Figure S1. Scatter plot of catchments within the first and second principle component space, using information from the signatures to perform a Principle Component Analysis (PCA). Each color of dot represents the class in which the catchment belongs for the first time period. These boxes specify the approximate direction and magnitude from the origin (0,0) of a signatures influence within the principle component space.
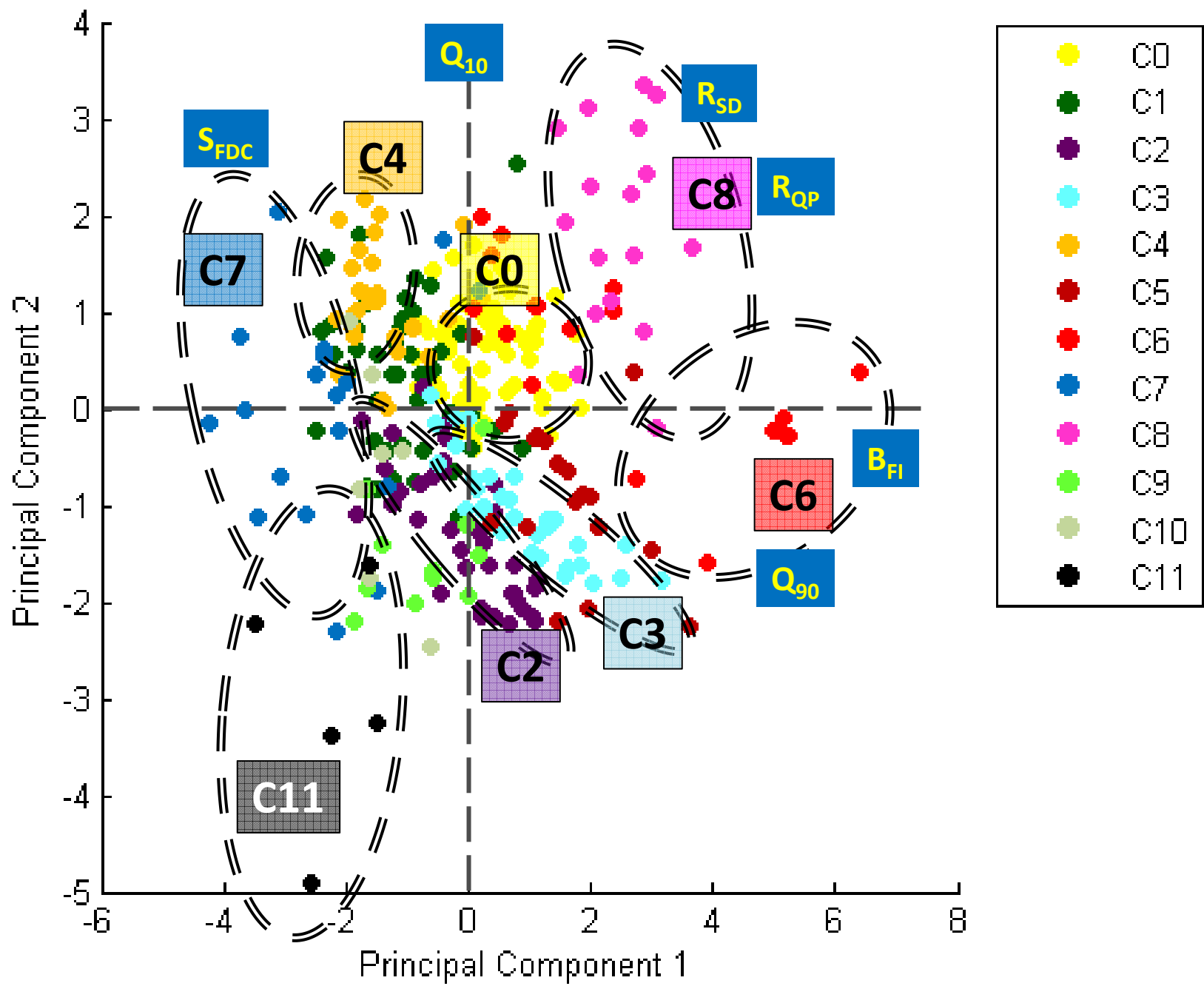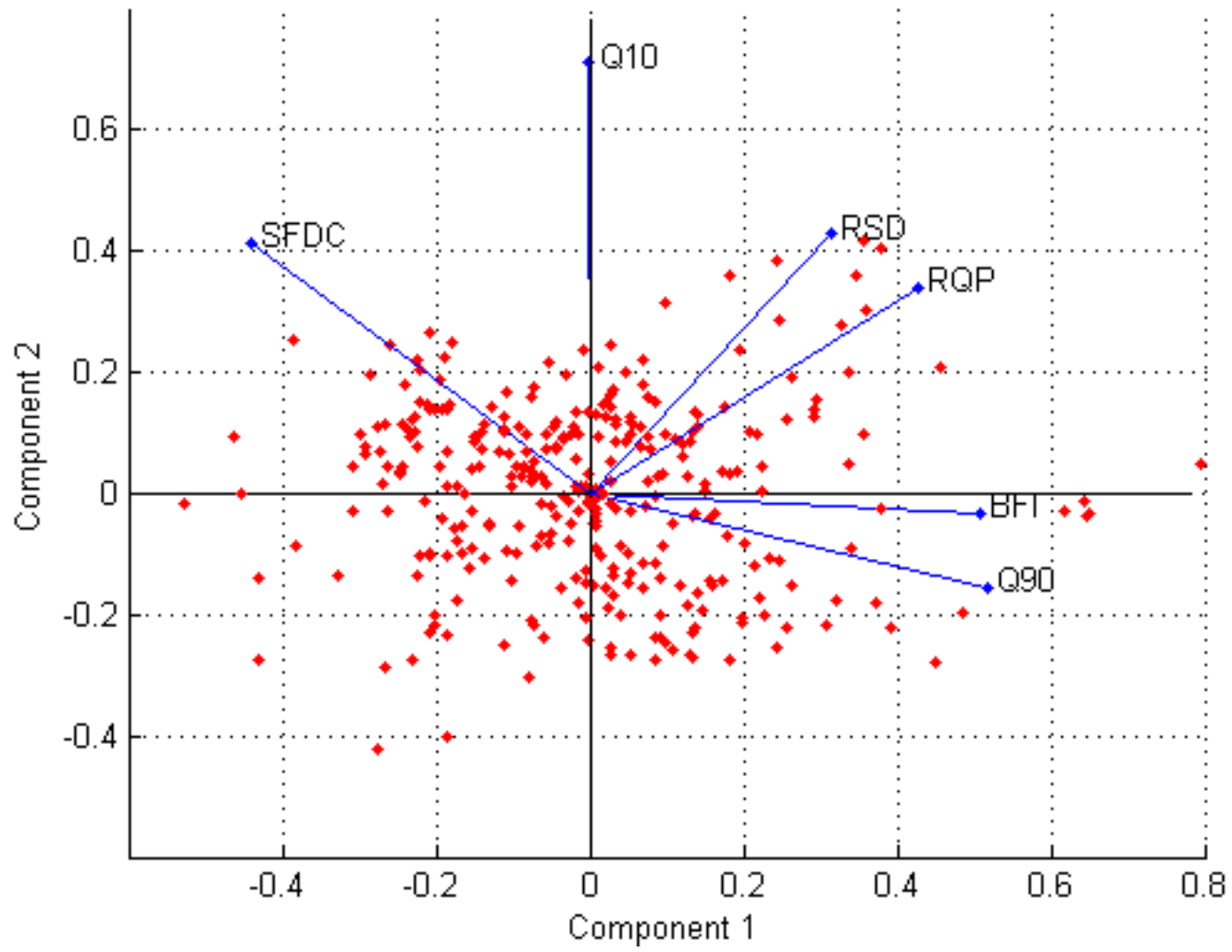
Figure S2. The X and Y axis represent the first and second principle component derived from information from the six signatures. The individual blue lines represent how the individual signatures are transformed within this two-dimensional principle component space. Red dots represent the individual catchments within this two principle component space. Blue lines that are close to each other (like Q_{90} and B_{FI}) indicate a positive correlation within the first two principle components, and blue lines shown to point in opposite directions of each other indicate a negative correlation.

Signatures	PC1	PC2
R_{QP}	0.43	0.34
B_{FI}	0.51	-0.03
S_{FDC}	-0.44	0.41
R_{SD}	0.31	0.43
Q_{10}	0.00	0.71
Q_{90}	0.52	-0.15

Figure S3. Cumulative and individual variance explained by each principle component in decreasing order derived from the six signatures. The first two principle components account for 69% of the variance explained
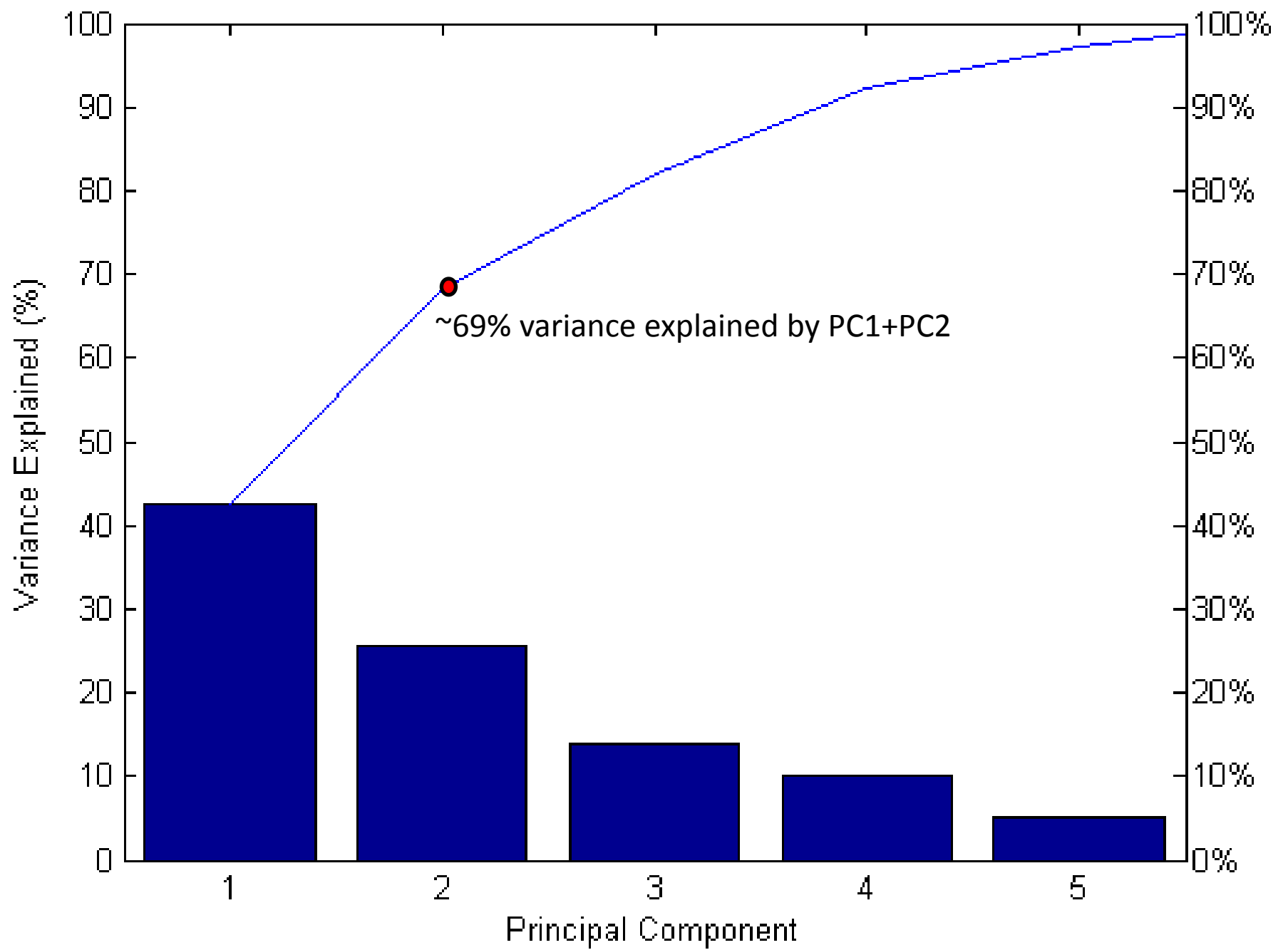
Figure S4. Scatter plot of catchments in the first and second principle component space, using information from key physical and climatic properties to perform a Principle Component Analysis. The color of the dot corresponds to the class that the catchment belongs to during the first time period. The first two principle components of physical and climatic characteristics separate the classes fairly well (7 distinct classes [C6, C8, C0, C1, C3, C11, C7] and 1 area that 3 classes overlap [C2, C4, C10]. C2, C4, and C10 overlap here due to their similarity in elevation and temperature. C11 separates from other groups from its dry conditions and low soil permeability. The boxes in the figure specify the approximate direction and magnitude from the origin (0,0) of a property's influence within the principle component space.
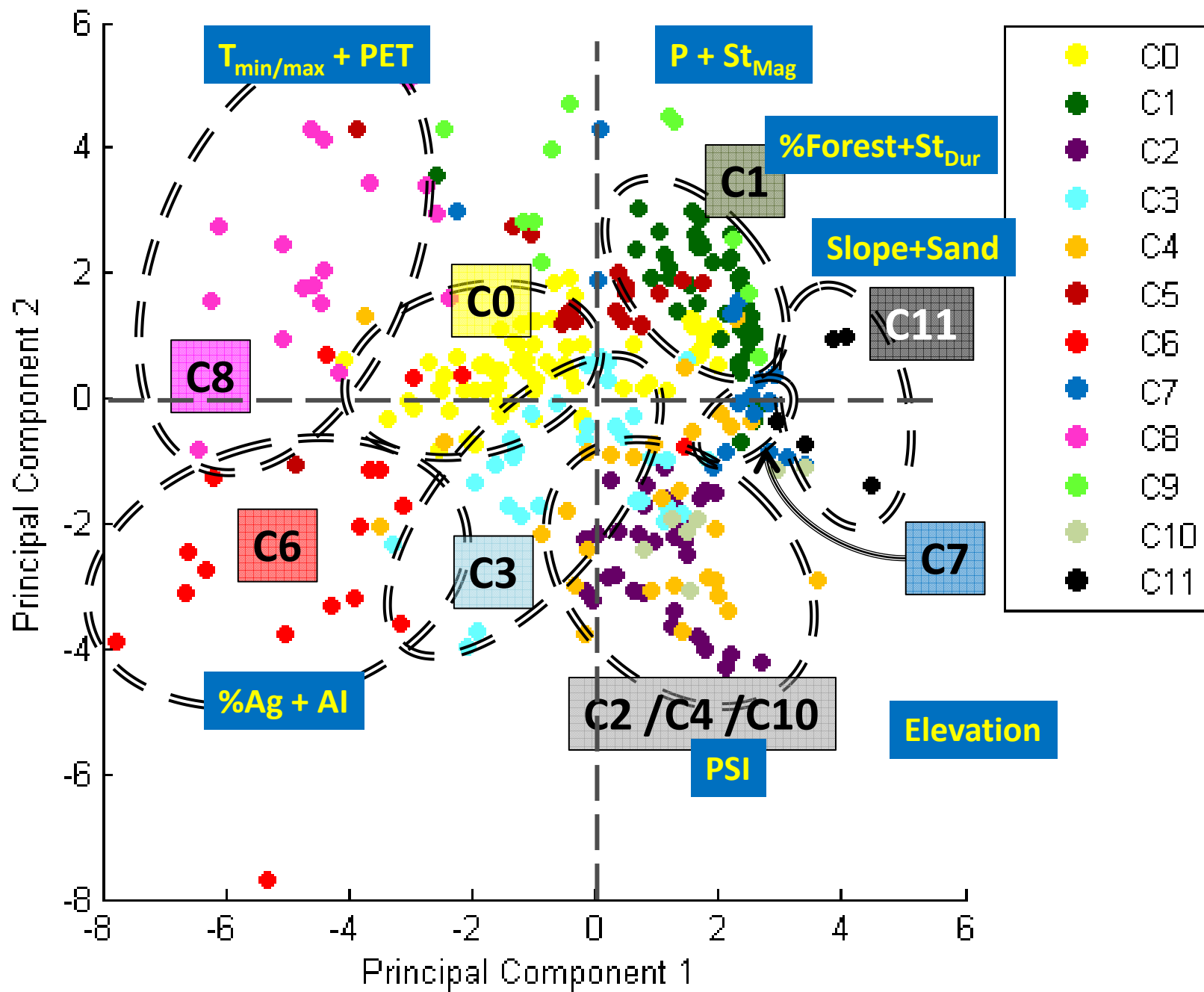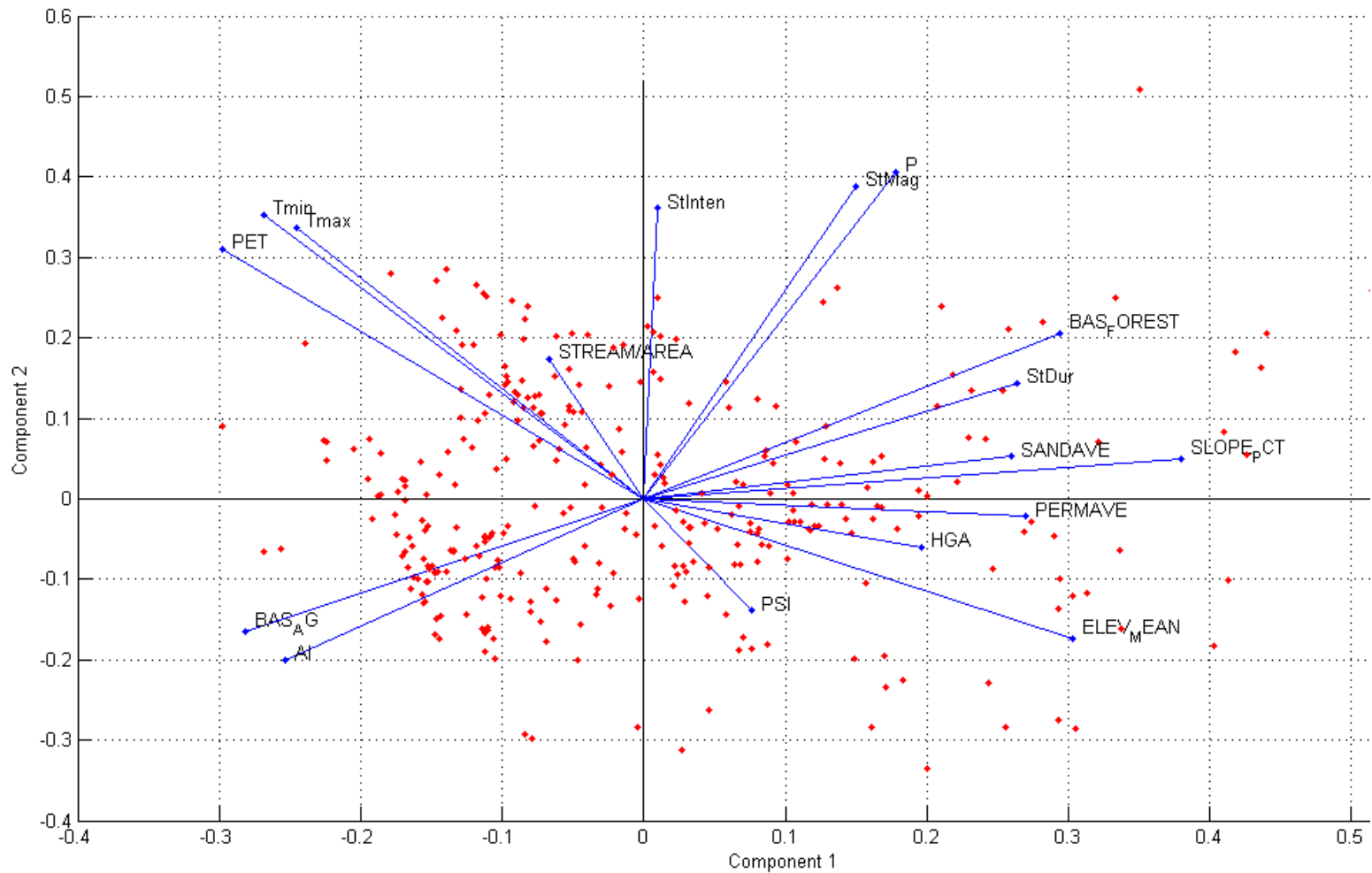
Figure S5. Individual component contribution to the first two principle components derived by information from physical and climatic properties. The exact direction and magnitude of each property is shown as a blue line and each catchment within this space is shown as a red dot.

Props	PC1	PC2	Props	PC1	PC2
STREAM/AREA	0.07	-0.17	PSI	-0.08	0.14
SOIL: HGA	-0.20	0.06	PRECIP	-0.18	-0.41
PERM%	-0.27	0.02	$TEMP_{max}$	0.24	-0.34
SAND%	-0.26	-0.05	$TEMP_{min}$	0.27	-0.35
MEAN_ELEVATION	-0.30	0.17	$STORM_{Inten}$	-0.01	-0.36
SLOPE_PCT	-0.38	-0.05	$STORM_{Mag}$	0.15	-0.39
FOREST	-0.29	-0.21	$STORM_{Dur}$	-0.26	-0.14
AGRICULTURE	0.28	0.16	PET	0.30	-0.31
ARIDITY INDEX	0.25	0.20			

Figure S6. Cumulative and individual variance explained by each principle component in decreasing order derived from physical and climatic properties.