Additional information	
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4.14 Calculated infiltration rate and capacity

Project Name: OPERANDUM (Grant Agreement no. 776848)

Author/s and affiliations: Alejandro Gonzalez-Ollauri[1] , Slobodan B. Mickovski[1]

[1] Built Environment Asset Management Centre, Glasgow Caledonian University, Glasgow, Scotland, UK

Infiltration rate **Infiltration capacity**	**Water Management**
Description and justification	It refers to the speed at which water moves into and through the soil profile. It is normally expressed as the volume of water (measured in terms of water column) infiltrating within a given soil area per unit of time. It is related to the soil's ability to allow water movement within the soil profile, to the storage of water in the soil, the water available to plants, or the generation of runoff. Calculated infiltration rate can be derived from classic soil infiltration models, from pedotransfer functions, or from simple soil water mass balances.
Definition	Volume of water infiltrating a soil volume per unit of time

Strengths and weaknesses	+ Driving variable and boundary condition in water-driven systems and processes + Bridges the atmosphere, plant, soil continuum under wetting/rainfall conditions + Can be estimated from well-established models and heuristic approaches - Computational effort can be high and needs expertise - Soil and meteorological information is needed - Some variables involved in the existing models are difficult to quantify
Measurement procedure and tool	Calculation of soil infiltration rate is generally based on Darcy's law, i.e., an equation that describes the flow of a fluid through a porous medium. Soil infiltration models normally assume that infiltration occurs vertically from a ponded surface to an isotropic soil profile of uniform water content (Rawls et al., 1989). The infiltrating water is assumed to travel as a piston flow with a sharp division between the saturated soil above the wetting front and the dry soil below (Fig. 1; Neitsch et al., 2011). The most commonly used infiltration models are the Philip model, the Green-Ampt model, and the Smith and Parlange model (e.g., Morbidelli et al., 2018). Model outcomes should be compared against site-specific infiltration tests (e.g., Guelph permeater test) to establish which model replicates infiltration best. However, the most widely used model is the Green-Ampt model due to its physically-based, integrated nature and ability to portray soil infiltration realistically. Information on the soil saturated hydraulic conductivity (Ks) and matric suction of the wetting front is needed to implement Green-Ampt, which can be retrieved from pedotransfer functions knowing the soil's particle size distribution and organic matter content (e.g., Saxton and Rawls, 2006; Toth et al., 2015). After setting up the initial moisture conditions and knowing the rainfall intensity and duration, one can estimate how far the wetting front travels in the vertical direction, how long it takes, what is the infiltration rate at that stage and how much water runs off or enters the soil profile. The equations for the Green-Ampt model are gathered for example in Neitsch et al. (2011). Alternatively, a heuristic approach can be followed to calculate soil infiltration under the assumption that infiltration occurs at a rate equal to Ks. A soil water mass balance can be established for a given rainfall event if rainfall intensity and duration are known. Accordingly, runoff (RF) can be calculated as RF=Pg-Ks.tr, where Pg is the rainfall depth (mm), Ks the saturated hydraulic conductivity (mm/h) and tr the duration of a given rainfall event (h). Actual infiltration (AI) can be then calculated as

	AI=Pg-RF. The depth of the wetting front (Zwf) can be calculated as Zwf= AI/(θs-θi), where θs and θi is the soil moisture content at saturation and initial conditions (both in mm^3/mm^3), respectively.
Scale of measurement	Soil column to catchment scale
Data source	
Required data	Soil texture, soil organic matter and rainfall intensity and duration
Data input type	Quantitative
Data collection frequency	Daily (rainfall), and before and after NBS implementation (soil attributes)
Level of expertise required	High – for executing the calculations
Synergies with other indicators	Direct relation to *soil stress under wetting (rainfall) conditions, water available to plants, runoff estimations*
Connection with SDGs	SDG 11 Sustainable cities and communities
Opportunities for participatory data collection	Participatory data collection is feasible through collecting rainfall data
Additional information	
References	Morbidelli, R., Corradini, C., Saltalippi, C., Flammini, A., Dari, J., Goviandaraju, R. S., 2018. Rainfall infiltration modelling: A review. Water, 10: 1873; doi:10.3390/w10121873 Neitsch, S., Arnold, J., Kiniry, J., Williams, J., 2011. Soil and Water Assessment Tool; Theoretical Documentation. Water Resources Institute Technical Report No 406, Texas. RAWLS W., STONE J., BRAKENSIEK D. (1989) Infiltration. In L. Lane, & M. Nearing, USDA-Water Erosion Prediction Project: Hillslope profile model documentation (Vol. 2, pp. 68-79). West Lafayette, Indiana: USDA-ARS National Soil Erosion Research Laboratory. Saxton, K., Rawls, W., 2006. Soil water characteristic estimates by texture and organic matter for hydrologic solutions. soil sci. Soc. Am. J. 70, 1569–1578. Toth, B., Weynants, M., Nemes, A., Mako, A., Bilas, G., Toth, G., 2015. New generation of hydraulic pedotransfer functions for Europe. Eur. J. Soil Sci. 66, 226–238.

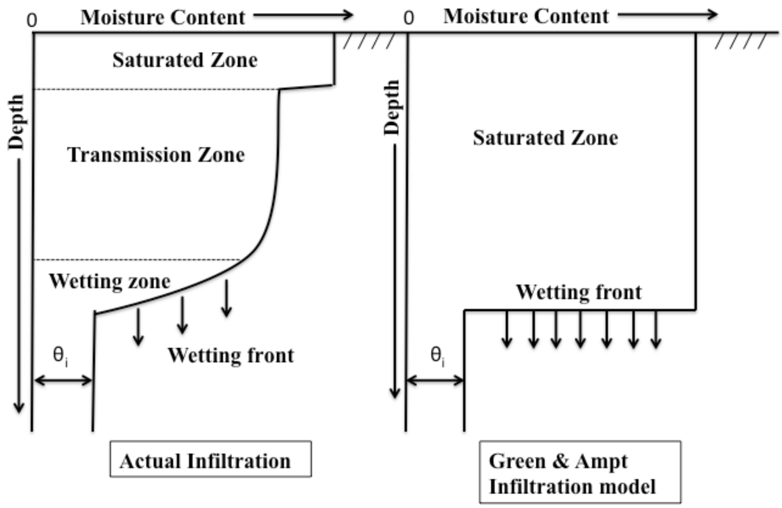

Figure: Soil moisture content distribution in the soil profile modelled by the Green-Ampt model (right) and a typically observed distribution (left) (Neitsch et al., 2011)

4.15 Evapotranspiration rate

Project Name: UNaLab (Grant Agreement no. 730052)

Author/s and affiliations: Laura Wendling[1], Ville Rinta-Hiiro[1], Maria Dubovik[1], Arto Laikari[1], Johannes Jermakka[1], Zarrin Fatima[1], Malin zu-Castell Rüdenhausen[1], Peter Roebeling[2], Ricardo Martins[2], Rita Mendonça[2]

[1] *VTT Technical Research Centre Ltd, P.O. Box 1000 FI-02044 VTT, Finland*

[2] *CESAM – Department of Environment and Planning, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal*

Rate of evapotranspiration	**Climate Resilience Water Management**
Description and justification	Evapotranspiration (ET) is a combination of two separate processes whereby water is lost from the soil surface by evaporation and from vegetation by transpiration. Water evaporates from surfaces when sufficient heat is supplied for liquid water to transition to water vapour. During transpiration, plant tissues vaporise water, which is then released to the atmosphere through stomatal openings on