Seasonally frozen soil modifies patterns of boreal peatland wildfire vulnerability – Supplemental Material

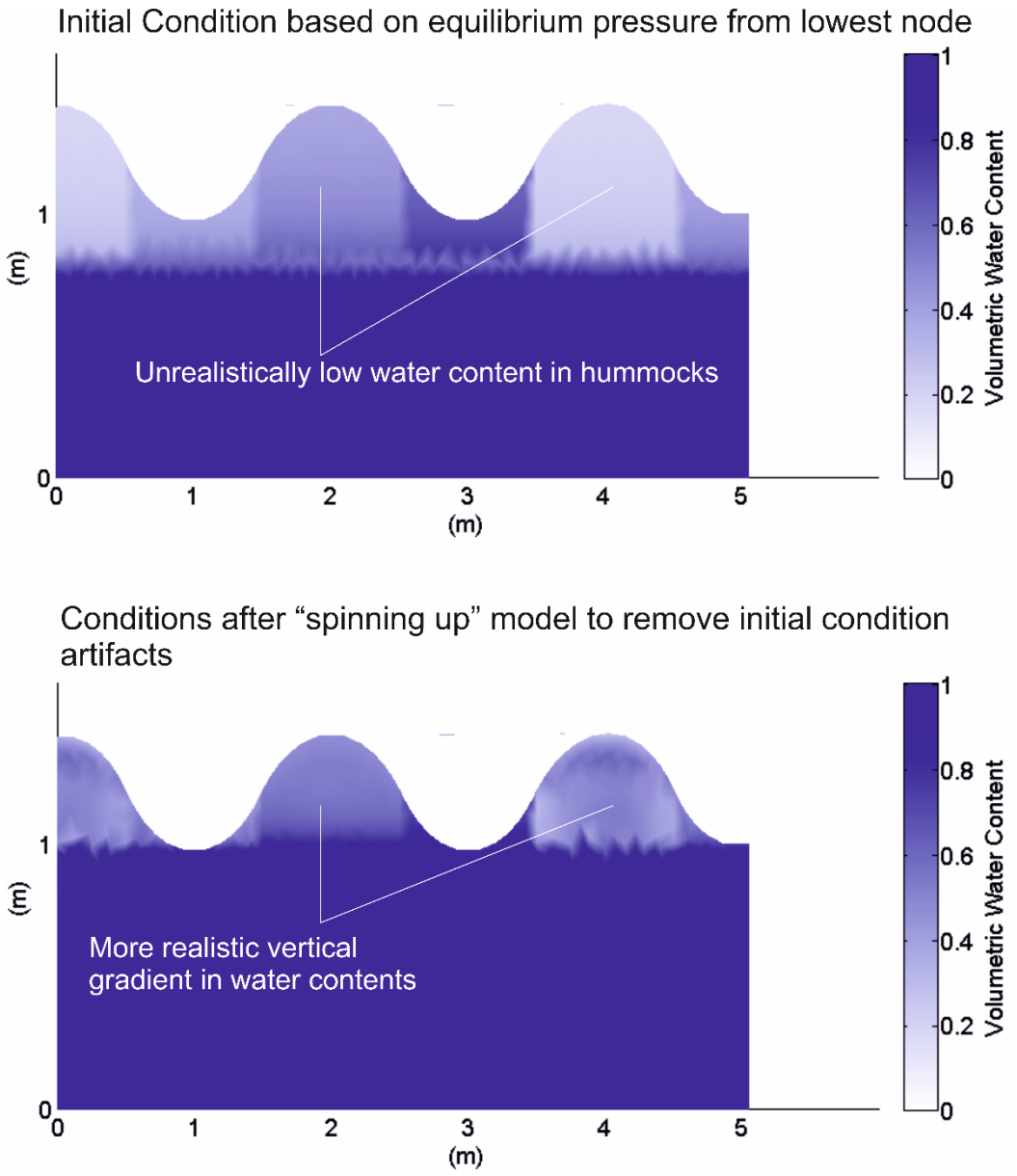

Figure S1 – Comparison between water contents in initial conditions where water content is based on equilibrium pressure head from base of the model domain (top), and after model spin up.

The model spin-up phase ensures that the starting conditions for the exploratory modelling are more closely reflecting the distribution of water contents found in the field. HYDRUS-2D has a number of options for specifying initial starting conditions, but given the variation in surface elevation across a hummock-hollow sequence none of these satisfactorily generates a

realistic distribution of water contents in the unsaturated zone. The water content distribution after the spin-up period reflect observations that hummocks are able to retain a moist vadose zone (e.g. Benscoter and Wieder, 2003; Shetler et al., 2008; Benscoter et al., 2011; Thompson and Waddington, 2013; Lukenbach et al., 2015) and are to an extent decoupled hydrologically from the water table; this means they are characterised by a very dry near-surface, but a moist interior.

Values extracted from the model runs corresponding to Figure 3 with breaks in the frost layer, show how the water contents at the near-surface (Figure S2A) and at 15cm depth (Figure S2B) vary with distance from the break. Areas of peat above the hole are able to maintain elevated water contents as evaporation is met by water supplied from saturated peat deeper in the profile, whereas only a short distance away from the break the water contents are lower. Surface tensions (Figure S2C) show that in areas away from the ice break tensions approach the hCritA value of 400 mb which limits evaporation, whereas surface tensions above the break in the ice are high, but not at hCritA.

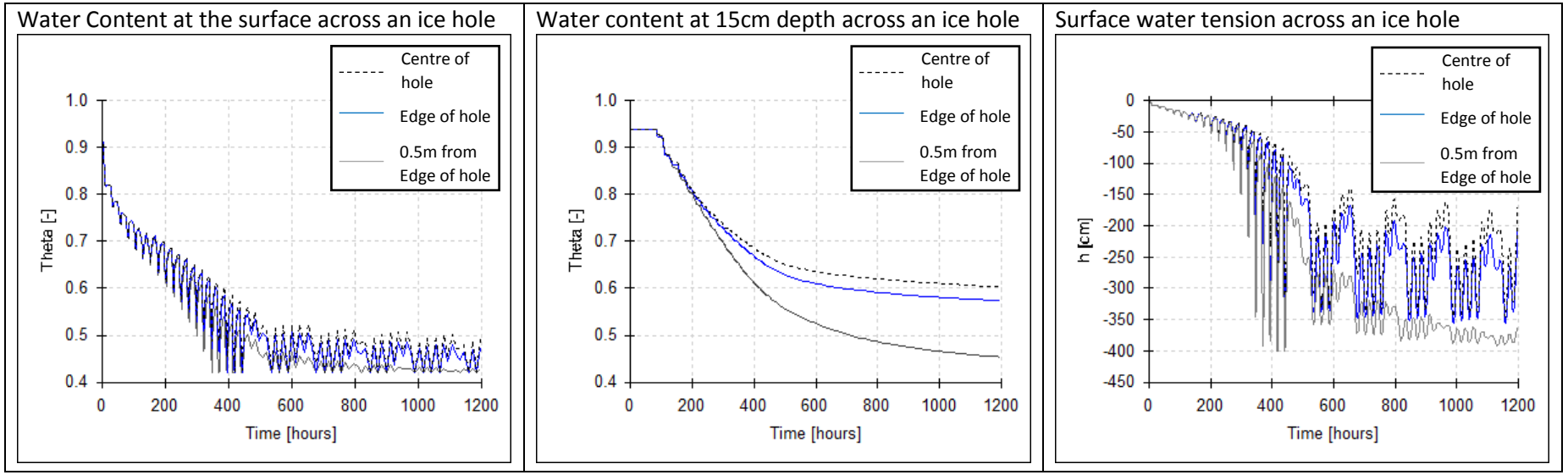

Figure S2 – Water content and surface tension plots showing how a hole in the frost layer can supply water to the evaporating surface, but the lateral extent of this water supply is limited.