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The influence of naturally occurring temperature and relative humidity variations on soil water repellency

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Heat-induced changes to soil water repellency have been the focus of many studies concerning wildfire and the mechanisms underlying repellency changes at high temperatures ($>150°C$) are reasonably well understood. Effects of heating to lower temperatures, as induced by insolation or sample preparation in the laboratory have seen less attention and results have been conflicting. At temperatures up to 105°C, for example, repellency has been shown to increase, decrease or remain unaffected.

Similarly, water repellency expression is known to be influenced by soil moisture content with repellency being absent above a soil specific threshold zone. Below this threshold, however, it is not clear how repellency is affected by moisture content. It has, for example been suggested that repellency peaks at low, but is reduced at very low moisture contents. The influence of relative humidity on relatively dry soils might here be of importance. A significant increase in repellency following short-term exposure to high relative humidity (97-100%) has been reported, which is likely to be caused by physicochemical processes. Although a minimum in repellency at about 40% relative humidity was suggested, effects at a low relative humidity, which is more likely to occur at dry field conditions, are yet only poorly understood. In this presentation, current findings and underlying hypotheses regarding the above issues are reviewed in the light of likely naturally occurring environmental conditions. A methodology is presented aiming at examining the effects of different relative humidity and temperatures below 65°C on water repellency, using a wide variety of soil samples. This approach will allow the identification of any critical thresholds and the evaluation of the importance of other soil properties in influencing changes in repellency behaviour. Preliminary findings will be discussed.