Supplementary Material:
Synthesizing the impacts of baseflow contribution on C-Q relationships across Australia using a Bayesian Hierarchical Model

Table S1. Recommendations on the filtering of flow and water quality data for analysis based on quality code (QC), obtained from individual state agencies.

State	NSW	SA	TAS	VIC	NT	QLD	WA
State agency contacted	WaterNSW	SA DEW	TAS DPIPWE	VIC DELWP	NT DEPWS	QLD DNRME	WA DER
QC recommendation for filtering flow data	QC<152 identifies suitable flow data for analysis	QC<=30 identifies suitable flow data for analysis	QC>=51 identifies suitable flow and water quality data for analysis	QC<=150 identifies suitable flow and water quality data for analysis	QC<100 identifies suitable flow and water quality data for analysis	QC<=26 identifies suitable flow and water quality data for analysis	QC<=3 identifies suitable flow and water quality data for analysis
QC recommendation for filtering water quality data	No QC records	QC for WQ not generally used for filtering data					

Table S2. The ranges and medians of percentage missing/erroneous flow data (which were then in-filled with AWRA-L model) across all study catchments for each water quality variable.

Water quality variable	min/%	median/%	max/%
TSS	0	0.13	46.3
TP	0	0	46.3
SRP	0	2.81	46.3
TN	0	0.72	46.3
NOx	0	3.98	46.3
EC	0	0.01	61.0

Table S3 Performance of the BFI-based model in predicting across all catchments for individual water quality variables (in rows), summarized as Nash Sutcliffe efficiency (NSE). The individual columns summarize performance for the three versions of the model based on different key predictors, *BFI_m*, *BFI_l* and *BFI_h*. The corresponding plots of the model fit are in Figures S7-S9, Supplementary Material.

Water quality variable	*BFI_m*	*BFI_l*	*BFI_h*
TSS	0.50	0.49	0.50
TP	0.54	0.54	0.54
SRP	0.62	0.62	0.62
TN	0.47	0.47	0.47
NOx	0.54	0.53	0.54
EC	0.93	0.93	0.93

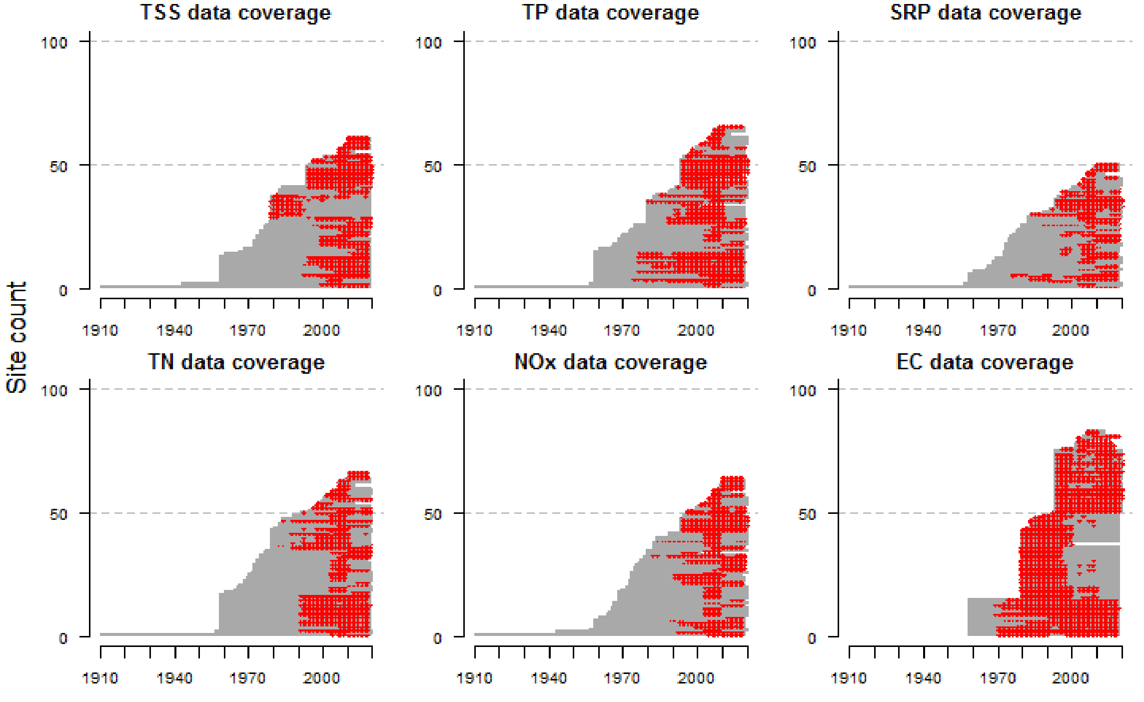

Figure S1. The temporal coverage of flow data (grey bars) and water quality data (red dots) across all catchments studied for individual water quality variables.

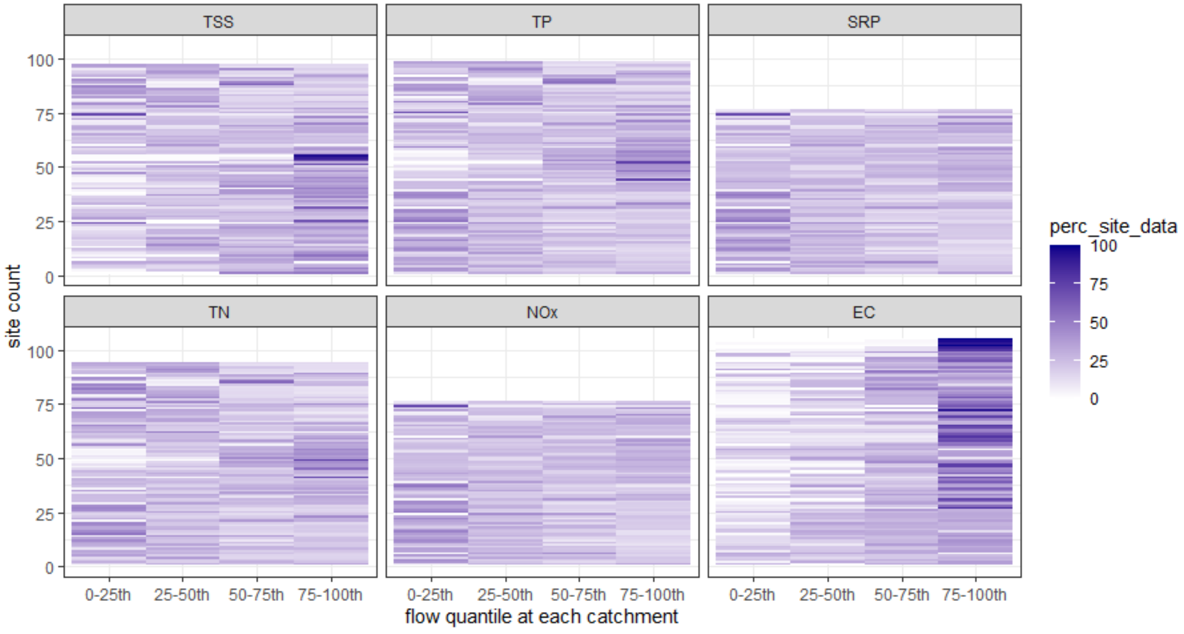

Figure S2. Flow regimes covered by the samples of each water quality variable, shown as the percentage of samples within each 25th percentile of the long-term daily flow. Each plot summarizes all catchments studied for individual water quality variables.

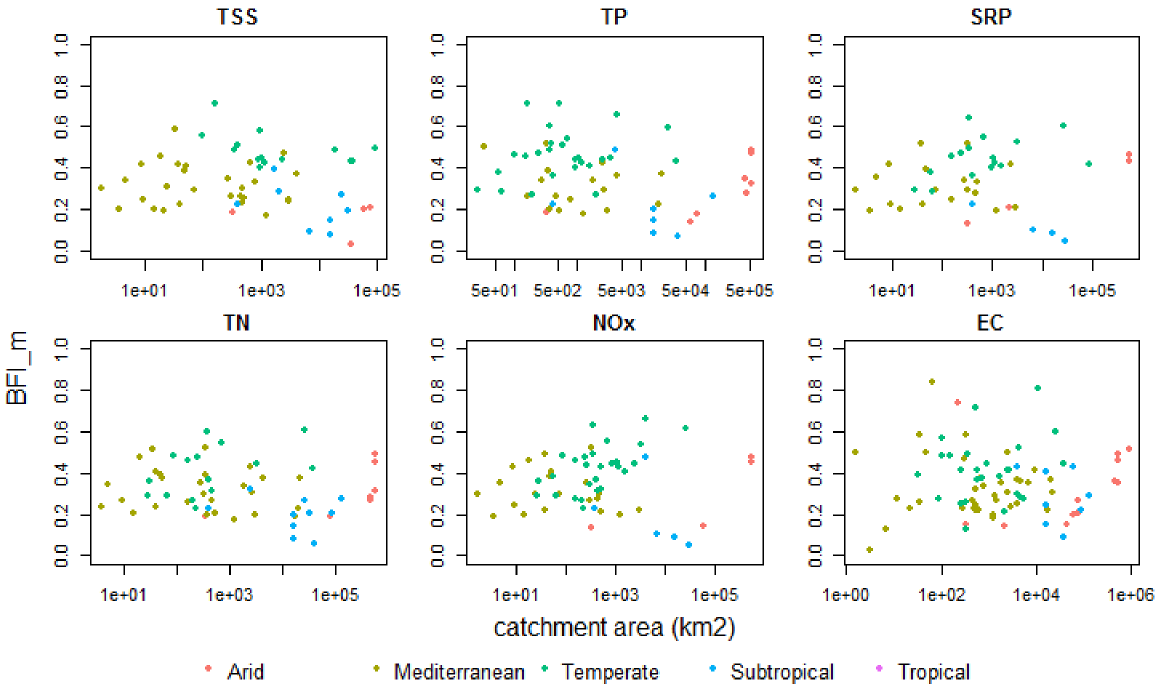

Figure S3. Relationship between *BFI_m* and catchment area (km2) for catchments analysed in each water quality variable.

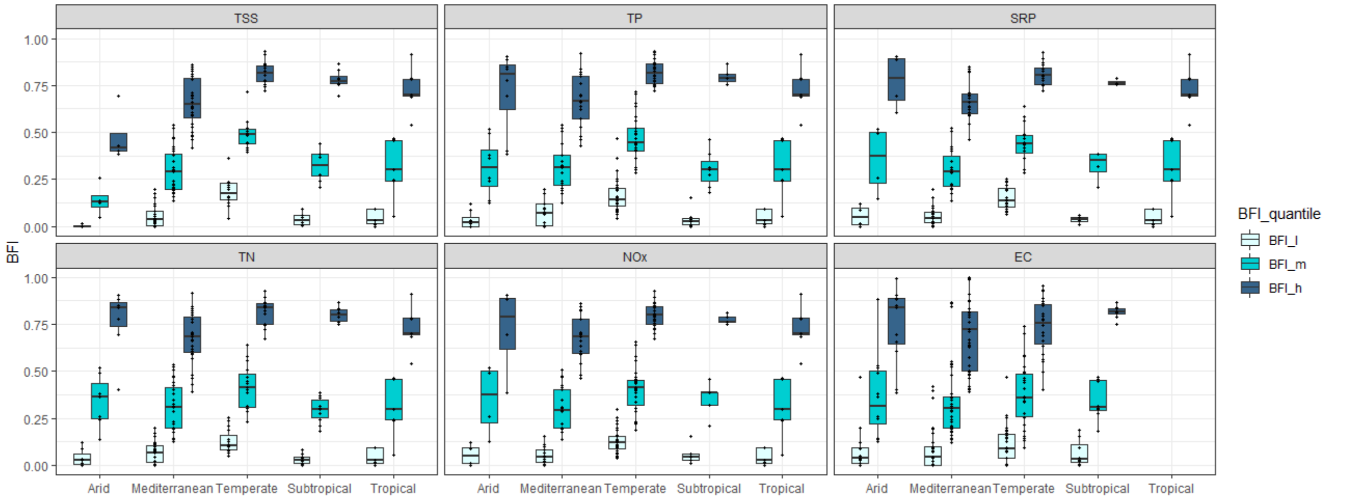

Figure S4. Range *BFI_m*, *BFI_l* and *BFI_h*, for catchments in each climate zone for each water quality variable analysed.

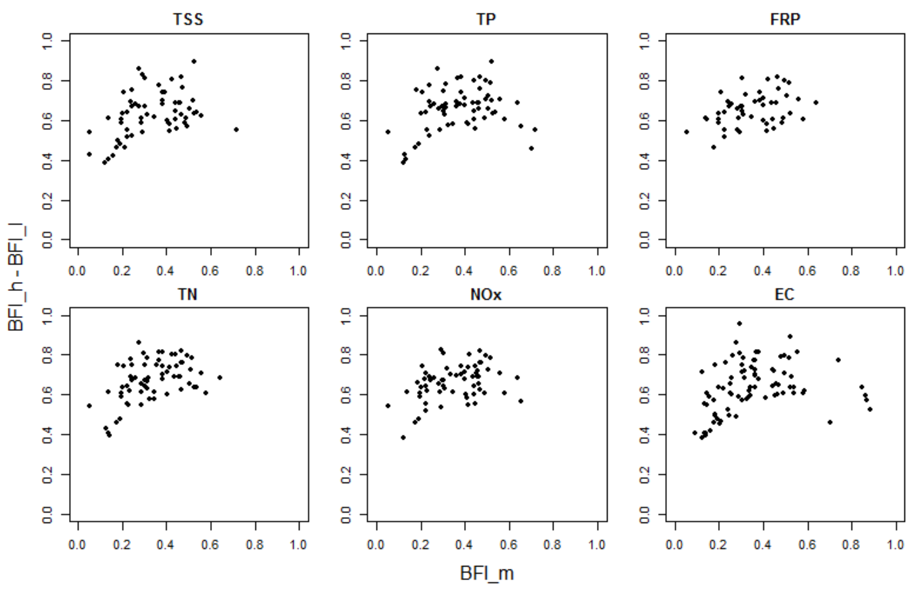

Figure S5. Relationships between the median BFI (*BFI_m*, x-axis) and range of variation of BFI (y-axis) in each catchment, the latter is estimated with the difference between the 90th and 10th percentile of BFI (*BFI_h - BFI_l*).

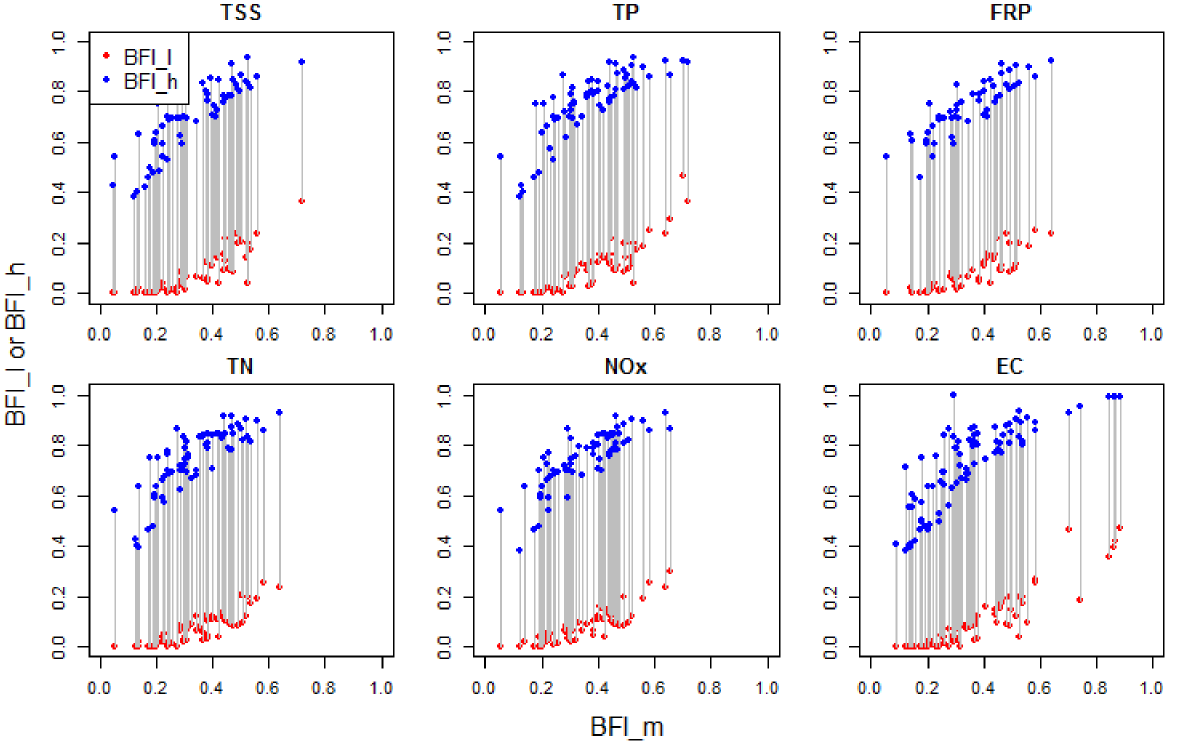

Figure S6. Relationships between the median BFI (*BFI_m*, x-axis) and *BFI_l* and *BFI_h* (y-axis) in each catchment, the grey lines highlight the differences between *BFI_h* and *BFI_l*.

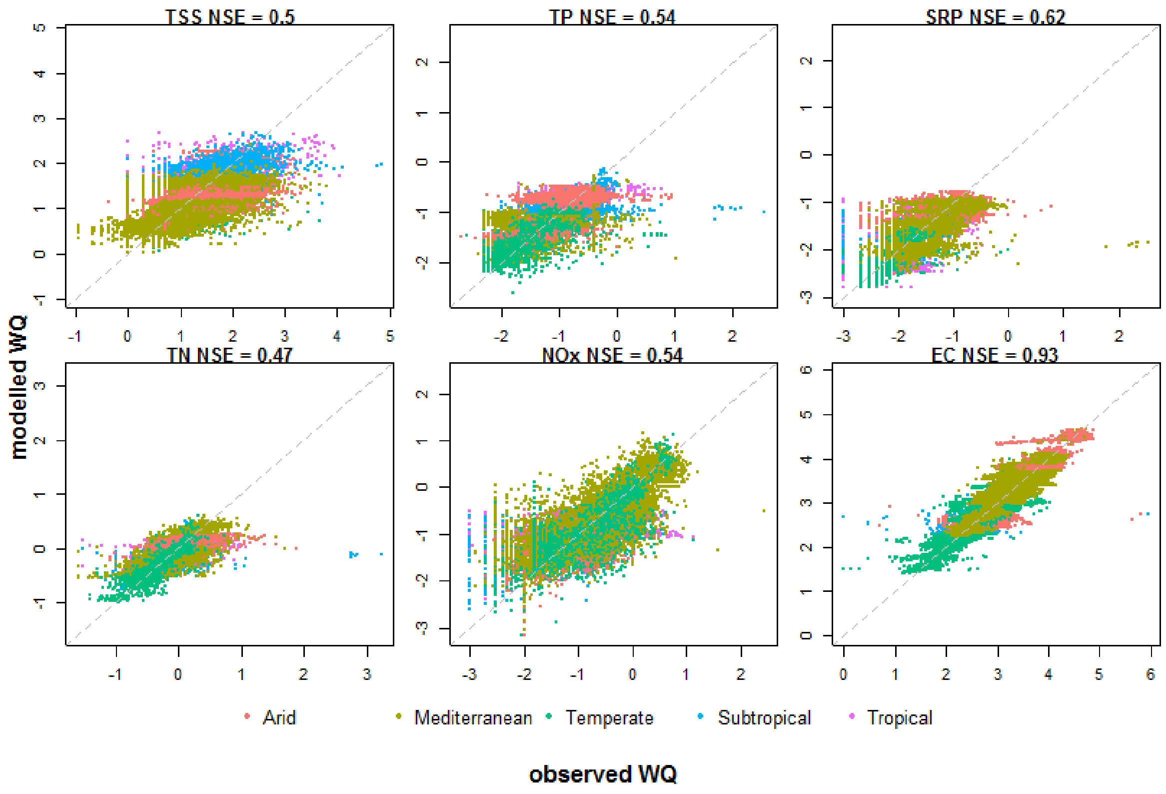

Figure S7. Modelled and observed water quality (both in log-10 scale) across all study catchments for each water quality variable in each panel, for the BFI-based model with *BFI_m* as the key predictor. The model performance for each water quality variable is summarized with the Nash Sutcliffe efficiency (NSE). Colours indicate different climate zones covered in the study catchments, and the grey dash line in each panel shows the 1:1 line (NSE = 1).

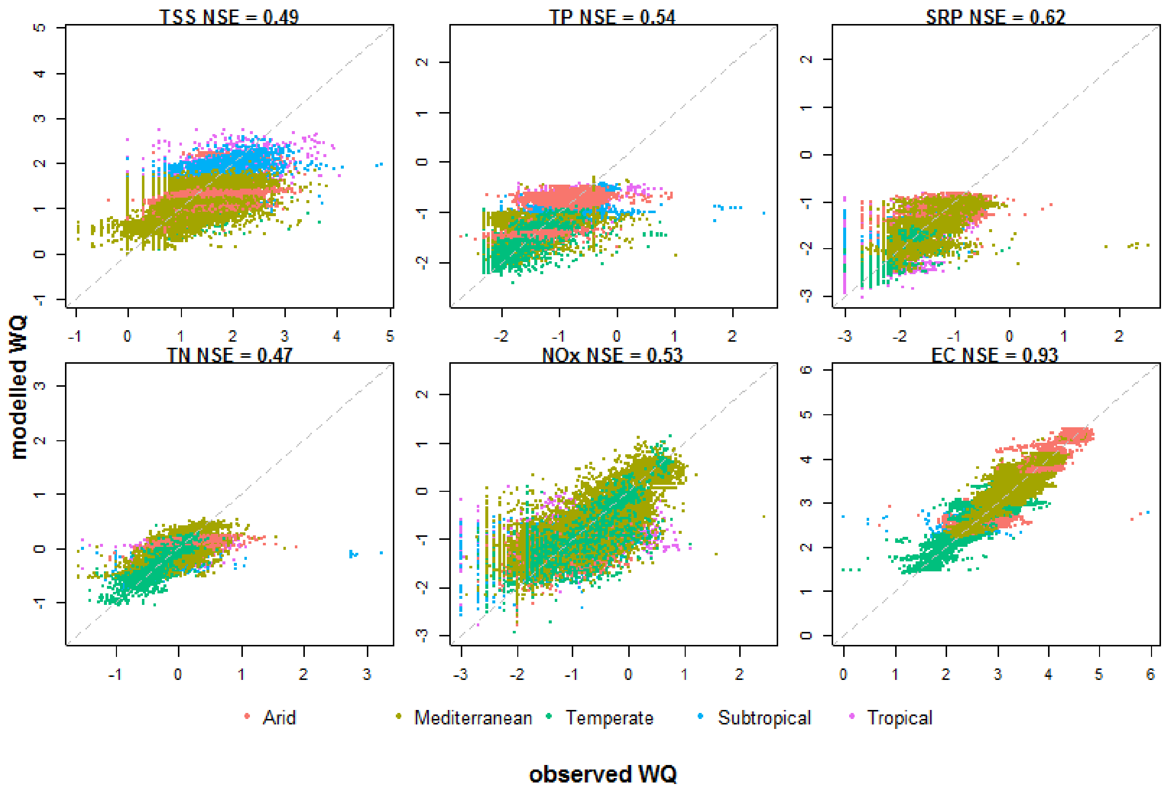

Figure S8. Modelled and observed water quality (both in log-10 scale) across all study catchments for each water quality variable in each panel, for the BFI-based model with *BFI_l* as the key predictor. The model performance for each water quality variable is summarized with the Nash Sutcliffe efficiency (NSE). Colours indicate different climate zones covered in the study catchments, and the grey dash line in each panel shows the 1:1 line (NSE = 1).

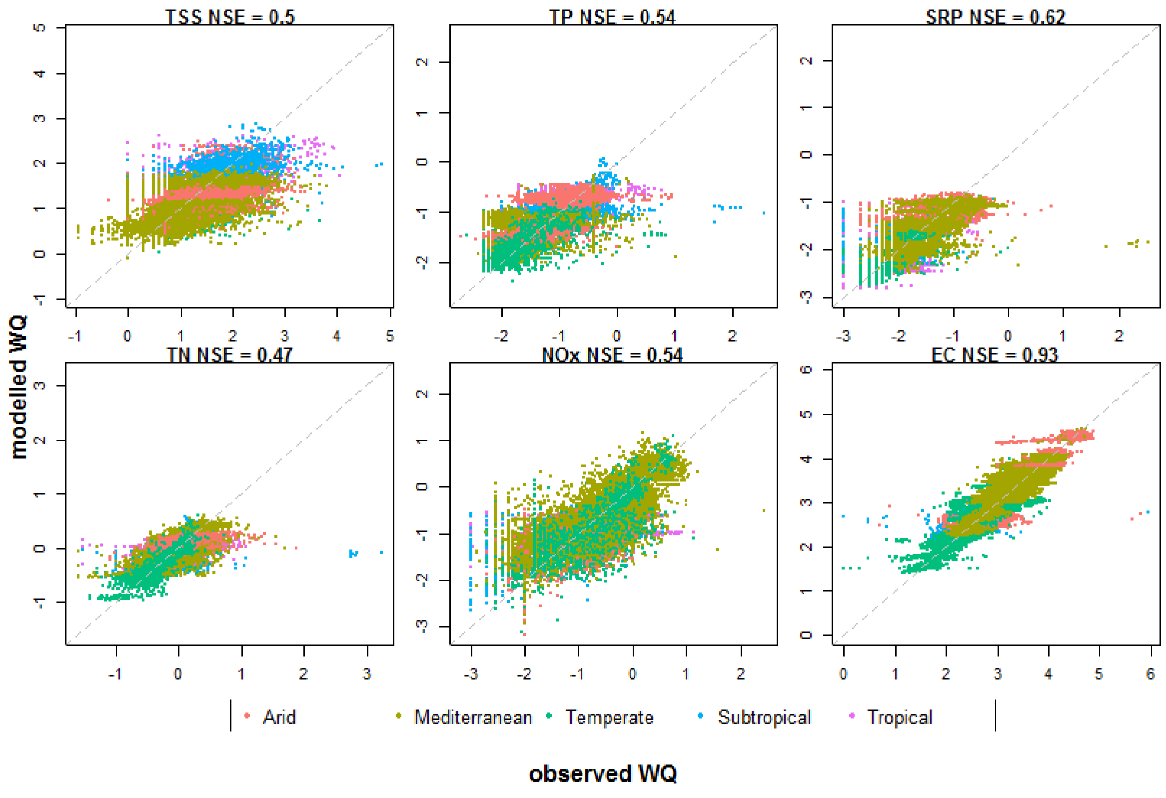

Figure S9. Modelled and observed water quality (both in log-10 scale) across all study catchments for each water quality variable in each panel, for the BFI-based model with *BFI_h* as the key predictor. The model performance for each water quality variable is summarized with the Nash Sutcliffe efficiency (NSE). Colours indicate different climate zones covered in the study catchments, and the grey dash line in each panel shows the 1:1 line (NSE = 1).

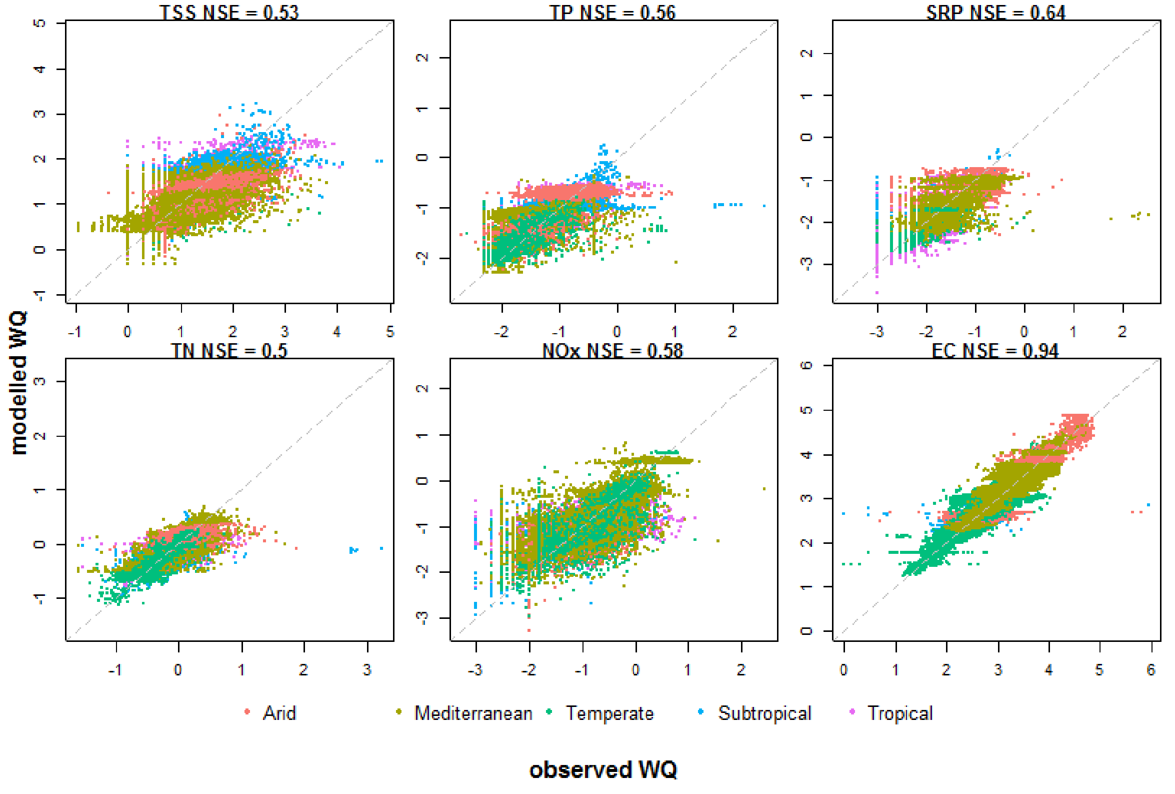

Figure S10. Modelled and observed water quality (both in log-10 scale) across all study catchments for each water quality variable in each panel, for the baseline model based on observed C-Q slopes. The model performance for each water quality variable is summarized with the Nash Sutcliffe efficiency (NSE). Colours indicate different climate zones covered in the study catchments, and the grey dash line in each panel shows the 1:1 line (NSE = 1).

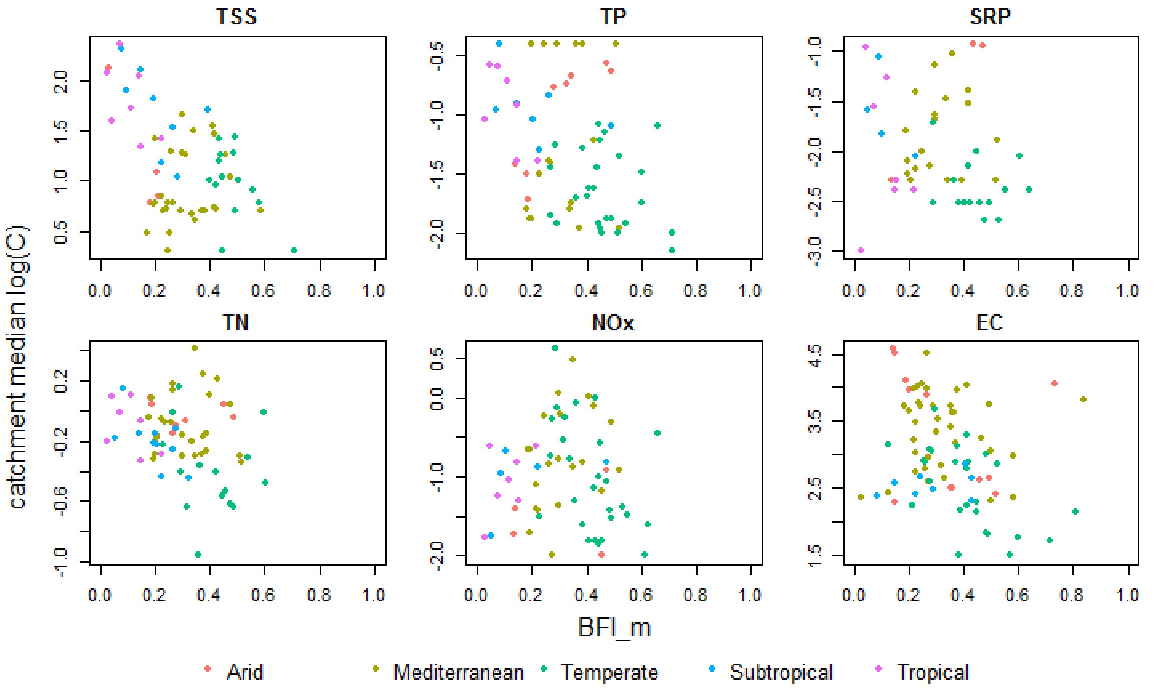

Figure S11. Relationship between *BFI_m* and catchment median concentration (in log scale) for each water quality variable.

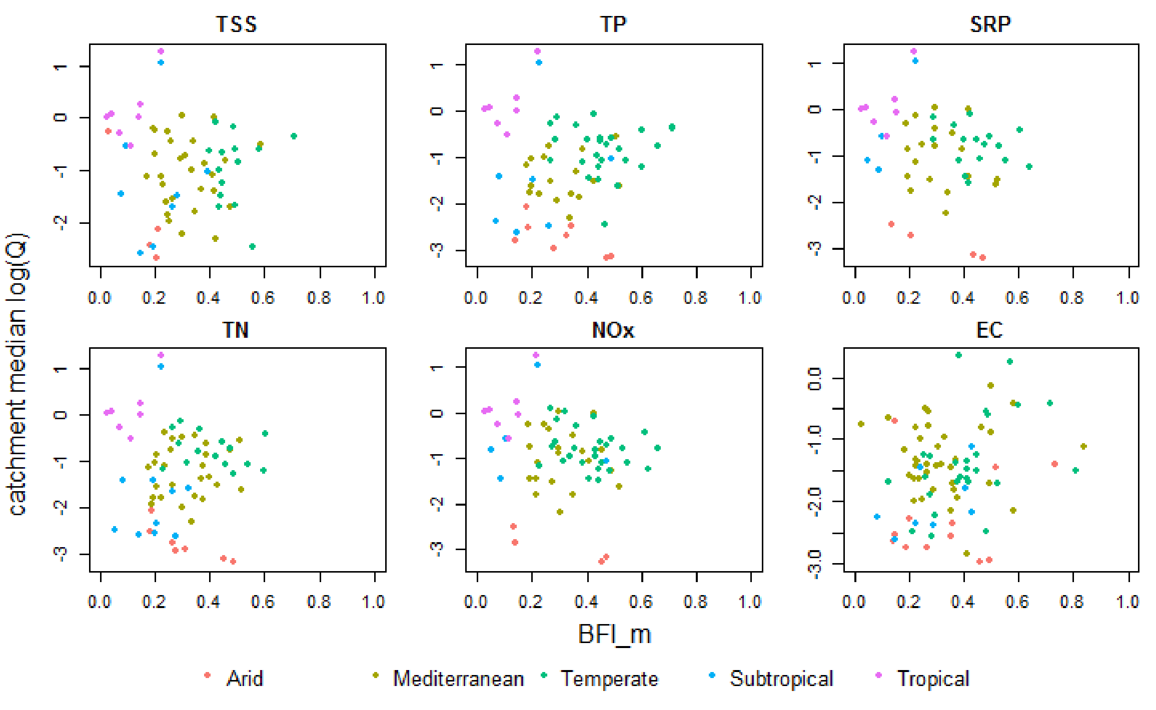

Figure S12. Relationship between *BFI_m* and catchment median flow (in log scale) for catchments analysed in each water quality variable.

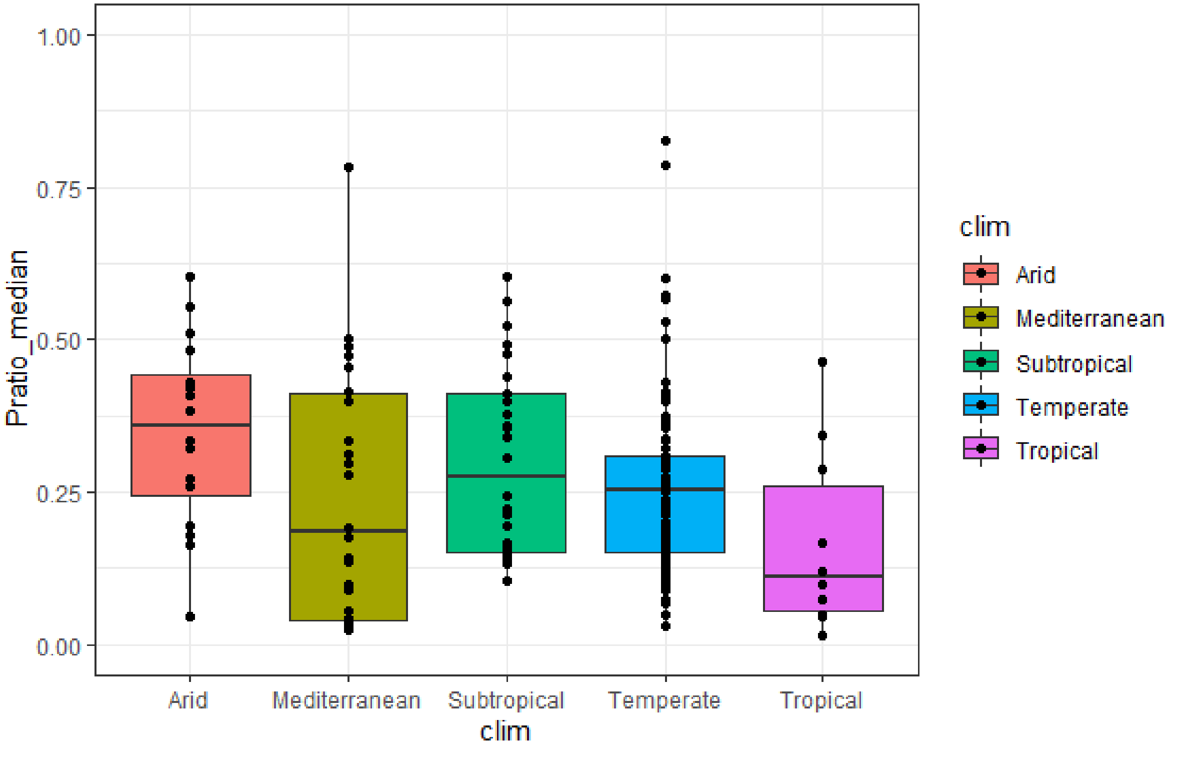

Figure S13. median SRP:TP ratio at individual catchments, by climate zones

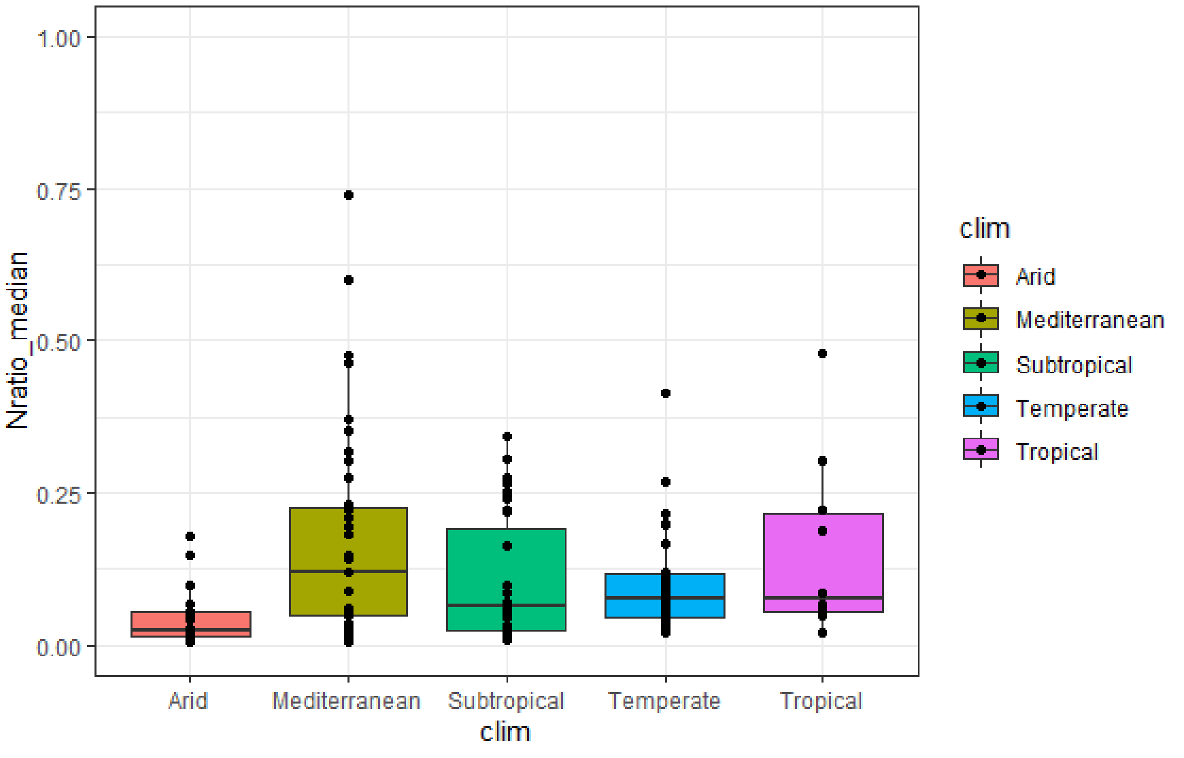

Figure S14. median NOx:TN ratio at individual catchments, by climate zones

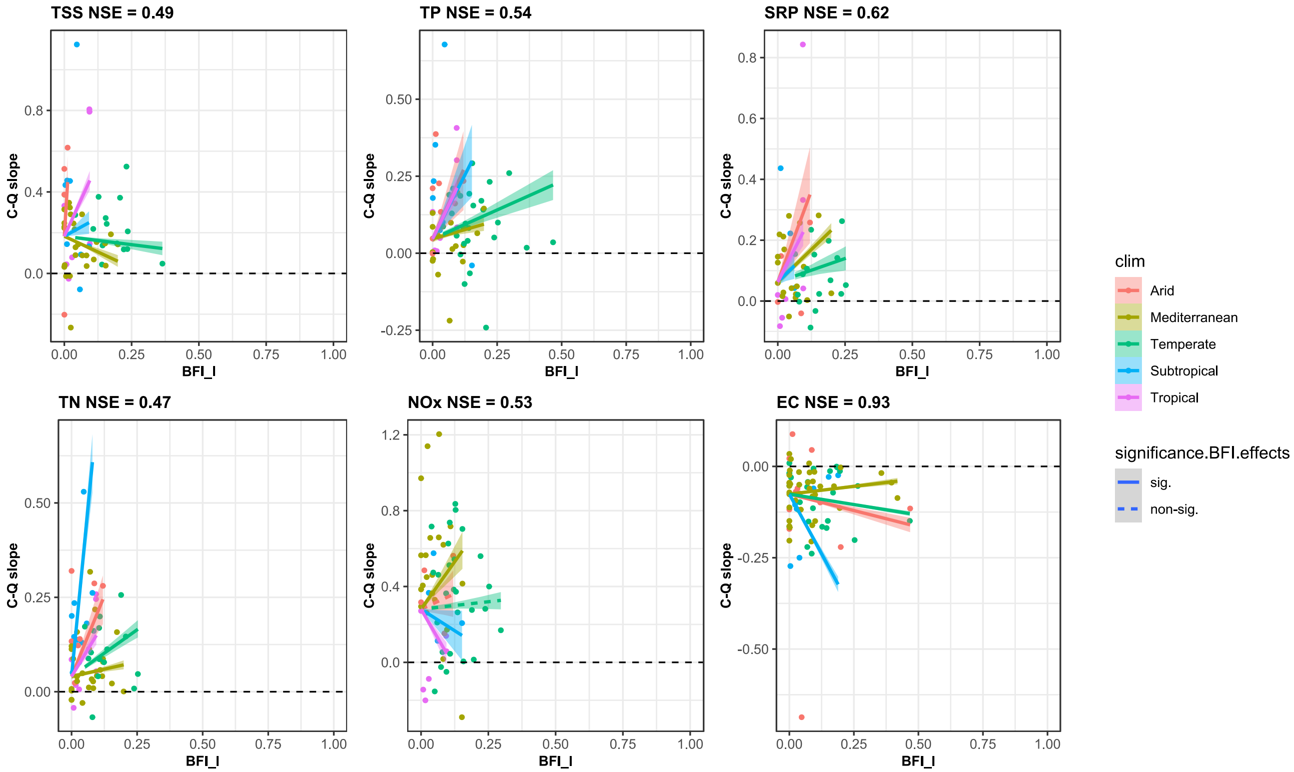

Figure S15. Catchment C-Q slope vs. catchment low BFI (*BFI_l*), coloured by climate zones. The lines represent modelled C-Q slope~*BFI_l* regression lines for individual climate zones, where *BFI_l* always has a significant impact on C-Q slope, based on the 95th credible intervals shown in Figure 5. The dots represent the observed C-Q slopes for individual catchments. The black dashed lines mark a zero C-Q slope which differentiate mobilisation (C-Q slope>0) from dilution (C-Q slope<0).

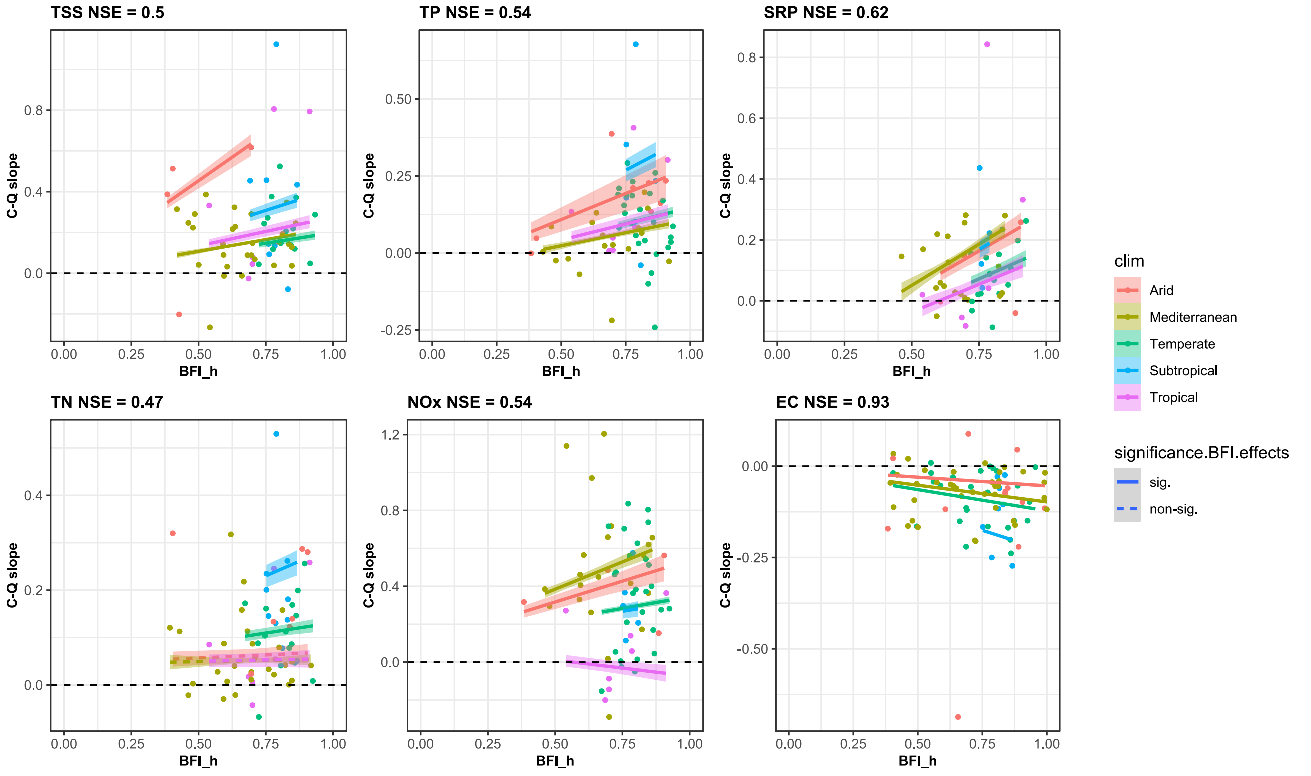

Figure S16. Catchment-level C-Q slope vs. catchment high BFI (*BFI_h*), coloured by climate zones. The lines represent modelled C-Q slope~*BFI_h* regression lines for individual climate zones, where *BFI_h* always has a significant impact on C-Q slope, based on the 95th credible intervals shown in Figure 5. The dots represent the observed C-Q slopes for individual catchments. The black dashed lines mark a zero C-Q slope which differentiate mobilisation (C-Q slope>0) from dilution (C-Q slope<0).