

# Manual for Package: sediment-transport

## Revision 1:9M

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## 1 @GrainSizeDistribution

### 1.1 GrainSizeDistribution

### 1.2 assign\_channel

### 1.3 bimodality

### 1.4 export\_csv

### 1.5 export\_shp

1.6 group\_channels

1.7 group\_curvature

1.8 group\_histograms

1.9 load\_coordinates

## 2 bedform

2.1 bedform\_dimension\_rijn

bed form dimensions  
cf. rijn 1984 iii

2.2 dune\_celerity

2.3 dune\_dimension\_allen\_1978

2.4 dune\_dimension\_bradley\_venditti

2.5 dune\_dimension\_gill

**2.6** `dune_dimension_julien_klaassen_1978`

**2.7** `dune_dimension_yalin`

**2.8** `dune_height_karim`

### **3** `bedload`

**3.1** `angle_of_repose`

**3.2** `bedload_direction`

`bedload transport direction`

**3.3** `bedload_einstein`

`bed load transport according to einstein jr.`

**3.4** `bedload_engelund_fredsoe`

`bed load transport according to engelund and fredsoe`

**3.5** `bedload_layer_thickness`

**3.6** `bedload_layer_thickness_mclean`



### 3.7 bedload\_transport\_ashida\_michue\_1972

### 3.8 bedload\_transport\_bagnold\_1941

### 3.9 bedload\_transport\_bagnold\_1973

### 3.10 bedload\_transport\_egashira

### 3.11 bedload\_transport\_mpm

bed load transport rate according to meyer-peter-mueller

### 3.12 bedload\_transport\_rijn

bed load transport  
method of van Rijn (1984)

```
function [Q_b q_b Phi_b] = bed_load_transport_rijn(C,d50,d90,U,d,b)
```

d50 [mm] (converted to m)

d90 [mm] (converted to m)

d : depth

b : width

### 3.13 bedload\_transport\_wu

bed load transport according to Wu

## 4 sediment-transport

analysis and prediction of fluvial sediment transport and  
morphodynamics

### 4.1 bifurcation\_critical\_aspect\_ratio

critical aspect ratio of a bifurcation  
c.f. redolfi and pittaluga

### 4.2 critical\_grain\_size

critical grain size for a given shear velocity

### 4.3 critical\_shear\_stress

critical shear Stress

### 4.4 critical\_shear\_stress\_ratio

critical shields parameter  
aka critical shear stress ratio  
aka shields curve

### 4.5 critical\_shear\_stress\_wiberg

### 4.6 critical\_shear\_stress\_wu

critical shear stress, according to wu

### 4.7 critical\_shear\_velocity

critical shear velocity

## 5 derive

### 5.1 derive\_critical\_grain\_size

### 5.2 derive\_mpm\_foramtive\_discharge

### 5.3 derive\_suspended\_sediment\_concentration\_profile

### 5.4 derive\_suspended\_sediment\_concentration\_profiles

### 5.5 mpm\_solve\_for\_dm

## 6 sediment-transport

analysis and prediction of fluvial sediment transport and  
morphodynamics

### 6.1 dimensionless\_grain\_size

dimensionless grain size

### 6.2 dynamic\_shear\_stress

dynamic shear stress

## 7 empirical-laod

### 7.1 sediment\_load\_ART\_syvitski\_2003

## 7.2 sediment\_load\_ART\_syvitski\_2003b

# 8 sediment-transport

analysis and prediction of fluvial sediment transport and  
morphodynamics

## 8.1 formative\_discharge

## 8.2 grain\_size\_from\_shear\_stress

## 8.3 hiding\_exposure\_wu

## 8.4 integration\_factor\_wright\_parker

## 8.5 mobility\_parameter\_rijn

# 9 morphodynamics/@Nodal\_Point

## 9.1 Adot

ODE of the nodal point relation (time-derivative of branch cs-area)

## 9.2 Nodal\_Point

Nodal point relation for bifurcations, according to Wang

### 9.3 `Qs_in`

sediment entering branches

### 9.4 `Qs_out`

sediment leaving branches

### 9.5 `derive_jacobian`

derive Jacobian of the nodal point relation

### 9.6 `discharge`

discharge through branches  
there is a problem with this relation, as soon as the bed of one  
channel is perturbed,  
the water level at the bifurcation changes, so the depth of the  
second channel is not  
entirely independent

### 9.7 `geometry`

cross section geometry of branches

### 9.8 `jacobian`

jacobian of the nodal point relation  
semi-autogenerated

### 9.9 `phase_diagram`

phase diagram

### **9.10 phase\_diagram\_wang**

phase diagram of Nodal point relation

### **9.11 solve**

solve the nodal point relation for critical points

### **9.12 stability\_analysis**

stability analysis for a given configuration

## **10 morphodynamics**

### **10.1 bar\_mode\_crosato**

bar mode of a river according to crosato

## **11 sediment-transport**

analysis and prediction of fluvial sediment transport and  
morphodynamics

### **11.1 mpm2diameter**

### **11.2 reference\_to\_flux\_averaged\_concentration\_rijn**

## **12 roughness-and-shear-stress**

### **12.1 bedform\_roughness\_rijn**

form drag according to van Rijn

## 12.2 bedform\_roughness\_rijn\_2007

## 12.3 chezy\_roughness\_engelund\_fredsoe

chezy roughness according to engelund and fredsoe

## 12.4 grain\_roughness\_mpm

## 12.5 grain\_roughness\_nikuradse

## 12.6 grain\_roughness\_rijn

grain roughness (skin friction) according to van Rijn

## 12.7 grain\_roughness\_wu

## 12.8 nikuradse\_roughness\_length

## 12.9 roughness\_einstein

chezey coefficient according to Einstein

## 12.10 roughness\_height\_mclean

12.11 roughness\_height\_mclean\_1972

12.12 skin2total\_stress\_ratio

12.13 skin\_2\_total\_friction\_eh

skin friction to total friction conversion according to engelund  
and hansen  
function [theta,C] = skin\_2\_total\_friction\_eh(theta\_t,Ct)

12.14 total2skin\_stress\_ratio

12.15 total\_2\_skin\_friction

12.16 total\_roughness\_engelund\_fredsoe

roughness lenght according to engelund and fredsoe

12.17 total\_roughness\_engelund\_fredsoe2

12.18 total\_roughness\_karim

12.19 total\_roughness\_karim2



**12.20**   `total_roughness_length_mclean`

**12.21**   `total_roughness_parker`

**12.22**   `total_roughness_rijn`

`total roughness according to van rijn`

**12.23**   `total_roughness_yalin`

**12.24**   `total_to_skin_stress_kishi`

## **13   sediment-transport**

`analysis and prediction of fluvial sediment transport and  
morphodynamics`

**13.1**   `saltation_layer_thickness`

**13.2**   `sediment_transport_scale`

**13.3**   `sediment_transport_waves`

`sediment transport by waves`

### 13.4 shear2shields

### 13.5 shear\_velocity\_mclean

### 13.6 shields\_number

normalized shear stress, shear stress ratio

## 14 suspension

### 14.1 adaptation\_length\_armanini

### 14.2 adaptation\_length\_bed

adaptatoion lenght of bed morphology

### 14.3 adaptation\_length\_flow

adaption length of the flow

## 15 suspension/concentration-profiles/@Hermite\_profile

### 15.1 Hermite\_profile

suspended sedimen profile in form of a hermite polynomial

### 15.2 fit

fit suspended sediment profile

### 15.3 predict

predict suspended sediment concentration

### 15.4 regmtx

regression matrix

### 15.5 transform

hermite profile

## 16 suspension/concentration-profiles/@Parabolic\_Constant\_Profile

### 16.1 Parabolic\_Constant\_Profile

parabolic-constant profile

### 16.2 fit

fit the suspended sediment concentration profile

### 16.3 predict

predict suspended sediment concentration

### 16.4 regmtx

regression matrix

### 16.5 transform

transformation of vertical coordinate

## 17 suspension/concentration-profiles/@Rouse\_Profile

### 17.1 Rouse\_Profile

suspended sediment concentration profile

### 17.2 fit

fit the suspended sediment concentration profile

### 17.3 mean\_concentration

### 17.4 predict

predict the suspended sediment concentration

### 17.5 regmtx

regression matrix

### 17.6 rouse\_number

rouse number (suspension number) for given grain size and shear velocity

### 17.7 rouse\_number\_to\_grain\_diameter

convert known rous number (suspension parameter) to grain size diameter

### 17.8 set\_parameters

## 17.9 transform

transform the vertical coordinate

## 18 suspension/concentration-profiles

### 18.1 Exponential\_SSC\_Profile

### 18.2 vertical\_ssc\_profile\_exponential

### 18.3 vertical\_ssc\_profile\_mclean

vertical profile of the suspended sediment according to McLean

## 19 suspension

### 19.1 matching\_level\_mclean

## 20 suspension/reference-concentration

### 20.1 reference\_concentration\_einstein

### 20.2 reference\_concentration\_mclean

### 20.3 reference\_concentration\_mclean\_2

reference concentration according to smith and mclean

20.4 reference\_concentration\_rijn

20.5 reference\_concentration\_wright\_parker

20.6 reference\_concentration\_zyserman\_fredsoe

## 21 suspension

21.1 reference\_height\_mclean

21.2 reference\_height\_rijn

21.3 settling\_time\_constant\_eddy\_viscosity

21.4 settling\_velocity

Settling velocity  
5.23d in julien-2010  
settling velocity according to cheng  
settling velocity in water  
stokes settling velocity  
d : [mm] diameter of sediment particle  
ws : [m/s] settling velocity  
signed ws < 0 : falling  
(Note: was R, radius in m)  
  
valid for small particles

## 21.5 settling\_velocity\_to\_diameter

invert settling velocity to diameter

## 21.6 stratification\_parameter\_rijn

## 21.7 stratification\_parameter\_wright\_parker

## 21.8 stratification\_profile\_mclean

## 21.9 suspended\_grain\_size

suspended grain size distribution based on bed material grain size distribution

assumes that probability of suspension is inverse proportional to grain diameter

as in Engelund-Hansen transport relation

- no hiding effects considered

- no threshold for large grains applied

- no flocking considered

note: actual distribution varies with the depth

d : [1xnd] grain size in arbitrary units (on linear, not on log scale)

h\_bed : [nsxnd] fractions of sediment of size d

## 21.10 suspended\_grain\_size\_non\_linear

suspended grain size distribution based on bed material grain size distribution

assumes that probability of suspension is inverse proportional to grain diameter

as in Engelund-Hansen transport relation

- no hiding effects considered
  - no threshold for large grains applied
  - no flocking considered
- note: actual distribution varies with the depth

`d` : [1xnd] grain size in arbitrary units (on linear, not on log scale)  
`h_bed` : [nsxnd] fractions of sediment of size `d`

### 21.11 `suspended_grain_size_rijn`

grain size of the suspended sediment according to van rijn, empirical

### 21.12 `suspended_sediment_adaptation_length_claudin`

### 21.13 `suspended_transport_mclean`

vertical profile of the suspended sediment according to McLean  
 $u := u_s / \kappa \log(z/z_0);$   
 $I = 1 / (\int_a^h c \, dz \int_a^h u \, dz) \int_a^h c \, u \, dz$

### 21.14 `suspended_transport_rijn`

suspended load transport according to van Rijn

### 21.15 `suspended_transport_van_rijn_simplified_1984`

### 21.16 `suspended_transport_wright_parker`



### 21.17 suspended\_transport\_wu

suspended sediment transport according to widthu

### 21.18 suspension\_parameter

### 21.19 viscosity\_correction\_sediment

## 22 test

### 22.1 test\_Rouse\_profile\_fit

### 22.2 test\_adaptation\_length\_bed

### 22.3 test\_bed\_load\_transport\_rijn

### 22.4 test\_bedform\_roughness\_rijn\_2007

### 22.5 test\_bedload\_transport\_mpm

### 22.6 test\_critical\_shear\_stress

22.7 test\_sediment\_transport

22.8 test\_sediment\_transport\_engelund\_hansen\_1

22.9 test\_sediment\_transport\_engelund\_hansen\_2

22.10 test\_sediment\_transport\_karim

22.11 test\_sediment\_transport\_relation

22.12 test\_sediment\_transport\_rijn

22.13 test\_settling\_velocity\_to\_diameter

22.14 test\_suspended\_transport\_mclean

22.15 test\_suspended\_transport\_wright\_parker

22.16 test\_total\_transport\_engelund\_hansen

### **22.17 test\_total\_transport\_yang**

## **23 total-transport**

### **23.1 fractional\_transport\_engelund\_hansen**

fractional sediment transport according to engelund and hansen

### **23.2 sediment\_transport\_directed**

directed sediment transport

### **23.3 sediment\_transport\_relation\_fit**

### **23.4 sediment\_transport\_relation\_predict**

### **23.5 total\_transport\_ackers\_white**

### **23.6 total\_transport\_bagnold**

total sediment transport according to bagnold

### **23.7 total\_transport\_eh\_distribution**

total sediment transport according to engelund hansen  
for a given grain size distribution

### **23.8 total\_transport\_engelund\_hansen**

total sediment transport according to Engelund and Hansen

### **23.9 total\_transport\_engelund\_hansen\_2**

sediment transport according to engelund and hansen

### **23.10 total\_transport\_karim**

### **23.11 total\_transport\_rijn**

total sediment transport according to van rijn

### **23.12 total\_transport\_wu**

total sediment transport according to wu 2000b

### **23.13 total\_transport\_yang**

## **24 sediment-transport**

analysis and prediction of fluvial sediment transport and  
morphodynamics

### **24.1 transport\_sensitivity\_engelund\_hansen**

### **24.2 transport\_stage\_mclean**

transport stage according to McLean

### 24.3 transport\_stage\_rijn

transport stage as defined by van Rijn