Process-oriented streamflow characterization in mountain rivers of semiarid areas: Sierra Nevada, Spain

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Objective

Assessment of different baseflow separation methods in mountain rivers of semiarid areas, in the Sierra Nevada area, in southern Spain, in the framework of a process-oriented approach for identifying the major sources/sinks of water.

The results only will provide a better understanding of baseflow separation in snowfed rivers in semiarid regions, but also assess hydrograph analysis in a process-oriented approach.
Study Site & Methodology

Sierra Nevada Mountain Range

<table>
<thead>
<tr>
<th>Area (km²)</th>
<th>Pmm</th>
<th>Snow</th>
<th>Tmean</th>
<th>Height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guadalefo Basin – R5</td>
<td>1058</td>
<td>660</td>
<td>109.3</td>
<td>1418.5</td>
</tr>
<tr>
<td>Orgiva Basin</td>
<td>530.1</td>
<td>745</td>
<td>109</td>
<td>1645.5</td>
</tr>
</tbody>
</table>

Gauge station 500 aprox

Data Analysis

Base Flow Analysis: HydroOffice

Hydrological variable influence on Discharge

Event Separation
Results: Base Flow separation methods

5 Methods applied:
- Local minimum
- Fixed Interval
- Sliding Interval
- BFLOW filter - RDF
- Eckhardt filter - RDFE

Base Flow calculation + Runoff for each method + Final runoff response

HydroOffice Tool
Area coloreado = Qdischarge - Bflow
Ploting the final runoff
Results: Base Flow separation methods

Observations:

- In terms of **days duration**, all methods provide similar events.
- In terms of **Qinitial** of the event, LM and FI provide higher max values of Q.
- In terms of **Qmax** of the event, LM and FI provide higher max values of Q.
- Month with higher Q values – Jan, Feb, Dec
- Month with lower Q values – Jul, Aug
- **Max value** of runoff – 30<Q<70 depending method
Results: BFI

- **BFI máx =1** means at some point all the discharge equals to baseflow

- **BFI >0.9** summer months

- **1 – BFI =** water running that does not come from baseflow = Pmm or Fusion

- Melting months appear to have

- At the annual scale, BFI in all methods do not have less value 0.8
Results: Process-oriented approach.

Example of a process-oriented approach analysis using the mean value of 5 methods:

- Fusion plays a key role in the runoff generation together with rain precipitation
- A clear classification in term of event driver seems to appear
- An event driver classification will provide a better understanding of how climate change is affecting runoff generation in snow areas in the Mediterranean area (semi-arid climate)
Next Research Steps

1 – Analysis of event drivers at different temporal scales.

When these events are finally analyzed, we will be able to understand in a better way the relationship between snow dynamics and the impact on streamflow.

2 - When these processes are clear, we could be able to apply this learning process to future scenarios since the approach was a process oriented one.
THANK YOU VERY MUCH!

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