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Advantages, problems and limitations of different field and laboratory approaches for investigating soil hydrophobicity switching patterns

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This poster presents the research approaches and early results of a programme of field and laboratory investigation to assess three-dimensional patterns of switching of soils between hydrophobic and hydrophilic states. It focuses on soils on terrain of burnt and unburnt eucalyptus, pine and scrub land-use in north-central Portugal. Although much is known about soil hydrophobicity, assessments of the overall hydrological and erosional significance of the soil property in any environmental situation are greatly hampered by a lack of knowledge on switching, mainly because of the destructive nature of methods of measuring the soil property, coupled with the often high local spatial variability of hydrophobicity within soils. In particular little is known about (i) three-dimensional patterns of change (are changes spatially progressive or near-simultaneous within soil profiles and across slopes), (ii) the speed and frequency of switching and (iii) the extent to which the degree of hydrophobicity at particular points change prior to becoming (and with increasing time since being) hydrophilic.

Four complementary approaches are being adopted by the research programme reported here. 1) Statistical analysis of differences in the frequency distributions of degree of hydrophobicity of seasonal snapshot surveys of hydrophobicity (surface and subsurface) at four grid networks on unburned and burned eucalyptus terrain in a an area of schist lithology in northern Portugal; (2) A similar statistical analytical approach, but this time focussing on drying sequences provided by daily surveys following individual rainstorms of two grids on unburned and newly burned scrubland; (3) Daily three-dimensional surveys of hydrophobicity around root systems of eucalyptus globules seedlings using excavated pits before and after rainstorms; and (4) laboratory investigation of three-dimensional patterns of hydrophobicity at intervals during simulated wetting and drying phases for a range of physical soil scenarios (e.g. with or without vertical cracks and holes and differing arrangements of surface and subsurface stone clasts). In the first two approaches, because of the destructive nature of measuring hydrophobicity with the Ethanol Molarity technique, sampling is carried out in clockwise fashion around each grid point (i.e. each survey involved measurements and sampling at a different clock position). In the third approach, pits are constructed in different points within the seedling area, but always including soil away from and close to roots. In the laboratory approach, different stages in drying or wetting phases are provided by replicated experiments. The poster focuses on the advantages, problems and limitations of the above approaches.