Analysis of the active length dynamics on intermittent streams using water presence sensors

Zanetti Francesca, Durighetto Nicola, Vingiani Filippo, Botter Gianluca

University of Padua (francesca.zanetti.3@unipd.it)

www.erc-dynet.it

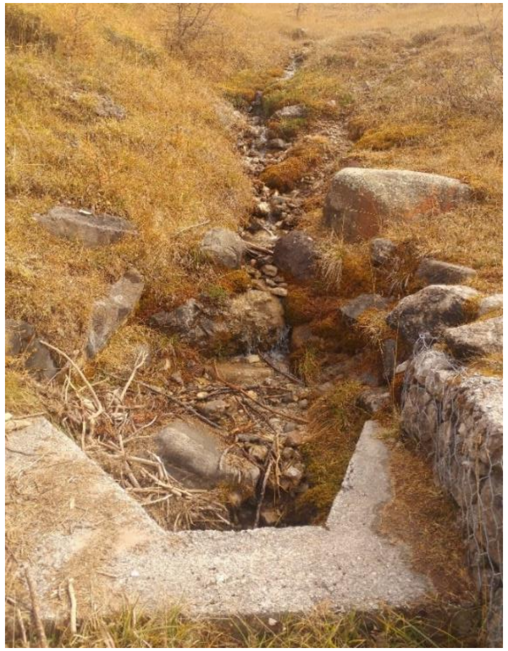
River networks are highly dynamical

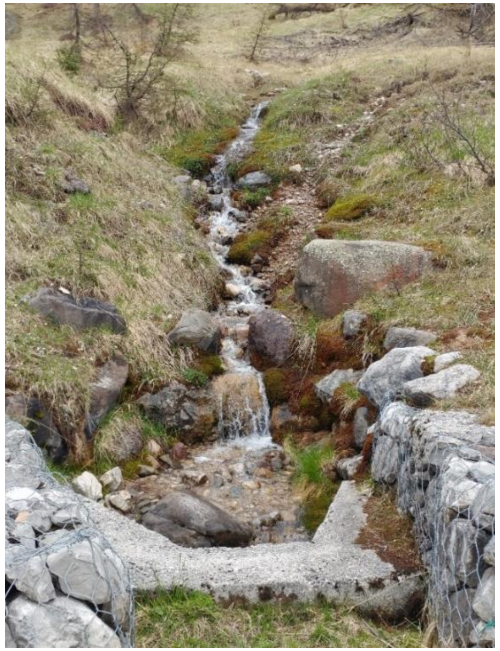
FLOWING WATER

DROUGHT

PONDING

Different conditions can be observed on the same stretch of a watercourse over time.

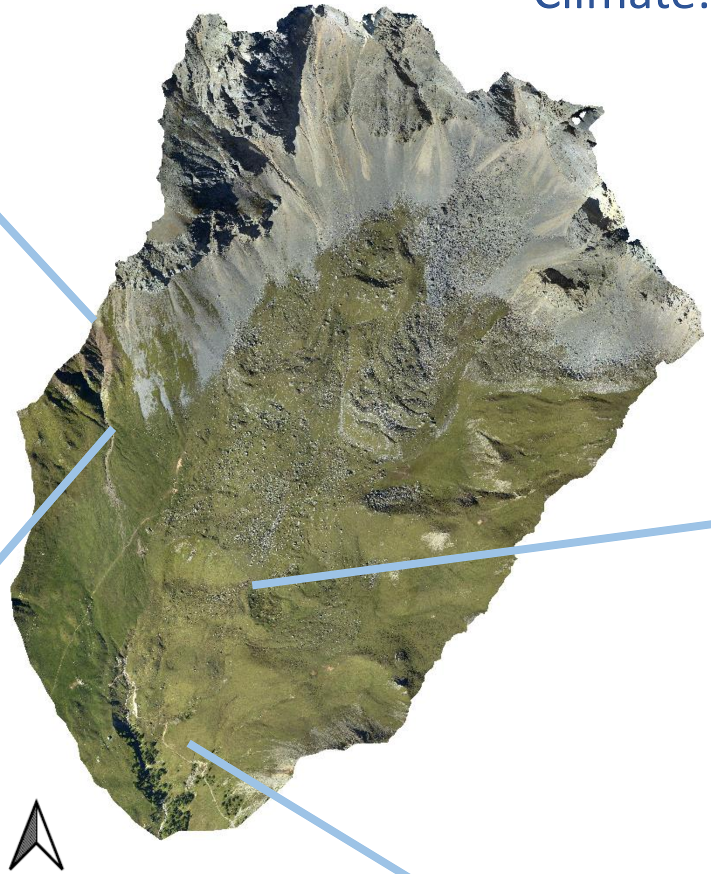




The Valfredda catchment

Area: 2.6 km^2
Altitude: 1900 to 3000 m a.s.l.
Climate: Alpine

Northwest: steep canyon of quartz porphyry rocks

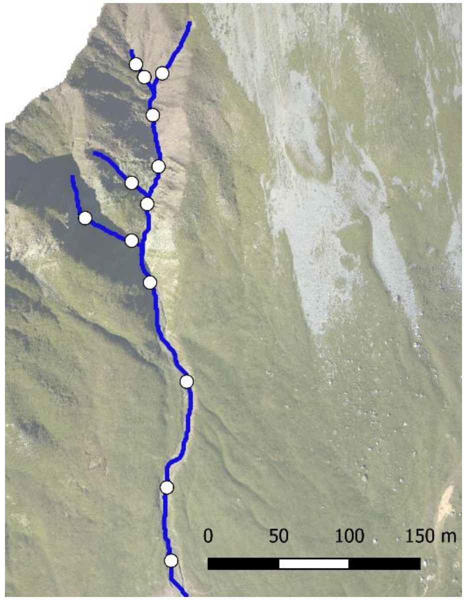


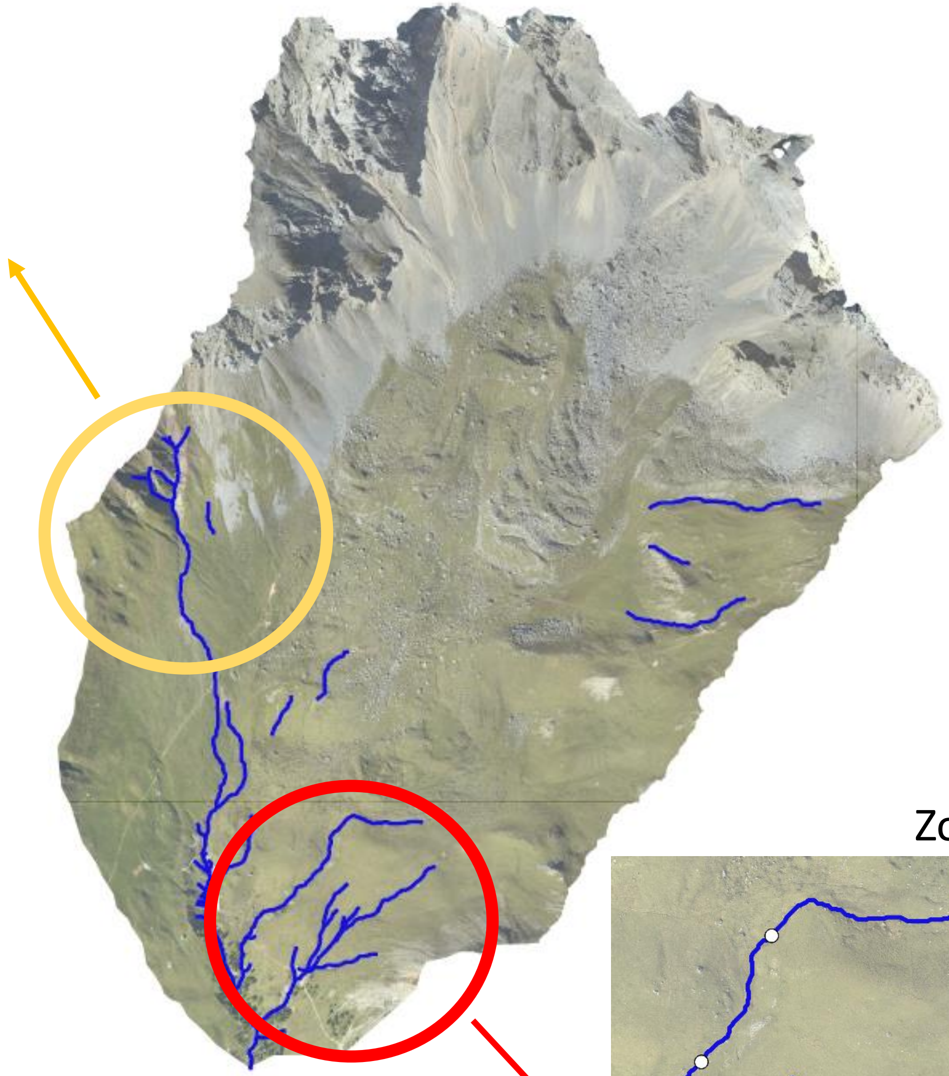
South: moraine deposites, mild slopes covered by pastures

Water presence sensors

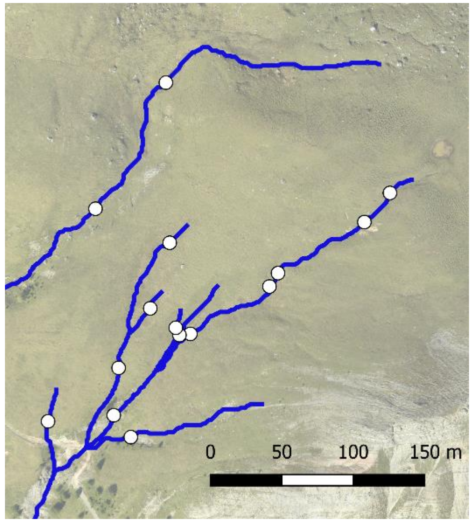
Onset HOBO pendant waterproof temperature and light data loggers

Zone 2





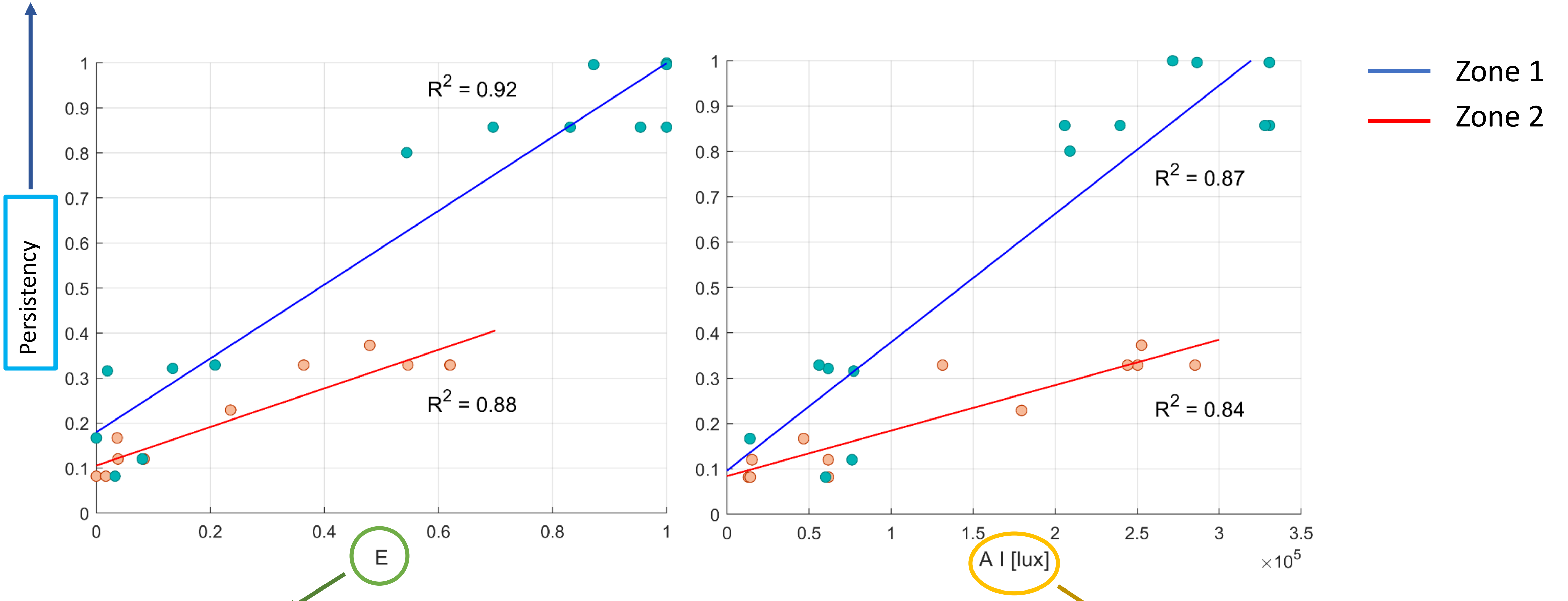
Zone 1



More than 30 HOBOs were placed on grassland and rocks

Data collected from HOBOs vs persistency of the corresponding nodes

Ratio between the number of surveys during which a node was wet and the total number of field surveys done



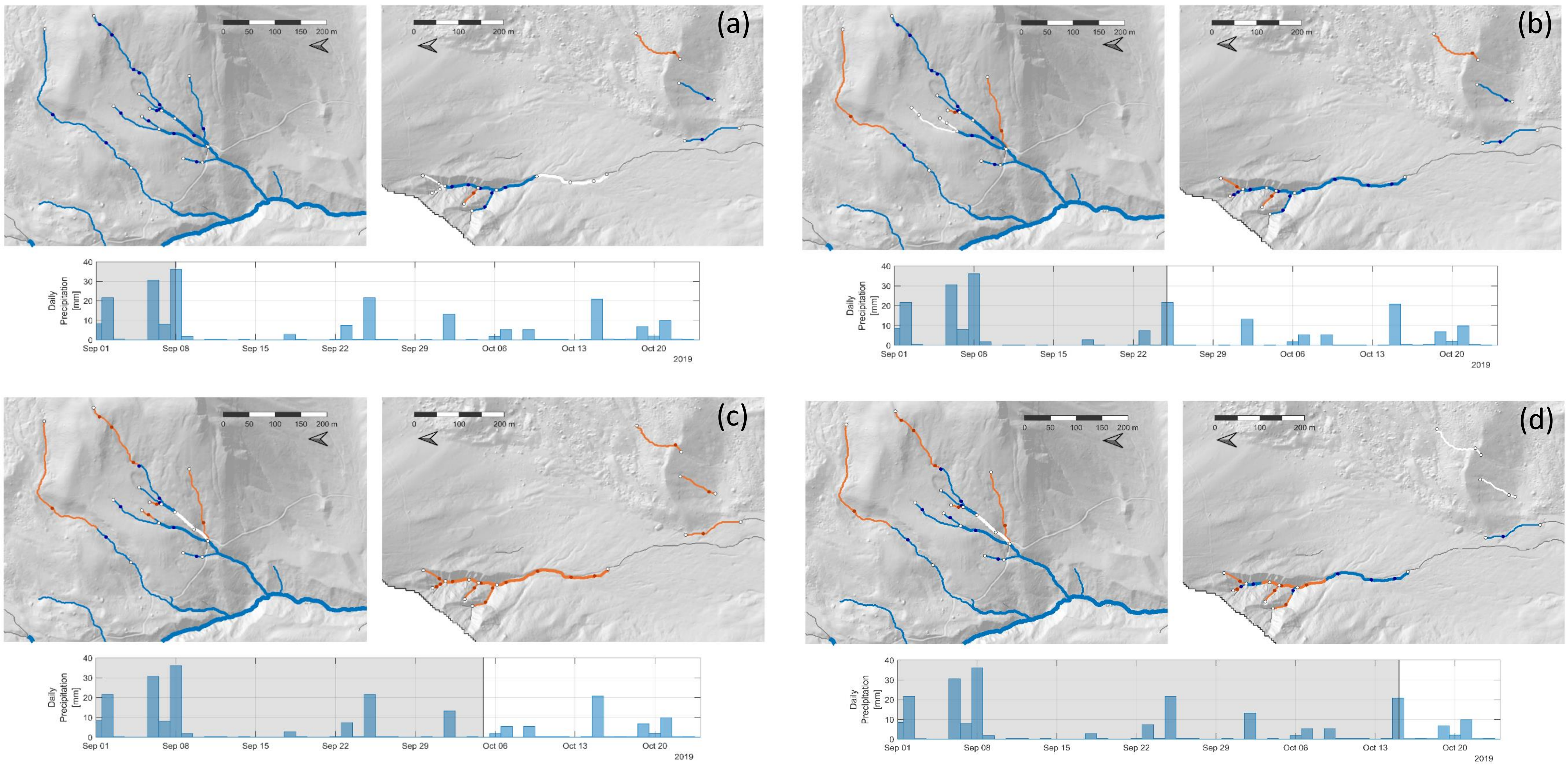
Exceedance of the threshold = probability that the electrical signal is greater or equal than the threshold that separates wet and dry status

Average intensity = mean of the electrical signal registered by each HOBO

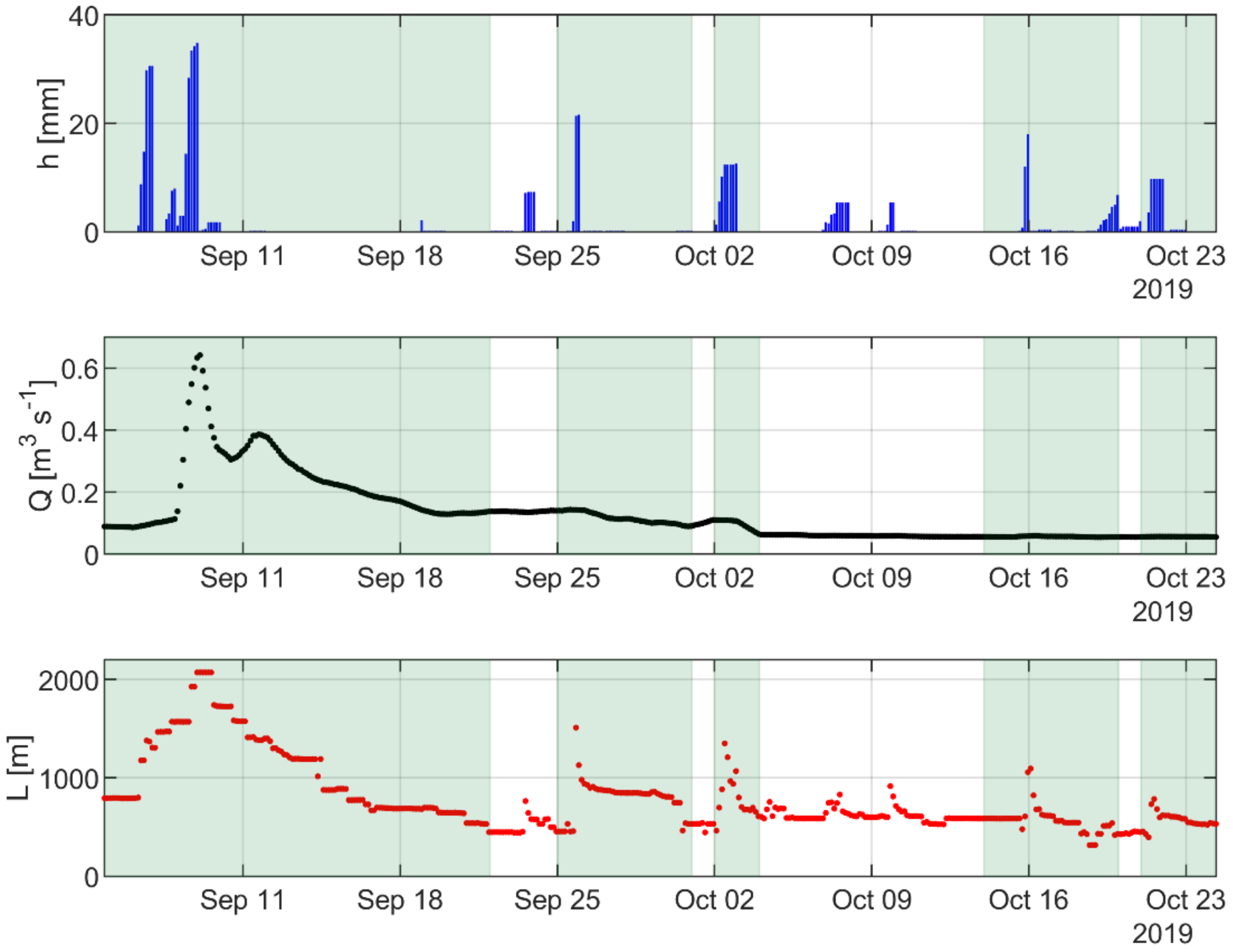
Maps of the active stream network

● Active sensor ● Non active sensor ○ No data

Active stretch — Non active stretch — No data



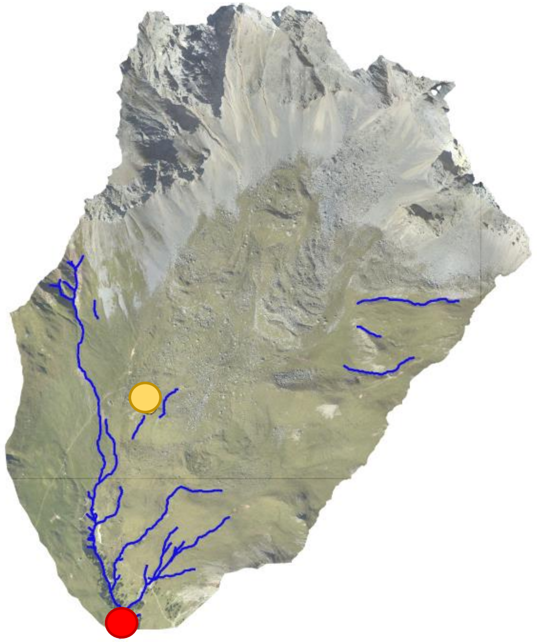
Active length and discharge measured



Rainfall data collected from the meteorological station (🟡)

Discharge data collected at the outlet of the catchment (🔴)

Length of the active stream network derived from the electrical signal registered by the HOBOs

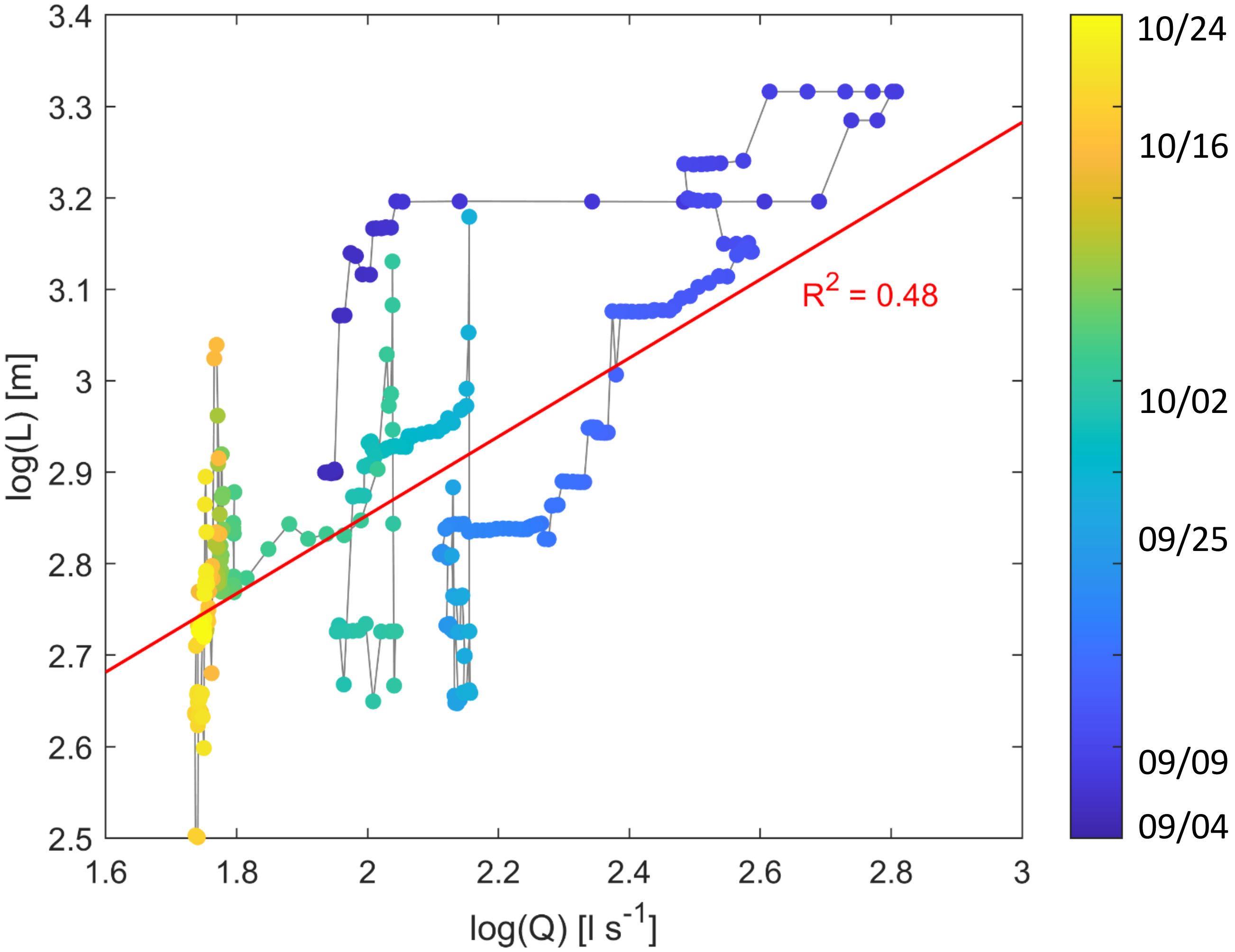


Active length and discharge power law model

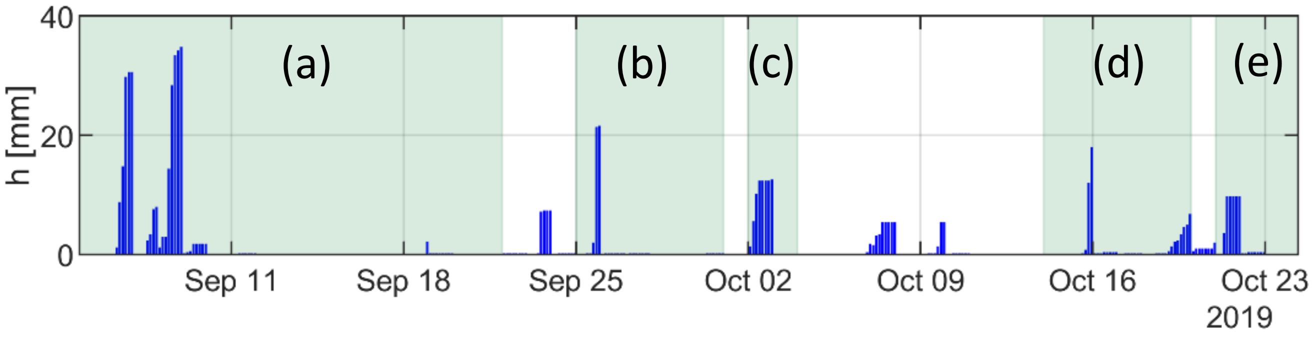
$$L = aQ^b$$

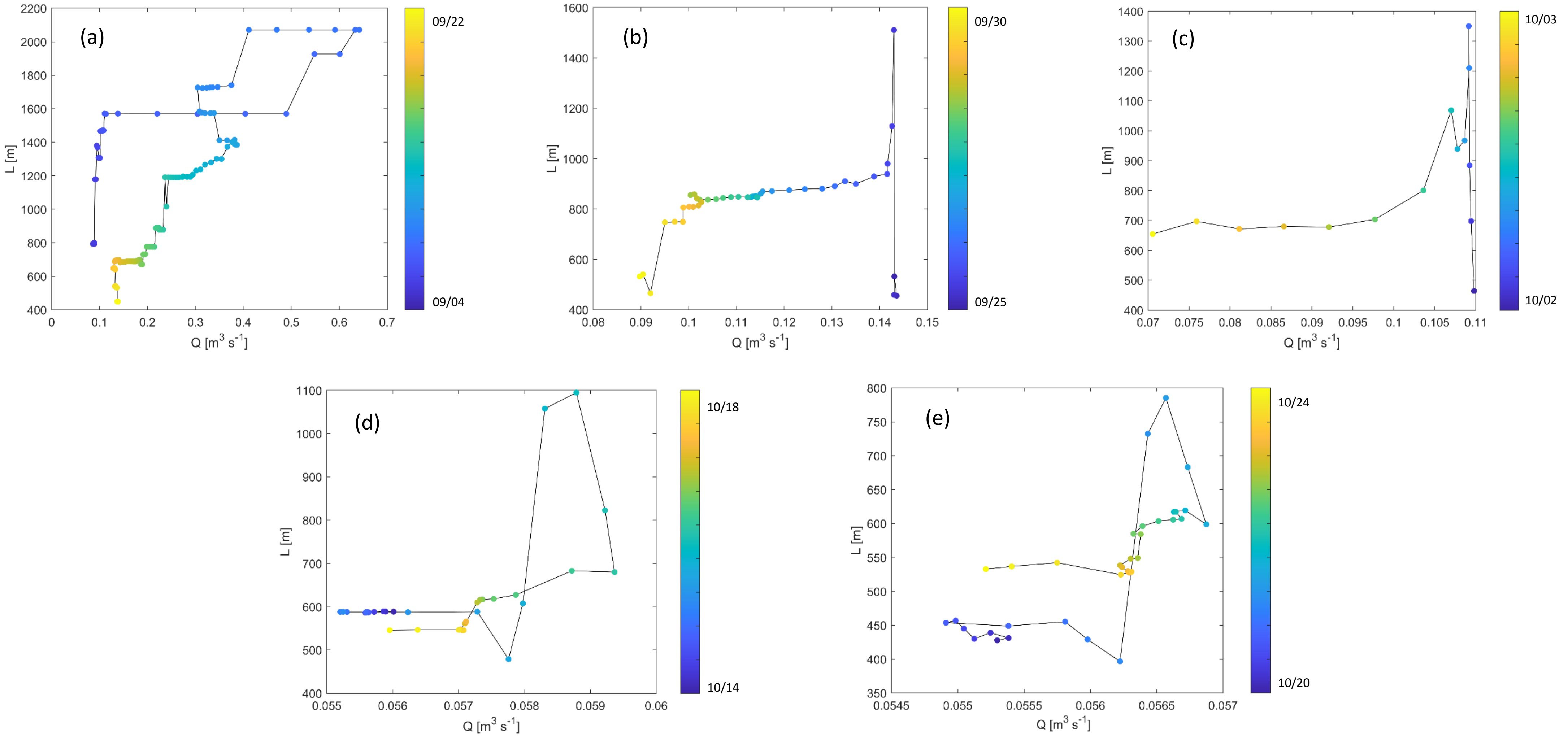
$$\log(L) = \log(a) + b\log(Q)$$

(Godsey and Kirchner, 2014)



Single events active length and discharge relationship





CONCLUSIONS

1. Water presence sensors provided precious information about high frequency space - time network dynamics

2. The mean intensity of the electrical signal and the exceedance of a suitable threshold were found to be highly correlated with the persistencies of the nodes

3. An in depth analysis of the relationship between catchment discharge (Q) and active length (L) was carried out

4. Hysteresis in the high frequency L- Q relationship were observed due to the different responsiveness of the streamflow and the active length to small precipitation inputs.