S1 Timing for sediment mobilization at the Purapel catchment

The available data on suspended sediments in the studied river have a daily resolution. Catchment size and flow velocity on first-order rivers are important in estimating whether or not a daily sampling may reproduce the main events of erosion. To estimate ranges for the travel time of particles in the studied landscape, we measured streamflows in a small river of the region (∼750 ha drained area) on two dates (high and low flow). We obtained a maximum flow velocity of 0.58 m/s during a flood in the wet season (August 2021), and a minimum of 0.03 m/s during the dry season (March 2022). Using that range of flow velocities, we estimated a travel time at constant velocity for all the distribution of distances to the gauge *Purapel en Sauzal* (Figure S1). For the flood, the maximum travel time is close to 26 hrs. During low flows it is of hundreds of hours.

We also estimated the Time of Concentration using several approaches, recognizing the very large uncertainties in its estimation (Grimaldi et al., 2012, Table S1). The highest Tc (Viparelli, 1961-1963) was very close to the maximum travel time estimated from the distances to the outlet.

Based on those results, we argue that a daily sampling can capture sediment mobilization for a wide range of hydrologic events affecting the entire catchment. To calculate suspended sediment discharge, we should assume a distribution which is unknown, since sub-daily data is not available. In the absence of that sub-daily data, we assumed a constant value for the entire day, which is obtained from the instant measurements published by the DGA.

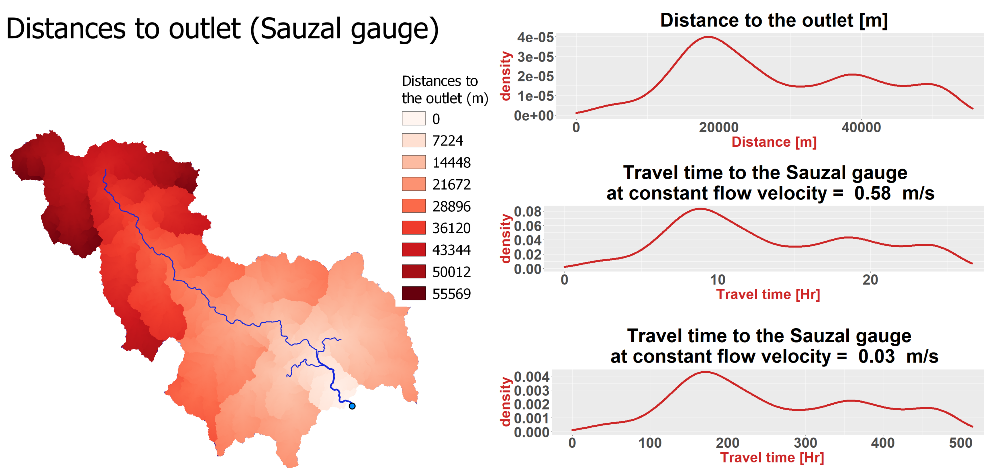

Figure S1: Estimations for travel time of particles between the hillslopes and the stream gauge at constant flow velocity. Distances to the outlet were calculated using TauDEM version 5 (`https://hydrology.usu.edu/taudem/taudem5/`)

Table S1: Several estimations for Time of Concentration. See Grimaldi et al. (2012) for details

Source of equation	Tc(Hours)	Tc(minutes)						
'Department of Public Works' (1995)	8,42892	505,7	L=	34,529	H=	1930		
Giandotti (1934)	14,6534	879,2	A=	406	L=	43,28	H=	154,1
Kirpich (1940)	2,02502	121,5	L=	141995	S=	0,26		
Viparelli (1961, 1963)	26,6133	1597	L=	55569	V=	0,58		

S2 Analysis of missing data of streamflow and suspended sediment concentration in the *Río Purapel en Sauzal* Station

The gauge *Río Purapel en Sauzal* was monitored by the Chilean Directorate of Water since 1981 on a daily basis. Streamflow (Q, m^3/s) records includes the period 1981-06-02 to 2019-06-30, while Suspended Sediment Concentration (SSC, mg/l) was recorded between 1985-06-06 and 2018-11-04. The Suspended Sediment Discharge, calculated as the product Q$\times$SSC, can be obtained for a total of 10,105 daily data. That means 33.06% of missing data.

Previous studies on Central-South Chile had reported a decline in sediment transport together with water in rivers after 2010 (Méndez-Freire et al., 2022; Tolorza et al., 2019). Under presumable non-stationary conditions, we discarded the usage of gap-filling techniques for trend analysis. Instead, we decided to carry out a monthly analysis using only months with less than 15 missing data (i.e., more than 50% of available data). The monthly amount of data (%) is in figure S2, and we noticed that our threshold of 50% discard a large amount of months, which difficult the analysis of trends.

To obtain more reliable results, we decided to aggregate the data by season, but increasing the threshold percent of available data from 50% to 66.6% (i.e, accepting a maximum of 30 missing daily data in each 90-day season period). Here we define seasons as Autumn (MAM), Winter (JJA), Spring (SON) and Summer (DJF).The percent of data by season is in figure S3.

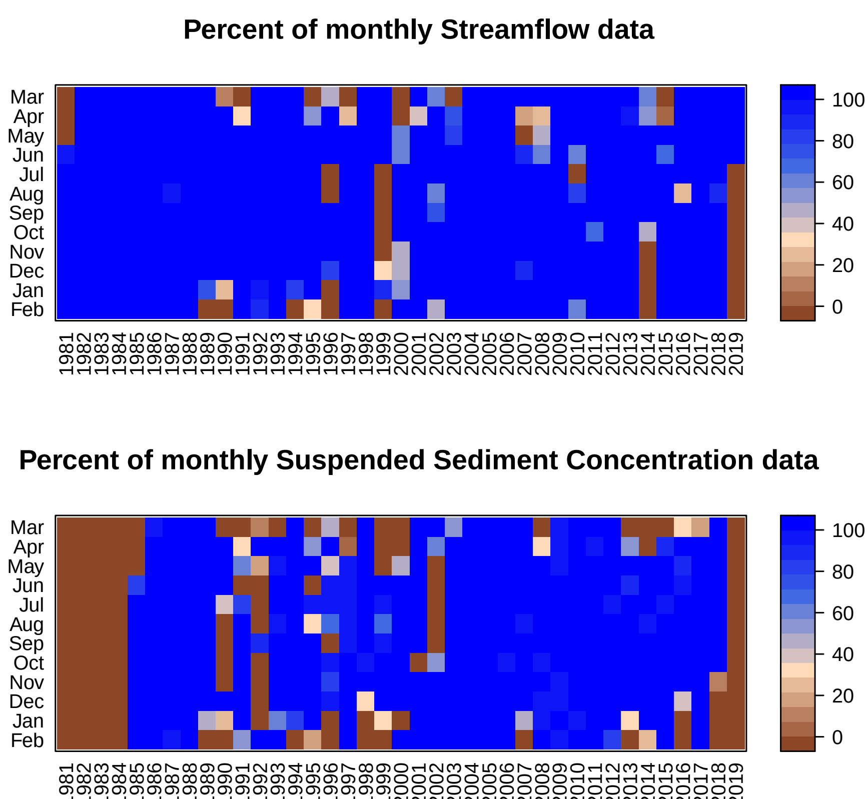

Figure S2: Percent of monthly data on a daily basis

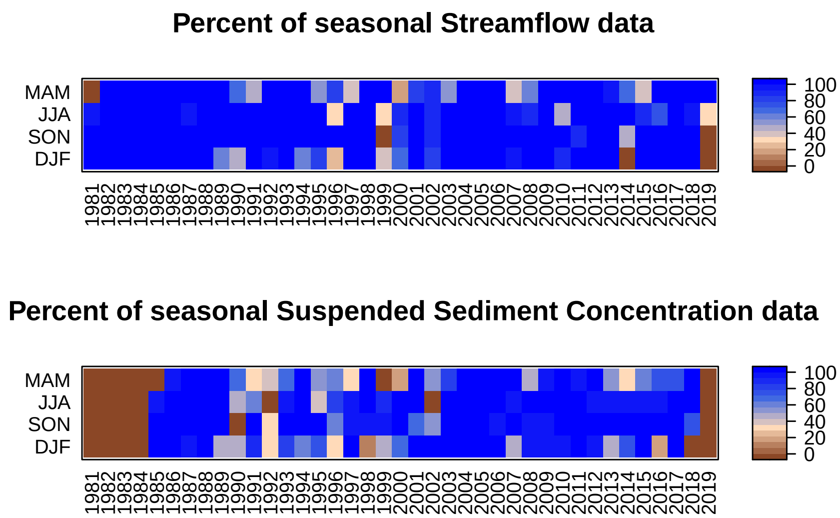

Figure S3: Percent of seasonal data on a daily basis

S3 Baseflow separation on daily streamflow data at Purapel en Sauzal station

We calculated the daily baseflow at Purapel en Sauzal station with the Lyne and Hollick filter (Ladson et al., 2013) by using several α values between 0.5 and 0.95 and $n.reflected$=30 days as parameters. The results for each α for 1994 is in Fig. S4 as an example. Daily CR2met precipitation is plotted for reference. All resulted baseflows are available in the supporting information Baseflow.RData file. We selected the results obtained with α=0.7 for further trend analysis, given the observed magnitudes and shape of the baseflow time series.

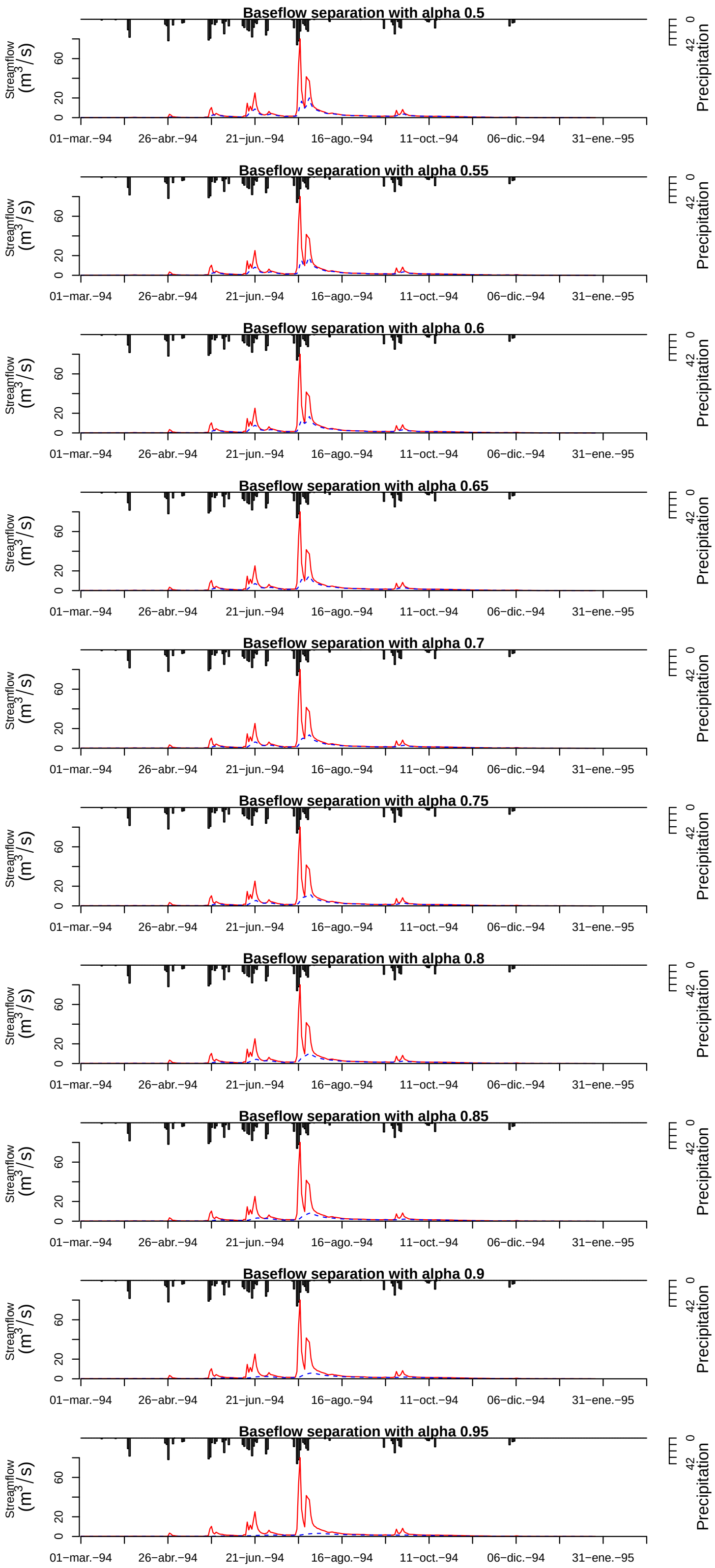

Figure S4: Streamflow (red), baseflow (blue) and rainfall (black) for the hydrologic year (M-F) 1994

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