

Supplemental Data Description

Chapter 1 Matlab Code

LognormalFlowSampler.m: Generates and saves samples from the lognormal distribution for a range of C_v and record length values.

ContourPlots.m: Create contour or surface plots for values of f_+ and RI as a function of C_v and β for different flow record lengths.

EffHistograms.m: Creates sediment yield histograms from a random sample of the lognormal flow record samples and plots them as a function of β , C_v , and flow record length. Also plots the lognormal sediment yield curve associated with that sample.

BrokenPowerLaw.m: Calculates f_+ and $Q_{eff.spread}$ as a function of C_v for single and broken power law discharge-sediment transport relations in compound channels.

Entrainment.m: Same as above except introduces the Meyer-Peter Mueller bedload equation with a sediment entrainment threshold.

Chapter 2 Magnitude Frequency Analysis R Scripts

Table S.1 Chapter 2 R Script names and descriptions

R Script	Description
Data Import and Analysis	
ImportDV.R	A function developed by USGS in the waterData package used to import daily flow data from NWIS [<i>Ryberg and Vecchia, 2012</i>].
ImportSaveFlow.R	A script that uses ImportDV.R to import, clean, format and save daily flow records from NWIS.
ImportSaveFlowExt.R	Same as above, but also imports data from a list of nearby gages with long-term records used to extend the flow record of a gage with a short-term record
RecordExtension.R	Uses procedure outlined by Moog et al. [1999] to extend flow record data.
FlowMetrics.R	Uses imported and extended flow record data to calculate statistical flow metrics.
NWIS_SuspDataClean.R	Using a list of selected sites and the USGS Sediment Data Portal Discrete Data table (downloaded from http://cida.usgs.gov/sediment), this script cleans and formats the suspended sediment data and calculates the concentration of sediment > 0.0625mm. Note that bed load data were compiled manually from various sources.
importPK.R	A script that imports instantaneous annual maximum discharge series for a list of sites and calculates the value of specified return intervals using the Weibull plotting position method.
importGSD.R	A script that imports grain size distribution data for bed material samples from NWIS and calculates the mean and median D_{50} and D_{84} based on available samples.
Sediment Rating Curve Analysis	
SuspRegAnalysis.R BedRegAnalysis.R	Imports formatted sediment load-discharge data pairs and calculates log-linear ordinary least squares and robust linear regression coefficients as well as bias correction factors. The bed load script uses available discharges with no sediment transport to estimate a sediment entrainment discharge threshold.

Table S.1 cont. Chapter 2 R Script names and descriptions

R Script	Description
Magnitude-Frequency Analysis	
SuspSedYield.R BedSedYield.R	Uses sediment rating curves calculated in from the SuspRegAnalysis.R and BedRegAnalysis.R scripts along with the flow records for each site to calculate the magnitude and frequency of sediment transport. Uses various methods to calculate the effective discharge including the histogram approach, fitting a log-normal PDF to the flow distribution, as well as calculating the empirical density function. Calculates sediment yield metrics, and plots sediment rating curves, flow distributions, sediment yield curves, and cumulative yield curves.
Results Analysis	
InterSiteCompare.R	Compares site characteristics (e.g., bed material size, drainage area, etc.) between fine bed and coarse bed sites. Also plots and compares relationships between metrics describing aspects of the flow regime, physical channel properties, and sediment yield characteristics.
BedResultsAnalysis.R SuspResultsAnalysis.R	Compiles flow, physical, and sediment yield metrics and runs log-linear and nonparametric correlation analyses to identify 1st order relationships among variables.

Note: The majority of these scripts have two forms: one for coarse bed and one for fine bed site data

Chapter 3 Bankfull Discharge Estimation & Prediction R Scripts

R scripts for importing USGS channel field measurements for creating at-a-station hydraulic geometry relations and determining bankfull discharge are given here.

Table S.2 List of R Scripts used in Chapter 3

R Script	Description
<code>importXS.R</code>	A script that imports discharge field measurement data and uses measured discharge values coupled with channel width, cross-section area, and calculated average depth to plot figures aiding in identification of bankfull discharge following the hydraulic geometry approaches discussed by Williams [1978].
<code>findQbf.R</code>	Once the bankfull discharge has been visually estimated using the plots from <code>importXS.R</code> , and input into a table, this script estimates the bankfull width and depth using linear interpolation and the field measurement data.
<code>QbfBedload.R</code> <code>QbfSuspload.R</code>	Analyses and compares the relationship between estimates of the bankfull discharge and other design discharge variables often used to estimate Q_{bf} such as the $Q_{1.5}$ and Q_2 floods, Q_{eff} , and Q_{s50} , the half yield discharge.

Chapter 4 Sediment Yield Uncertainty Analysis R Scripts

MFA Uncertainty Analysis R Code:

RegUncertainty.R: Implements ordinary least squares, robust linear with bootstrapped uncertainty bands, and Bayesian robust regression methods to develop the sediment rating curves.

MFAuncertainty.R: Calculates the relative widths of uncertainty intervals for Q_{eff} and Q_{s50} for all sites using ordinary least squares methods for the sediment rating curve and a kernel density function for the flow frequency distribution.

UncertaintyBoot.R: Calculates the relative widths of uncertainty intervals for Q_{eff} and Q_{s50} for all sites by bootstrapping the sediment yield curve and hence bootstrapping Q_{eff} and Q_{s50} instead of calculating the product of sediment rating curve uncertainty bands with flow frequency distribution uncertainty bands as in **MFAuncertainty.R**.

Non-stationarity R Code:

urbanization.R: Imports flow records for a site, breaks flow record up into decades, calculates decadal flow duration curve as well as decadal mean and standard deviation.

Fits a lognormal distribution to the flows using method of moments. Generates a lognormal sediment yield curve and cumulative sediment yield curve to demonstrate the influence of urbanization and non-stationarity in the flow record on Q_{eff} and Q_{s50} .

Sediment Transport R Code:

transportBed.R: Imports cross-sectional geometry as well as at-a-station hydraulic geometry measurements to create various representations of the discharge-depth, discharge-velocity, and discharge-width relationships. Uses these relationships to drive various bed load transport models to calculate Q_{eff} and Q_{s50} and compare these estimates with those generated from the data-based log linear models for coarse bed sites used elsewhere in this dissertation.

transportSusp.R: Same as above, only imports data from fine bed sites and estimates Q_{eff} and Q_{s50} using total load equations.