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Modelling soil water repellency at the daily scale in Portuguese burnt and unburnt eucalypt stands

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Soil water repellency can impact soil hydrology, especially soil wetting. This creates a challenge for hydrological modelling in repellency-prone regions, since current models are generally unable to take it into account. This communication focuses on the development and evaluation of a daily water balance model which takes repellency into account, adapted for eucalypt forest plantations in the north-western Iberian Peninsula.
The model was developed and tested using data from three eucalypt stands. Two were burnt in 2005, and the data included bi-weekly measurements of soil moisture and water repellency along a transect, during two years. The third was not burnt, and the data included both weekly measurements of soil water repellency and soil moisture along transects, and continuous measurements of soil moisture at one point, performed for one year between 2011 and 2012. All sites showed low repellency during the wet winter season (although less in the unburnt site, as the winter of 2011/12 was comparatively dry) and high repellency during the dry summer season; this seasonal pattern was strongly related with soil moisture fluctuations.
The water balance model was based on the Thornthwaite-Mather method. Interception and tree potential evapotranspiration were estimated using satellite imagery (MODIS NDVI), the first by estimating LAI and applying the Gash interception model, and the second using the SAMIR approach. The model itself was modified by first estimating soil water repellency from soil moisture, using an empirical relation taking into account repellent and non-repellent moisture thresholds for each site; and afterwards using soil water repellency as a limiting factor on soil wettability, by limiting the fraction of infiltration which could replenish soil moisture. Results indicate that this simple approach to simulate repellency can provide adequate model performance and can be easily included in hydrological models.