Supplementary information for the article: River suspended-sand flux computation with uncertainty estimation, using water samples and high-resolution ADCP measurements

1 Comparing the empirically-fitted Rouse profile

The presented toolbox includes also a method similar to the SDC method using the Rouse profile (Rouse, 1937). Instead of using the exponential profile of Camenen and Larson (2008) and the Bayesian modeling BaM! (Mansanarez et al., 2019), in this so-called SDC-Rouse method, the Rouse profile is fitted empirically to the data points. Except this more traditional and widely used approach for the vertical integration, the lateral integration and determination of the point concentration remain the same.

The relative differences $\epsilon_{\Phi,\mathrm{Rouse-ISO}}$ and $\epsilon_{\Phi,\mathrm{SDC-Rouse}}$ between the sand fluxes estimated using the SDC-Rouse method Φ_{Rouse} and the ISO Φ_{ISO} or SDC Φ_{SDC} method, respectively, are determined as:

$$\epsilon_{\Phi,\mathrm{Rouse-ISO}} = (\Phi_{\mathrm{Rouse}} - \Phi_{\mathrm{ISO}})/\Phi_{\mathrm{ISO}} \tag{1}$$

and

$$\epsilon_{\Phi,\mathrm{SDC-Rouse}} = (\Phi_{\mathrm{SDC}} - \Phi_{\mathrm{Rouse}})/\Phi_{\mathrm{Rouse}} \tag{2}$$

The relative differences $\epsilon_{\Phi,\mathrm{Rouse-ISO}}$ range from -40 to 36 % and show a slight underestimation of the sand fluxes determined using the Rouse profile compared to the ISO method for the Isère River measurements (Figure 1). In contrast, no such bias is visible for the relative differences between the SDC and SDC-Rouse methods, which range from -30 to 32 % (Figure 2). In general, the relative differences between the three different methods (ISO, SDC, SDC-Rouse) are usually smaller than the estimated uncertainty in the flux U'_{Φ}. Except the relative difference $\epsilon_{\Phi,\mathrm{Rouse-ISO}}$ calculated for the Amazon which accounts for 32 % is larger than the uncertainty U'_{Φ} (26.6 %). This shows that the uncertainty in the flux measurement is larger than the difference between the applied methods.

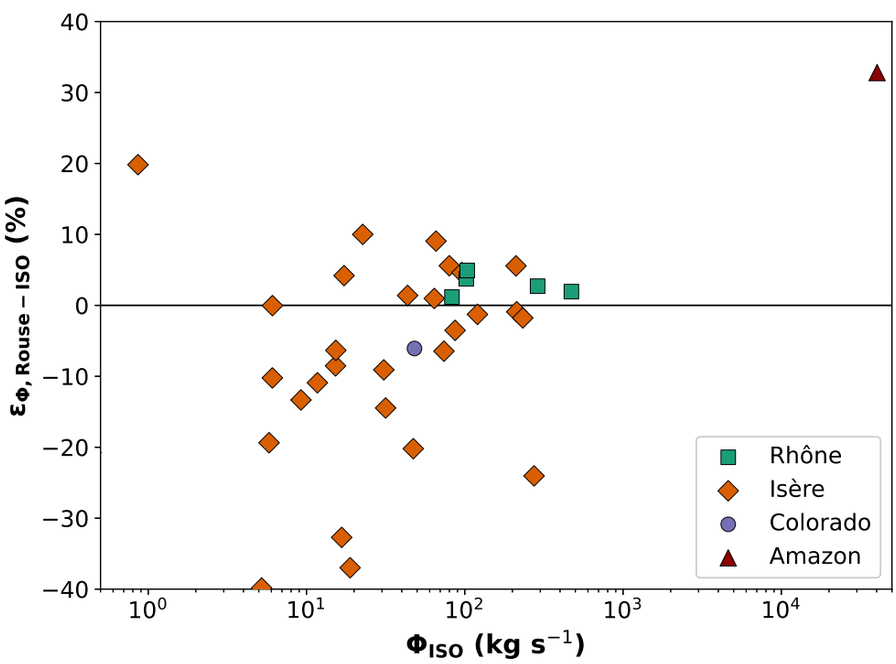

Figure 1: Relative difference $\epsilon_{\Phi,\mathrm{Rouse-ISO}}$ as a function of the suspended-sand flux Φ_{ISO} determined using the ISO method for all four studied rivers, Φ_{Rouse} is determined using an empirically fitted Rouse profile for all four studied rivers.

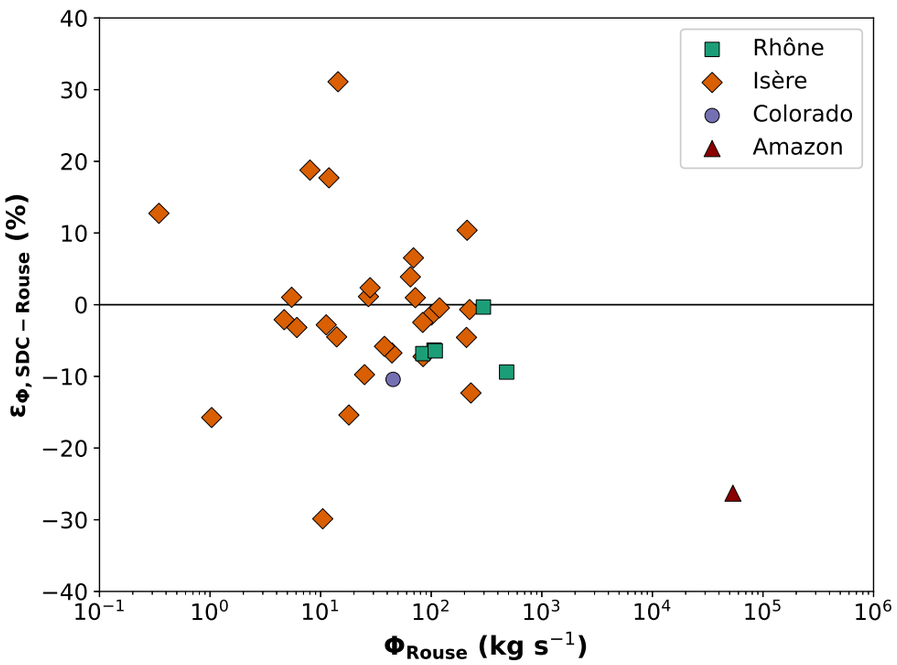

Figure 2: Relative difference $\epsilon_{\Phi,\mathrm{SDC-Rouse}}$ as a function of the suspended-sand flux Φ_{SDC} determined using the SDC method for all four studied rivers, Φ_{Rouse} is determined using an empirically fitted Rouse profile for all four studied rivers.