Supporting Information for

Power-Law between the Apparent Drainage Density and the Pruning Area

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Introduction

In this supporting information, we present total six figures supporting the NHDPlusV2 data analysis and the empirical topographic analyses for the 14 studied river networks in the contiguous United States. They are listed in the ascending order of Connectivity Status Index : the Labette Creek, the South Prong Alafia River, and the North Fork Salt River, the Farmington River, the Ottauquechee River, the Schoharie River, the Racoon Creek, the Carmel River, the St. Joe River, the French Broad River, the White River, the Brushy River, the St. Regis River, and the Molalla River.

Figure S1 illustrates the layout of all studied river networks. Figure S2 depicts the distribution of source area values provided in NHDPlusV2. Figure S3 shows the power law relationship between upstream length and its corresponding upslope area along the mainstream (i.e., Hack's law). The semi-log linear trends over stream-orders are presented in Figure S4 for the number of streams and the mean length, and in Figure S5 for the mean drainage area and the mean eigenarea, which result the associated Horton's ratios. Figure S6 shows the area-exceedance distribution and its corresponding normalized plot by the estimated power-law exponent.

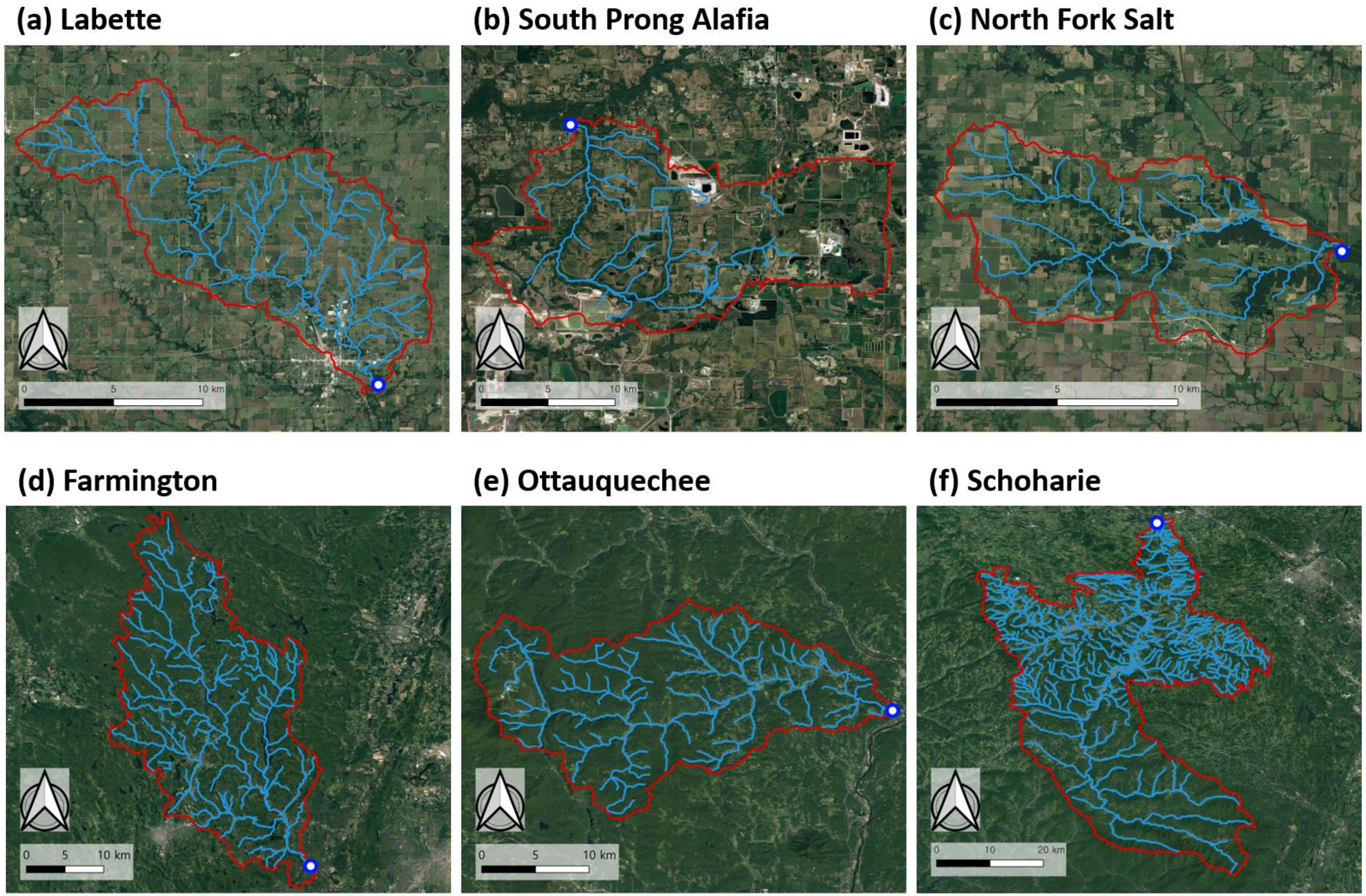

Figure S1. Structures of 14 river networks investigated in this study. The presented order is the same as in Table 1. A circle mark in each figure represents the river basin outlet. River network layouts (light blue color lines) are originated from NHDPlusV2. Satellite images on the background of the study areas are obtained from ©Google Earth.

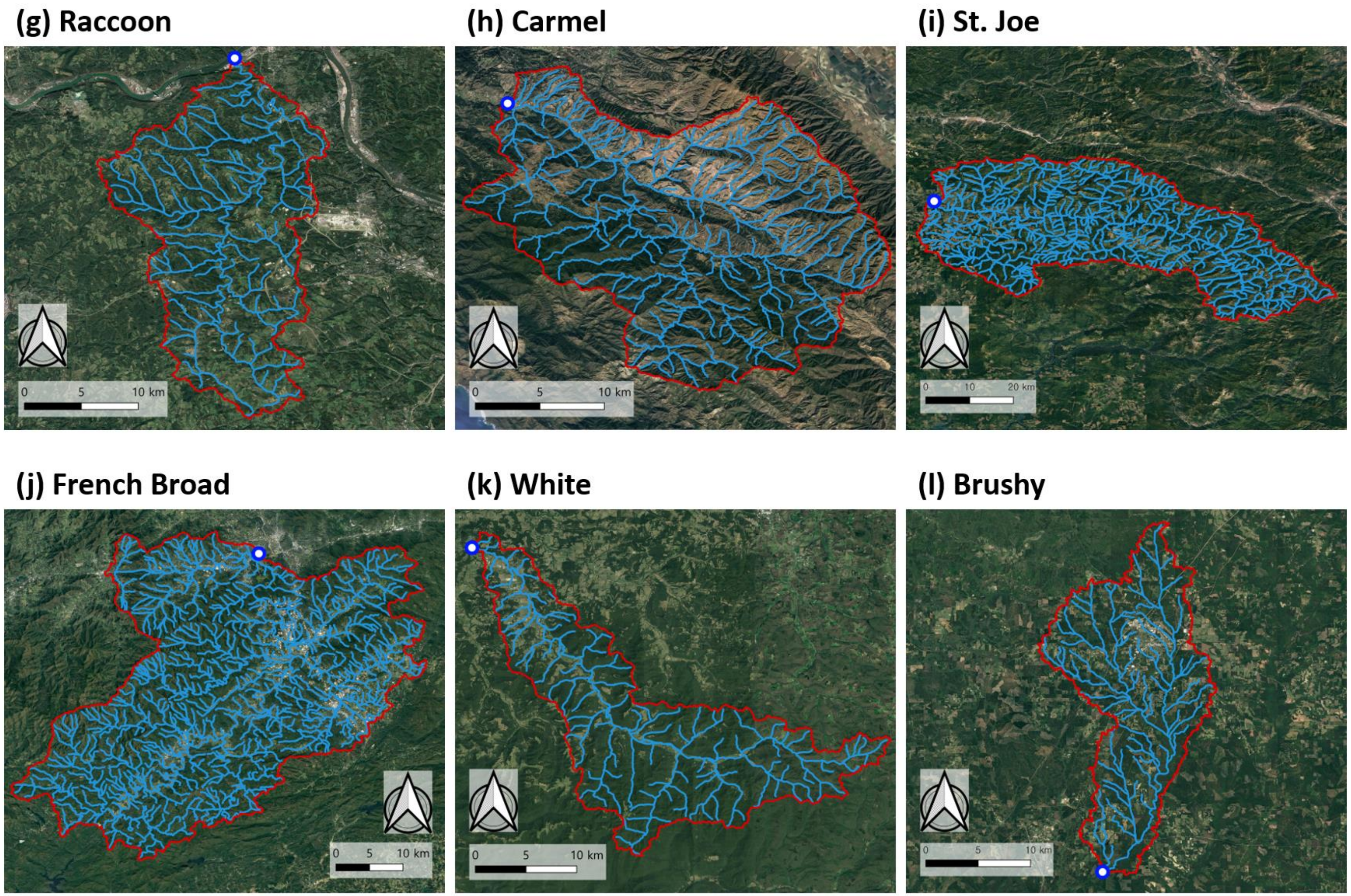

Figure S1. (con't)

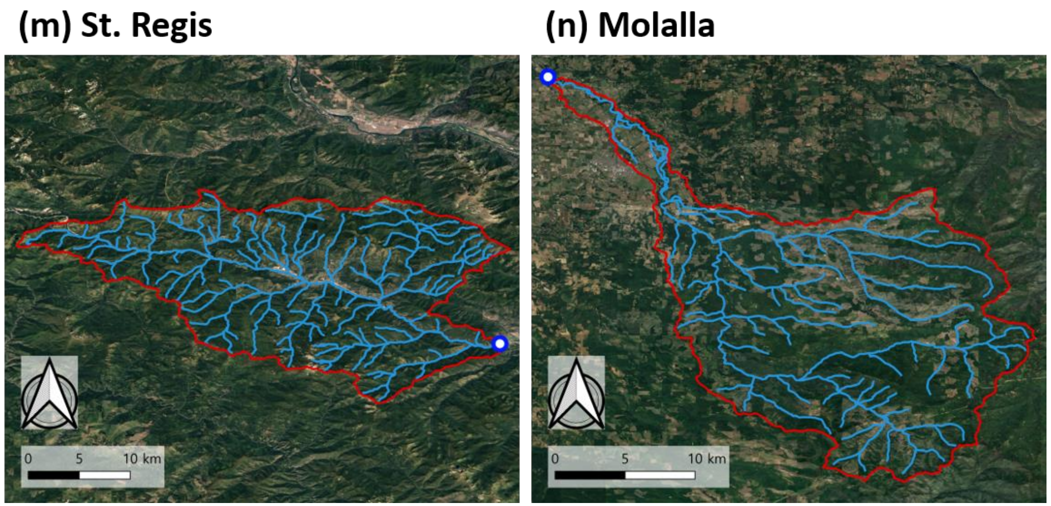

Figure S1. (con’t)

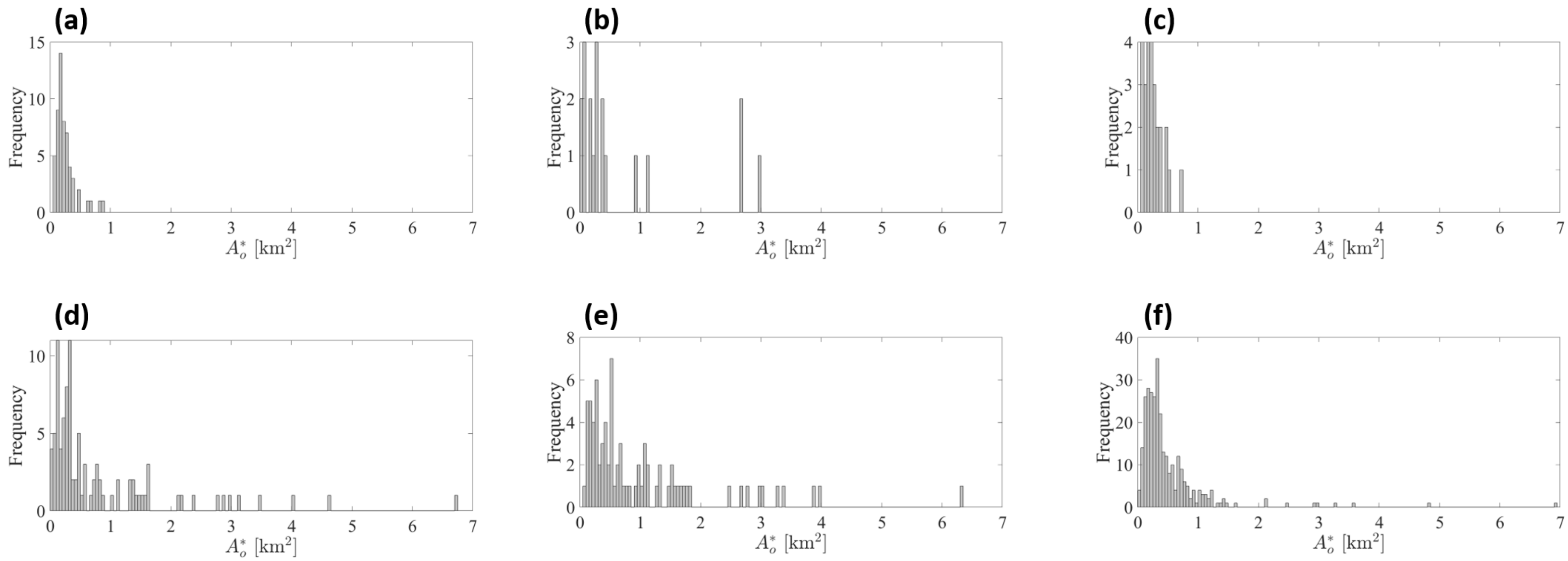

Figure S2. Histogram generated from source area values at every channel head in NHDPlusV2 dataset A_o* for 14 studied river networks. The presented order is the same as in Figure S1. Each of median value was assigned as a channel forming area A_o to delineate respective river networks (Table 1 in the main text).

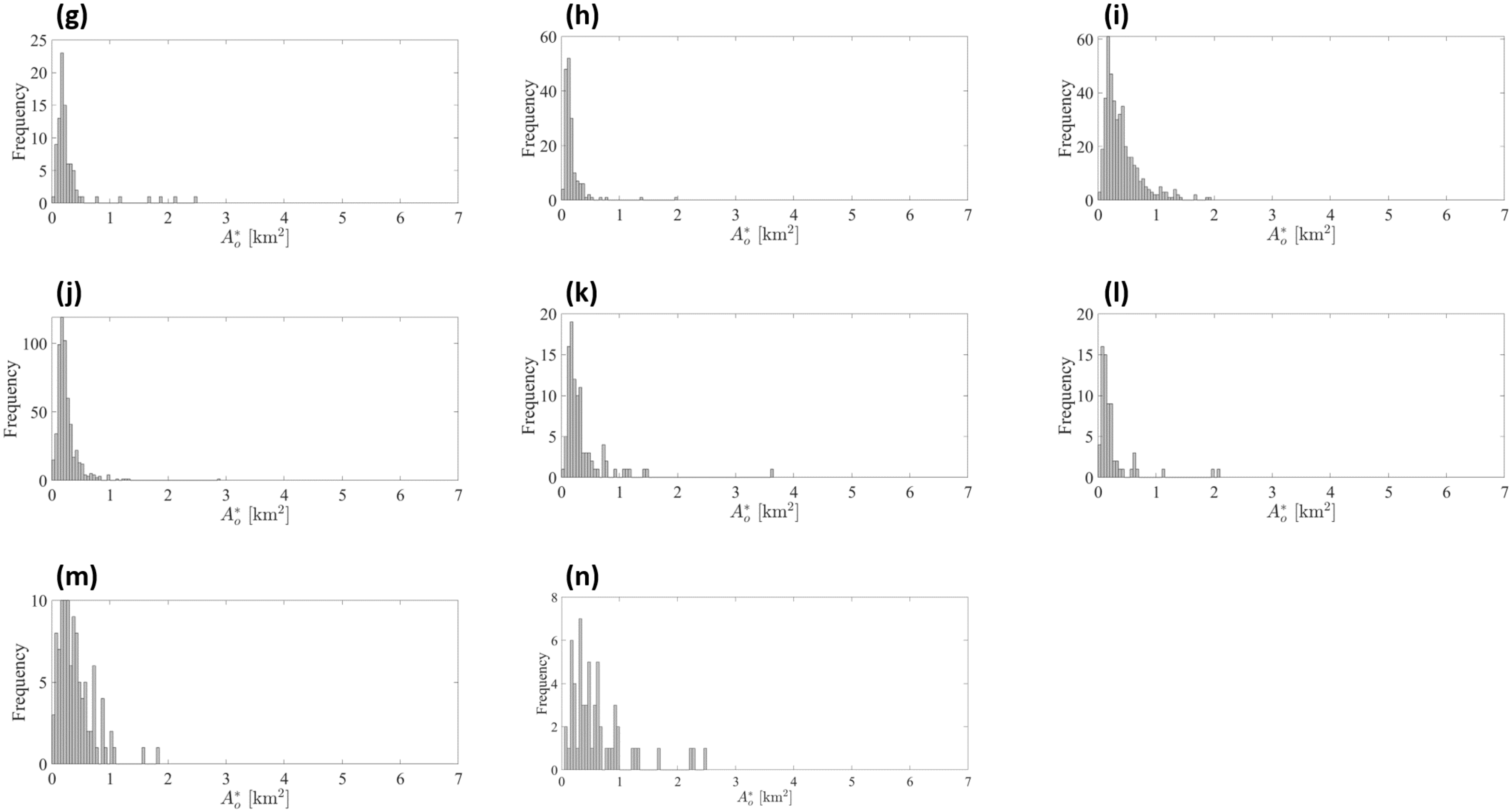

Figure S2. (con't)

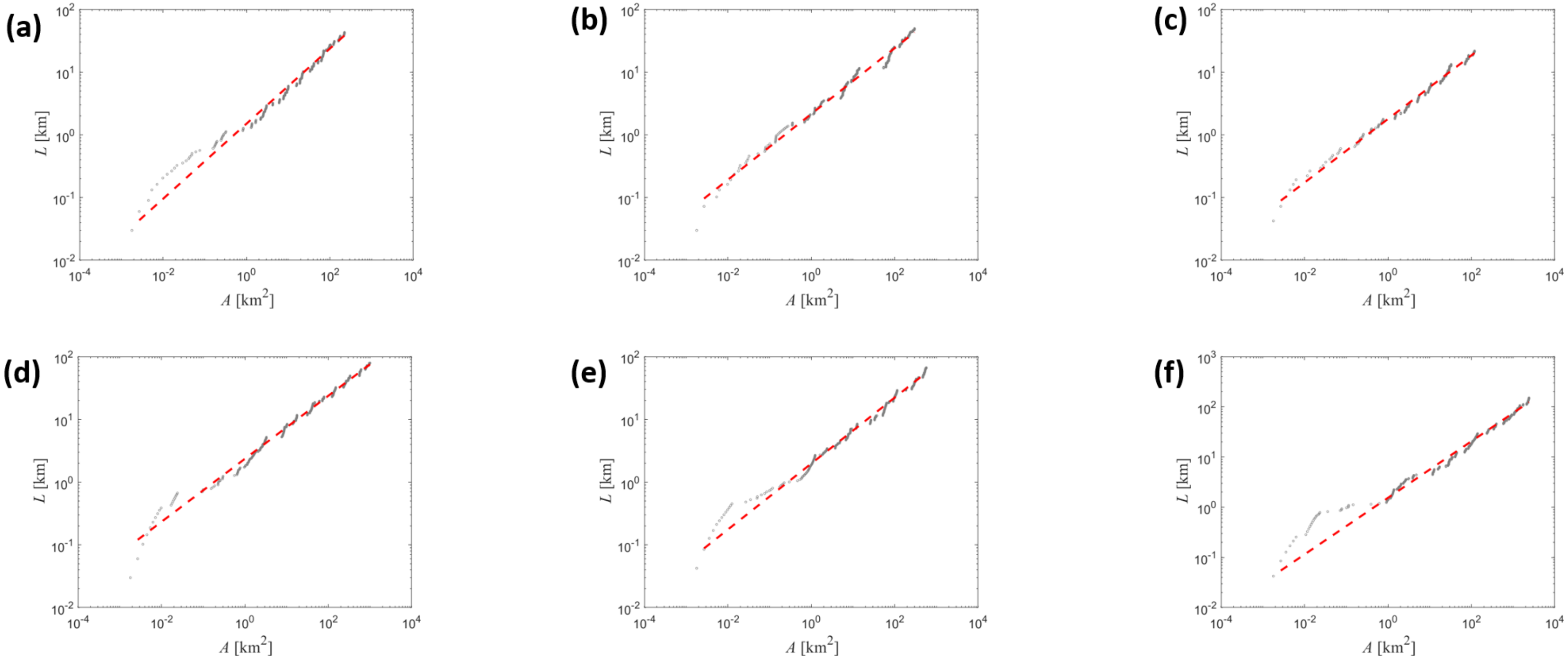

Figure S3. Relationship between upstream length L and its corresponding upslope area A along the mainstream is shown for 14 studied river networks. The presented order is the same as in Figure S1. Grey dots and red dashed lines indicate each variable data and the power law fitting, respectively.

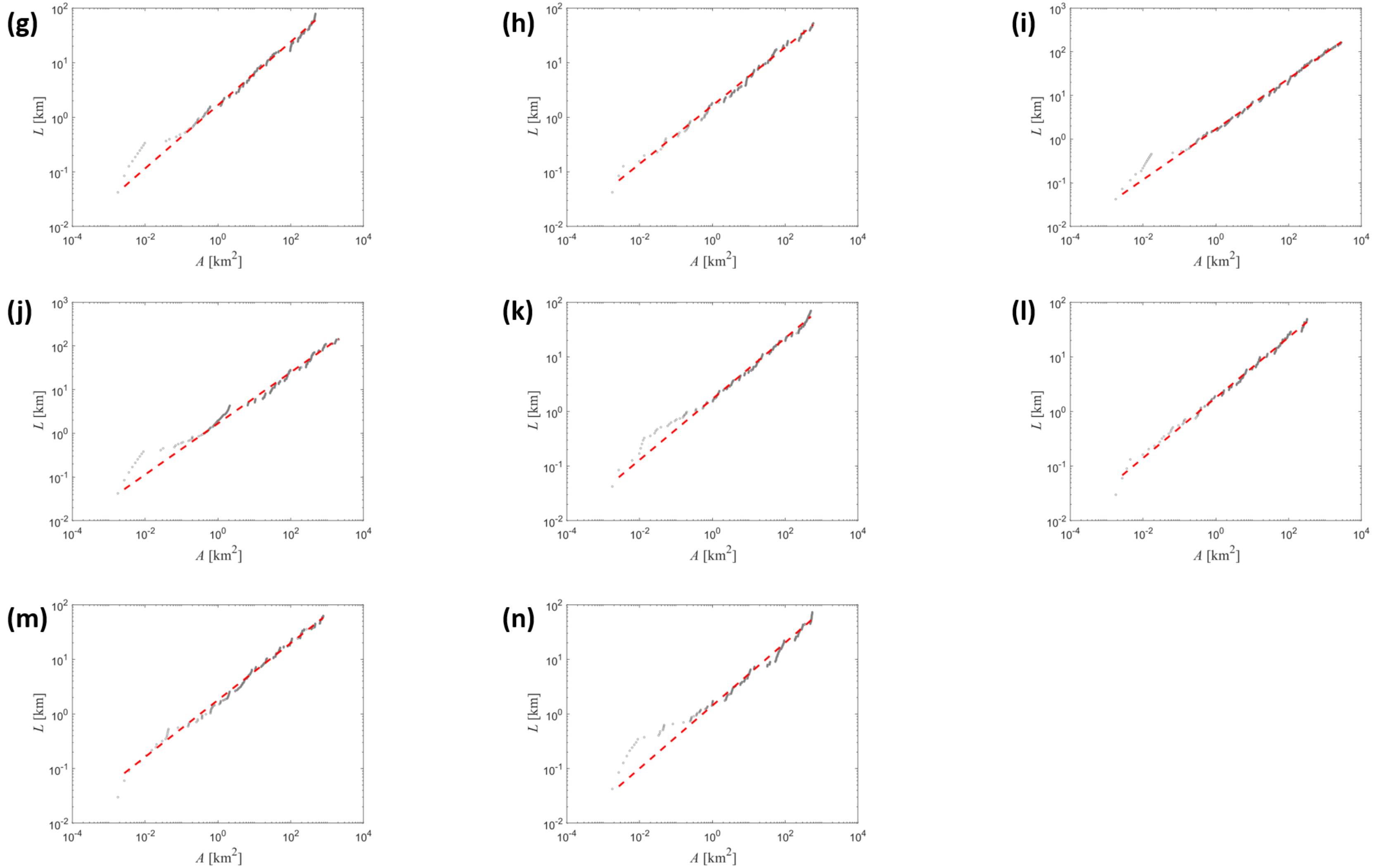

Figure S3. (con't)

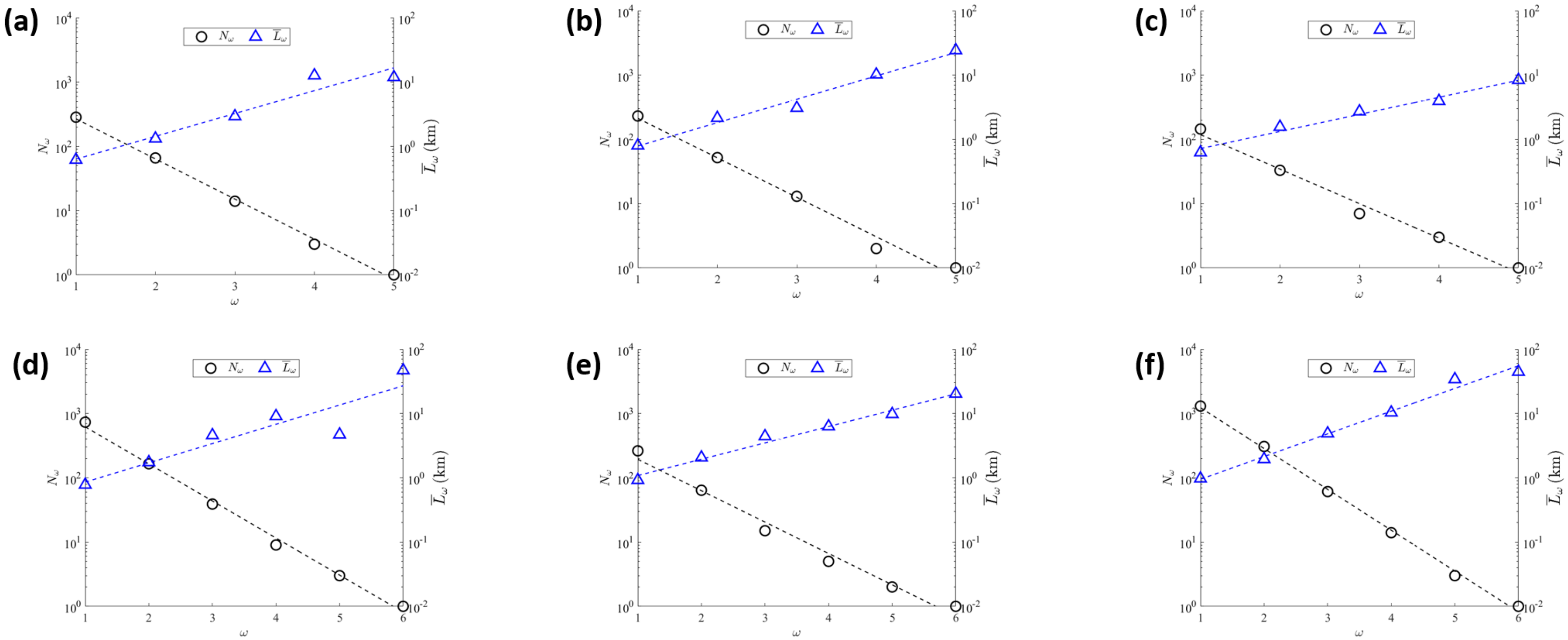

Figure S4. Variations of the number of streams (black circle) and the averaged stream lengths (blue triangle) are shown across stream order ω ($1 \leq \omega \leq \Omega$) for studied 14 river networks. The presented order is the same as in Figure S1.

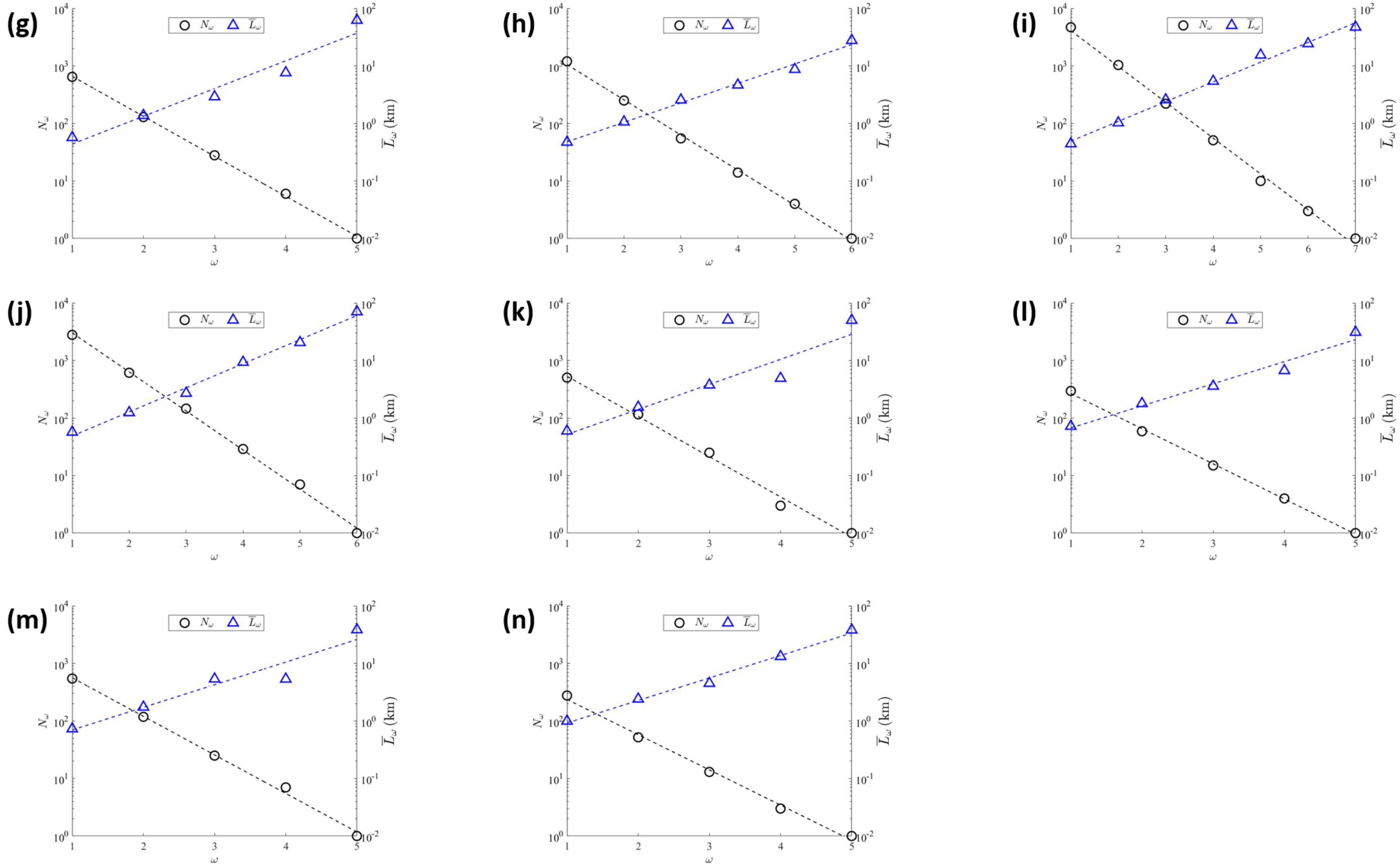

Figure S4. (con't)

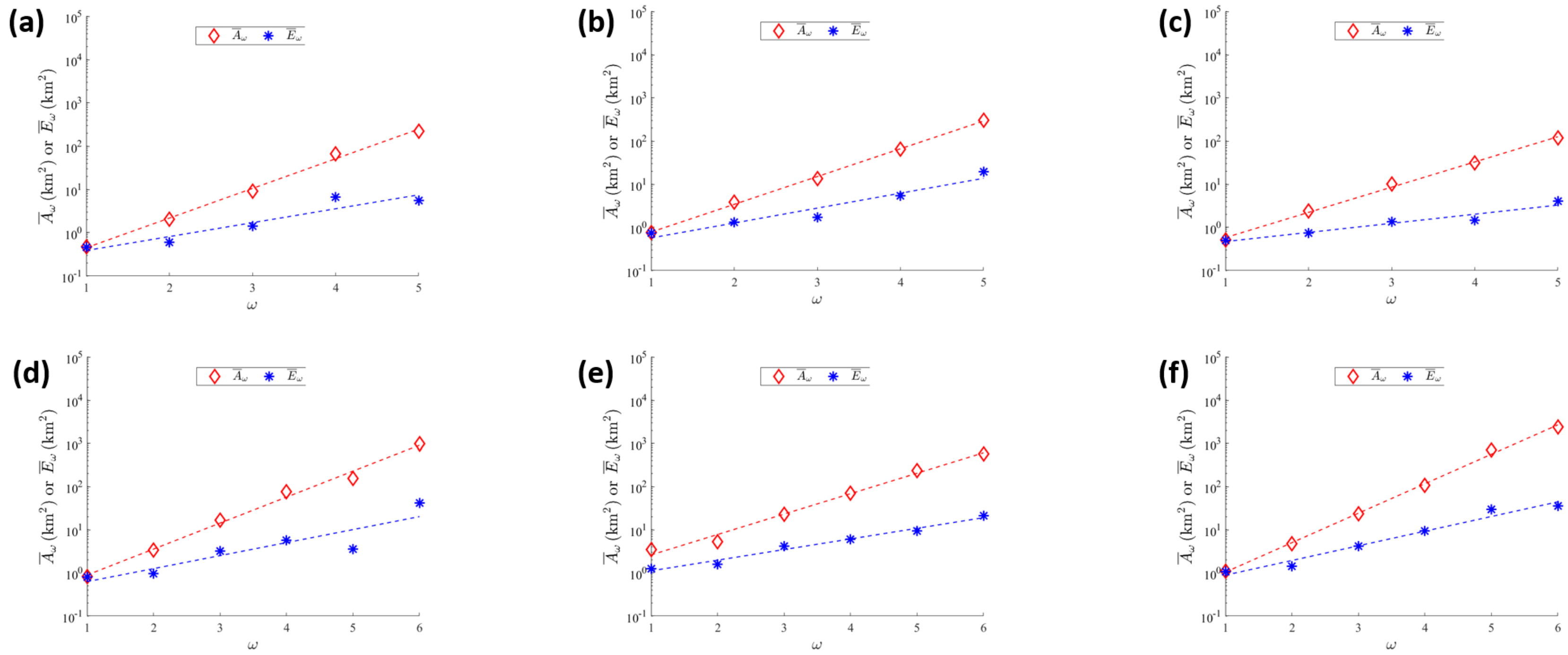

Figure S5. Variations of the averaged upslope areas and eigenareas (red diamond and blue asterisk, respectively) are shown across stream order ω ($1 \leq \omega \leq \Omega$) for studied 14 river networks. The presented order is the same as in Figure S1.

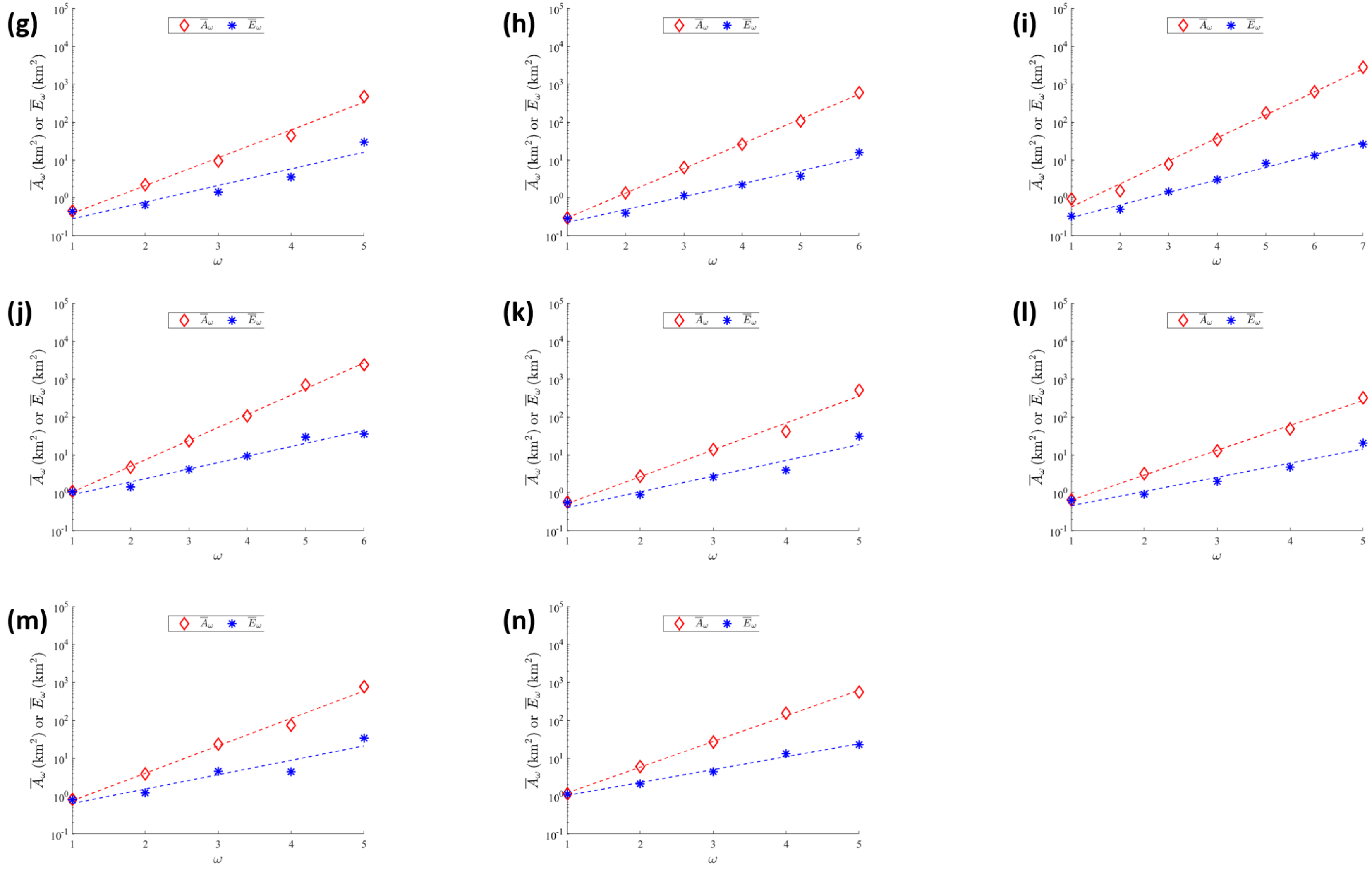

Figure S5. (con't)

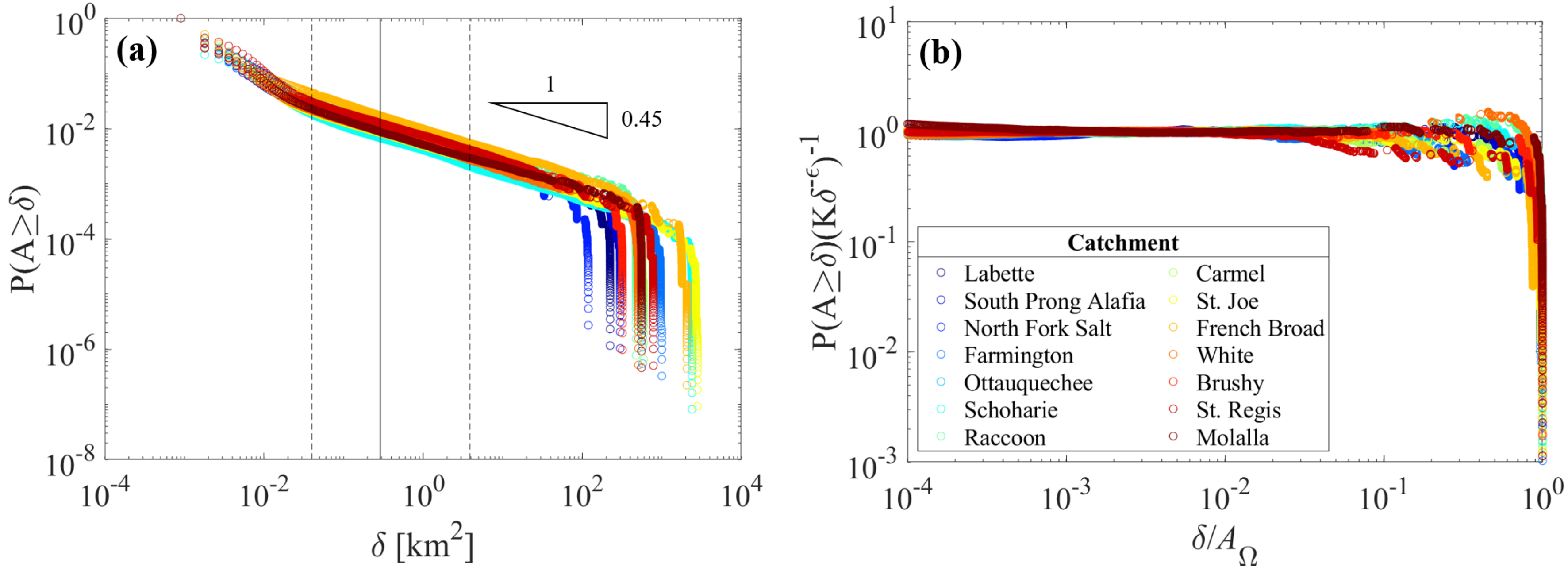

Figure S6. (a) Exceedance probability distribution of upstream area δ. The averaged ε is estimated as 0.45 for all studied networks. Bold black line indicates the average of all source areas A_o reported in Table 1. Dashed lines depict the average of minimum and maximum source areas shown in Figure S2 in SI. (b) Normalized exceedance probability distribution of upstream area by individual power-law exponents. Color-codes for each catchment is consistent with Figure 2 in the main text.