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Supplement of

Predicting probabilities of streamflow intermittency across a temperate mesoscale catchment

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Supplement

S1 Soil maps

Spatial information on soils is obtained from homogenized soil maps of Luxembourg and Belgium (Table S1). Available data includes information on soil texture, drainage behaviour and soil profile (Table S2). Soil texture in the initial data source was grouped into different texture sets (j, Table 3) each holding up to 6 different texture classes. Values of saturated hydraulic conductivity (K_s) and field capacity (θ_a) were derived by pedotransfer functions from Carsel and Parrish (1988) for each texture class. Average K_s and θ_a were calculated as $\bar{K}_{s,j}$ and $\bar{\theta}_{a,j}$ for each set of texture classes (j). The drainage information comprises 4 different classes including the categories “very well drained”, “well drained”, “moderately drained” and “poorly drained”.

A class specific K_s and θ_a was assigned to each drainage class of a texture set. We used the maximum K_s of the matrix texture within a texture set for the drainage class “very well drained” and the minimum Ks of the matrix texture for the drainage class “poorly drained”. Accordingly we assigned the minimum θ_a within a texture set to the “very well drained” drainage class and the maximum θ_a within a set to the “poorly drained” drainage class. Classes Values of $\bar{K}_{s,j}$ and $\bar{\theta}_{a,j}$. were assigned to the “moderate and imperfect” drainage subclass. K_s for the class of “well drained” were calculated for each matrix texture subclass from the maximum and the average of the subclass j as:

$$(max(K_{s,j}) + \bar{K}_{s,j})/2 \qquad (6)$$

Hence, we calculated the θ_a for “well drained” as the average of minimum θ_a and the $\bar{\theta}_{a,j}$.of a texture set:

$$(\min(\theta_{a,j}) + \bar{\theta}_{a,j})/2 \qquad (7)$$

The profile class was included as a horizon-correction factor to adjust the values to the measured effective hydraulic conductivities. For the horizon-correction we assume that soils with B-horizon drain slightly better than soils with Bt-horizon and therefore have assigned a higher effective hydraulic conductivity. This assumption is based on unpublished field measurements from the CAOS research group (Catchments as Organized Systems, see. e.g. Zehe et al., 2014) which revealed the differences between identical soil classes having either B horizons or Bt horizons. Although studies focusing on alteration of hydraulic conductivity with clay illuviation in Bt horizons are rare the assumption is supported by several studies (e.g. Alletto et al., 2006; Coquet et al., 2005; Ferrer Julià et al., 2004; Lavkulich and Arocena, 2011). Based on the available soil data from the Attert catchment soils without B/Bt-horizon are assumed to have the poorest drainage and therefore a lower hydraulic conductivity (Table S2). Including the horizon correction and drainage classes the calculated hydraulic conductivity is able to represent the order of magnitude found from field measurements of the saturated hydraulic conductivities $K_{s,ef}$ measured by the CAOS research group. Following the assumptions for the K_s we included slight correction factors for θ_a accounting for the presence or absence of the B/Bt-horizons.

Values for all permutations of subclasses (Table S2) of K_s as well as of θ_a were calculated and mapped in raster format using ArcGIS resulting in predictor maps for K_s and θ_a. Catchment average values were calculated for K_s as well as for θ_a using Eq. 3. Some of the calculated K_s class permutation could be validated with the 400 soil texture and $K_{s,ef}$ data available from the CAOS research group and were well within the range of the validation data. However, the validation data for many classes contained only a small number of measurements and thus show a high deviation of measured values.

Table S1: References for all soil maps that have been homogenized for the Attert basin.

Country	Scale	Reference
Belgium	1:20,000	Public Service of Wallonie, 2007
Luxembourg	1:25,000	Wagener et al. 1971, 1972, 1975; Puraye et al., 1980, 1988, 1995, 1998
	1:50,000	Vermeire, 1967
	1:100,000	Wagener et al., 1969

Table S2: Soil classification of the homogenized soil map for the Attert basin. Classes have been joined from sources in Table S1.

Class	Sub-class/Set	Soil Textures within a set	$\bar{K}_{s,j}$. [cm/d]	$\bar{\theta}_{a,j}$ [mm]
Matrix Texture j	A	silty soils, textural classes silt, Silt loam,silt clay loam	38.45	255
	G	gravelly soils with matrix textural class silt,silt loam, loam, loam, clay loam, silt clay loam, sandy clay loam, sandy loam	79.40	198
	L	sandy-loamy soils, textural classes sandy loam, loam, silt loam	140.60	180
	S	loamy-sandy soils, textural classes loamy sand, sandy loam	825.12	54
	U	clayey soils, textural classes sandy clay, clay, silty clay	12.91	116
	V	peat soils	825.12	54
			Value selection	
Drainage	B	very well drained	$max(K_{s,j})$	$min(\theta_{a,j})$
	b	well drained	$(max(K_{s,j}) + \bar{K}_{s,j})/2$	$(min(\theta_{a,j}) + \bar{\theta}_{a,j})/2$
	D	moderately drained	$\bar{K}_{s,j}$	$\bar{\theta}_{a,j}$
	I	poorly drained	$min(K_{s,j})$	$max(\theta_{a,j})$
			Horizon-Correction Factor	Correction Factor
Profile	a	with Bt horizon	0.5	1.2
	b	with B horizon	1	1.0
	B	with either B and/or Bt horizons	0.75	1.1
	p	without B horizon	0.5	0.8

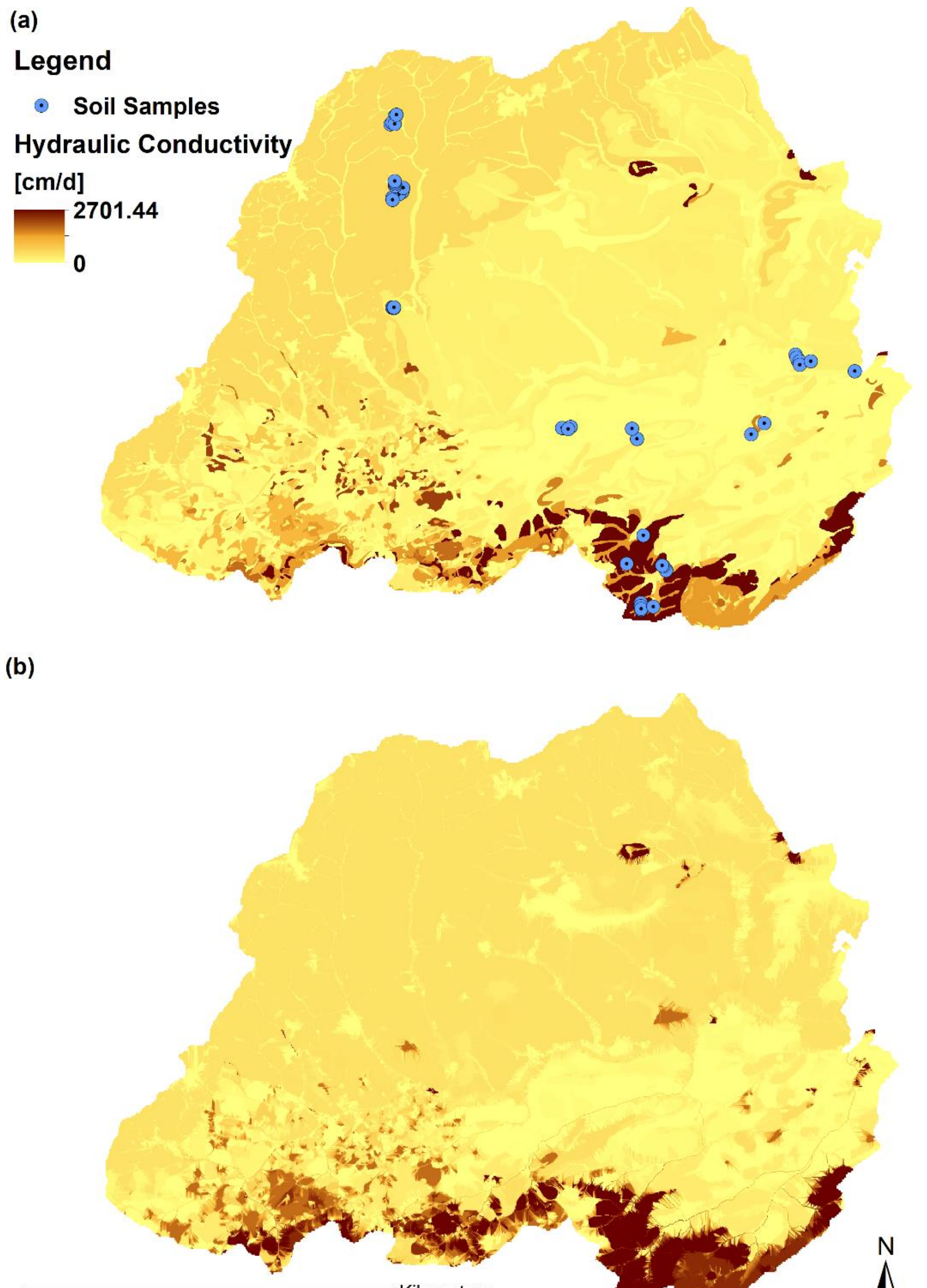

Figure S1: The hydraulic conductivity map (a) was derived from the homogenized soil maps by the procedure described in this supplement. Soil sample sites from the CAOS (Catchment As Organized Systems) soil data base are also shown in (a). This data set comprises 400 sampling sites. The upslope area averages of the hydraulic conductivity are shown in (b).

S2 Precipitation distribution in the Attert catchment

Spatial variability of precipitation is not a major control in the Attert catchment. Figure S2 shows the spatial distribution of precipitation for the modelled time periods. Figure S3 shows the local precipitation at the measurement points plotted against the local residuals of the statistical models.

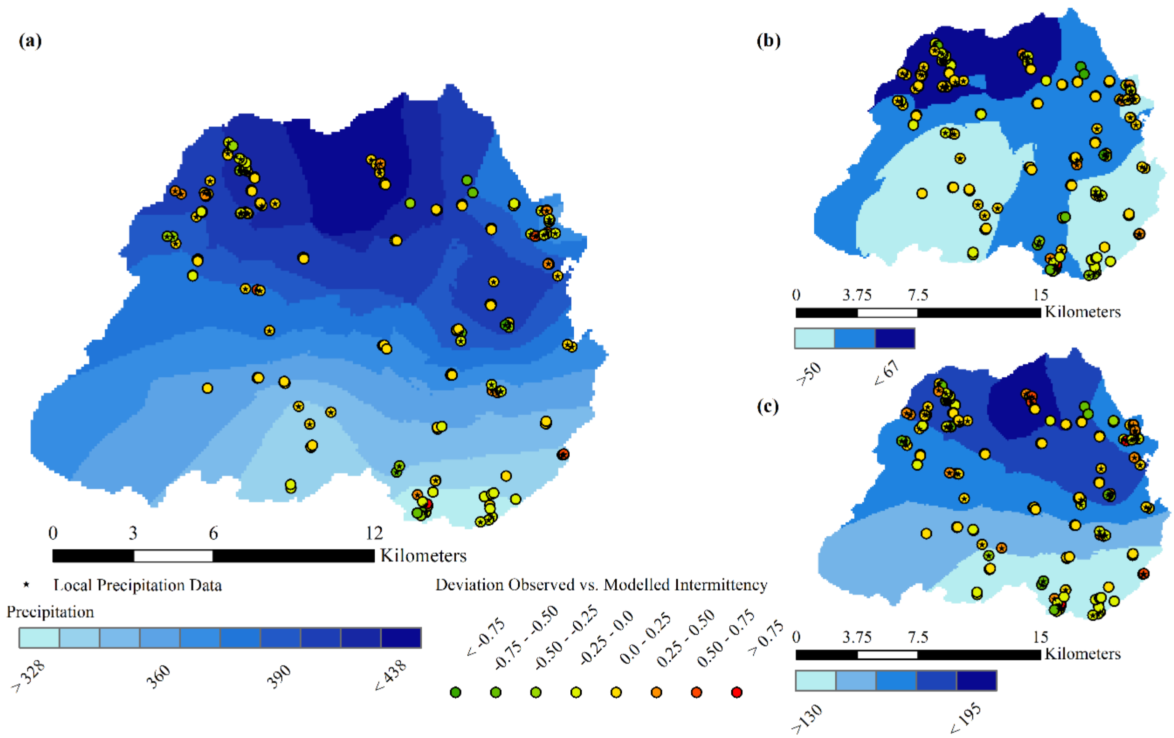

Figure S2: Cumulative Precipitation distribution in the Attert catchment for the annual period July 2016 to July 2017 (a), the wet period (February to April, (b)) and dry period (June to August, (c)). Note: wet and dry here refers to discharge, not to rainfall input. Precipitation data is interpolated with ordinary kriging from site specific local precipitation data (black stars). Precipitation data was provided from a precipitation modelling approach by Neuper & Ehret (2019) which combines weather radar and ground-based precipitation data. The deviation between observed and modelled intermittency is plotted for the corresponding periods.

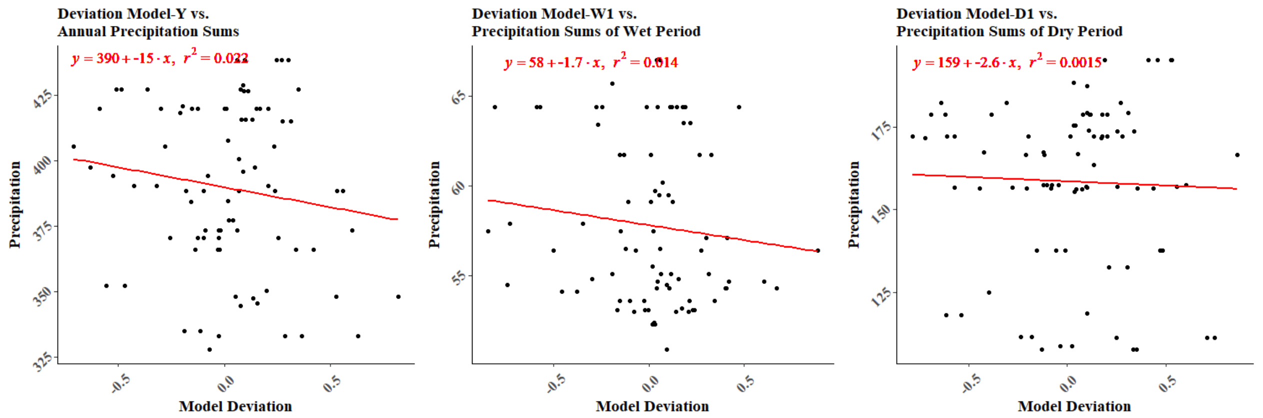

Figure S3: Deviation between observed and modelled plotted against the corresponding precipitation sums of the modeled periods.

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