Geophysical Research Abstracts
Vol. 16, EGU2014-12612-1, 2014
EGU General Assembly 2014

The fine-scale spatial distribution of surface moisture content in Canadian and Irish peatlands

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Natural peatlands are characterised for having a water-table close to the surface, saturating all the layers of the peat profile. In contrast, in drained peatlands there is a decrease of the water-table position and a subsequent drop of moisture content of the superficial layers. When the peat reaches levels of moisture content below 125% (in a dry weight basis) it becomes more vulnerable to burn in a smouldering fire. While the moisture distribution through the vertical peat profile has been well studied, there is little research looking at how the moisture content is spatially distributed horizontally. There are even less studies analysing the variability of physical properties of the peat in a fine scale.

In this study, we investigated the spatial distribution of moisture content, bulk density and vegetation in the superficial layers of two peatlands. Samples from a Canadian old undisturbed peatland (Burned Crow Century, AB, Canada) were taken during the summer 2013 and from a drained Irish peatland (Wicklow Mountains National Park, Ireland) were taken during the autumn 2013. We estimate spatial distribution and scale of variability of vegetation and peat physical properties such as moisture content and bulk density.

In the Canadian samples we found a significant association between vegetation types and moisture content and bulk density of the peat. While for the Irish peatland there is only association between vegetation and bulk density of the peat, as the moisture content is more homogeneous through all the vegetation types. For both datasets, the scale of spatial autocorrelation is up to 50cm in peat physical properties, which is consistent with the spatial scale of the hummock-hollow microtopography. The variables in our analysis have a direct effect on the propagation of the smouldering fire in peatlands, for that reason a better knowledge of the scale and spatial variability of the peat properties can help regulating water-table levels in certain local areas of a peatland to prevent unwanted fires.

keywords: soil physical properties, bulk density, peat, spatial variability, ecohydrology, microtopography.