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Characteristics and controlling factors of river networks in the Yellow River source zone

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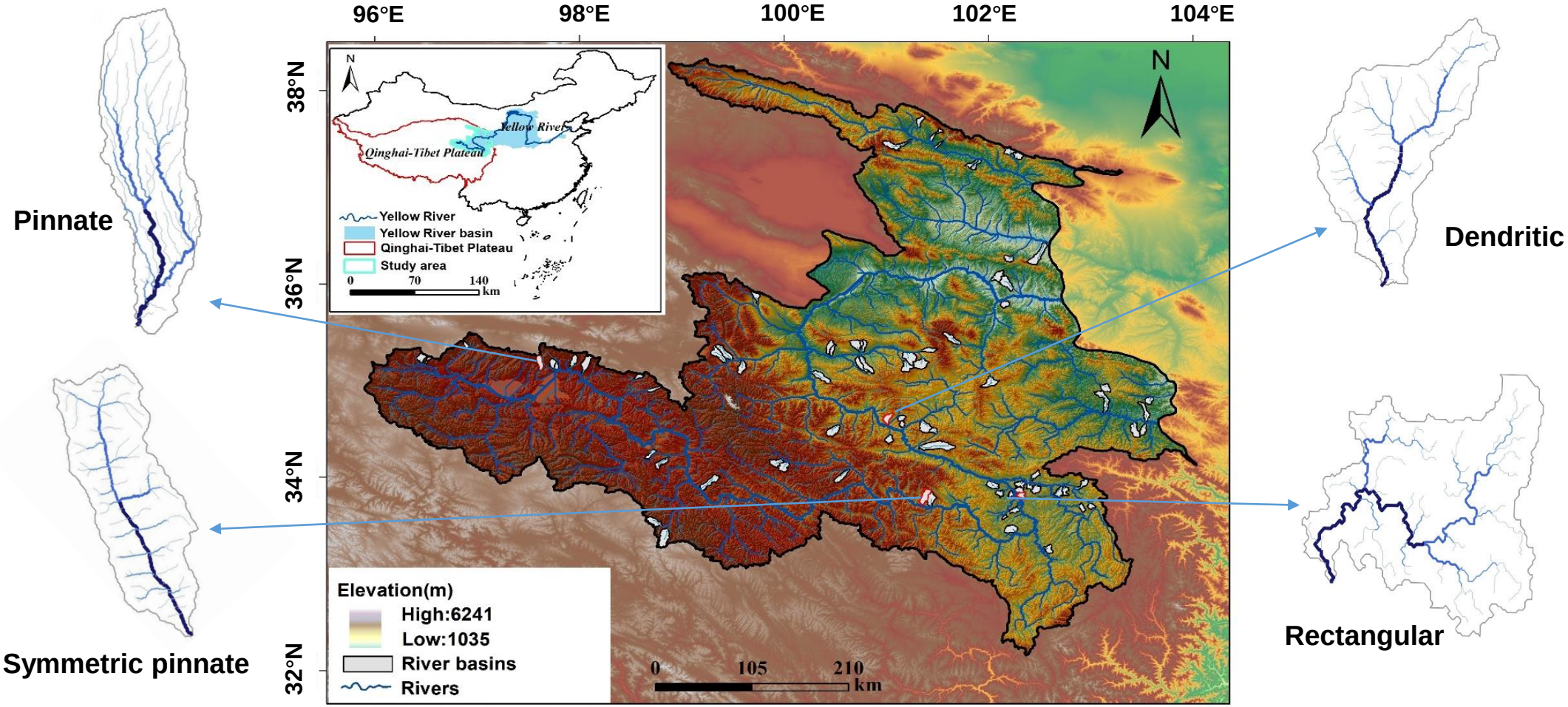
Yellow River source zone

- **Drainage network patterns**

Spatial distribution of 83 representative river networks in the Yellow River source zone



Characteristics of River Networks

- **Basin shape**

Aspect ratio：

$$AR = W / L_b$$

W : Basin width, $W = A / L_b$
L_b : Euclidean distance between the basin outlet and mainstream source
A : Drainage area

- **Drainage texture**

Drainage density：

$$D = L_T / A$$

L_T : Total length of streams

- **Flow direction**

Flow direction frequency：

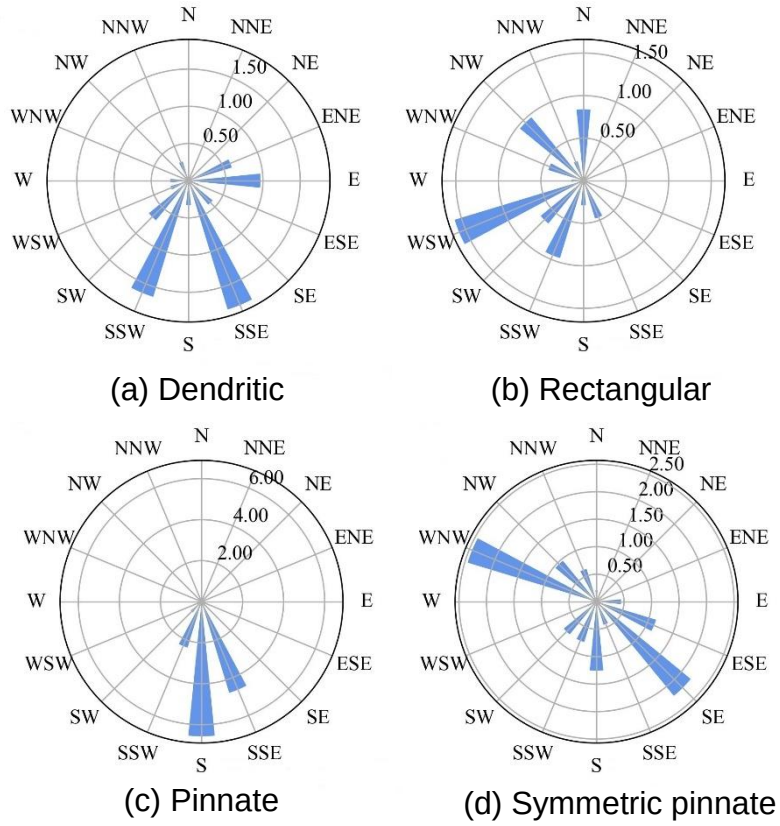
$$f_i = n_i \cdot L_i \Big/ \sum_{i=1}^{16} L_i$$

L_i : Total length of reaches in the direction group
n_i : Number of reaches in the direction group

Maximum frequency:

$$M = \max(f_i)$$

Flow direction rose maps of different drainage patterns



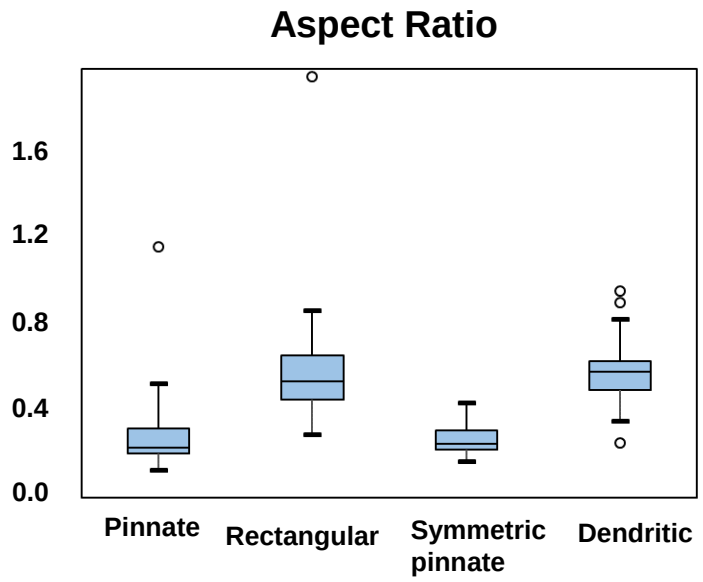
(a) Dendritic (b) Rectangular

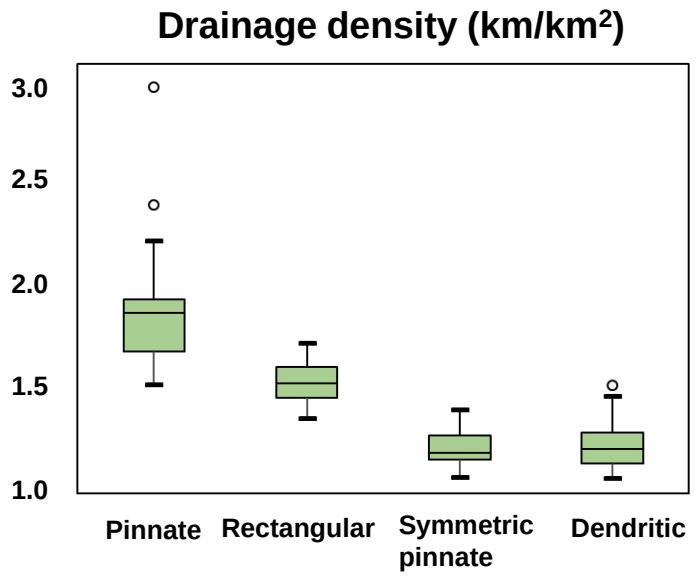
(c) Pinnate (d) Symmetric pinnate

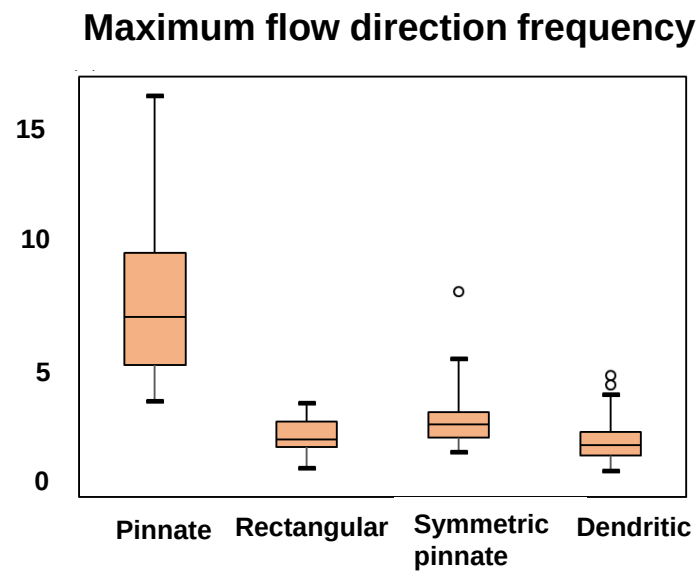
Li M, Wu B, Chen Y, et al. Quantification of river network types based on hierarchical structures. CATENA, 2022, 211: 105986.

Characteristics of River Networks

- **Pinnate** and **symmetric pinnate** patterns are more **elongated**.
- **Drainage density** values of **pinnate** and **rectangular** patterns are relatively **high**.
- Tributaries of **pinnate** patterns tend to flow to the **same direction**, leading to a **dominant** flow direction.
- Tributaries of **dendritic** patterns can flow to different directions more **freely**.

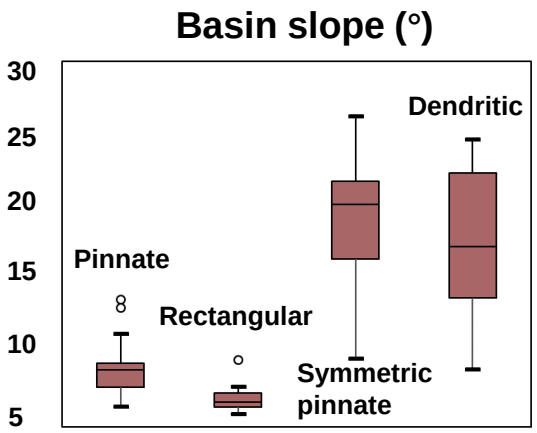


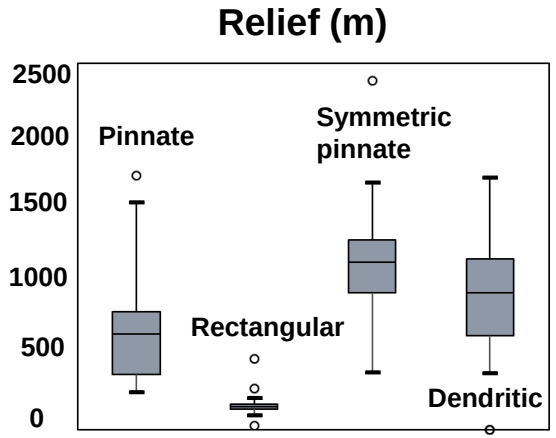


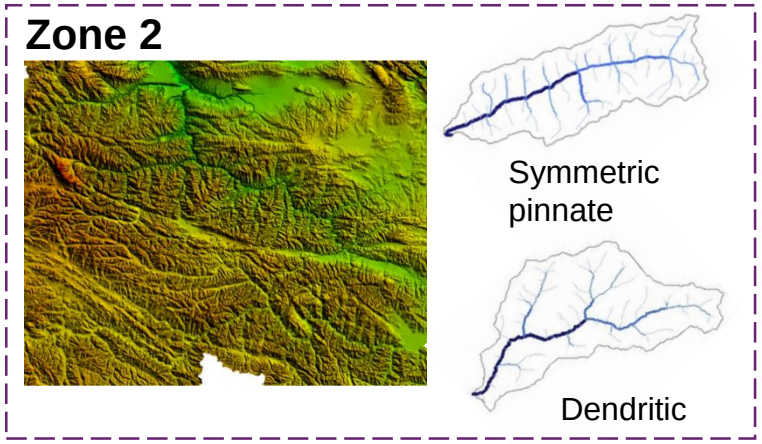


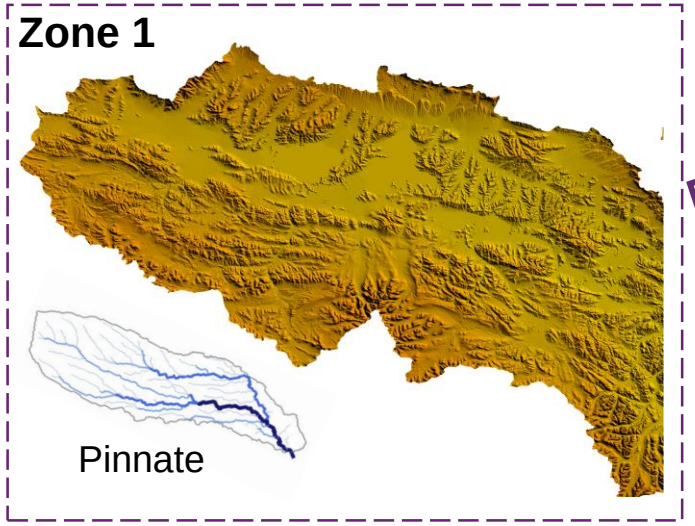
Controlling factors

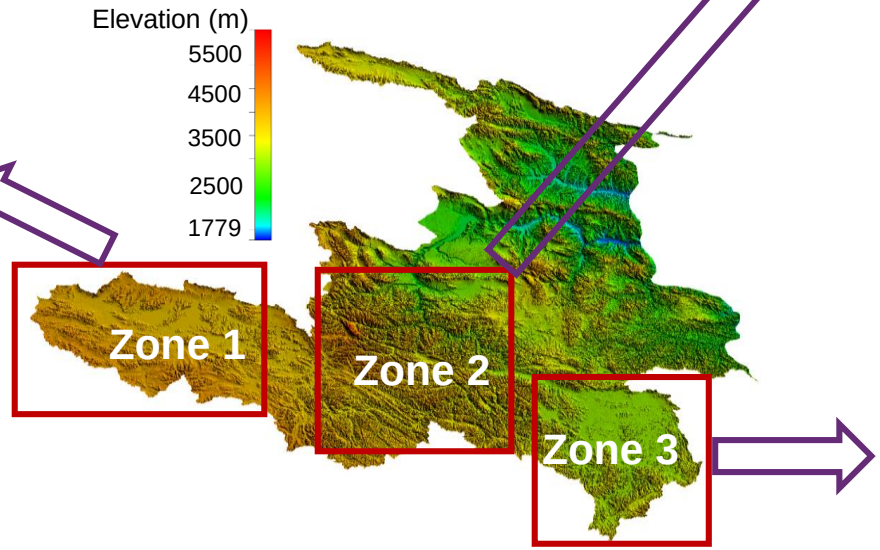
- Topography

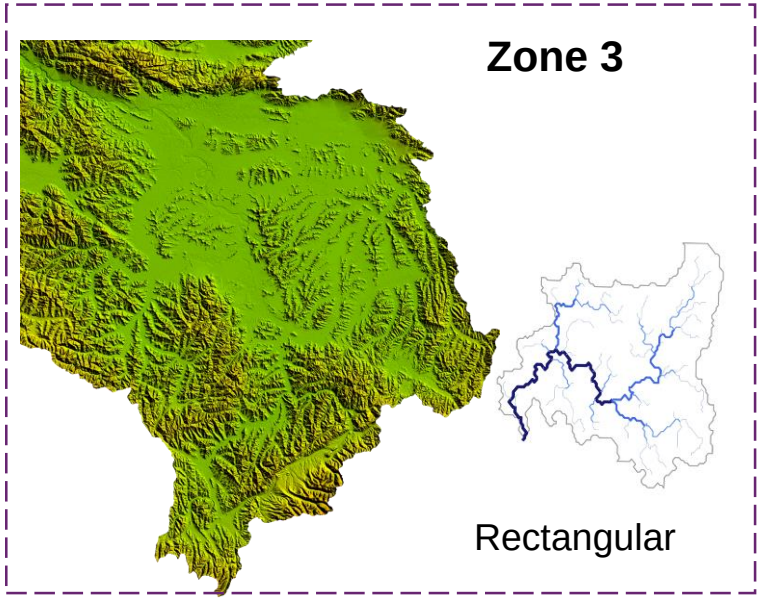






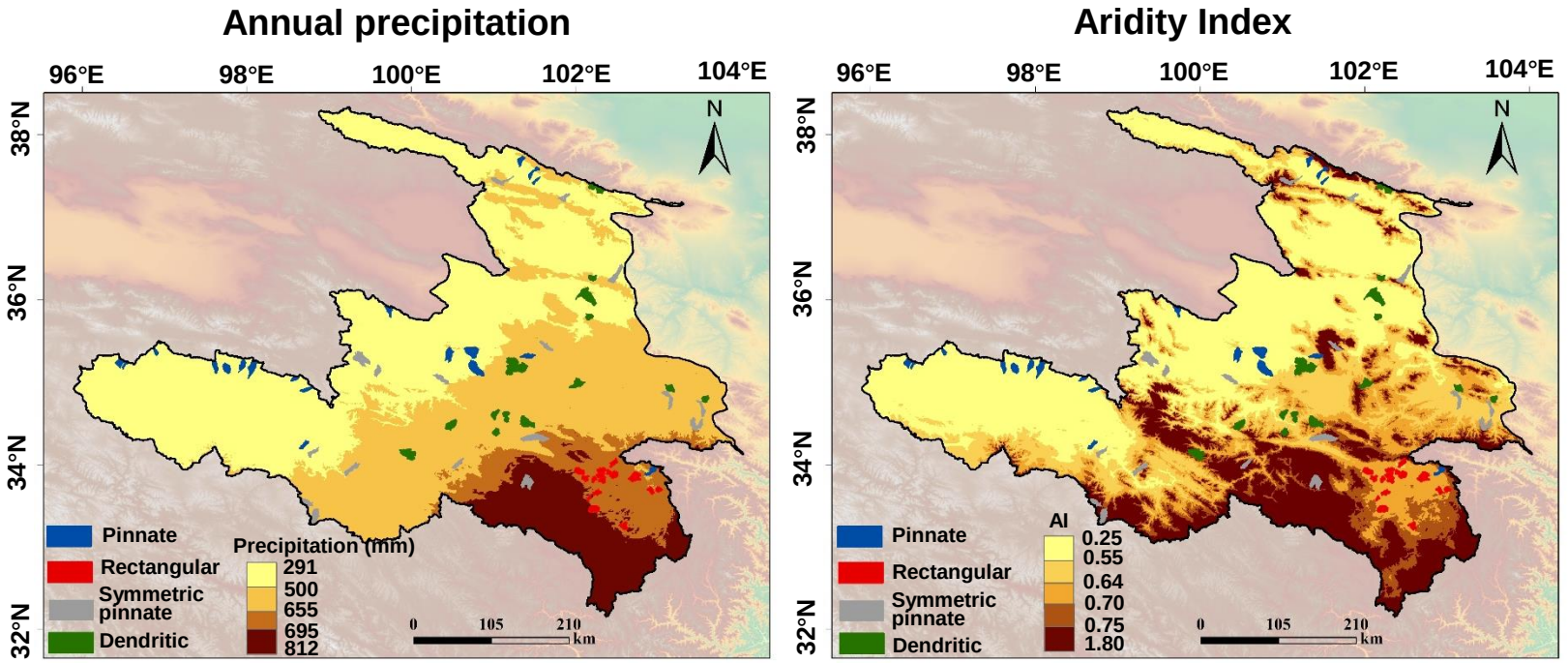


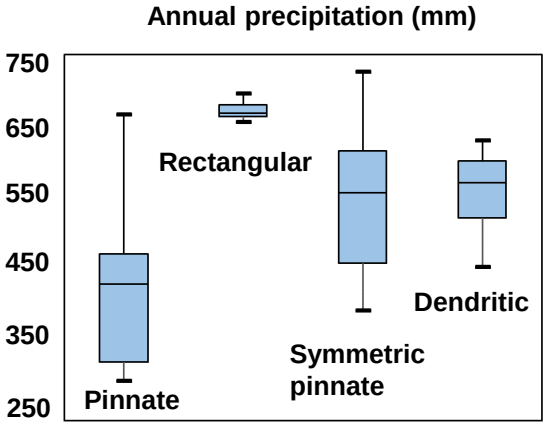


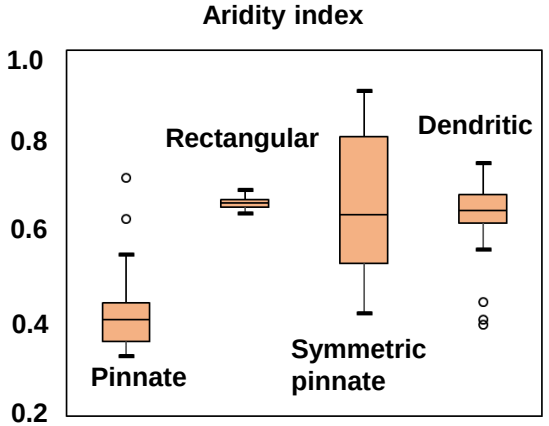


Controlling factors

- **Climate**
  - **Pinnate** patterns mainly occur in arid areas.
  - **Rectangular** patterns are mainly concentrated in the Ruoergai basin with humid climate.







Controlling factors

- **Relationships between river network attributes and topography and climate**

  - **Pinnate**

    Moderate slopes
    Arid environments

  - **Rectangular**

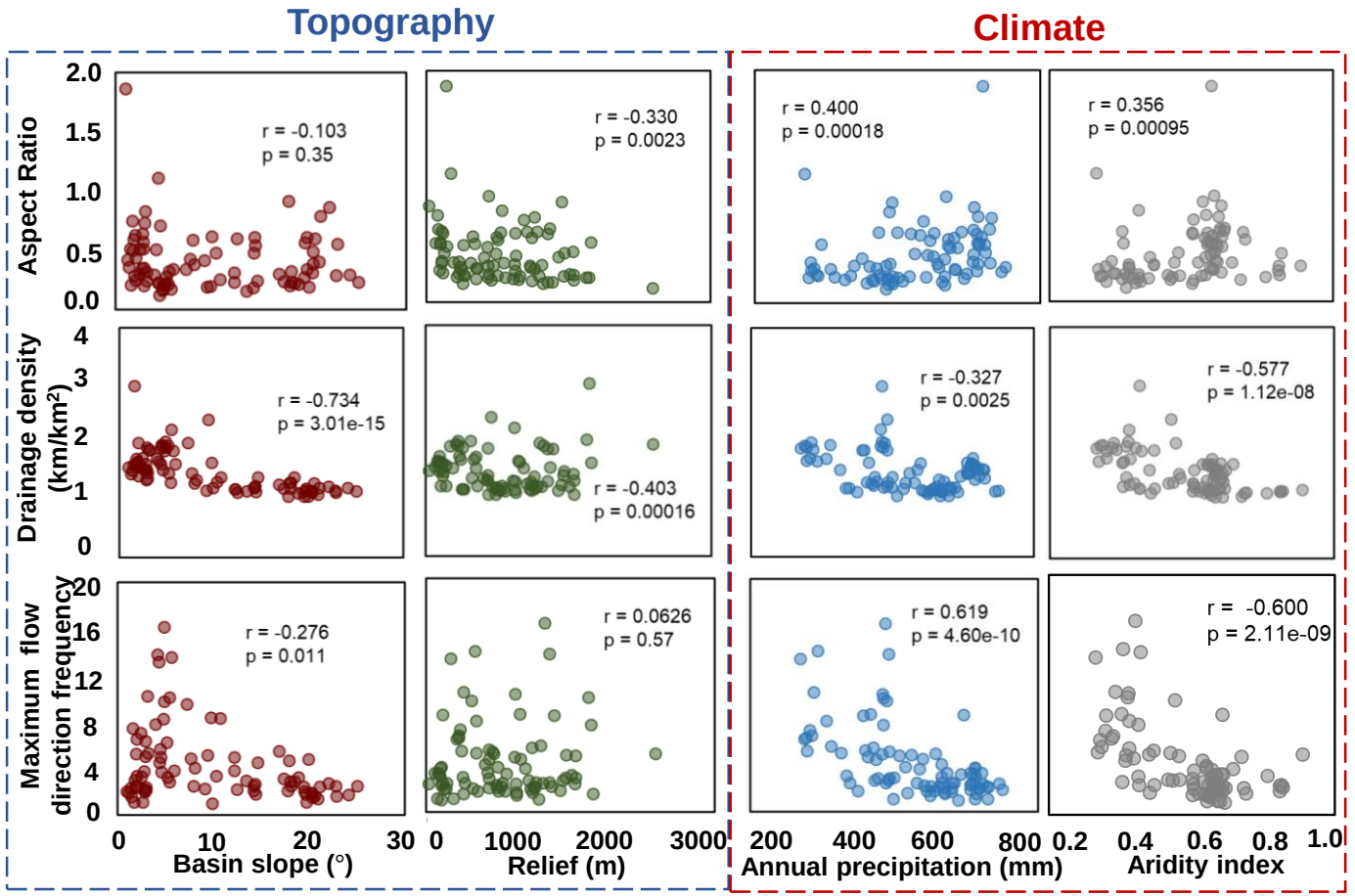
    Broad plain & fluvial
    Humid environments

  - **Symmetric pinnate**

    Steep slopes
    Semi-humid regions

  - **Dendritic**

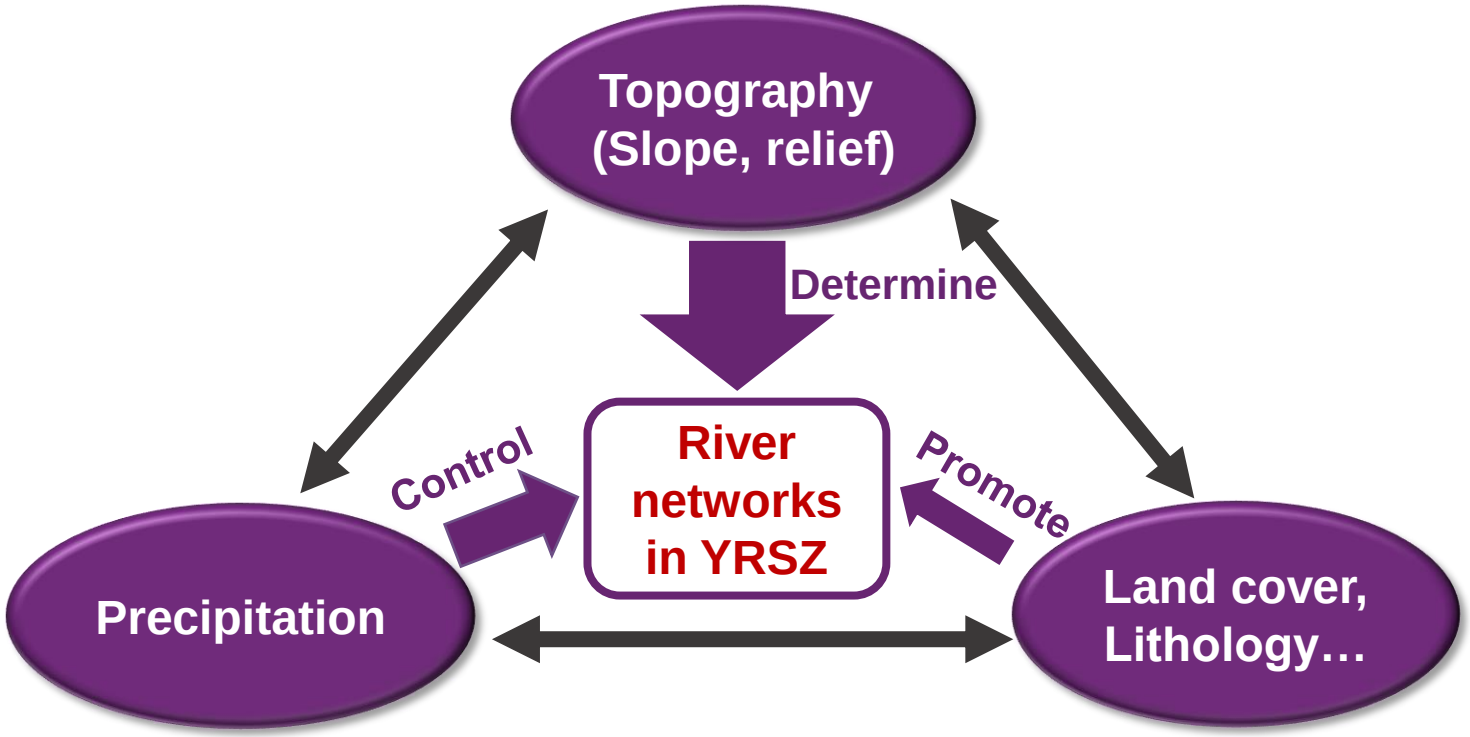
    Mountainous areas
    Semi-humid regions



 Li M, Wu B, Chen Y, et al. Planform geometries and controlling factors of river networks in the Yellow River source. Acta Geographic Sinica, 2022 (Under Review)

Conclusions

- **Topography** **determines** the differentiation of river networks in the Yellow River source zone.



- **Precipitation** plays an **important role** in shaping river networks. The influence of precipitation would be enhanced where there are fewer terrain restrictions.

Thank you!

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