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Median bed-material sediment particle size across rivers in the contiguous US

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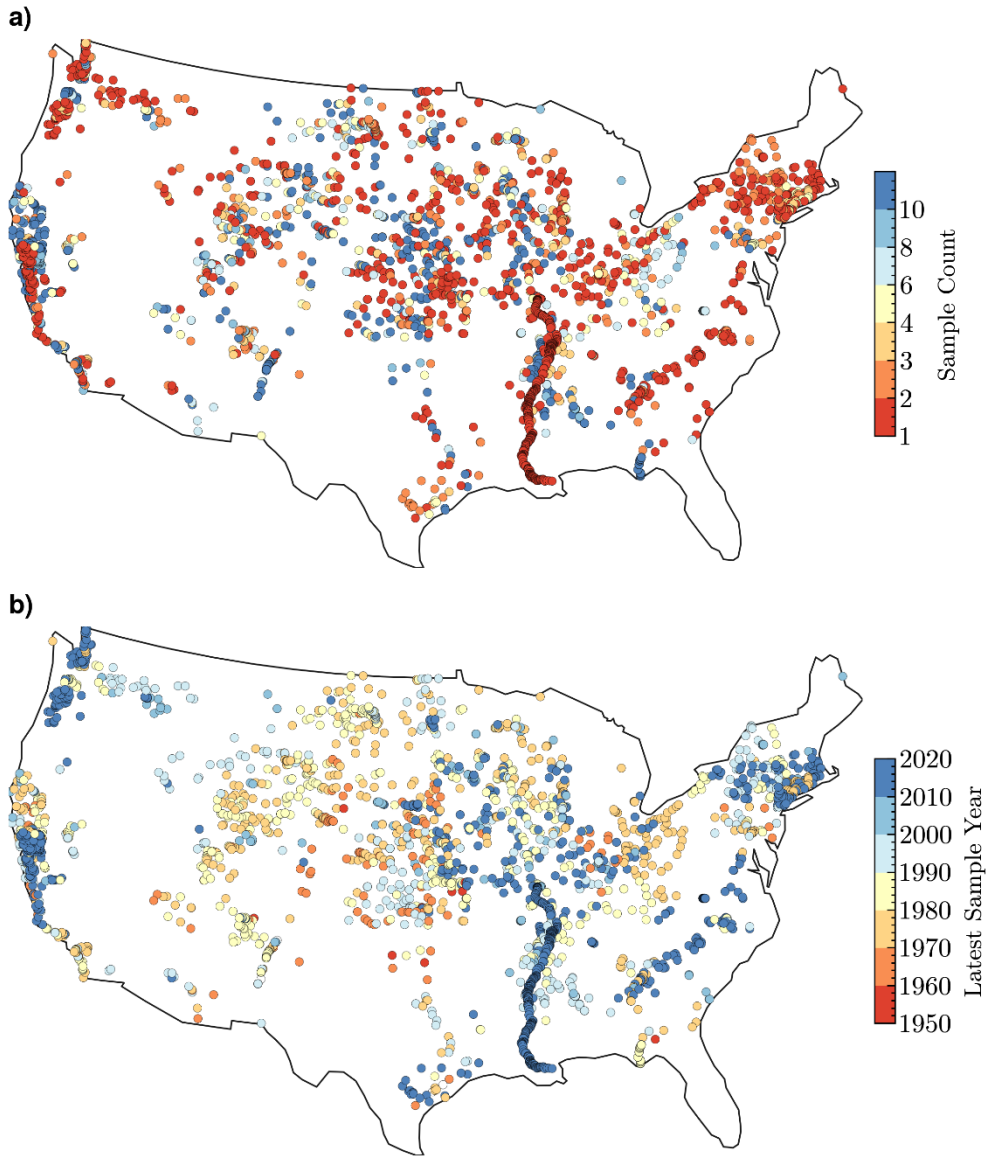

Figure S1: Spatial distribution of sample counts (a) and latest sampling year (b) of the 2577 sampling locations.

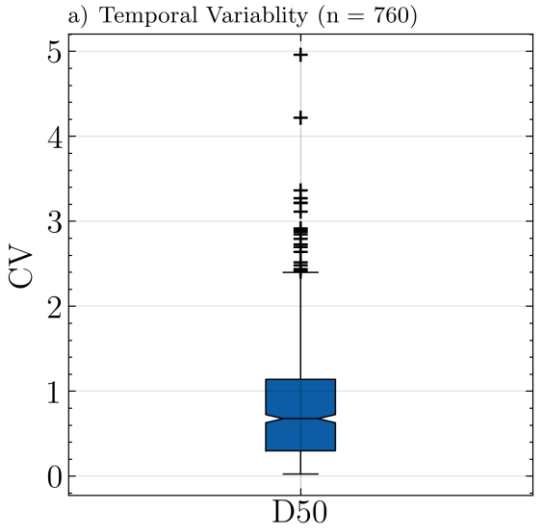

Figure S2: Distribution of the coefficient of variation (CV) for the 760 stations that have at least 5 samples over time.

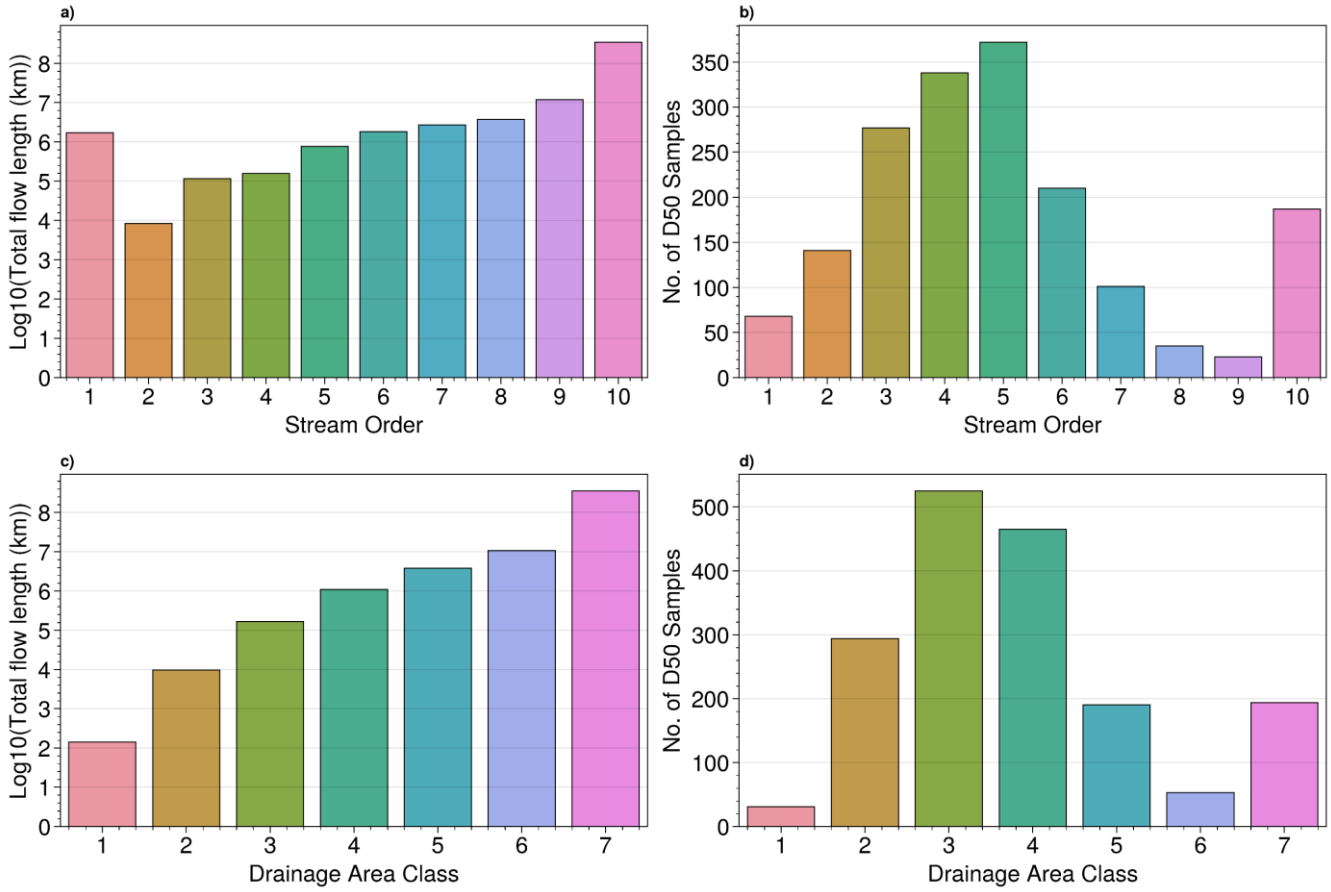

Figure S3: Distributions of total channel length (a,c) and number of D50 samples (b,d) within different classes of stream orders (a,b) and drainage areas (c,d). For Fig. 2 (c), (d), Drainage area class corresponds to categories of streams based on drainage areas, i.e., Class 1,<=10sqkm; Class 2, 10~100sqkm; Class 3, 100~1000sqkm; Class 4, 1000~1e+4sqkm; Class 5, 1e+4~1e+5sqkm; Class 6,1e5~1e+6sqkm; Class 7), > 1e+6sqkm.

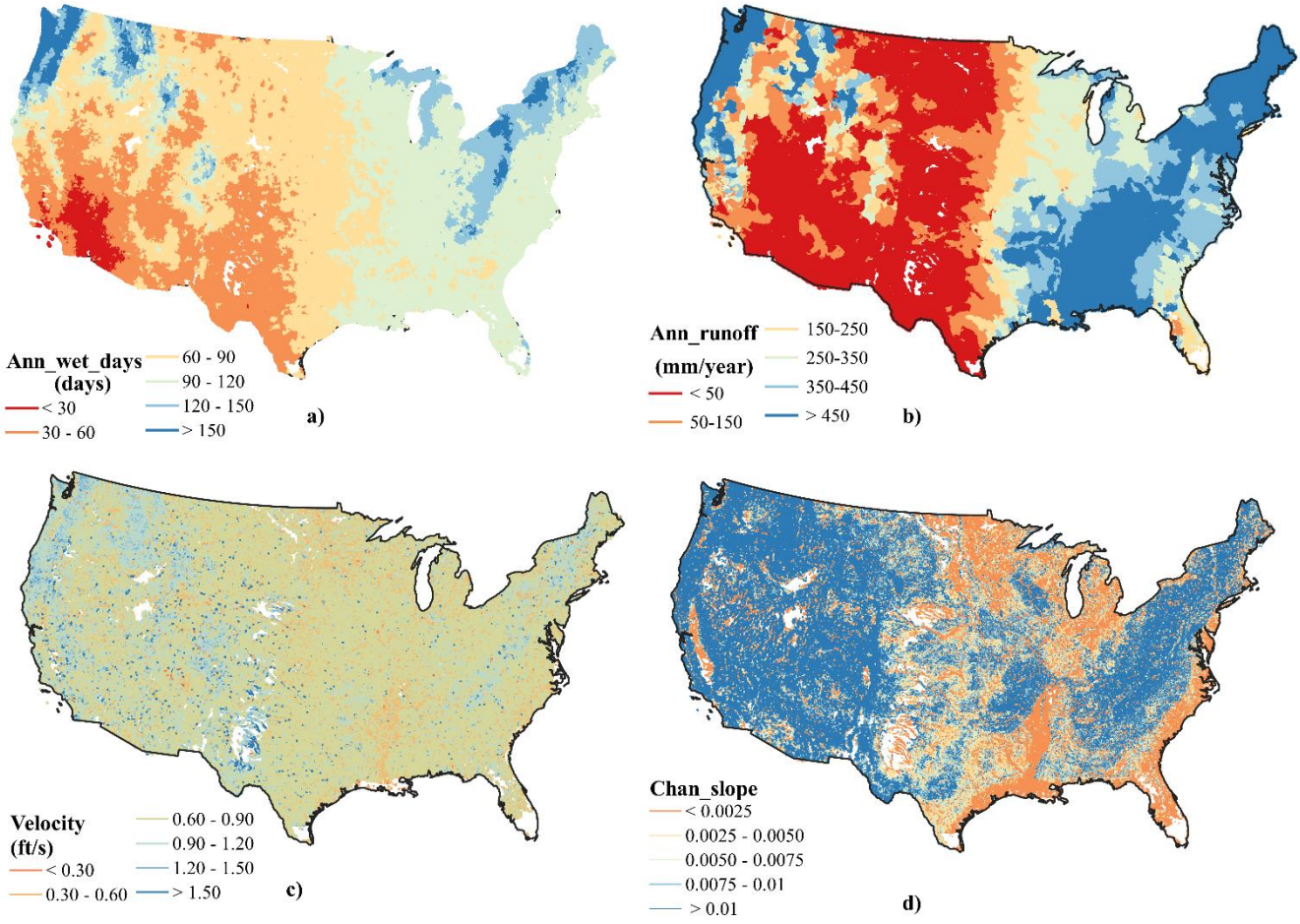

Figure S4: Spatial maps of predictive variables from NHDPlus. a. Annual average number of wet days (Ann_wet_days); b. Mean annual runoff (Ann_runoff); c. Mean annual flow velocity (Velocity); d. Slope of the flowline (Chan_slope).

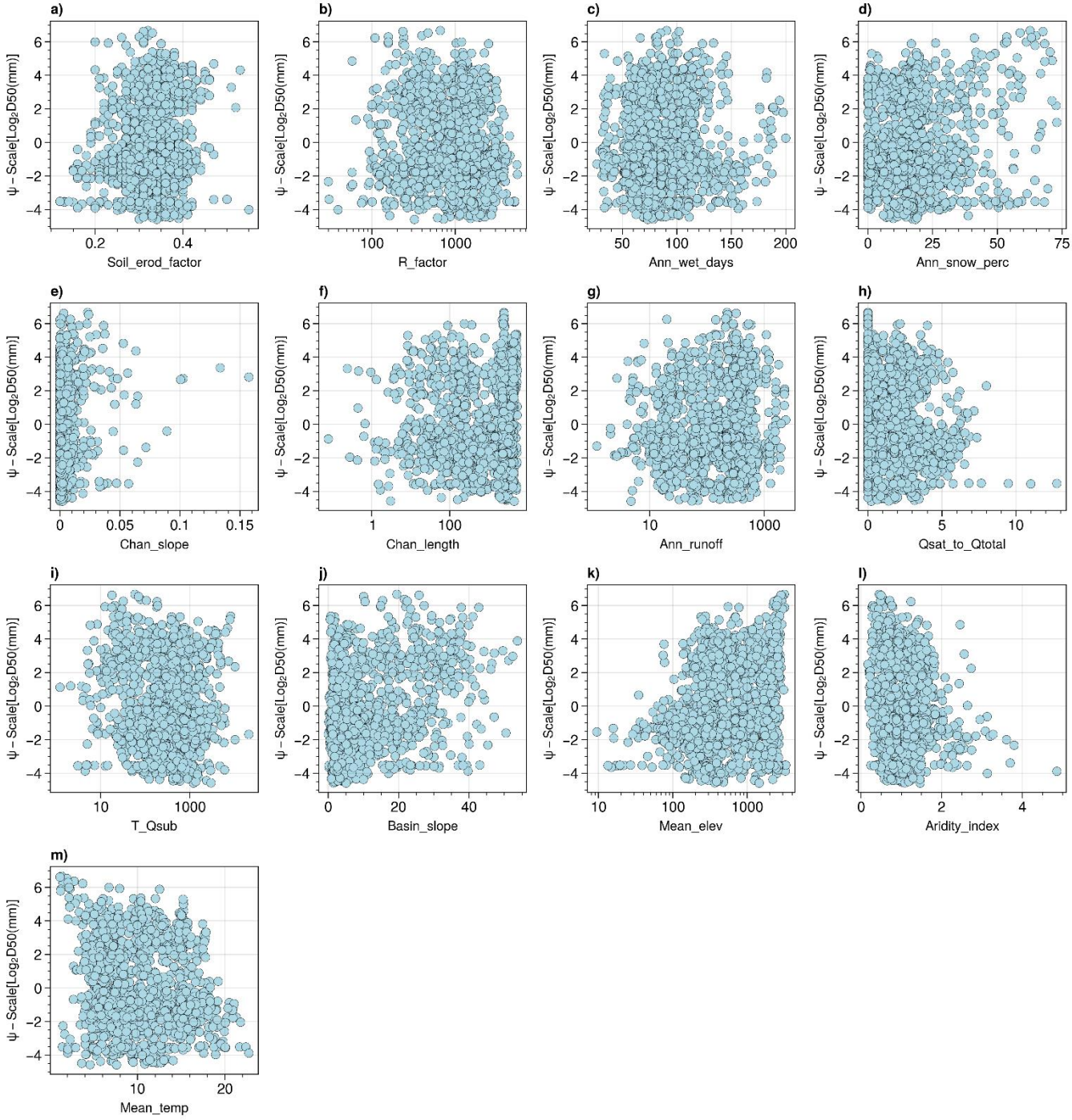

Figure S5. Scatter plots between D50 and the selected 13 features

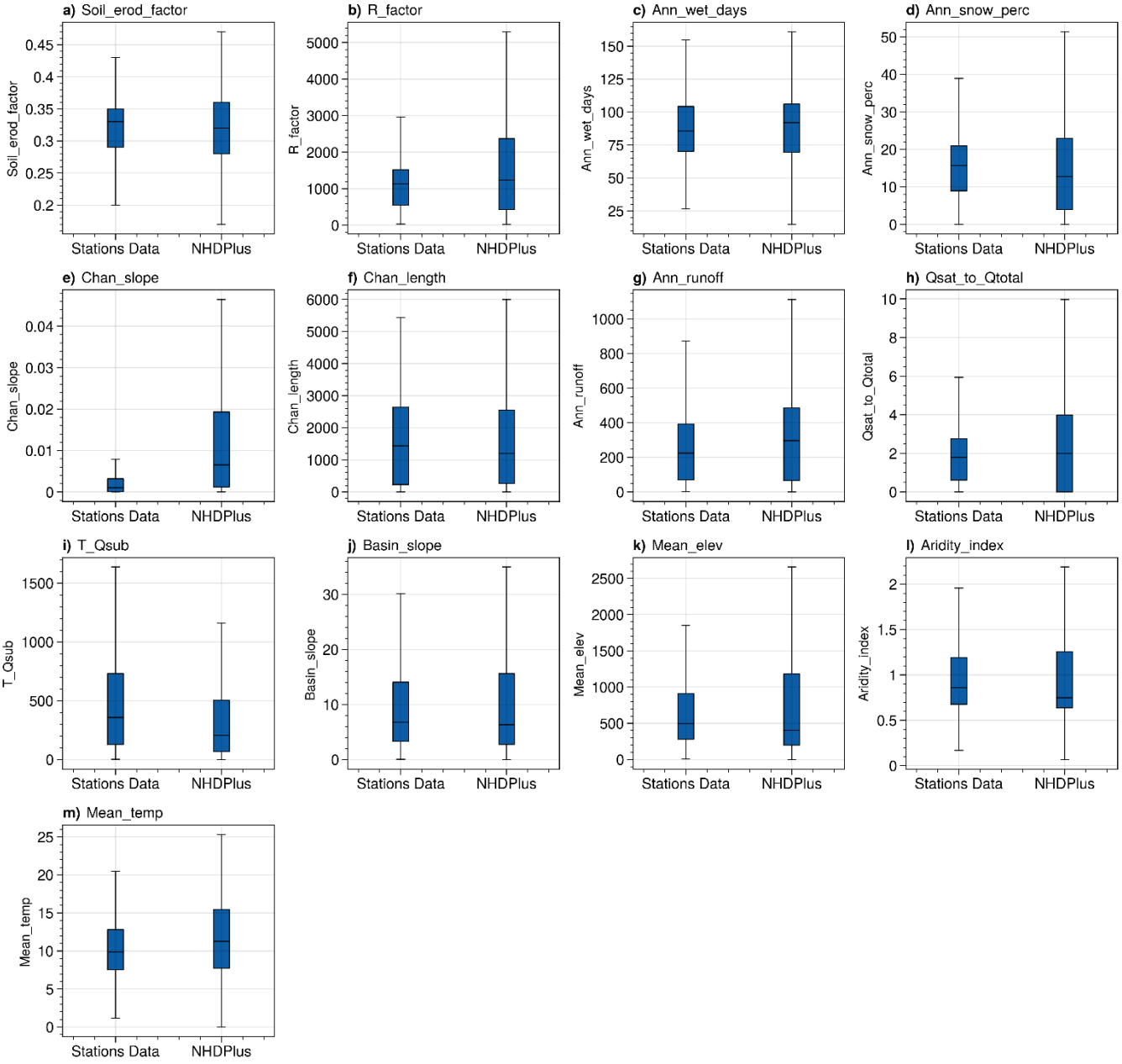

Figure S6: Box plots for the comparison of the ranges of 13 parameters between stations with measured D50 data and all flowlines (i.e., NHDPlus).

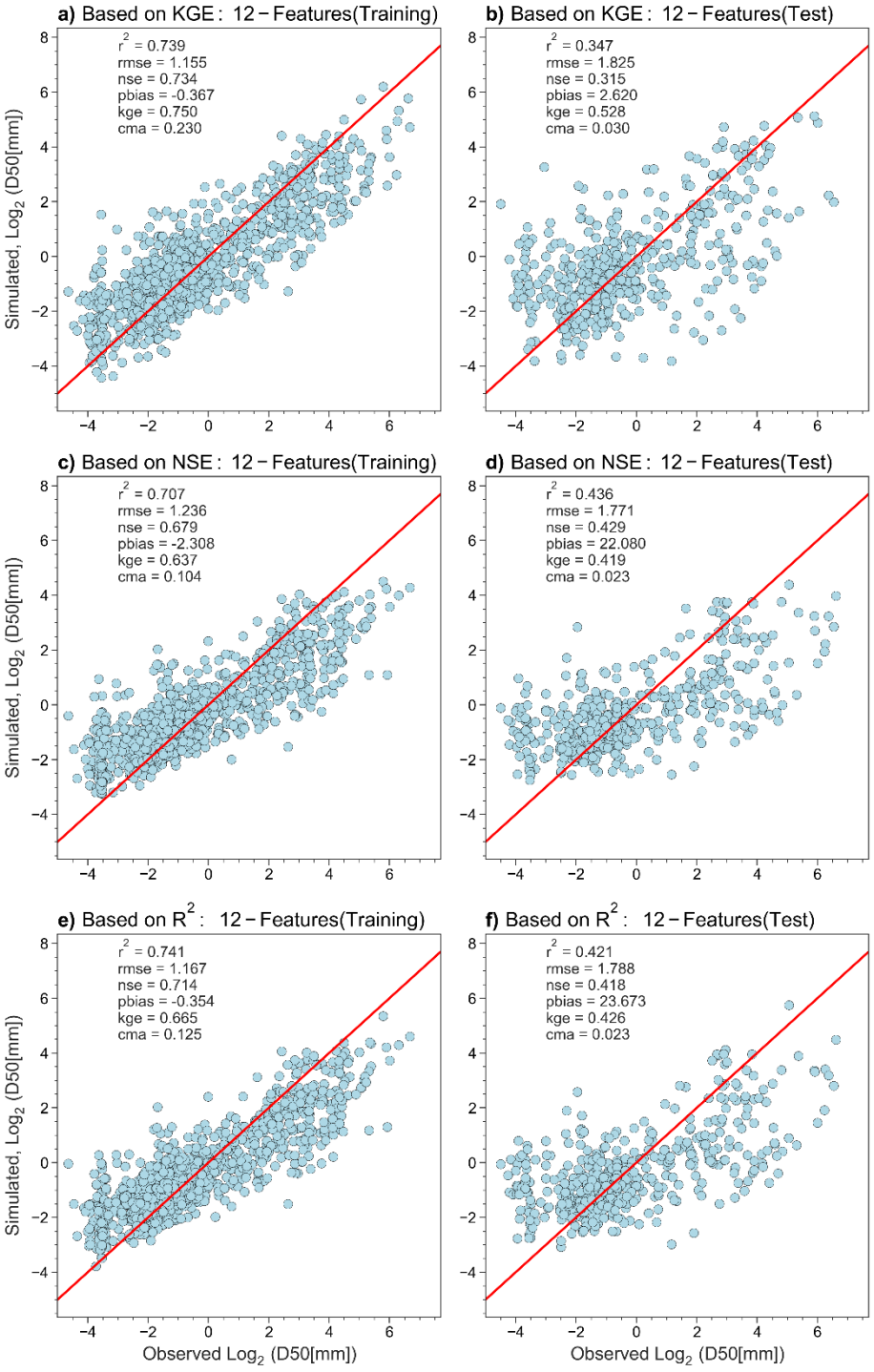

Figure S7: ML modeling using different objective functions

Table S1: List of the 76 predictive variables

Group	Acronym	Description
Soil		
1	TOT_SILTAVE	Accumulated average percent of silt in soil based on total upstream routing
2	TOT_CLAYAVE	Accumulated average percent of clay in soil based on total upstream routing
3	TOT_SANDAVE	Average percent of sand in soil based on total upstream routing
4	TOT_KFACT	Accumulated average value for all upstream catchments for KFactor based on total upstream routing
5	TOT_KFACT_UP	Average value for KFactor in the upper soil horizon based on total upstream routing
6	TOT_NO10AVE	Accumulated average percent by weight of soil material less than 3 inches in size that passes through a No. 10 sieve (2 millimeters) based on total upstream routing
7	TOT_NO200AVE	Accumulated average percent by weight of soil material less than 3 inches in size that passes through a No. 200 sieve (.074 millimeters) based on total upstream routing
8	TOT_NO4AVE	Average percent by weight of soil material less than 3 inches in size that passes through a No. 4 sieve (5 millimeters) based on total upstream routing
Lithology and Geology		
1	TOT_OLSON_K	Estimated mean accumulated percentage of lithological potassium oxide (K2O) content in surface or near surface geology of all upstream NHDPlusV2 catchments
2	TOT_OLSON_CAO	Estimated mean accumulated percentage of lithological calcium oxide (CaO) content in surface or near surface geology of all upstream NHDPlusV2 catchments
3	TOT_OLSON_FE	Estimated mean accumulated percentage of lithological ferric oxide (Fe2O3) content in surface or near surface geology of all upstream NHDPlusV2 catchments

4	TOT_OLSON_MGO	Estimated mean accumulated percentage of catchment that contains by the Olson geology of type rock type, Carbonate-rock aquifers.
5	TOT_OLSON_P	Estimated mean accumulated percentage of catchment that contains lithological phosphorus pentoxide (P2O5) content in surface or near surface geology of all upstream NHDPlusV2 catchments
6	TOT_OLSON_S	Estimated mean accumulated percentage of lithological sulfur (S) content in surface or near surface geology of all upstream NHDPlusV2 catchments
7	TOT_OLSON_SI	Estimated mean accumulated percentage of lithological silicon dioxide (SiO2) content in surface or near surface geology of all upstream NHDPlusV2 catchments
8	TOT_OLSON_UCS	Estimated mean accumulated lithological compressive strength, measured as uniaxial compressive strength (in megaPascals, MPa) of surface or near surface geology of all upstream NHDPlusV2 catchments
9	TOT_OLSON_PERM	Estimated mean accumulated percentage of lithological hydraulic conductivity (in micrometers per second) of surface or near surface geology of all upstream NHDPlusV2 catchments
10	CARB	Estimated percent of the catchment covered by Carbonate rocks such as limestone and dolostone
11	CLAST_C	Estimated percent of the catchment covered by Clastic sediments/rocks primarily made of sands, gravels, cobles, or larger clasts.
12	CLAST_F	Estimated percent of the catchment covered by Clastic sediments/rocks primarily made of fine-grained materials such as shale, siltstone, claystone, mudstone.
13	CLAST_U	Estimated percent of the catchment covered by Clastic sediments/rocks of unknown or highly variable clast sizes
14	EVAP	Estimated percent of the catchment covered by Evaporites or playas.

15	META	Estimated percent of the catchment covered by Metamorphic rocks.
16	PLUT_OTH	Estimated percent of the catchment covered by Igneous, generally mafic, other less quartz-rich plutonic rocks, such as monzonite or gabbro.
17	PLUT_QTZ	Estimated percent of the catchment covered by Igneous, generally felsic, quartz-rich plutonic rocks such as granitoids, granite, granodacite.
18	VOLC_OTH	Estimated percent of the catchment covered by Igneous, generally mafic, volcanic rocks, such as basalt that are mineralogically equivalent to the less quartz-rich plutonic rocks
19	VOLC_QTZ	Estimated percent of the catchment covered by Igneous, generally felsic, volcanic rocks such as rhyolite and dacite that are mineralogically equivalent to the quartz-rich plutonic rocks
20	WATER	Estimated percent of the catchment covered by Water or ice.
Topography		
1	BANKFULL_WIDTH	Estimated bankfull width of flowline reach calculated using Bieger 's regression equation (Bieger et al, 2015)
2	BANKFULL_DEPTH	Estimated bankfull depth of flowline reach calculated using Bieger 's regression equation (Bieger et al, 2015)
3	BANKFULL_XSEC_AREA	Estimated bankfull cross sectional area of flowline reach calculated using Bieger 's regression equation (Bieger et al, 2015)
4	sinuosity	Flowline reach sinuosity at the flowline reach scale only
5	TOT_BASIN_SLOPE	Average slope in percent of all upstream flowline catchments
6	TOT_ELEV_MEAN	Mean elevation in meters of all upstream flowline catchments
7	TOT_STREAM_SLOPE	Average slope in percent flowlines
8	TOT_STREAM_LENGTH	Total length of all upstream flowlines in kilometers
Climate		
1	TOT_RF7100	Accumulated estimated watershed mean annual average for the Rainfall and Runoff factor ("R factor" of Universal Soil Loss Equation) for the period 1971-2000 in hundreds of foot-ton force-inch/acre-hour per year for the period 1971-2000

2	TOT_WDANN	Accumulated value for all upstream catchments for the annual 30 year average (1961-1990) number of days of measurable precipitation
3	TOT_PRSNOW	Accumulated estimated mean annual snow as a percent of total precipitation, 1905-2002
4	AI	Aridity Index
5	TOT_Temprature	Accumulated annual value of temperature
6	TOT_RFACT	R factor of Universal Soil Loss Equation
NHDPlus		
1	lengthkm	Flowline length in kilometers
2	streamorde	stream order
3	totdasqkm	Drainage area in square kilometers
4	maxelevsmo	maximum elevation of flowline
5	minelevsmo	minmum elevation of flowline
6	slope	Flowline slope
7	ve_ma	flow velocity
8	pathlength	Flowline distance from the basin outlet(termnial outlet)
Hydrology		
1	TOT_RUN7100	Accumulated estimated 30-year (1971-2000) average annual runoff, mm/year based on total upstream accumulation
2	TOT_STRM_DENS	Density of streams defined as stream length (meters) divided by catchment(s) area (square meters).
3	TOT_HLR_1	Accumulated estimated percent of catchment that contains subhumid plains with permeable soils and bedrock
4	TOT_HLR_2	Accumulated estimated percent of catchment that contains humid plains with permeable soils and bedrock
5	TOT_HLR_3	Accumulated estimated percent of catchment that contains subhumid plains with impermeable soils and permeable bedrock
6	TOT_HLR_4	Accumulated estimated percent of catchment that contains humid plains with permeable soils and bedrock
7	TOT_HLR_5	Accumulated estimated percent of catchment that contains arid plains with permeable soils and bedrock

8	TOT_HLR_6	Accumulated estimated percent of catchment that contains subhumid plains with impermeable soils and bedrock
9	TOT_HLR_7	Accumulated estimated percent of catchment that contains humid plains with permeable soils and impermeable bedrock
10	TOT_HLR_8	Accumulated estimated percent of catchment that contains semi arid plains with impermeable soils and bedrock
11	TOT_HLR_9	Accumulated estimated percent of catchment that contains humid plateaus with impermeable soils and permeable bedrock
12	TOT_HLR_10	Accumulated estimated percent of catchment that contains arid plateaus with impermeable soils and permeable bedrock
13	TOT_HLR_11	Accumulated estimated percent of catchment that contains humid plateaus with impermeable soils and bedrock
14	TOT_HLR_12	Accumulated estimated percent of catchment that contains semi arid plateaus with permeable soils and impermeable bedrock
15	TOT_HLR_13	Accumulated estimated percent of catchment that contains semi arid plateaus with impermeable soils and bedrock
16	TOT_HLR_14	Accumulated estimated percent of catchment that contains arid playas with permeable soils and bedrock
17	TOT_HLR_15	Accumulated estimated percent of catchment that contains semi arid mountains with impermeable soils and permeable bedrock
18	TOT_HLR_16	Accumulated estimated percent of catchment that contains humid mountains with permeable soils and impermeable bedrock
19	TOT_HLR_17	Accumulated estimated percent of catchment that contains semi arid mountains with impermeable soils and bedrock
20	TOT_HLR_18	Accumulated estimated percent of catchment that contains semi arid mountains with permeable soils and impermeable bedrock
21	TOT_HLR_19	Accumulated estimated percent of catchment that contains very humid mountains with permeable soils and impermeable bedrock
22	TOT_HLR_20	Accumulated estimated percent of catchment that contains humid mountains with permeable soils and impermeable bedrock
23	TOT_SATOF	Accumulated mean saturation overland flow as a percent of streamflow based on total upstream accumulation

24	TOT_IEOF	Accumulated mean infiltration-excess overland flow as a percent of streamflow based on total upstream accumulation
25	TOT_TWI	Accumulated average topgraphic wetness index based on total upstream accumulation
26	TOT_CONTACT	Accumulated contact time, the length of time it takes for water to drain along subsurface flow paths to the stream, based on total upstream accumulation