SUPPLEMENTARY MATERIAL

to

Understanding Hydrologic Variability across Europe through Catchment Classification

Anna Kuentz¹, Berit Arheimer¹, Yeshewatesfa Hundecha¹, Thorsten Wagener^{2, 3}

¹ *Swedish Meteorological and Hydrological Institute, 601 76 Norrköping, Sweden*

² *Department of Civil Engineering, University of Bristol, BS8 1TR, Bristol, UK*

³ *Cabot Institute, University of Bristol, UK*

Table of Content:

A. CART TREE NODES DESCRIPTION	2
B. MATERIAL FOR THE ANALYSIS OF THE CART CLASSIFICATION (BASE MATERIAL FOR TABLE 3)	3
B.1 FLOW SIGNATURES	3
B.1.1 DISTRIBUTION (BOXPLOTS) OF FLOW SIGNATURES IN THE DIFFERENT CLASSES	3
B.1.2 MATRIX OF MEDIAN FLOW SIGNATURES FOR EACH CLASS COMPARED TO THE WHOLE SET OF STREAM GAUGES	6
B.2 CATCHMENT DESCRIPTORS	7
B.2.1 DISTRIBUTION (BOXPLOTS) OF CATCHMENT DESCRIPTORS IN THE DIFFERENT CLASSES	7
B.2.2 MATRIX OF MEDIAN CATCHMENT DESCRIPTORS FOR EACH CLASS COMPARED TO THE WHOLE SET OF STREAM GAUGES / CATCHMENTS	14
B.3 LARGER MAP OF THE CLASSIFICATION AND DETAILED MAPS FOR CLASSES CORRESPONDING TO MORE THAN ONE NODE IN THE CART TREE	15
C. DISTRIBUTION (BOXPLOTS) OF CATCHMENT DESCRIPTORS AND FLOW SIGNATURES IN THE DIFFERENT CLASSES OF FS AND CD CLASSIFICATIONS (PLOTS ARE COMMENTED IN SECTION 3.2)	17
C.1 CLASSIFICATION BASED ON FLOW SIGNATURES (FS CLASSIFICATION)	17
C.1.1 BOXPLOTS OF FLOW SIGNATURES	17
C.1.2 BOXPLOTS OF CATCHMENT DESCRIPTORS	20
C.2 CLASSIFICATION BASED ON CATCHMENT DESCRIPTORS	27
C.2.1 BOXPLOTS OF FLOW SIGNATURES	27
C.2.2 BOXPLOTS OF CATCHMENT DESCRIPTORS	30

A. CART tree nodes description

Tabell A: CART tree nodes description. For each node: number of flow stations affected to the node, percentage of stations affected to the node according to their original class from the FS classification. And total number of catchments affected to the node. The nodes are named after the affected class from the FS classification (1a, 1b, 1c are the nodes affected to class 1, etc). The green boxes show the percentage of correctly classified gauges at each node.

For example, the node 1a contains 455 catchments of which 17 are gauged. Of these 17 gauges, 59% were originally classified in class 1 of the classification based on flow signatures, 6% in class 3, 29% in class 5 and 6% in class 6. As a majority (59%) of flow gauges at this node comes from class 1 of the FS classification, the node is affected to class 1.

CART node	Nb of Gauges	Repartition (% of nb of gauges) of original classes											Total No. catchments
		1	2	3	4	5	6	7	8	9	10	11	
1a	17	59	0	6	0	29	6	0	0	0	0	0	455
1b	98	77	0	2	1	4	0	5	0	5	4	2	6423
1c	9	56	0	0	0	33	0	0	11	0	0	0	811
3a	492	2	0	35	7	14	5	0	16	13	1	7	13645
3b	29	0	0	48	0	10	7	0	21	7	0	7	424
3c	18	0	0	50	0	6	6	0	17	11	0	11	213
3d	20	10	0	40	15	0	10	0	10	10	0	5	177
4	73	1	6	10	53	4	3	3	12	7	0	1	5112
5a	33	0	0	6	0	64	0	0	6	18	0	6	932
5b	43	0	0	9	0	88	0	0	0	2	0	0	833
6a	17	0	0	0	0	0	53	6	0	29	0	12	228
6b	14	0	0	14	14	0	57	0	14	0	0	0	138
6c	202	3	0	3	2	0	53	10	10	7	5	6	1971
7	33	3	0	0	0	0	12	70	0	3	6	6	678
8	64	2	0	6	8	0	20	5	45	8	2	5	670
9a	10	10	0	0	0	20	0	0	0	70	0	0	200
9b	48	4	0	6	8	13	0	0	0	67	0	2	769
10	81	0	0	1	0	0	11	17	3	3	57	9	762
11a	15	0	0	0	0	13	0	0	0	0	0	87	110
11b	10	0	0	0	0	10	0	10	0	0	0	80	146
11c	40	15	0	0	0	0	8	3	5	5	10	55	518

B. Material for the analysis of the CART classification (base material for table 3)

B.1 Flow signatures

B.1.1 Distribution (boxplots) of flow signatures in the different classes

Figure A: boxplots of flow signatures in the different classes of the CART classification (1/3).

Figure B: boxplots of flow signatures in the different classes of the CART classification (1/3).

Figure C: boxplots of flow signatures in the different classes of the CART classification (1/3).

B.1.2 Matrix of median flow signatures for each class compared to the whole set of stream gauges

Figur D: Visualization of median flow signatures in each class of the CART classification - Position of the class median flow signature in the distribution (percentiles) of the same flow signature among the whole set of gauges.

B.2 Catchment descriptors

B.2.1 Distribution (boxplots) of catchment descriptors in the different classes

Figure E: boxplots of catchment descriptors in the different classes of the CART classification (1/7).

Figure F: boxplots of catchment descriptors in the different classes of the CART classification (2/7).

Figure G: boxplots of catchment descriptors in the different classes of the CART classification (3/7).

Figure H: boxplots of catchment descriptors in the different classes of the CART classification (4/7).

Figure I: boxplots of catchment descriptors in the different classes of the CART classification (5/7).

Figure J: boxplots of catchment descriptors in the different classes of the CART classification (6/7).

Figure K: boxplots of catchment descriptors in the different classes of the CART classification (7/7).

B.2.2 Matrix of median catchment descriptors for each class compared to the whole set of stream gauges / catchments

Figure L: Visualization of median catchment descriptors in each class of the CART classification - Position of the class median catchment descriptor in the distribution (percentiles) of the same catchment descriptor among the whole set of gauges (a)/catchments (b). Plot a is built when looking at only gauged catchments while plot b is built using all 35215 classified catchments. When more than one node in the CART tree (fig. 6 of the m) is affected to a given class, the detailed characteristics of each node are shown in the figure.

B.3 Larger map of the classification and detailed maps for classes corresponding to more than one node in the CART tree

Figur M: Map of the CART classification

Figure N: detailed maps for classes corresponding to more than one node in the CART tree. The names 1a, 1b, 1c etc are the names of the nodes shown in Fig. 6 of the main article and table 1 of the present supplementary material.

C. Distribution (boxplots) of catchment descriptors and flow signatures in the different classes of FS and CD classifications (plots are commented in section 3.2)

C.1 Classification based on flow signatures (FS classification)

C.1.1 Boxplots of flow signatures

Figure O: boxplots of flow signatures in the different classes of the FS classification (1/3)

Figure P: boxplots of flow signatures in the different classes of the FS classification (2/3)

Figure Q: boxplots of flow signatures in the different classes of the FS classification (3/3)

C.1.2 Boxplots of catchment descriptors

Figure R: boxplots of catchment descriptors in the different classes of the FS classification (1/7)

Figure S: boxplots of catchment descriptors in the different classes of the FS classification (2/7)

Figure T: boxplots of catchment descriptors in the different classes of the FS classification (3/7)

Figure U: boxplots of catchment descriptors in the different classes of the FS classification (4/7)

Figure V: boxplots of catchment descriptors in the different classes of the FS classification (5/7)

Figure W: boxplots of catchment descriptors in the different classes of the FS classification (6/7)

Figure X: boxplots of catchment descriptors in the different classes of the FS classification (7/7)

C.2 Classification based on catchment descriptors

C.2.1 Boxplots of flow signatures

Figure Y: boxplots of flow signatures in the different classes of the CD classification (1/3)

Figure 2: boxplots of flow signatures in the different classes of the CD classification (2/3)

Figure AA: boxplots of flow signatures in the different classes of the CD classification (3/3)

C.2.2 Boxplots of catchment descriptors

Figure BB: boxplots of catchment descriptors in the different classes of the CD classification (1/7).

Figure CC: boxplots of catchment descriptors in the different classes of the CD classification (2/7).

Figur DD: boxplots of catchment descriptors in the different classes of the CD classification (3/7).

Figure EE: boxplots of catchment descriptors in the different classes of the CD classification (4/7).

Figur FF: boxplots of catchment descriptors in the different classes of the CD classification (5/7).

Figure GG: boxplots of catchment descriptors in the different classes of the CD classification (6/7).

Figur HH: boxplots of catchment descriptors in the different classes of the CD classification (7/7).