Cairo 2018 Water Week

CWW 2018

Water Conservation for Sustainable Development
14-18 October 2018
Cairo Egypt.

Ministry of Water Resources and Irrigation

SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

Simple hydrologic modelling for water budget calculations in data scarce countries

TS34: Water Management in Agriculture Sector under Scarcity Condition and Global Heating

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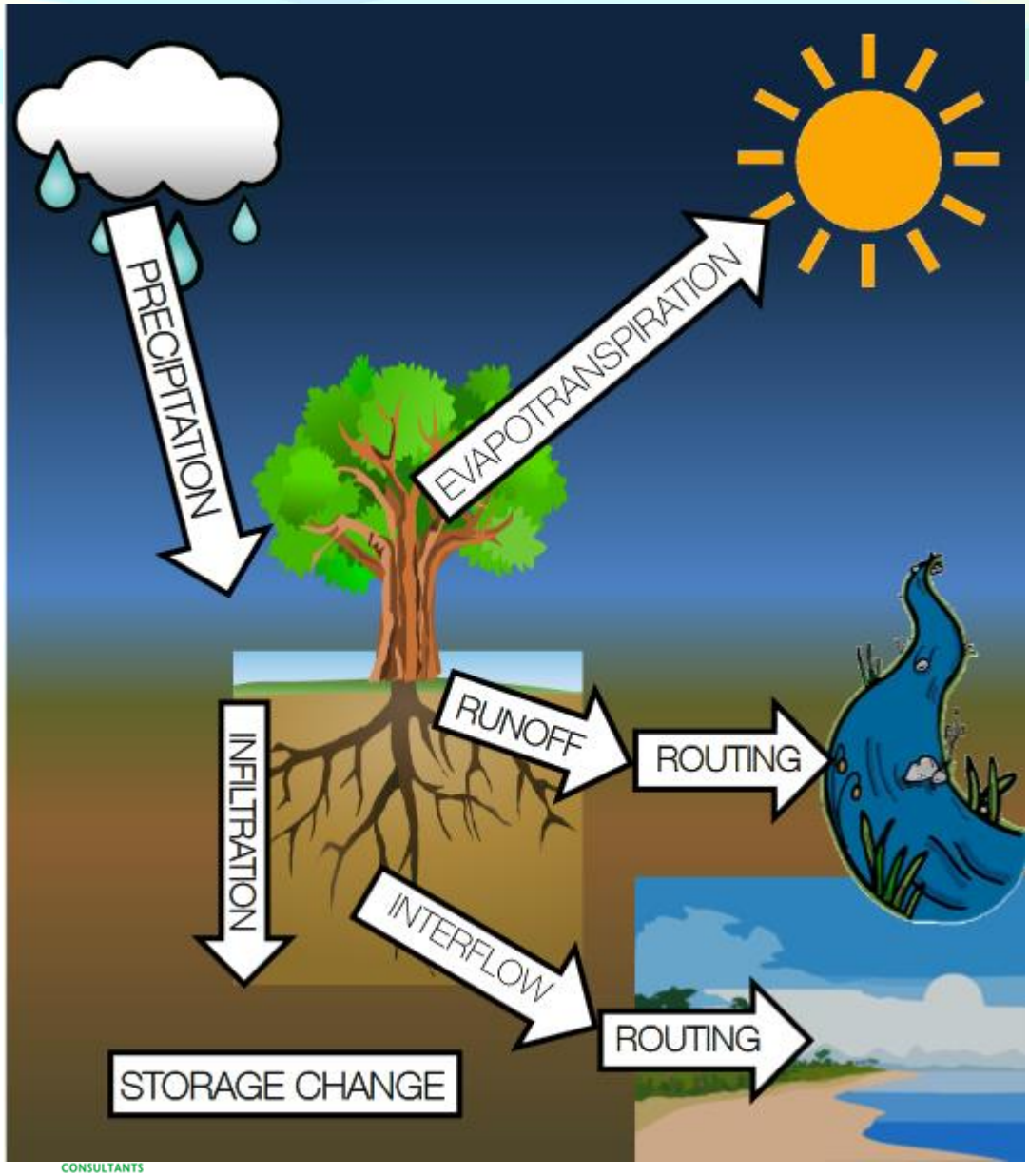
The Hydrologic Cycle



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The HEC-HMS Soil Moisture Accounting (SMA) Model

1. Origin

SMA model is patterned after Leavesley's Precipitation – Runoff Modelling System (1983) and is described in detail by Bennet (1998).

2. Model Capabilities

Model simulates the movement of water through and storage of water on vegetation, on the soil surface, in the soil profile and in groundwater layers. SMA is a continuous, conceptual and semi-lumped model. SMA cannot model groundwater flow in aquifers.

3. Data inputs and outputs

Given precipitation and potential evapotranspiration time series data, the model computes catchment's surface runoff, groundwater flow, losses due to evapotranspiration, deep percolation and change in storage over the entire catchment.

4. Model time step simulation

For dry or semi-dry climates with sporadic rainfall events, daily simulation (in contrast to monthly values) is preferred to counteract on the cumulative effect of high potential evapotranspiration.

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The HEC-HMS Soil Moisture Accounting (SMA) Model

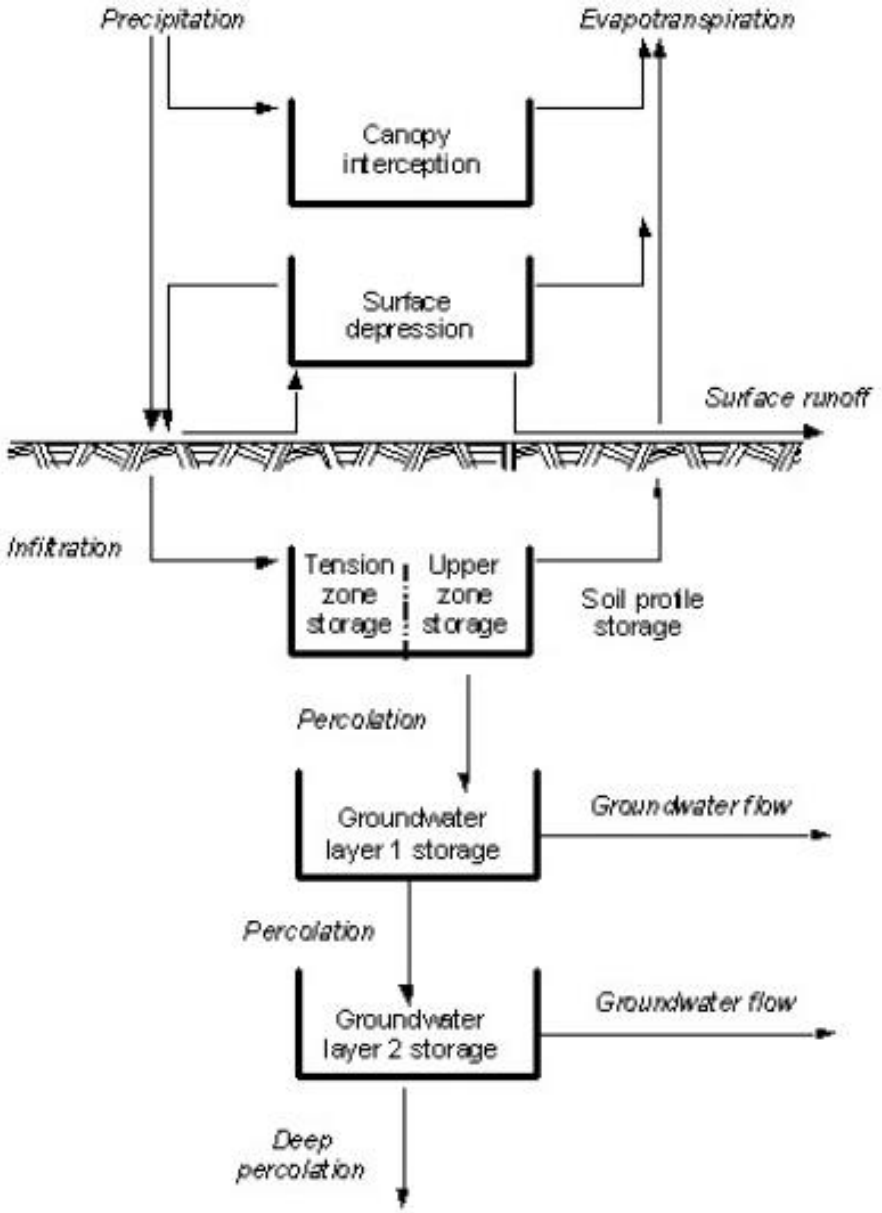

Table 1 Surface depression storage BENNET (1998)

Description	Slope, %	Surface storage, mm
Paved impervious	NA	3.2-6.4
Steep	>30	1
Moderate to gentle	5-30	12.7-6.4
Flat, furrow	0-5	50.8

Table 1. Canopy Interception Values

Type of Vegetation	**Canopy Interception**	
	in.	**mm**
General Vegetation	0.05	1.270
Grasses and Deciduous Trees	0.08	2.032
Trees and Coniferous Trees	0.1	2.540

The HEC-HMS Soil Moisture Accounting (SMA) Model

1. Canopy – Interception Storage

Precipitation that is captured on trees, shrubs and grasses that does not reach the earth's surface. Removed from the model by evaporation.

2. Surface – Interception Storage

Volume of water held in shallow surface depressions and not captured from Canopy storage and in excess of infiltration. If this storage is filled then excess water is available for surface runoff. This volume is emptied either by evaporation and / or infiltration.

3. Soil Profile Storage

Soil storage is divided into two compounds. The *upper* (water held in the soil pores) and the *tension* (water attached to soil particles) storage. Upper zone loses water due to evaporation and/or percolation. Tension zone loses water only from evaporation. ET occurs from the upper zone first and tension storage last.

4. Groundwater Storage

Storage is simulated as two, consecutive, linear reservoirs. Water percolates to groundwater from the soil profile. Losses from groundwater storage are due to groundwater flow and percolation from one layer to another.

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The HEC-HMS Soil Moisture Accounting (SMA) Model

1. Maximum Infiltration Rate (mm/h)

Sets an upper bound of infiltration from the ground surface in the soil. Actual infiltration is a linear function between surface and soil water storage.

2. Impervious (%)

Percentage of catchment which directly connects impervious areas. All precipitation becomes excess precipitation and directly surface runoff.

3. Soil Storage (mm)

Soil storage represents the total storage available in the soil layer. It can be computed by multiplying soil depth with soil porosity.

4. Tension Storage (mm)

Specifies the amount of water storage in the soil that does not drain under the effects of gravity. Percolation from the soil layer to the upper groundwater layer will occur whenever the current soil moisture exceeds the tension storage. Water in tension storage is only removed by ET.

5. Soil Percolation (mm)

Sets an upper bound of infiltration from the soil layer to groundwater. Actual percolation is a linear function between upper groundwater and soil water storage.

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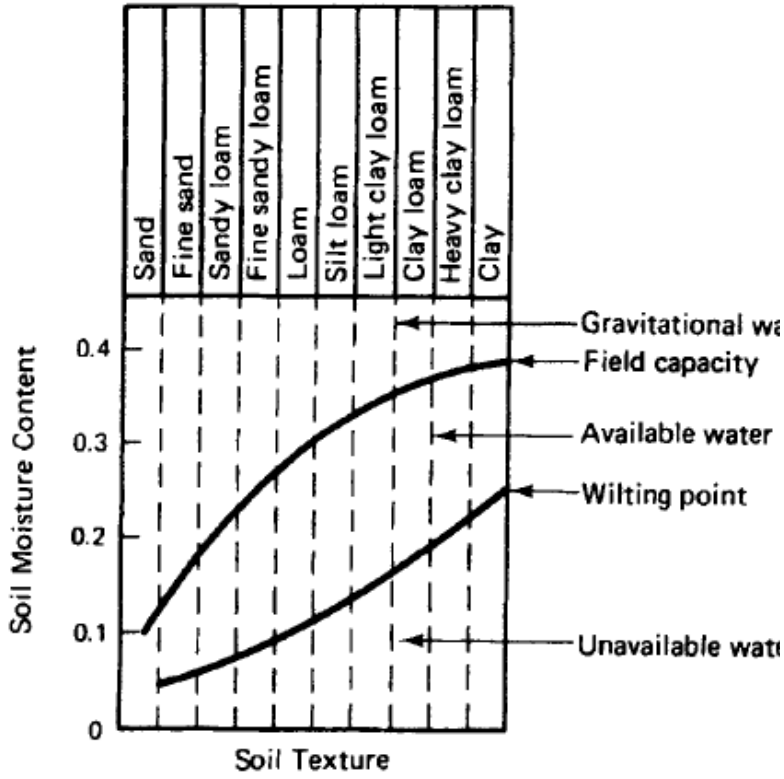
Soil Physics

Low infiltration rate	less than 15 mm/hour
medium infiltration rate	15 to 50 mm/hour
high infiltration rate	more than 50 mm/hour

Soil Texture	Porosity, cm^3/cm^3	Saturated hydraulic conductivity (cm/hr)
Sandy	0.437	21
Loamy sand	0.437	6.11
Sandy loam	0.453	2.59
Loam	0.463	1.32
Silt loam	0.501	0.68
Sandy clay loam	0.398	0.43
Clay loam	0.464	0.23
Silty clay loam	0.471	0.15
Sandy clay	0.43	0.12
Silty clay	0.479	0.09
Clay	0.475	0.06



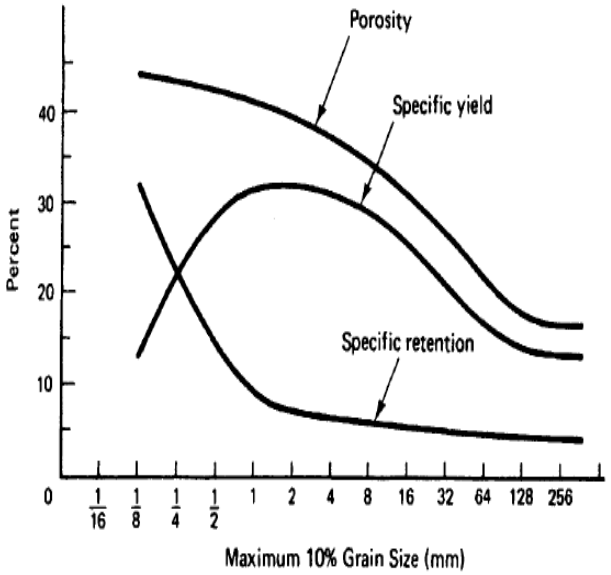
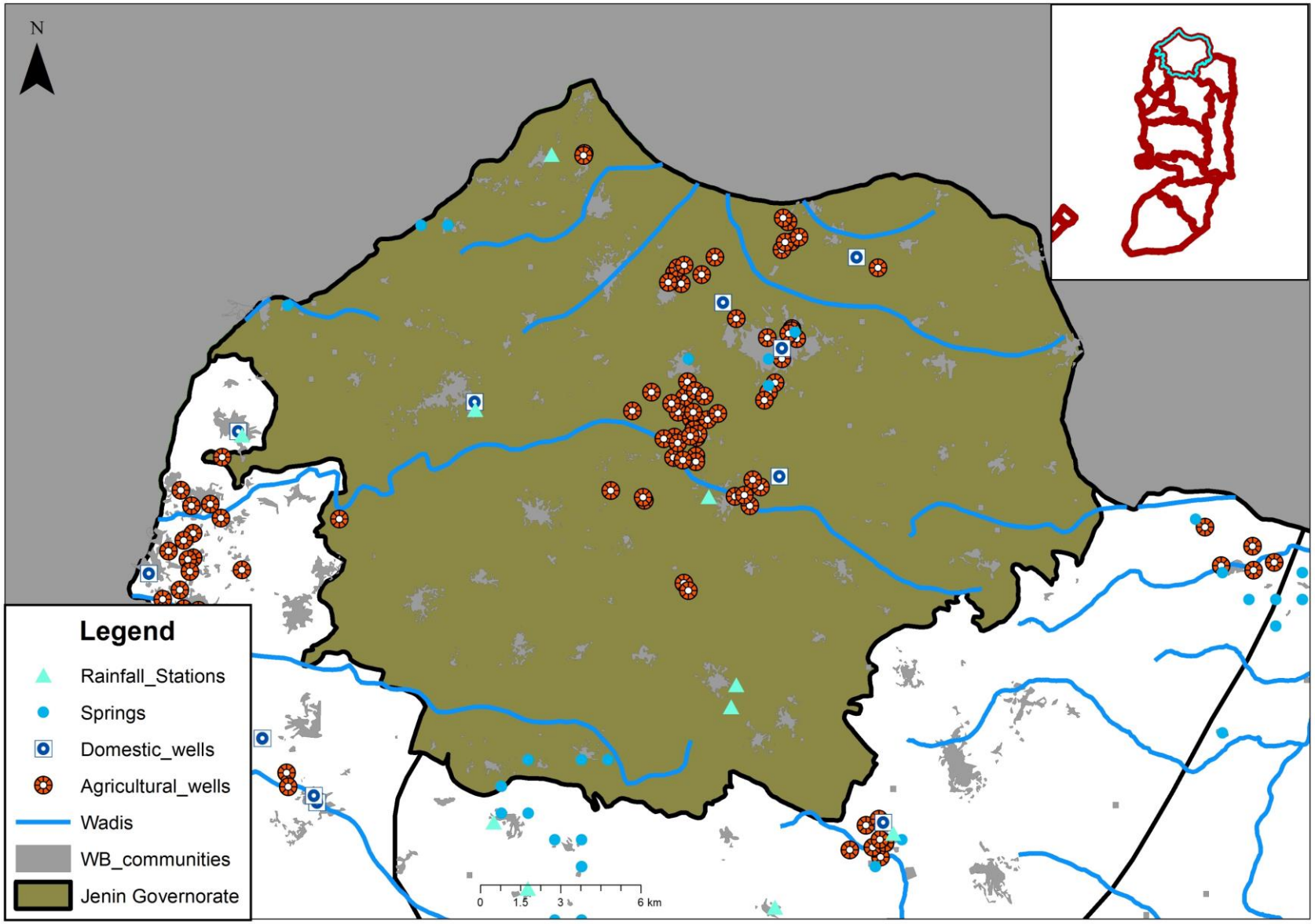
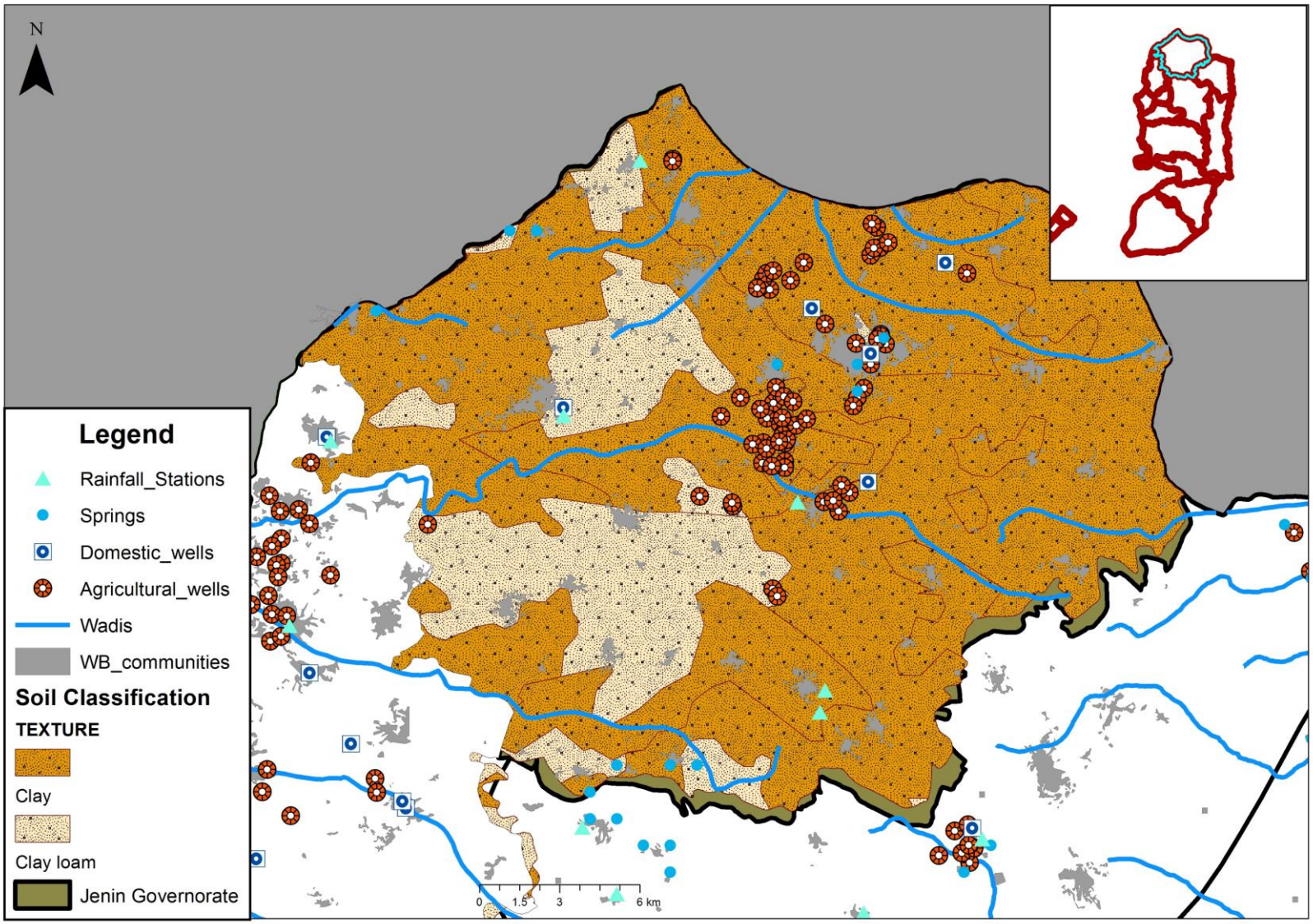


FIGURE 3–10 Variation of specific retention, specific yield, and porosity with the grain size for which the cumulative total (starting with the coarsest material) reaches 10% of the total.

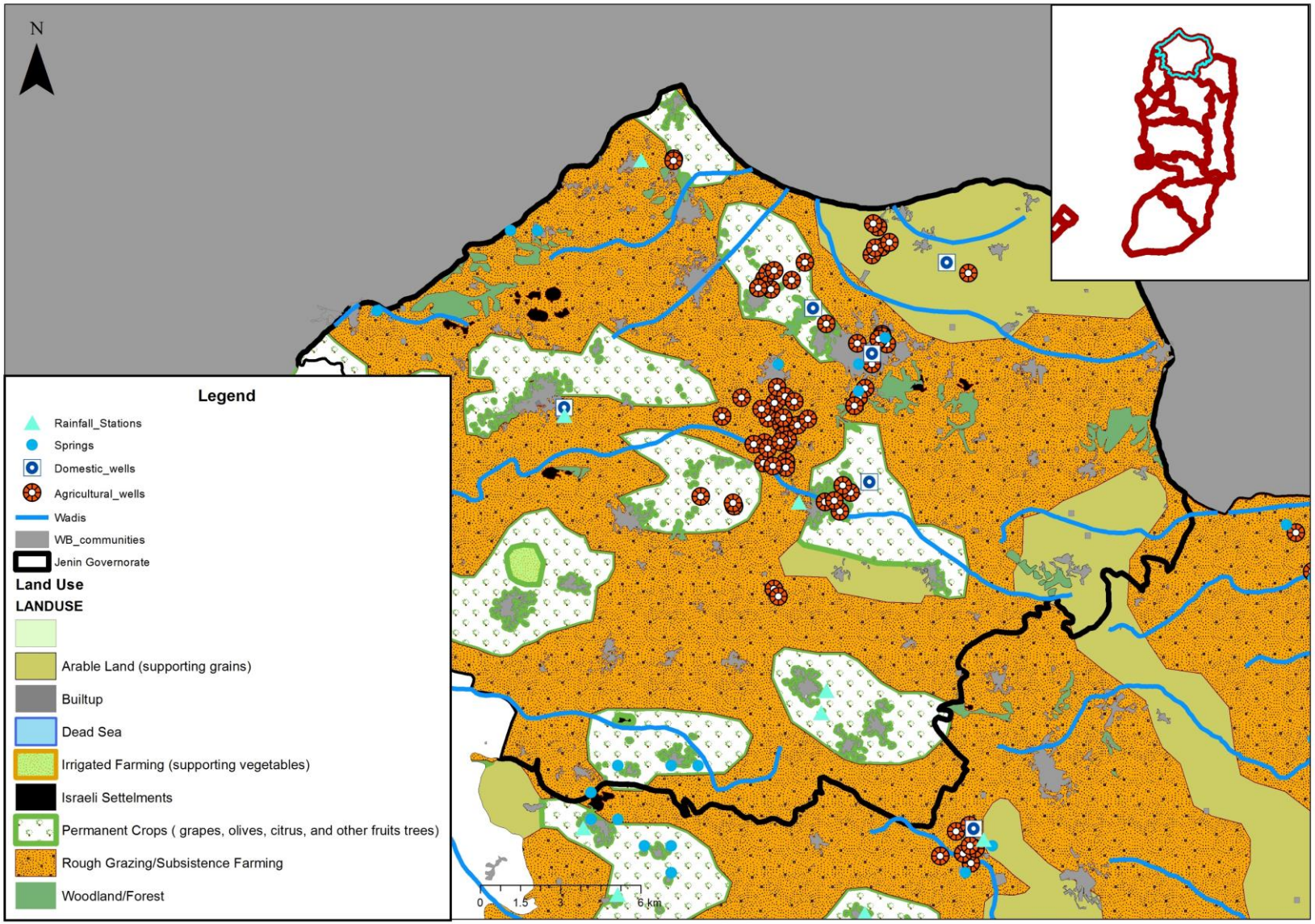
Application to Jenin Governorate, Palestine



Application to Jenin Governorate, Palestine



Application to Jenin Governorate, Palestine



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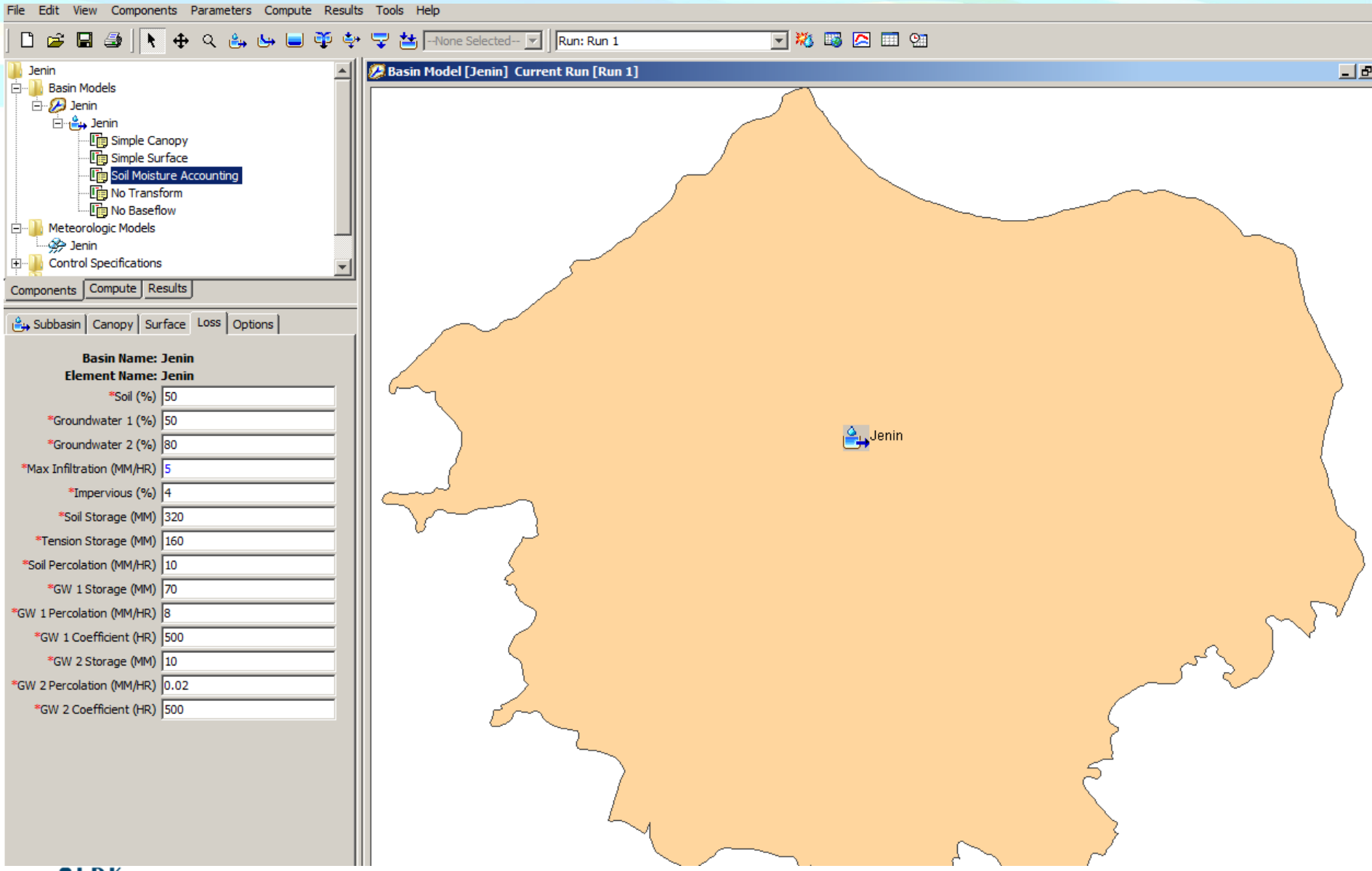
Soil Physics

	JENIN
POPULATION (average over 2007-2016)	285,421
DOMESTIC WATER DEMAND (m^3)	8,334,287
ABSTRACTION FROM DOMESTIC WELLS (m^3)	3,322,969
IRRIGATED LAND (dunum)	51,014
RAINFED LAND (dunum)	251,879
TOTAL AREA (dunum)	302,893
IRRIGATION WATER DEMAND (m^3)	26,283,490
LIVESTOCK WATER DEMAND (m^3)	1,935,344
ABSTRACTION FROM AGRICULTURE WELLS (m^3)	1,185,595
AVERAGE YEARLY RAINFALL (mm)	372
DATA FROM X AGRICULTURE WELLS	20
RECORDED AGRICULTURE WELLS (total number) from GIS shape files	62
DATA FROM X DOMESTIC WELLS	9

HEC-HMS SMA model Formulation



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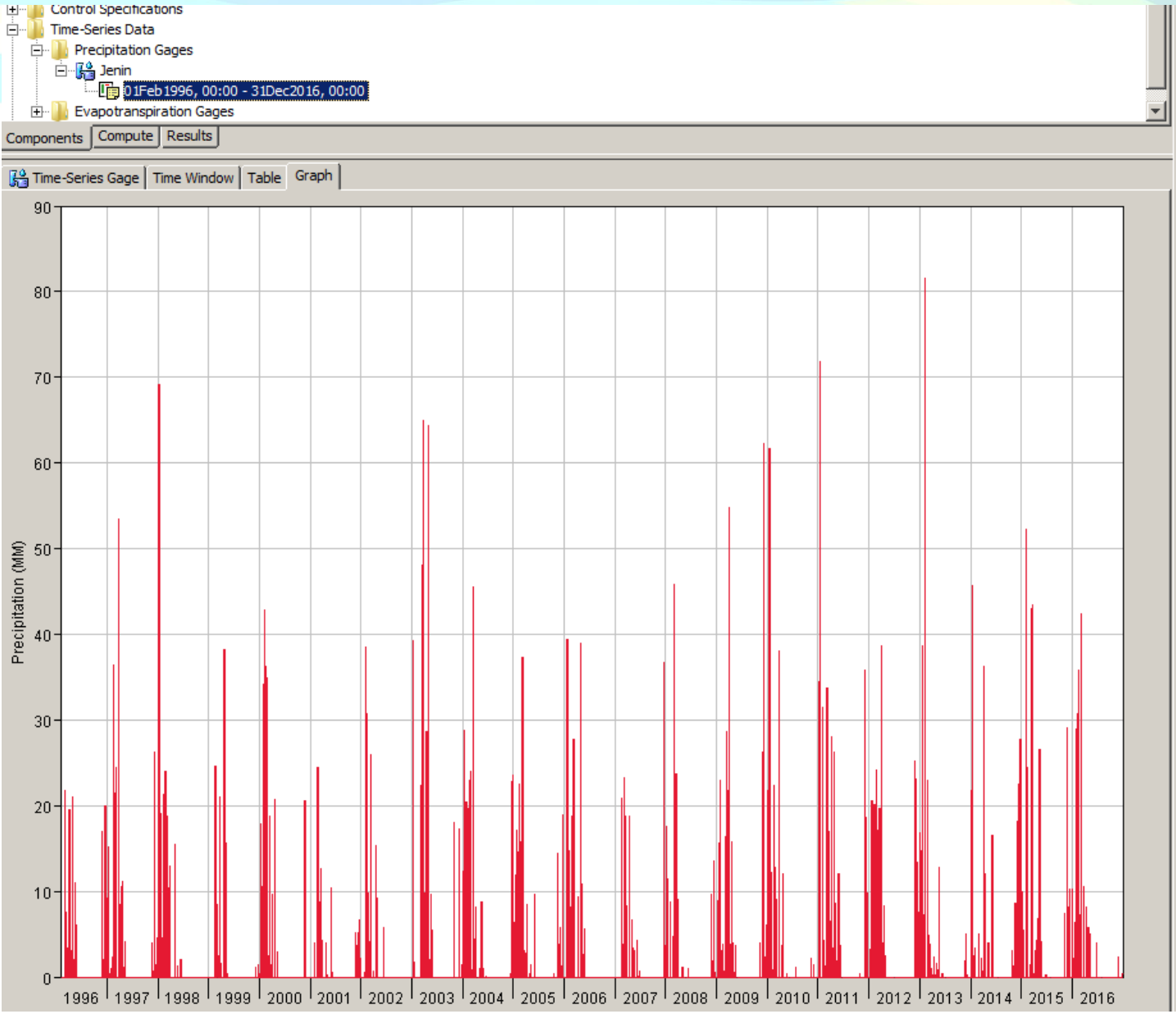
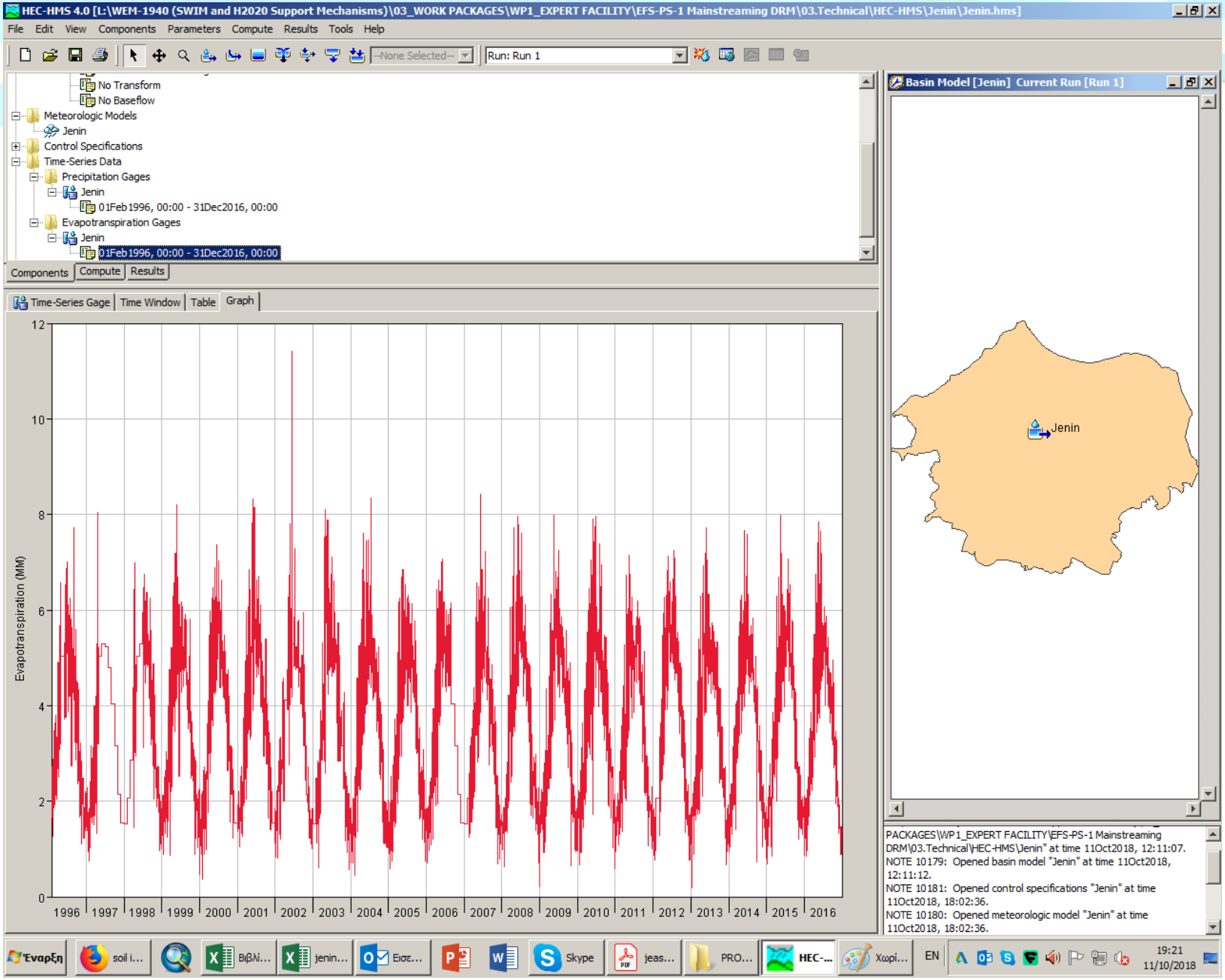
Daily Rainfall Data



PACKAGES\WP1_EXPERT FACILITY\EFS-PS-1 Mainstreaming DRM\03.Technical\HEC-HMS\Jenin" at time 11Oct2018, 12:11:0
NOTE 10179: Opened basin model "Jenin" at time 11Oct2018, 12:11:12.
NOTE 10181: Opened control specifications "Jenin" at time 11Oct2018, 18:02:36.
NOTE 10180: Opened meteorologic model "Jenin" at time

HEC-HMS SMA model Formulation



Thank you for your attention.