Surface Area Weighted Stage Estimation in AADF, cont’d
Presented to the Swan Falls Technical Working Group
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Overview

• Review of previous findings
• Evaluation of weighted stage method SA1
  – AADF Analysis
    • Stage, $\Delta$Stage Analysis of 2015
  – Impact to 2015 Shortfall
• Conclusions and Recommendations
• Previous analysis limited to December 2015
• Findings
  – Two methods are from distinct distributions
  – Composite gage distributions showed less variance and reduced potential for outliers
  – All 5 methods were in good agreement with daily $\triangle \text{stage} < 0.05'$
  – Methods diverge with $\triangle \text{stage} > 0.05'$
    • Single gage method exaggerated change
  – Composite methods show slight differences
  – SA1 method was selected for further analysis
    • Least weight attributed to Loveridge
    • Tightest distribution
Analysis Overview

I. Extend analysis to 2015 dataset
   I. Distribution of 2015 daily stage, $\Delta$stage
   II. Impact to 2015 Shortfall
Impact to 2015 Shortfall

**AADF Comparison - Shortfall 2015**

- **CFS**
- **SF Minimum Flow**
- **Current Method**
- **SA1 Method**

Graph showing the comparison between SF Minimum Flow, Current Method, and SA1 Method over the period from 3/9/2015 to 4/2/2015.
<table>
<thead>
<tr>
<th>Date</th>
<th>Current Method</th>
<th>3 day AADF (cfs)</th>
<th>SA1 Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Res Adjust (cfs)</td>
<td>Flow (cfs)</td>
<td>Res Adjust (cfs)</td>
</tr>
<tr>
<td>3/26/2015</td>
<td>116</td>
<td>5883</td>
<td>106</td>
</tr>
<tr>
<td>3/27/2015</td>
<td>55</td>
<td>5860</td>
<td>-18</td>
</tr>
<tr>
<td>3/28/2015</td>
<td>-370</td>
<td>5541</td>
<td>-136</td>
</tr>
<tr>
<td>3/29/2015</td>
<td>244</td>
<td>5563</td>
<td>130</td>
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<tr>
<td>3/30/2015</td>
<td>450</td>
<td>5675</td>
<td>372</td>
</tr>
<tr>
<td>3/31/2015</td>
<td>-76</td>
<td>5839</td>
<td>83</td>
</tr>
<tr>
<td>Total Shortfall</td>
<td></td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

• Surface area weighted headwater estimation
  • Reduces variability of AADF
  • Less susceptible to wind induced error
  • Simple methodology
  • Easily implemented

• Results of December 2015 are generalized to entire year

Recommendation

• Monitor 2016 with single and composite gage methodologies
SA Method Variability

Cumulative Distribution Function of $\Delta$ Storage (Daily)

$SA_1 - SA_3 = 2$
$SA_3 - SA_1 = 8$

$SA_1 - SA_3 = 8$
$SA_3 - SA_1 = 11$

$SA_1 - SA_3 = 47$
$SA_3 - SA_1 = 55$

Max $\Delta$ Stage Difference CDF
- 75th Percentile (0.004')
- 90th Percentile (0.014')
- 97.5th Percentile (0.016')

Max $\Delta$ Stage - Min $\Delta$ Stage (feet)
SA Method

Variability

Maximum Variation
Wind at GDVI
CJ Dam
Cottonwood
Loveridge
Maximum Absolute Value Frequency

SA1

SA3
CJ Strike at Dam and Loveridge Residual from Median

- Absolute Residual @ Dam
- Absolute Residual @ Loveridge
Conclusions

• Weighted average stage estimation apparently reduces wind induced error
• SA1 attributes least weight to Loveridge and is most defined Δ stage distribution
• Weighted stage estimation exaggerates Δ stage when all gages show similar trends
• Smoothes AADF

Recommendations

• SFTWG should consider implementation of weighted average stage estimation
• Extend analysis beyond December 2015 data
• Further analysis of inflow and outflow to determine validity of weighted average stage
• Further analysis of potential Loveridge time lag