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Contact-angle of water drop on a sloped water repellent soil

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Soil water repellency is a well-known phenomenon worldwide and currently well documented in the scientific literature. Most methods used to characterize the magnitude and/or persistency of soil water repellency is directly or indirectly related to the initial advancing contact angle at the solid-liquid-vapor interface. These methods are commonly involved by placing a water (or solution) drops on horizontal surface of water repellent soil (WRS)particles attached to a plane surface. Under natural conditions, however, a soil surface layer is mostly sloped due to micro and/or macro topography. Therefore, the formation of advancing contact angle (downhill) and receding contact angle (uphill) should be considered, rather than a unique value of the contact angle. The difference between the advancing and receding contact angle values is defined as the contact angle hysteresis, commonly attributed to surface roughness and/or chemical heterogeneities. For a given tilt angle, a water drop exceeding a critical volume will slide downhill. Alternatively, for a given drop volume, a critical sliding angle can be defined. Measurements of advancing, receding and sliding angles on sloped WRS is indispensable for our understanding on water adhesion due to hysteresis and may provide critical values for predicting the initiation of water runoff in sloped landscapes on the micro and macro scales of WRS. Accordingly, the main objective of this study was to measure the advancing and receding contact angles on a sloped WRS as a function of: i) water drop volume, ii) particle size distribution and iii) surface slope. The measurements of contact angles on sloped WRS were taken with an advanced goniometer microscope (OCA20, DataPhysics) with external tilting device and SCA20 software for analyzing contact angles highly resolved with respect to time and spatial scales. The results obtained will be presented and the rolling-drop-criteria will be discussed.