A soft monitoring approach for comparing runoff on a network of small poorly gauged catchments

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Small catchment scale \((\approx 1 \, \text{km}^2)\)

**Scale of interest**

- **UNDERSTANDING HYDROLOGICAL PROCESSES**
- **IMPACT OF AGRICULTURAL MANAGEMENT**

**HYDROLOGICAL MONITORING NETWORK**
Mostly available for large catchments \((> 100 \, \text{km}^2)\)

Small catchments = ungauged

Hydrological data acquisition ?
Study sites

Catchment characteristics

- 11 small ungauged catchments (≈ 1 km²)
- Headwater position
- Dominant Land Use: vineyard, forest and scrubland
- Main geology type: Schist and limestone
- Soil texture: sandy loam to loamy clay

Catchment characteristics

- Mediterranean climate
- Prolonged dry season
- High intensity
- Short duration

Rainfall events

EPHEMERAL CHANNELS

How to gauge?
Gauging the ungauged catchments: a soft hydrological monitoring

- Stage recorder
- Rain gauge

**Insulator**: teflon

**Conductor 1**: copper

**Conductor 2**: (water + metal bar)

**Linear Relation between Water level & capacitance**

- Easy to install and to move
- Inexpensive
- Not invasive

Discharge?
Discharge estimation (1)

\[ V = \frac{k}{n} \frac{2}{R^3} \cdot S^{\frac{1}{2}} \]

Manning equation

Natural channels and controlled conditions

Manning roughness coefficients:
- 5 cover types
- 3 densities
- 5 water level

n_min: high flow and low density

n_max: low flow and high density
Discharge estimation (2)

• Eleven envelope curves to consider discharge uncertainty

\[ Q_{\min}(t) = \frac{1}{n_{max}} \sqrt{S} \cdot f(h(t)), \quad < \quad Q_{\text{real}} \quad < \quad Q_{\max}(t) = \frac{1}{n_{min}} \sqrt{S} \cdot f(h(t)) \]
Catchment responses variability

Y axis: runoff event depth (mm)

X axis: rainfall event depth (mm)

Error bar = uncertainty

• Variability of catchment responses

• threshold of rainfall depth
Catchment responses variability

Y axis: coeff. of variation of runoff coefficient

X axis: Mean runoff coefficient

• Group 1: unstable responses
• Group 2: intermediate responses
• Group 3: stable responses
Inter-catchment comparison

Y axis: Annual runoff coefficient

X axis: Frequency of occurrence of catchment response

- 3 extremes catchment responses
- Uncertainty & overlapping
Conclusions

• Small catchment : a scale of interest
• Soft hydrological monitoring is promising
• Catchment comparison and processes identification
• Data for Top-down modelling approach

THANK YOU FOR YOUR ATTENTION !!!
Results at annual scale