EGU General Assembly 2021

Session HS2.4.5 – Space-time dynamics of floods: processes, controls and risk

The unit peak discharge as a tool for flood magnitude comparison and analysis (EGU21-11192)

Francolí river, October 2019 (source: ACN)

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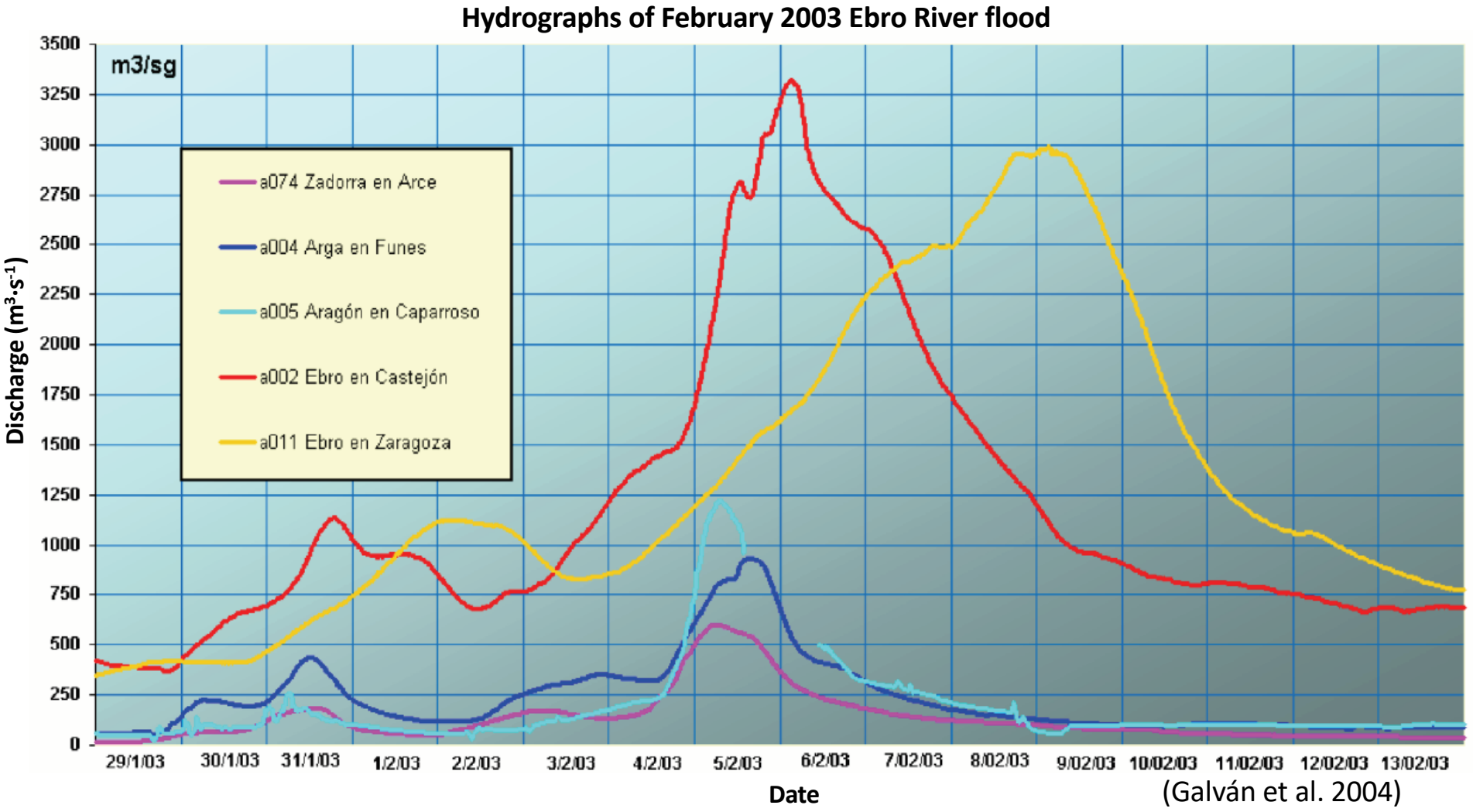
- To analyze the river flood dynamics, it is common to fix the observations of the flow at a characteristic checkpoint of the basin showing its evolution over time: the hydrograph.



(Galván et al. 2004)

- A different way to perform the flood analysis is to calculate the **unit peak discharge** of the flood (the peak flow divided by the contributory area of the basin) along different checkpoints of the drainage axis.

- This methodology generally shows that as **the contributory area of the basin increases the unit peak discharge decreases**.

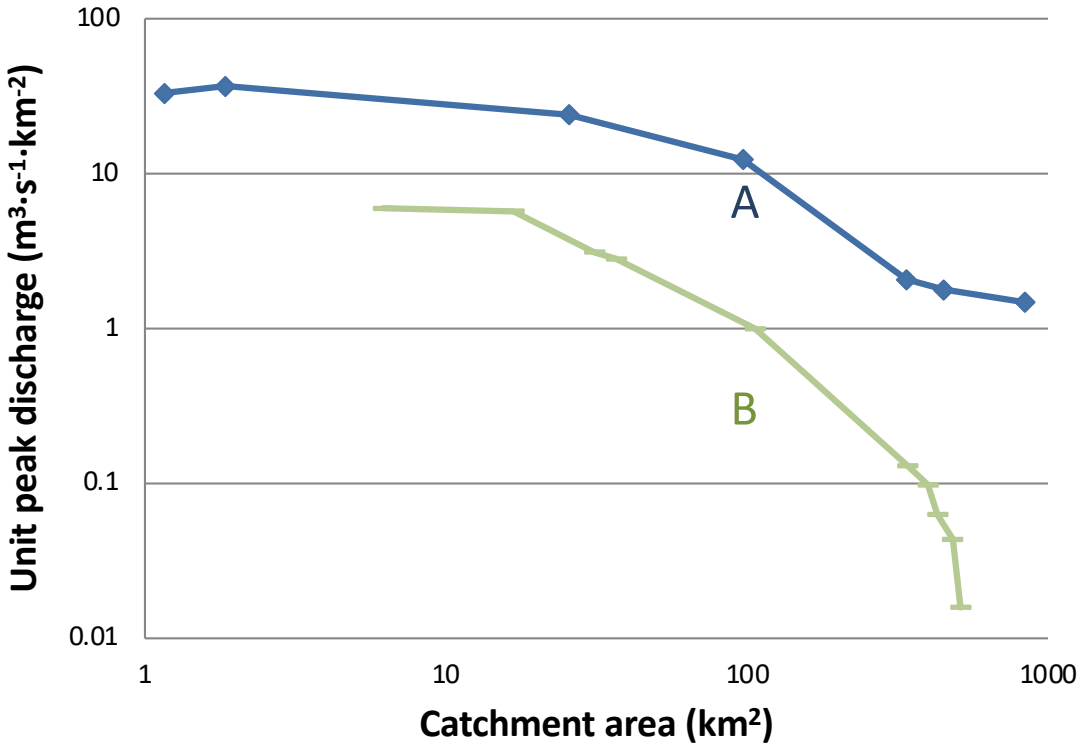
- This is due to the reduction of the amount of precipitation and of the slope of the riverbed as it moves away from the headwaters.

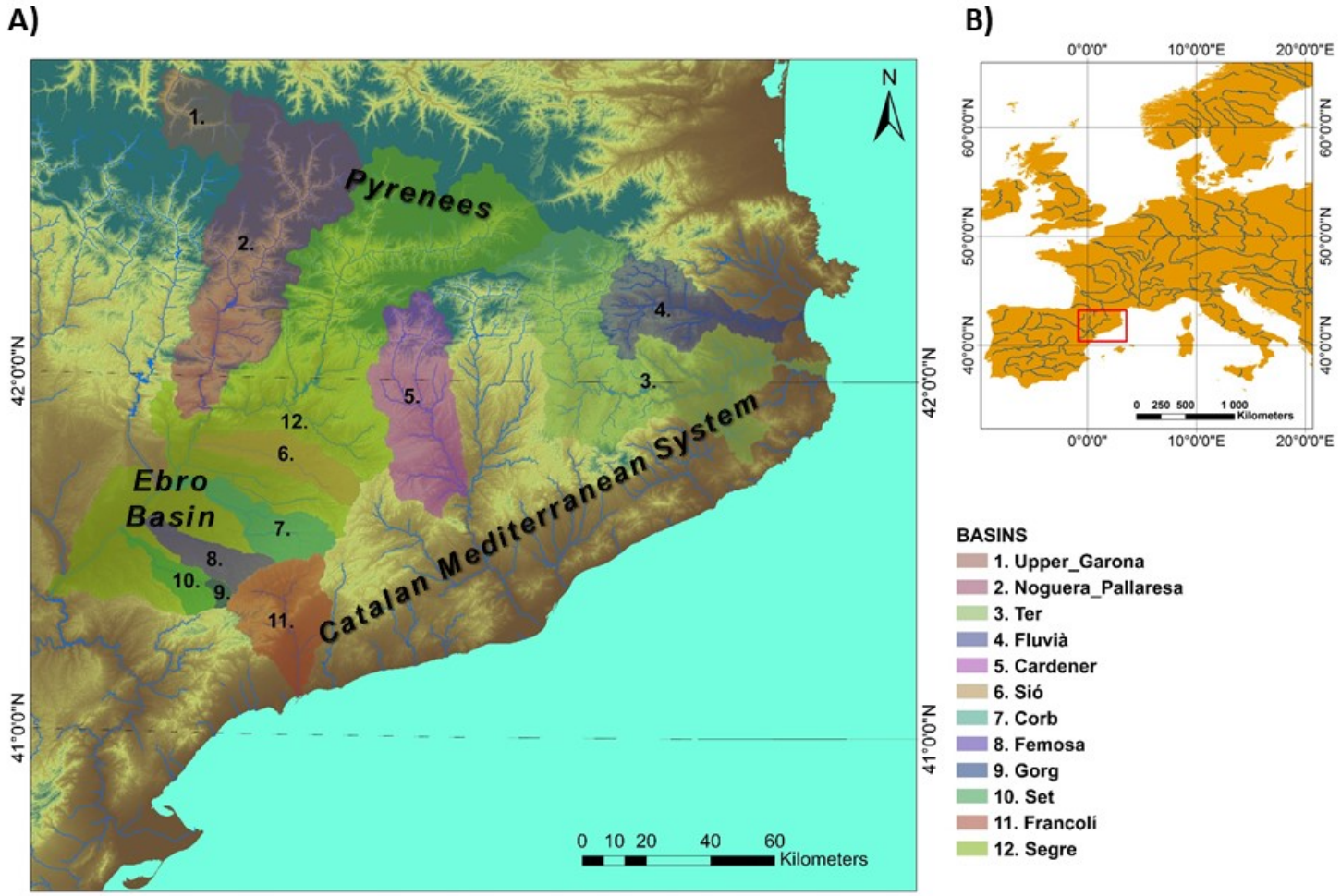
- However, this simple scheme can vary depending on the: temporal and spatial rainfall distribution (controlled by sea proximity and orography), presence of snow, soil moisture, geological substrate, land use, or human activities.

Unit peak discharge ($m^3 \cdot s^{-1} \cdot km^2$) vs catchment area ($km^2$)

- An horizontal line represents an homogeneous distribution of rainfall in all the basin and a uniform response of the soil. This a theoretical case, rarely happening in Nature.
- A line having a gentle slope indicates a flood produced by rainfall affecting large areas of the basin (case A).
- A line with an steep slope implies the rainfall mainly occurs at the headwaters without affecting the middle and lower parts of the basin. Case B shows a change of unit peak discharge of several orders of magnitude ->

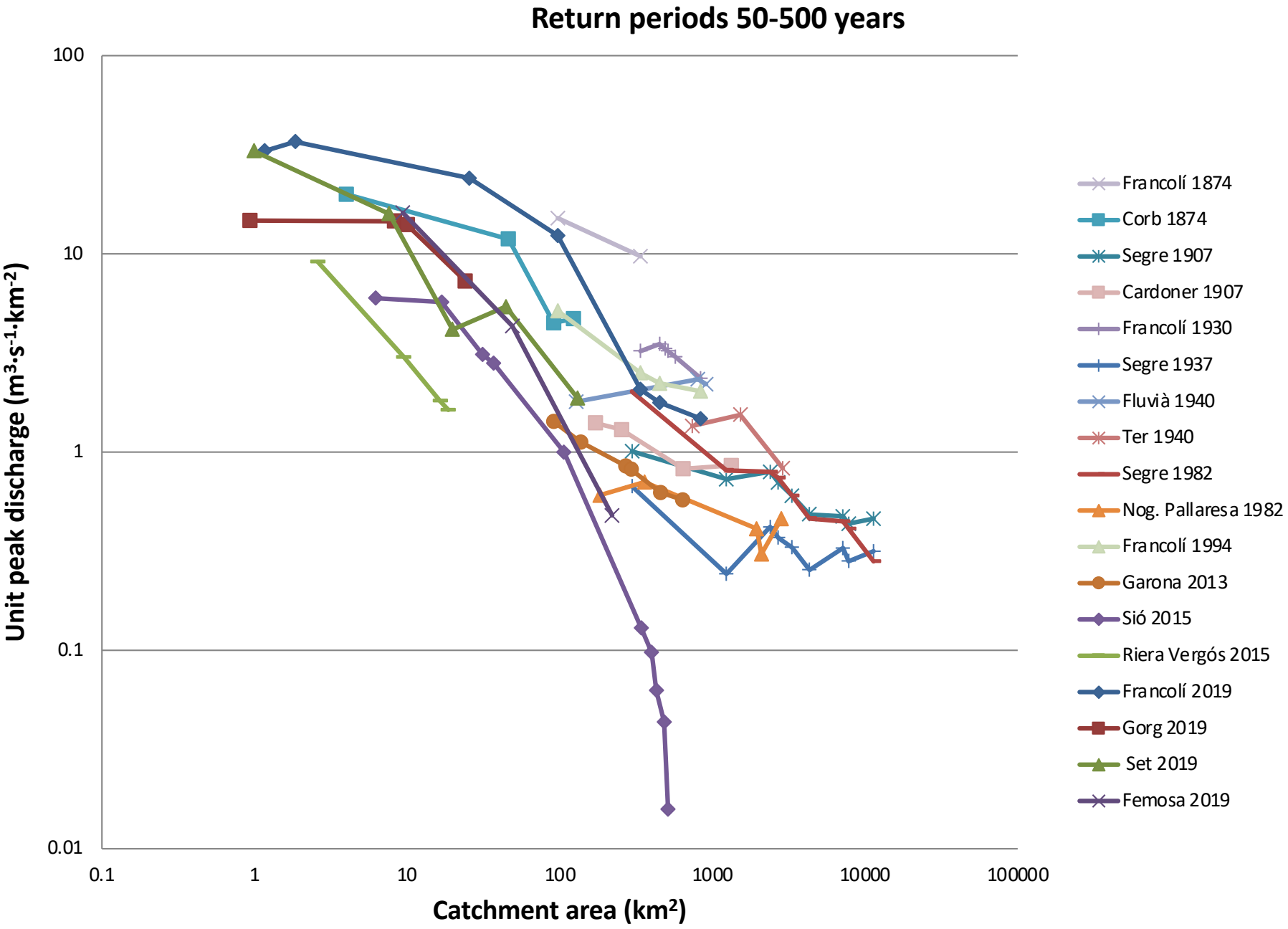
-> flood infiltration through a dry bed and a highly permeable floodplain.



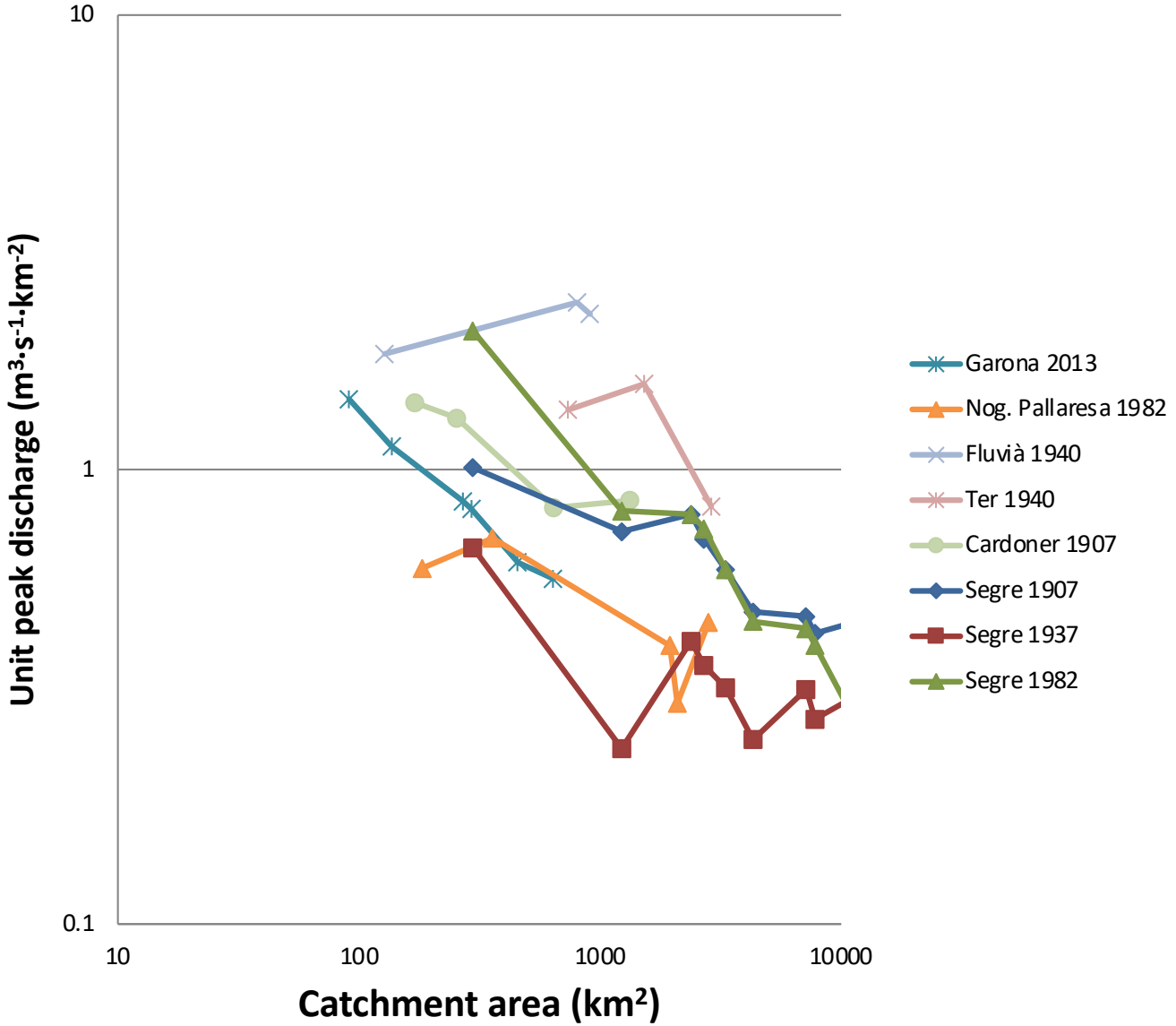


- We show hydrological data of several historical and recent floods in NE basins of the Iberian Peninsula (unit peak flow vs catchment area).
- Small basins (< 1000 km^2) of: central (Garonne, Noguera Pallaresa, Segre) and eastern Pyrenees (Ter, Fluvià), Ebro Depression (Sió, Ondara, Corb) and Catalan Pre-Coastal Range (Francolí).

Differences in magnitude and extension of NE Iberian floods

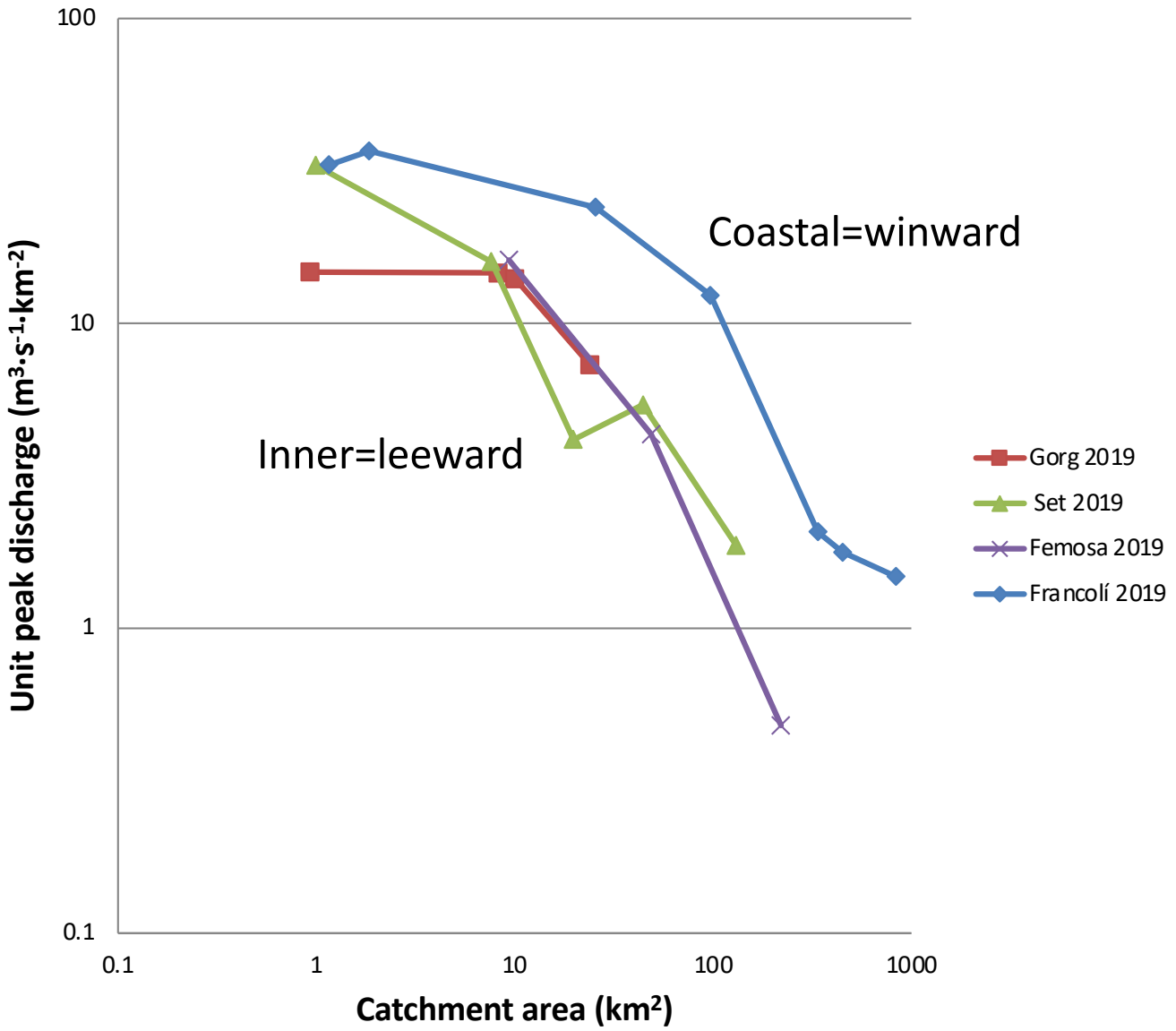


Pyrenean basins: W Atlantic fronts and Mediterranean influence
Unit peak discharge between 0.5-2 $m^3 \cdot s^{-1} \cdot km^2$-Larger catchment areas-Snow melting

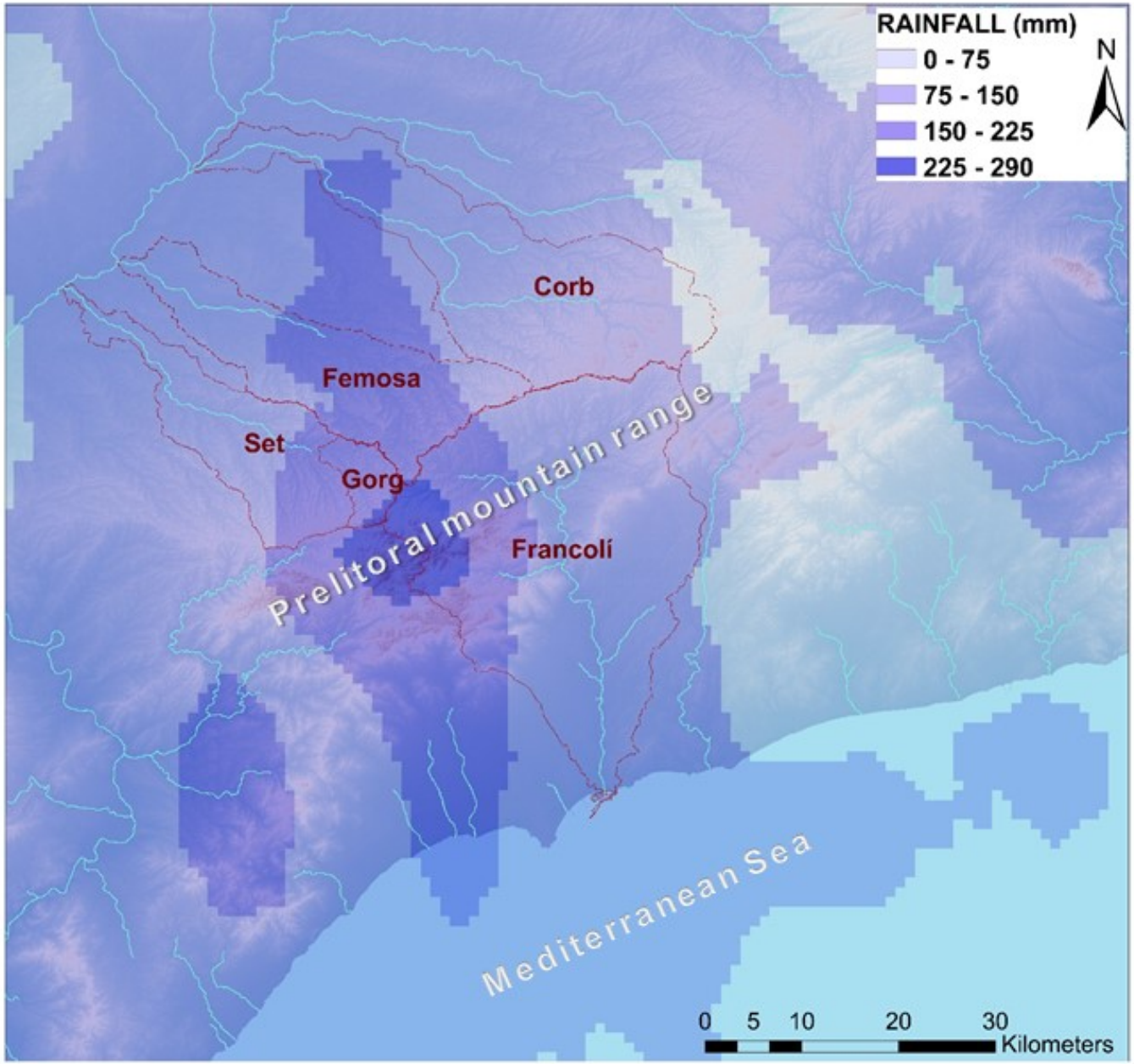


Mediterranean coastal basins: flash-floods, influence of mountain ranges

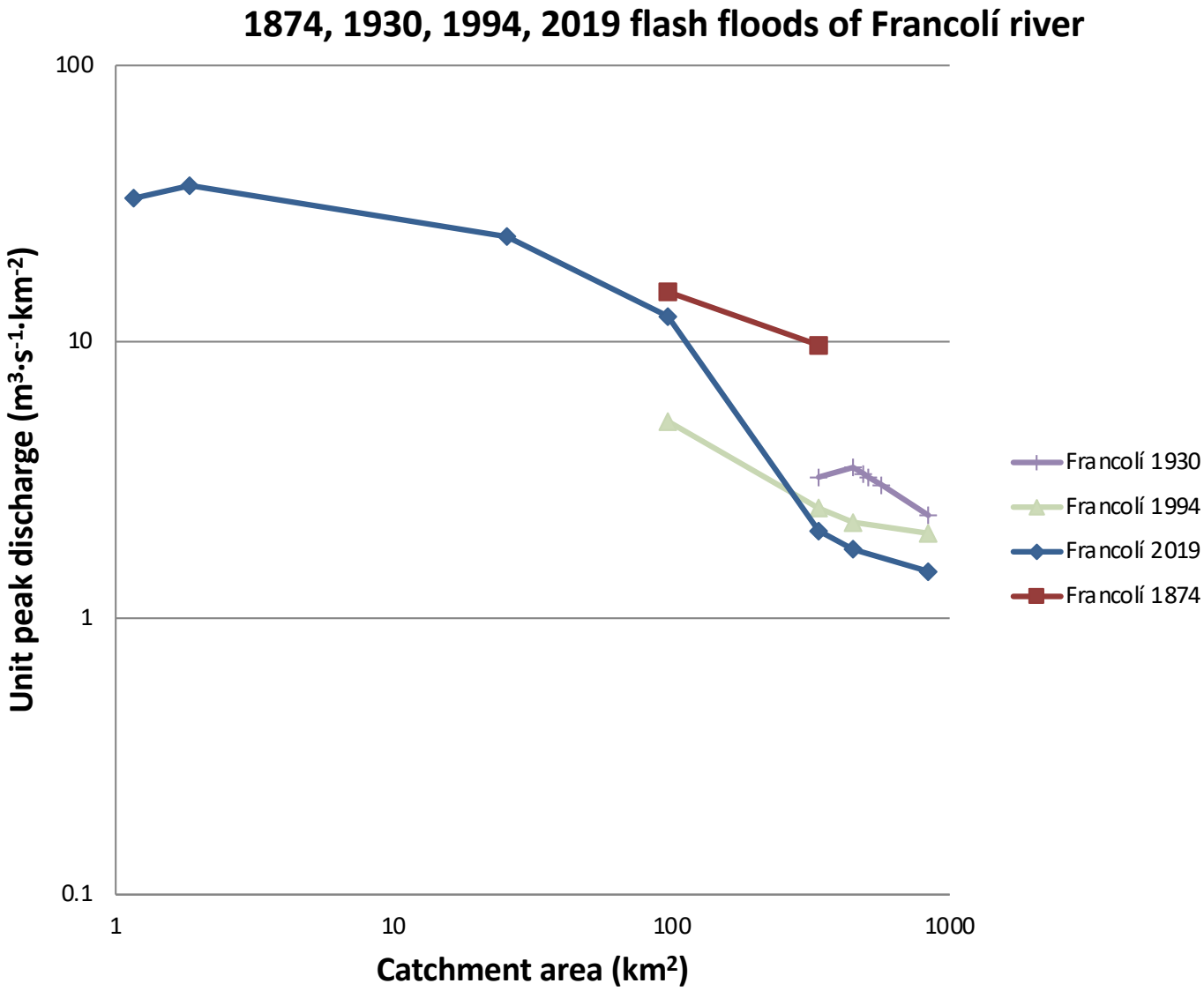
Unit peak discharge between 1- 40 $m^3 \cdot s^{-1} \cdot km^2$



Rainfall radar distribution of October 2019 event in coastal and inner catchments



Unit peak discharge in different floods of the same river



Exhaustion of discharge downstream owing to a rainfall concentrate in headwater and downstream floodplain infiltration and retention