Looking at the hydrological results from the Asu catchment in a wider context

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Asu catchment results examined in a wider context

Location (Landsat)
Asu catchment results examined in a wider context

Catchment information

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area:</strong></td>
<td>6.8 km²</td>
</tr>
<tr>
<td><strong>Maximum elevation</strong></td>
<td>95m asl</td>
</tr>
<tr>
<td><strong>Maximum relief variation</strong></td>
<td>~50m</td>
</tr>
<tr>
<td><strong>Topography</strong></td>
<td>Dissected plateau, slopes up to 30%</td>
</tr>
<tr>
<td><strong>Mean annual rainfall</strong></td>
<td>~2400mm</td>
</tr>
<tr>
<td><strong>Dry season (=less wet season!)</strong></td>
<td>June – September</td>
</tr>
<tr>
<td><strong>Geology</strong></td>
<td>Flat bedded unconsolidated sediments (sands and clays) of the Barreiras formation</td>
</tr>
<tr>
<td><strong>Soils</strong></td>
<td>Oxisols (85% clay) on plateau Deep sandy soils in valley, transitional on slopes</td>
</tr>
<tr>
<td><strong>Vegetation</strong></td>
<td>Terra firme forest (~180 species ha⁻¹, dbh &gt;10cm)</td>
</tr>
</tbody>
</table>
Asu catchment results examined in a wider context
Measurements

- Rainfall
- Runoff
- Groundwater storage
- Soil moisture storage
- Interception
- Evaporation fluxes
- $\text{CO}_2$ fluxes

In streamflow, groundwater, throughfall
- DOC
- POC
- Nutrients
- CWD (coarse woody debris)
Asu catchment results examined in a wider context
Cross-section along hydrological transect

CROSS-SECTION ALONG HYDROLOGICAL TRANSECT

15M SHAFT
with TDR

T1, 2

T3

WATER LEVEL 16 JULY 2002

BOREHOLES

INTERFLOW TRENCH

DELTA-T PROFILE PROBES

STREAM

T12, 13

T8, 9

T6, 7

T4, 5

Height above stream at gauge (m)

Distance from stream (m)
Asu catchment results examined in a wider context
Schematic diagram showing processes

<table>
<thead>
<tr>
<th>Year</th>
<th>Rain (mm)</th>
<th>Baseflow (mm)</th>
<th>%</th>
<th>Stormflow (mm)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>2975</td>
<td>744</td>
<td>55</td>
<td>618</td>
<td>45</td>
</tr>
<tr>
<td>2003</td>
<td>2054</td>
<td>540</td>
<td>69</td>
<td>241</td>
<td>31</td>
</tr>
</tbody>
</table>
Asu catchment results examined in a wider context
Key features of Bacia Asu

- Deeply weathered and permeable catchment
- Large storage in deep unsaturated zone (up to 36 m deep)
- Large storage in saturated zone
- Long time constant of drainage from this storage
- Valley floor area ~35%
  - kept near saturation by ground water discharge
  - main source of storm runoff (& DOC)
- Baseflow has very little DOC
- Some evidence of contribution from slopes (in v. large events)
Asu catchment results examined in a wider context
Moisture storage changes beneath the plateau

![Graph showing storage changes and daily rainfall over time.]
Asu catchment results examined in a wider context
Storage in saturated zone - Groundwater levels at different distances from the stream

0 – 230m - valley floor
272 m - foot of slope
403 – 780m - plateau
Asu catchment results examined in a wider context
Relation of stormflow to catchment area for studies near Manaus

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Years</th>
<th>Area (km²)</th>
<th>Annual rainfall</th>
<th>Stormflow (%)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calado</td>
<td>1984-85</td>
<td>0.23</td>
<td>2870</td>
<td>5</td>
<td>Lesack (1993)</td>
</tr>
<tr>
<td>Barro Branco</td>
<td>1981</td>
<td>1.3</td>
<td>2312</td>
<td>9</td>
<td>Leopoldo et al. (1995)</td>
</tr>
<tr>
<td></td>
<td>1982</td>
<td>1.3</td>
<td>2365</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1983</td>
<td>1.3</td>
<td>1949</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Asu</td>
<td>2002</td>
<td>6.8</td>
<td>2975</td>
<td>45</td>
<td>Hodnett et al. (2004)</td>
</tr>
<tr>
<td></td>
<td>2003</td>
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<td>2054</td>
<td>31</td>
<td></td>
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</tbody>
</table>
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Figure modified from Lesack (1993)
Asu catchment results examined in a wider context

Figure from Chauvel et al. (1987)
Asu catchment results examined in a wider context
Catchment form – DEMs from map and shuttle radar

Digitised topog. map MI 517/2

Shuttle X-SAR Radar
Asu catchment results examined in a wider context

Conclusions

• Results apply to deeply weathered permeable catchments
• Balance between storm flow and baseflow depends on proportion of catchment area which is valley floor with a shallow watertable
• Results from very small catchments cannot be scaled up directly without taking this into account
• Interflow / return flow on slopes may depend on presence of “clay cap” – not known how widespread this is
• Much geomorphological variation on the Barreiras sediments N of Manaus – range of valley forms in different areas.
Asu catchment results examined in a wider context
Results continued

• In areas with a shallow depth of weathering:
  – much less storage
  – less baseflow (quantity and duration)
  – soil / weathered zone may fill to the surface creating very large contributing areas