emerged at a spatial scale of  $40.8 \pm 0.6$  m ( $\pm$  SE). Over the growing season, with progressively deeper absolute groundwater tables, peat volume change increased heterogeneity of peat surface elevation, and elevation differences became more pronounced. Spatial variation in  $\Delta PV$  was mainly related to changes in aquifer thickness, and to a lesser extent also to larger vegetation units (microsites), with magnitude of  $\Delta PV$  increasing from moist lawn < wet hollow < wet flank.

Our results show that  $\Delta PV$  can be substantial and is highly spatially variable. As a consequence of the high spatial variability, the spatial representativeness of point scale simulation models including  $\Delta PV$  is restricted to a range up to about 40 m. This study provides empirical evidence of a link between large scale vegetation units and peat volume change, one of the mechanisms hypothesised to play an important role in hydrological self-regulation in northern peatlands.