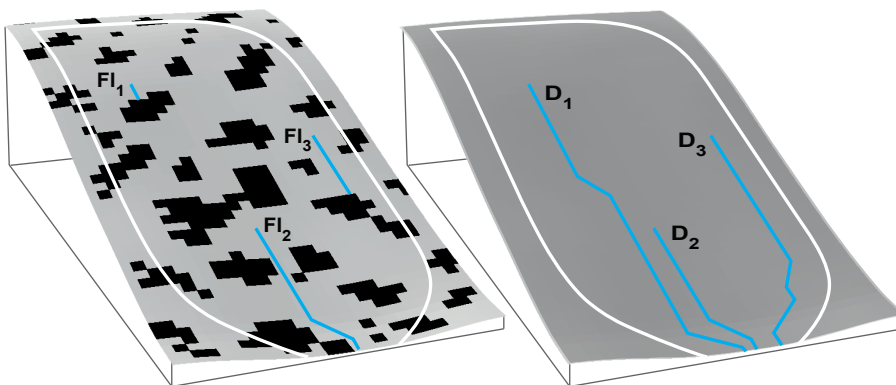


(a)

**Structural-connectivity calculations**Flow length  
( $Fl_i$ , m)Flow path distance to hillslope outlet  
( $D_i$ , m)Structural connectivity  
( $SC_i$ , dimensionless)

$$SC_i = Fl_i / D_i$$

**Virtual example**

$$Fl_1 = 3 \text{ m}; D_1 = 59 \text{ m}$$

$$Fl_2 = 24 \text{ m}; D_2 = 24 \text{ m}$$

$$Fl_3 = 11 \text{ m}; D_3 = 36 \text{ m}$$

$$SC_1 = 0.05$$

$$SC_2 = 1.00$$

$$SC_3 = 0.31$$

Sink areas
  Source areas
  Flow paths

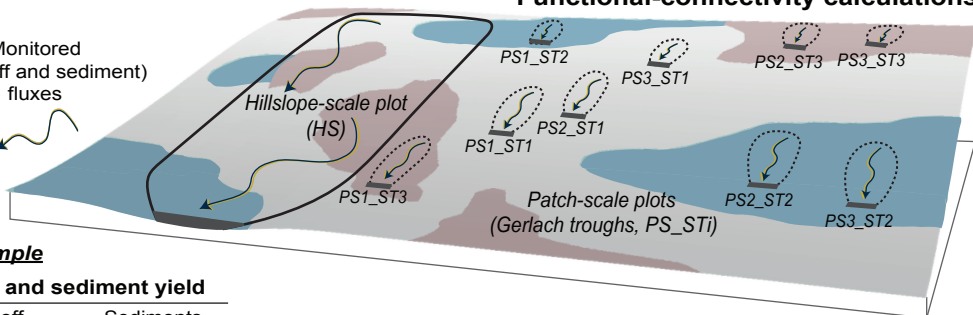
(b)

**Functional-connectivity calculations**

Soil surface types

Monitored  
(runoff and sediment)  
fluxes

ST1  
 ST2  
 ST3

**Virtual event example****Unit-area runoff and sediment yield**

	Runoff $R$ (mm)	Sediments $S$ ( $\text{g m}^{-2}$ )
HS	1.2	3.9
PS_ST1*	4.4	22.8
PS_ST2*	0.8	2.0
PS_ST3*	3.2	9.5

\*Averaged from the corresponding replicate plots

**Integrated patch-scale response****of runoff ( $R_{IPS}$ , mm)**

$$R_{IPS} = \sum_{i=1}^n (R_{PS\_STi} * A_{STi})$$

$$R_{IPS} = 3.44 \text{ mm}$$

**of sediment yield ( $S_{IPS}$ ,  $\text{g m}^{-2}$ )**

$$S_{IPS} = \sum_{i=1}^n (S_{PS\_STi} * A_{STi})$$

$$S_{IPS} = 15.98 \text{ g m}^{-2}$$

**Functional connectivity****of runoff ( $C_R$ , dimensionless)**

$$C_R = R_{HS} / R_{IPS}$$

$$C_R = 0.35$$

**of sediments ( $C_S$ , dimensionless)**

$$C_S = S_{HS} / S_{IPS}$$

$$C_S = 0.24$$

**Proportional area of surface types in HS**

	ST1	ST2	ST3
A	0.60	0.20	0.20