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4.40 Soil water flux

Project Name: OPERANDUM (Grant Agreement no. 776848)

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Soil water flux and degree of saturation	**Water Management**
Description and justification	Soil water flux – is the transport of water into the soil from the atmosphere, into the atmosphere from the soil and within the soil, establishing the soil water mass balance. It is intrinsically related to the stress state of the soil and to ecohydrological processes occurring at the plant-soil-atmosphere continuum (e.g., plant uptake and evapotranspiration). Degree of saturation is a measure of the soil water mass balance. It is directly related to soil strength, matric suction, and soil water flux. Vegetation plays a key role in ecosystems by linking biophysical processes—such as absorption of solar radiation, rainfall interception, and evapotranspiration—to biogeochemical processes—such as photosynthesis and volatile organic compound emission. Moreover, vegetation links the terrestrial carbon cycle to hydrology through stomatal aperture (Jarvis and McNaughton, 1986), and through other processes such as soil-water extraction by roots (de Jong van Lier et al., 2006). Terrestrial water fluxes are controlled to a large extent by above-ground and below-ground biological processes where vegetation plays a major role.

Definition	The degree of saturation is the ratio of the volume of water to the volume of voids, usually represented as percentage, it can vary from 0 (totally dry soil) to 100 (completely saturated soil). The gradient of the total potential of soil water in both, the soil fully saturated by water (saturated flow) as well as in soil not fully saturated by water (unsaturated flow) creates a flow (flux) in the soil.
Strengths and weaknesses	+ A number of models exist for monitoring and prediction of fluxes, albeit usually at a larger scale + Degree of saturation: easy to measure with gravimetric methods in the lab and in situ with reflectometers; intrinsically related to matric suction through soil water retention function; related to meteorological variables rainfall and temperature - Some phenomena associated with vegetation, and this NBS, have not been modelled through the soil water flux
Measurement procedure and tool	Soil water flux is calculated using the hydraulic gradient measured with a tensiometer at two depths and the hydraulic ·conductivity corresponding to the average soil water content between the two depths determined with a neutron probe or by direct sampling and lab testing (moisture content determination). The degree of saturation is calculated as a ratio of the moisture content and specific gravity on one side and the void ratio on the other. Time domain reflectometry sensors
Scale of measurement	Point, micro
Data source	
Required data	For the flux: hydraulic gradient between two points; soil water content For the saturation degree: soil water content, specific gravity of the soil particles, void ratio of the soil
Data input type	Quantitative, numerical
Data collection frequency	Continuous
Level of expertise required	Intermediate to high
Synergies with other indicators	Digital terrain model; soil moisture content, groundwater table level, soil strength
Connection with SDGs	11,13,15,17

Opportunities for participatory data collection	Yes, through citizen science
Additional information	
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4.41 Soil water retention capacity

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Soil water retention capacity	**Water Management**
Description and justification	Soils can store water in their matrix and skeleton depending on their structure, texture and mineral composition. There is an intrinsic relationship between the amount of water stored in the soil and the matric suction, which is established through the soil water retention function. This function defines field capacity and wilting point, which difference establishes the water available to plants in the soil. Soil water retention is also related to soil strength and bridges soil hydrology with mechanics. Soils that can hold a lot of water support more plant growth and are less susceptible to leaching losses of nutrients and pesticides. All of the water held by soil is not available for plant growth. Soil water retention capacity is mainly determined by the soil texture (sand, silt, clay contents), structure (bulk density and porosity), and organic matter content. It can influence the choice of NBS as well as the stability/effectiveness of the NBS put in place to mitigate against natural hazards. In general, the higher the percentage of silt and clay sized particles, the higher the water holding capacity. The small particles (clay and silt) have a much larger surface area than the