AUSTRALIAN RAINFALL AND RUNOFF

REVISION PROJECT 6
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

APPENDICES A to M
Appendix A  Excluded catchments

The table below lists the gauge and pluviograph number of the catchments that were identified but not able to be included in the analysis. Where inclusion criteria was not met, a comment has been included. Other catchments have been excluded because data was not able to be collected or the catchment was located close to other catchments with a better match to inclusion criteria.

Table A-1 Catchments excluded from analysis

<table>
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<th>State</th>
<th>Comment</th>
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<td>15 yrs overlapping data only; 77% missing flow data</td>
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<td>NSW</td>
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<td>NSW</td>
<td>11% missing flow data</td>
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<td>210072</td>
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</tr>
<tr>
<td>210076</td>
<td>210076</td>
<td>NSW</td>
<td>No useable data</td>
</tr>
<tr>
<td>212001</td>
<td>568058</td>
<td>NSW</td>
<td>Affected by transfers</td>
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<td>212014</td>
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<td>568102</td>
<td>NSW</td>
<td>Timing of rainfall and streamflow not matching</td>
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<td>NSW</td>
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<td>NSW</td>
<td>35% missing pluvio data</td>
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<td>P63108</td>
<td>NSW</td>
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<td>NT</td>
<td>Close to other catchments</td>
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<tr>
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<td></td>
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<td>No data in file provided</td>
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<tr>
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<td>Only equivalent of 16 years overlapping data</td>
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<td>122004</td>
<td>QLD</td>
<td>11% missing flow data</td>
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<td>122004</td>
<td>QLD</td>
<td>Insufficient events could be extracted</td>
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<td>QLD</td>
<td>7 yrs overlapping data only</td>
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<td>143032A</td>
<td>P40528</td>
<td>QLD</td>
<td>Also known as 533021; No overlapping data</td>
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<td>540006</td>
<td>QLD</td>
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<td>25% missing flow data; 63% missing pluvio data</td>
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</tr>
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<td>AW503507 AW503507</td>
<td>SA</td>
<td>14 yrs overlapping data only</td>
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</tr>
<tr>
<td>AW504528 AW504563</td>
<td>SA</td>
<td>Zero flows from 1993 to end of record</td>
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</tr>
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<td>34% missing flow data</td>
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<td>TAS</td>
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<td>Catchment area &lt;20km²</td>
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<td>TAS</td>
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Appendix B  Catchment maps
141001B; South Maroochy River @ Kiamba
211013; Ourimbah Creek @ U/S Weir
213200; O'Hares Creek @ Wedderburn
Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge
- Other Sources
- Watercourse
- Waterbody
- Built-Up Areas

Gauge Location
Catchment Boundary
Rainfall Gauge

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2219; Swan River u/s Hardings Falls
228217; Toomuc Creek @ Pakenham
229106; McMahons Creek @ Upstreams Weir
406216A; Axe Creek @ Sedgwick
422321; Spring Creek @ Killarney
602199; Goodga River @ Black Cat
Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge

Pluviograph Stations
- Bureau of Meteorology
- Other Sources

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609005; Balgarup River @ Mandelup Pool
614003; Marrinup Brook @ Brookdale Siding
614005; Dirk Brook @ Kentish Farm

Legend
- **Gauge Location**
- **Catchment Boundary**
- **Rainfall Gauge**
- **Pluviograph Stations**
  - Bureau of Meteorology
  - Other Sources
- **Watercourse**
- **Waterbody**
- **Built-Up Areas**

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Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge
- Bureau of Meteorology
- Other Sources
- Watercourse
- Waterbody
- Built-Up Areas

Gauge Location
Catchment Boundary
Rainfall Gauge
Pluviograph Stations
Bureau of Meteorology
Other Sources
Watercourse
Waterbody
Built-Up Areas

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614047; Davis Brook @ Murray Valley Pltn
809312; Fletcher Creek Trib @ Frog Hollow
A5040523; Castambul @ Sixth Creek
Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge

Pluviograph Stations
- Bureau of Meteorology
- Other Sources

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  herein.

AW501500; Hindmarsh @ Hindmarsh Vy Res Offtake W
Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge

Pluviograph Stations
- Bureau of Meteorology
- Other Sources
  - Watercourse
  - Waterbody
  - Built-Up Areas

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AW503506; Echunga Creek u/s Mt Bold Reserve
G8150151; Celia Creek u/s Darwin River Dam

Legend
- Gauge Location
- Catchment Boundary
- Rainfall Gauge
- Pluviograph Stations
- Bureau of Meteorology
- Other Sources
- Watercourse
- Waterbody
- Built-Up Areas

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Map created by: SKM

October 22, 2013 | VW07245_PreliminaryTechnicalReport\VW07245_FinalCatchmentMaps_v2.mxd
Prepared by: SI
Checked by: ZG

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G8170066; Coomalie Creek @ Stuart Highway
G8170075; Manton River u/s Manton Dam
Appendix C  Pre-burst distribution for each duration

Figure C-1 Range of pre-burst rainfall for 3-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)

Figure C-2 Range of pre-burst rainfall for 6-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)
Figure C-3 Range of pre-burst rainfall for 12-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)

Figure C-4 Range of pre-burst rainfall for 24-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)
Figure C-5 Range of pre-burst rainfall for 48-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)

Figure C-6 Range of pre-burst rainfall for 72-hour bursts (box indicates quartiles and line shows 10th and 90th percentile values)
Appendix D  Ratio of 3 hour to 6 hour pre-burst relationships

- **Mean annual rain (mm/yr):**
  - $y = 0.0007x + 2.5891$
  - $R^2 = 0.0571$

- **Median annual API (mm):**
  - $y = 0.0777x + 3.0165$
  - $R^2 = 0.1519$

- **24hr IDF2013 2% AEP design rainfall (mm):**
  - $y = 0.0024x + 2.0578$
  - $R^2 = 0.015$

- **Median event API (mm):**
  - $y = -0.0018x + 2.3369$
  - $R^2 = 0.0557$

- **Top 2%ile value API (mm):**
  - $y = -0.0038x + 2.3124$
  - $R^2 = 0.0294$

- **Top 5%ile value API (mm):**
  - $y = -0.0027x + 2.2734$
  - $R^2 = 0.033$

- **Top 10%ile value API (mm):**
  - $y = -0.0015x + 2.3426$
  - $R^2 = 0.0354$

- **Top 20%ile value API (mm):**
  - $y = -0.0012x + 2.2876$
  - $R^2 = 0.031$
Appendix E  Pre-burst distributions and API for each site and duration
Ourimbah Creek @ U/S Weir (NSW)

**API (mm) vs. Burst duration (hours):**

- API values range from 0 to 160 for different burst durations (3, 6, 12, 24, 48, 72 hours).
- The box plots show the distribution of API values for each burst duration.

**Pre-burst rainfall (mm) vs. Burst duration (hours):**

- Pre-burst rainfall values range from 0 to 200 for different burst durations (3, 6, 12, 24, 48, 72 hours).
- The bar charts display the pre-burst rainfall for each burst duration, with red squares indicating the median values.
Jerrabomberra Creek @ Four Mile Creek (ACT)

**Graph 1:**
- **Y-axis:** API (mm)
- **X-axis:** Burst duration (hours)
- The graph shows the API (mm) for different burst durations (3, 6, 12, 24, 48, 72 hours).

**Graph 2:**
- **Y-axis:** Pre-burst rainfall (mm)
- **X-axis:** Burst duration (hours)
- The graph illustrates the pre-burst rainfall (mm) for various burst durations (3, 6, 12, 24, 48, 72 hours).
Axe Creek @ Sedgewick (VIC)

**Graph 1:**
- **Y-axis:** API (mm)
- **X-axis:** Burst duration (hours)
- The box plots show the distribution of API values for different burst durations (3, 6, 12, 24, 48, 72 hours). The central mark indicates the median, and the box boundaries represent the interquartile range (IQR).

**Graph 2:**
- **Y-axis:** Pre-burst rainfall (mm)
- **X-axis:** Burst duration (hours)
- The bar chart displays the pre-burst rainfall for the same burst durations as in Graph 1. Each bar shows the rainfall amount for a specific burst duration.
Caboolture River @ Upper Caboolture (QLD)

API (mm)

Burst duration (hours)

Pre-burst rainfall (mm)

Burst duration (hours)
Buller River @ Buller (WA)

Burst duration (hours)

API (mm)

Pre-burst rainfall (mm)

Burst duration (hours)
Hamilton River @ Worsley (WA)

![Box plots showing API (mm) vs Burst duration (hours)](attachment:hamilton_river_api_vs_burst_duration.png)

![Bar charts showing Pre-burst rainfall (mm) vs Burst duration (hours)](attachment:hamilton_river_pre_burst_rainfall_vs_burst_duration.png)
Appendix F  Distribution of pre-burst rainfall for each region

Figure F-1 Distribution of pre-burst rainfall normalized by burst rainfall for each PMP method region. Northern Territory catchments and Fletcher Creek are shown in a separate plot.
Appendix G  Sensitivity of loss values to approach

G.1 Introduction

Prior to commencing to Phase 4 the ARR Technical Committee endorsed some additional investigations to explore different approaches to estimate loss values. The variability between users is considered in terms of both losses and modelled flow volume error. The sensitivity of the model to the routing characteristics is tested by repeating the calibrations using three methods of selecting RORB routing parameter $k_c$. Finally, the influence of the runoff routing model structure is assessed by calibrating losses using the URBS runoff routing model and comparing these values to those achieved using RORB.

This appendix documents the sensitivity of the Initial Loss – Continuing Loss (IL/CL) conceptual loss model to the subjective nature of user calibration, the selection of routing parameter and the flood model utilized. The work concentrated on the Initial Loss – Continuing Loss (IL/CL) model but the broad conclusions are expected to also be applicable to the application of SWMOD.

Phase 1 also noted that the application of SWMOD was constrained by the lack of information on the hydraulic properties of soils. Some further analysis was undertaken to explore the sensitivity of the SWMOD parameters to assumptions regarding the soil hydraulic properties.
**G.2 IL/CL - Sensitivity to modeller**

**Introduction**

In estimating the loss values for the pilot catchments, the modelled hydrograph is fitted to the surface runoff (derived from recorded streamflow with the baseflow removed). The goodness of fit is assessed subjectively using the following criteria:

- Volume
- Overall shape
- Peak
- Timing

This subjective procedure leads to changes in loss estimates based on the user calibrating the model. To assess the sensitivity of the calibration to this subjectivity, calibrations performed as part of the Phase 1 pilot study are revisited using different modellers in a blind test.

**Table G-1 Summary of catchments examined**

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Area (km²)</th>
<th>State</th>
<th>Mean Annual Rainfall (mm)</th>
<th>No. events</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>36</td>
<td>WA</td>
<td>1150</td>
<td>20</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>36</td>
<td>QLD</td>
<td>1800</td>
<td>27</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>52</td>
<td>ACT</td>
<td>820</td>
<td>20</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>29</td>
<td>NT</td>
<td>1430</td>
<td>28</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>41</td>
<td>QLD</td>
<td>1650</td>
<td>27</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>44</td>
<td>SA</td>
<td>1000</td>
<td>15</td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>32</td>
<td>QLD</td>
<td>1210</td>
<td>29</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>38</td>
<td>TAS</td>
<td>920</td>
<td>20</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>42</td>
<td>VIC</td>
<td>1060</td>
<td>10</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>53</td>
<td>WA</td>
<td>800</td>
<td>7</td>
</tr>
</tbody>
</table>

**Variation in Initial Loss values**

The resulting estimates of loss are summarised in the following figures and tables. Although there are significant differences for some individual events (Figure G-1), there is no bias; both the pilot and revisited calibrations have a similar distribution of Initial Loss values across the events (this is seen by the low changes in median losses for each catchment seen in Table G-2).
Figure G-1 Initial Loss values for the original pilot calibration and the revisited calibration

Table G-2 Median Initial Loss values for pilot and revisited calibrations

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Initial Loss (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>17</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>60</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>19</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>32</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>25</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>36</td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>45</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>30</td>
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<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>20</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>31</td>
</tr>
</tbody>
</table>

P6/S3/016B: 23 October 2014
Figure G-2 Comparison of Initial Loss boxplots for pilot and revisited calibrations

Variation in Continuing Loss values

The results for Continuing Loss are presented in the following figures and table. Similar to Initial Loss, estimates of Continuing Loss are sensitive to the user. Additionally, there is a small bias present; the revisited calibration has slightly higher Continuing Loss than the original pilot study. Furthermore, the median Continuing Loss for the revisit is slightly higher than the pilot study value for seven of the ten catchments (Table G-3).

Figure G-3 Continuing Loss values for the original pilot calibration and the revisited calibration
Table G-3 Median Continuing Loss values for pilot and revisited calibrations

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Pilot calibration</th>
<th>Revisited calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>8.8</td>
<td>9.6</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>7.0</td>
<td>7.2</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>2.3</td>
<td>3.4</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>2.0</td>
<td>1.7</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>5.0</td>
<td>7.9</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>2.1</td>
<td>1.7</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Figure G-4 Comparison of Continuing Loss boxplots for pilot and revisited calibrations
Variation in volume error

In the revisited calibrations matching flow volume was prioritised over matching peaks. Resultantly, the volume error tends to be closer to zero in the revisited calibrations (Figure G-5). This is particularly apparent in the Yates Flat, Toomuc Creek and Dirk Brook catchments (as seen in Figure G-6). For Sixth Creek there is a consistent underestimation of the volume which indicates an error in the separation of baseflow, or else possibly in the adopted routing parameters or in the representativeness of the input rainfalls.

Table G-4 Median volume error for pilot and revisited calibrations

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Pilot calibration</th>
<th>Revisited calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>-4.4%</td>
<td>-0.8%</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>-6.8%</td>
<td>-7.0%</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>-17.9%</td>
<td>-16.0%</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>-17.5%</td>
<td>-17.9%</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>-4.3%</td>
<td>-2.8%</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>-49.4%</td>
<td>-49.7%</td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>-8.5%</td>
<td>-7.3%</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>-4.4%</td>
<td>-9.4%</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>-7.9%</td>
<td>-1.4%</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>-10.1%</td>
<td>-3.3%</td>
</tr>
</tbody>
</table>
Figure G-6 Comparison of volume error between the pilot and revisited calibrations
G.3 IL/CL - Sensitivity to routing parameter

Introduction

The results from stage 1 of this investigation (SKM, 2012) made it clear that to reduce errors in the identification of the loss parameters some account needs to be given to the time-lags involved in the travel of rainfall-excess through the catchment. While it was apparent that simple empirical equations are not adequate to represent the lag, it is worth exploring the improvements that can be gained by adopting routing approaches based on different levels of accuracy. To this end, the sensitivity of loss values was evaluated for 3 different approaches to specifying the routing parameter, $k_c$, namely:

- **Variable $k_c$** – The routing parameter was adjusted for each event to ensure the best fit to the surface runoff hydrograph. Due to the freedom of not having a fixed $k_c$ this method is time intensive for a large number of events but resulted in the best match to the recorded hydrographs.

- **Adopted $k_c$** – As part of Phase 1, $k_c$ values were derived for each catchment from calibration to the largest events on record. Using this fixed $k_c$ value for all events in a catchment is less demanding than having a variable value; however, the procedure of calibrating $k_c$ for each catchment takes time.

- **Regional $k_c$** – The routing parameter was based upon the regional prediction procedure described in Pearse et al. (2002) where the $k_c$ is a simply a product of the average flow distance in the catchment. A value of 1.14 was adopted as this was the median of the CRCCH data set compiled by Dyer (1994). The simplicity of this method makes it considerably more time effective than either the variable or adopted $k_c$ procedures.

Range of routing parameter values examined

The range of $k_c$ values to estimate the loss values is shown in Table G-5 and Figure G-7.

**Table G-5 Adopted and regional routing parameter values**

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Adopted $k_c$</th>
<th>Regional $k_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>14</td>
<td>6.9</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>4</td>
<td>6.4</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>4</td>
<td>9.4</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>8</td>
<td>8.4</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>20</td>
<td>9.1</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>6</td>
<td>9.8</td>
</tr>
<tr>
<td>422321</td>
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<td>6.6</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>10</td>
<td>8.1</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>12</td>
<td>10.2</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>10</td>
<td>7.0</td>
</tr>
</tbody>
</table>
It can be seen that for all 10 catchments the adopted $k_c$ values are similar to the median value from the variable $k_c$ calibrations. This confirms that the routing characteristics of a catchment can be effectively estimated from a “handful” of events.

The effectiveness of the regional $k_c$ approach varies between catchments. For Finch Hatton, Manton River and Toomuc Creek the regional $k_c$ is close to the adopted and median values, however, for Jerrabomberra, North Maroochy and Yates Flat the regional approach resulted in values that were towards the end of the observed range.

**Variation of Initial Loss values**

The Initial Loss values resulting from the application of the different routing parameters are shown in Figure G-8 and the median values are summarised in Table G-6.

**Table G-6 Median Initial Loss values for different $k_c$ values**

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Variable $k_c$</th>
<th>Adopted $k_c$</th>
<th>Regional $k_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>20</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>54</td>
<td>51</td>
<td>30</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>15</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>32</td>
<td>39</td>
<td>31</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>24</td>
<td>21</td>
<td>45</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>25</td>
<td>32</td>
<td>33</td>
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<tr>
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<td>40</td>
<td>37</td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>40</td>
<td>44</td>
<td>41</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>22</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>28</td>
<td>32</td>
<td>18</td>
</tr>
</tbody>
</table>
Figure G-8 Comparison of Initial Loss for different routing parameter values

Legend:

$V$ = Variable $k_c$

$A$ = Adopted $k_c$

$R$ = Regional $k_c$
The increase in scatter in Initial Loss associated with adoption of the simpler (more constrained) approach to specification of the routing parameter is evident in Figure G-10.

**Variation in Continuing Loss values**

The Continuing Loss values resulting from the application of the different routing parameters are shown in Figure G-10 and the median values are summarised in Table G-7.

**Table G-7 Median Continuing Loss values for different $k_c$ values**

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>CL (mm/h)</th>
<th>Variable $k_c$</th>
<th>Adopted $k_c$</th>
<th>Regional $k_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>9.5</td>
<td>9.6</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>6.0</td>
<td>7.2</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>2.5</td>
<td>3.4</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>2.2</td>
<td>2.4</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>1.7</td>
<td>1.7</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>2.7</td>
<td>2.6</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>8.2</td>
<td>7.9</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>1.2</td>
<td>1.5</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>1.8</td>
<td>1.7</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td></td>
</tr>
</tbody>
</table>
Figure G-10 Comparison of Continuing Loss for different routing parameter values
The increase in scatter in Continuing Loss associated with adoption of the simpler (more constrained) approach to specification of the routing parameter is evident in Figure G-11.

**Variation of volume error**

The volume errors resulting from the application of the different routing parameters are shown in Figure G-12 and the median values are summarised in Table G-8.

**Table G-8 Median continuing volume error for different $k_c$ values**

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Catchment</th>
<th>Variable $k_c$</th>
<th>Adopted $k_c$</th>
<th>Regional $k_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>614005</td>
<td>Dirk Brook @ Kentish Farm</td>
<td>-7.2%</td>
<td>-0.8%</td>
<td>-44.1%</td>
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<tr>
<td>125006</td>
<td>Finch Hatton Creek @ Dam Site</td>
<td>-8.4%</td>
<td>-7.0%</td>
<td>-2.7%</td>
</tr>
<tr>
<td>410743</td>
<td>Jerrabomberra Creek @ Four Mile Creek</td>
<td>-1.9%</td>
<td>-16.0%</td>
<td>31.4%</td>
</tr>
<tr>
<td>G8170075</td>
<td>Manton River u/s Manton Dam</td>
<td>-4.4%</td>
<td>-17.9%</td>
<td>-16.9%</td>
</tr>
<tr>
<td>141009</td>
<td>North Maroochy River @ Eumundi</td>
<td>-0.4%</td>
<td>-2.8%</td>
<td>-42.6%</td>
</tr>
<tr>
<td>A5040523</td>
<td>Sixth Creek @ Castambul</td>
<td>-36.3%</td>
<td>-49.7%</td>
<td>-17.9%</td>
</tr>
<tr>
<td>422321</td>
<td>Spring Creek @ Killarney</td>
<td>-8.3%</td>
<td>-7.3%</td>
<td>-9.9%</td>
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<tr>
<td>2219</td>
<td>Swan River u/s Hardings Falls</td>
<td>-5.1%</td>
<td>-9.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>228217</td>
<td>Toomuc Creek @ Pakenham</td>
<td>0.3%</td>
<td>-1.4%</td>
<td>-14.3%</td>
</tr>
<tr>
<td>603190</td>
<td>Yates Flat Creek @ Woonanup</td>
<td>-2.5%</td>
<td>-3.3%</td>
<td>-22.2%</td>
</tr>
</tbody>
</table>

It is shown in Figure G-12 that the variable $k_c$ approach represents the best hydrograph fitting in...
terms of volume (in terms of both the median and spread of error for all catchments). This is an expected result – the freedom afforded by a variable $k_c$ allows more events to be fitted suitably.

The adopted $k_c$ calibrations perform largely better than the regional $k_c$ approach. The poorest performing catchments using the regional method are the same catchments with large differences between the regional and adopted $k_c$ (Dirk Brook, Jerrabomberra and North Maroochy). A notable exception is Sixth Creek, which performed better under the regional method. It can be seen that regardless of the chosen method the volume is consistently under predicted for Sixth Creek events. As investigated in the Phase 1 pilot study, this underestimation is also present when using the IL/PL and SWMOD models. This implies that the baseflow separation for this catchment needs to be revisited.

An increase in $k_c$ generally corresponded to an increase in the absolute value of the median volume error for most catchments. For given losses an increase in the routing parameter leads to a smoother hydrograph and lower peak flows that occur over a longer time, whereas a smaller $k_c$ leads to shorter, more intense peak flows. Once the losses are estimated and the peaks fitted a lower $k_c$ typically results in a lower flow volume. This translates into a correlation between $k_c$ and volume error.

The increase in scatter in volume error associated with adoption of the simpler (more constrained) approach to specification of the routing parameter is evident in Figure G-13.
Figure G-12 Comparison of volume error for different routing parameter values

- V = Variable $k_c$
- A = Adopted $k_c$
- R = Regional $k_c$
Figure G-13 Comparison of median volume error obtained from using different routing approaches
G.4 IL/CL - Sensitivity to model selection

Introduction

To test whether the estimation of losses is sensitive to the runoff routing model selected, loss values were also estimated using an URBS model with separate routing parameter defined for channel and overland routing ($\alpha$ and $\beta$). Given that regional predictions are not available for URBS, these parameters were varied for each event. The estimated loss values were then compared to those estimated using RORB where the $k_c$ parameter was varied with each event.

Variation in Initial Loss values

The comparison of the Initial Loss values estimated from the 2 models is shown in Figure G-14. Although there are a small number of events which have large differences, the majority of loss values derived from the two models are similar and there is no obvious bias in the values.

Figure G-14 Initial Loss values for the RORB and URBS calibrations

This is reinforced by the similarity of the two boxplots for each catchment, seen in Figure G-15. It should be noted that Toomuc Creek had few storm events suited to calibration and consequently the shape of the boxplot is more sensitive to changes in the losses of individual events than the other catchments.
Figure G-15 Comparison of Initial Loss boxplots for RORB and URBS calibrations

Variation in Continuing Loss values

Figure G-16 shows the Continuing Loss values from the two different models. Once again although there are some events with quite different values of loss, there is no obvious bias in the results and the median values from the two models are quite similar (Figure ).

Figure G-16 Initial Loss values for the RORB and URBS calibrations
Comparison of Variation in volume error

The volume error from each of the models is compared in Figure G-18. It can be seen in that in terms of volume error the URBS model performed marginally better than the RORB model. Of the performed calibrations, URBS described flow volume better for 55% of the events. This result can be attributed to the greater freedom afforded in URBS by the separation of routing into overland and in-channel routing (which provides additional fitting flexibility).

Figure G-17 Comparison of Continuing Loss boxplots for RORB and URBS calibrations

Figure G-18 Volume error for the RORB and URBS calibrations
G.5 SWMOD - Sensitivity to soil water storage curve shape

Introduction

As a variable infiltration capacity model, the SWMOD model utilizes a relationship between infiltration capacity and the saturated fraction of the catchment. This relationship is governed by:

\[ C_f = C_{\text{max}} - (C_{\text{max}} - C_{\text{min}}) \times \left( \frac{1}{F} \right)^{\beta} \]

Where

- \( C_f \) is the infiltration capacity at fraction \( F \) of the sub-catchment;
- \( F \) is the saturation fraction of the sub-catchment;
- \( \beta \) is the shape parameter;
- \( C_{\text{max}} \) is the maximum infiltration capacity; and
- \( C_{\text{min}} \) is the minimum infiltration capacity.

In this study, the soil water retention curve was constructed using properties provided by McKenzie et al (2000). 5\(^{th}\) percentile and 95\(^{th}\) percentile estimates of the soil water holding capacity were used as estimates for minimum and maximum infiltration capacity respectively, and were used in conjunction with the median estimate to fit shape parameter \( \beta \).

This analysis is concerned with testing if there is any appreciable increase in model performance when using a fitted \( \beta \) over assuming a linear relationship (that is, \( \beta = 1 \)). Calibrations using both fitted \( \beta \) values and linear relationships were performed for four of the pilot catchments.

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Soil id</th>
<th>( \beta )</th>
<th>Proportion of catchment area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirk Brook</td>
<td>19482</td>
<td>1.7</td>
<td>90.8%</td>
</tr>
<tr>
<td>19505</td>
<td></td>
<td>1.26</td>
<td>9.2%</td>
</tr>
<tr>
<td>Spring Creek</td>
<td>15532</td>
<td>5.2</td>
<td>61.7%</td>
</tr>
<tr>
<td>16358</td>
<td></td>
<td>1.6</td>
<td>38.1%</td>
</tr>
<tr>
<td>16530</td>
<td></td>
<td>1.05</td>
<td>0.1%</td>
</tr>
<tr>
<td>16585</td>
<td></td>
<td>1.05</td>
<td>0.1%</td>
</tr>
<tr>
<td>Finch Hatton Creek</td>
<td>7364</td>
<td>1.39</td>
<td>100%</td>
</tr>
<tr>
<td>Toomuc Creek</td>
<td>21769</td>
<td>1.33</td>
<td>74.5%</td>
</tr>
<tr>
<td>21885</td>
<td></td>
<td>1.24</td>
<td>21.1%</td>
</tr>
<tr>
<td>21990</td>
<td></td>
<td>1.0</td>
<td>4.4%</td>
</tr>
</tbody>
</table>
Initial Moisture Content

Figure G-19 shows the different Initial Moisture contents estimated for the linear and Beta infiltration capacity relationships. The Initial Moisture content was not sensitive to the shape of the infiltration capacity relationship. This is an expected result; altering $\beta$ does not change the minimum infiltration capacity – resultantly, the Initial Moisture deficit for a given Initial Moisture content should not be affected.

![Graph showing Initial Moisture Content comparison](image)

**Figure G-19 Comparison of Initial Moisture content boxplots for both the linear and fitted beta infiltration capacity relationships**

Capacity Factor

In initial conceptualization SWMOD only used one parameter – Initial Moisture content. After it was shown that this parameter did not allow the model to match observations effectively the Capacity Factor was introduced to increase flexibility.

Figure G-20 shows the resulting Capacity Factors for the 2 infiltration capacity relationships. For all catchments the Capacity Factor is no closer to one for the $\beta$ calibrations than the linear calibrations. In fact, for Spring Creek both the median Capacity Factor and the range of values are larger for the $\beta$ calibrations. This implies that there is no advantage to using the fitted infiltration capacity relationship in terms of Capacity Factor.
Figure G-20 Comparison of Capacity Factor boxplots for both the linear and fitted beta infiltration capacity relationships

Figure G-21 shows the volume errors for the 2 infiltration capacity relationships. It can be seen that volume error is consistent between calibrations for all but the Dirk Brook catchment, where model performance has improved significantly. It is therefore highlighted that the potential benefits of using fitted $\beta$ values are catchment specific. All of the catchments use relationships with $\beta$ significantly larger than one; however, the change in performance does not correspond with how non-linear the infiltration capacity relationship is.

Figure G-21 Comparison of volume error content boxplots for both the linear and fitted beta infiltration capacity relationships
G.6 SWMOD - Sensitivity to scaling of soil water holding capacity

Introduction

As detailed in the pilot study, estimates of water holding capacity compiled by the Water Corporation in Western Australia and the findings of Ladson et al. (2006) have highlighted the possibility that water holding capacity values estimated using the values presented by McKenzie et al. (2000) may lead to an under-prediction of water holding capacity. Indeed, in a comparison of four Western Australian catchments, estimates calculated McKenzie et al. (2000) were over three times smaller than those compiled with the Department of Water data.

Table G-10 Comparison of water holding capacity calculated using McKenzie et al. (2000) values and calculated using soil water storage relationships in SWMOD by DoW, WA (Leanne Pearce, Water Corporation, pers. Comm.)

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Calculated using McKenzie et al. (2000) (mm)</th>
<th>Department of Water (mm)</th>
<th>Ratio of difference</th>
</tr>
</thead>
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<tr>
<td>Serpentine Creek</td>
<td>132</td>
<td>447</td>
<td>0.29</td>
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<tr>
<td>Samson Brook Dam</td>
<td>141</td>
<td>525</td>
<td>0.26</td>
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<tr>
<td>South Dandalup Dam</td>
<td>127</td>
<td>467</td>
<td>0.27</td>
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<tr>
<td>Wellington Dam</td>
<td>285</td>
<td>521</td>
<td>0.54</td>
</tr>
</tbody>
</table>

To explore potential improvements to model performance gained by addressing this discrepancy, the linear relationship ($\beta = 1$) calibrations are compared to a revisited set of calibrations where all soil water holding capacity values have been multiplied by three (denoted “linear x3 calibrations”). This analysis is performed for six of the pilot catchments.

Initial Moisture Content

As expected, the Initial Moisture content is higher in the “linear x3 calibration”. Figure G-22 shows that when the infiltration capacity values are scaled there are fewer negative values used (particularly in Spring Creek). This is a desirable result; negative Initial Moisture content represents where $c_{\text{min}}$ is not high enough for an Initial Moisture content of zero to give a high enough Initial Moisture deficit (which somewhat corresponds with Initial Loss). The reduction in negative values for the “linear x3 calibrations” suggests that the scaled infiltration capacity values may be closer to the actual capacity for some catchments.
Figure G-22 Initial Moisture Content values for the 3x multiplier both not applied and applied to the linear infiltration capacity relationship

Figure G-23 Comparison of Initial Moisture content boxplots for the 3x multiplier both not applied and applied to the linear infiltration capacity relationship
Capacity Factor

Figure G-24 shows the impact of increasing the capacities on the Capacity Factor. The Capacity Factor is systematically higher without the application of the multiplier than it is with it. This reduction is particularly apparent in the Dirk Brook and Spring Creek catchments (which have high median Capacity Factor values without the multiplier).

It should be noted that the Capacity Factor reduction also occurs in catchments where the value is acceptable before applying the multiplier. This can be seen in Toomuc Creek, Yates Flat and North Maroochy, where the Capacity Factor values are further from one after applying the multiplier.

Figure G-24 Capacity Factor values for the 3x multiplier applied to the linear infiltration capacity relationship
It is seen in Figure G-27 that the volume error is largely consistent between the linear and “linear x3 calibrations” except for Spring Creek (where there is moderate improvement when the multiplier is used).

Though similar volume errors between calibrations may suggest that model performance has not changed significantly, the resulting value of the Capacity Factor must be considered. The Capacity Factor was originally introduced to the model when the Initial Moisture content alone did not allow the model to adequately fit observations and therefore a better fit can also be attributed to a Capacity Factor closer to unity.
Figure G-26 Volume error for the 3x multiplier both not applied and applied to the linear infiltration capacity relationship

Figure G-27 Comparison of volume error boxplots for the 3x multiplier both not applied and applied to the linear infiltration capacity relationship
G.7 Correlation between Initial Loss and SWMOD Initial Moisture deficit

Introduction

Initial Moisture deficit is defined as $c_{\text{min}}$ minus the Initial Moisture content. This represents the amount of moisture that initially must enter the soil before runoff can commence – in this regard it is conceptually similar to Initial Loss in the IL/CL loss model.

This analysis is concerned with examining the correlation between Initial Loss and Initial Moisture deficit. A representative $c_{\text{min}}$ for each catchment is defined by weighted average where each soil’s associated $c_{\text{min}}$ is scaled by catchment area that soil type covers. The Initial Moisture deficit for each event in all ten catchments is compared to the Initial Loss value derived in the adopted $k_c$ IL/CL RORB calibrations.

Results

It can be seen in Figure G-28 that some moderate correlation exists between IL and Initial Moisture deficit in some catchments (in particular North Maroochy and Spring Creek). It is clear that this relationship is catchment-specific – for instance, there is no correlation seen in Finch Hatton or Toomuc Creek.

The use of a weighted average $c_{\text{min}}$ could be re-evaluated in further analysis – a weighted average was chosen to ensure that the infiltration properties of each soil in a catchment are adequately represented, however runoff will begin in soils with the lowest $c_{\text{min}}$ value first (hence minimum $c_{\text{min}}$ may be a useful alternate representative value).
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

Figure G-28 Initial Moisture deficit vs. Initial Loss for each catchment
G.8 Conclusions

The investigation described in this report is based on limited scope of work, however on the basis of the results presented it can be concluded that:

- Differences in results arising from subjective judgements by different practitioners has a negligible to small influence on estimates of initial and Continuing Loss rates;
- Calibration performance improves when site- and event-specific characteristics are considered, and any increase in the uncertainty in the timing of simulated hydrographs propagates through to additional uncertainty in estimates of loss parameters;
- The selection of an alternative routing model structure has little influence on the derived estimates of the loss parameters;
- Loss parameters are not sensitive to the shape of the soil water storage curve adopted for the variable infiltration capacity (SWMOD) model;
- While it is necessary to scale regional estimates of soil water holding capacity to yield values that are consistent with site-specific analyses, the impact on calibration performance is low; and,
- There is moderate correlation between Initial Loss characteristics obtained from fixed- and variable- infiltration models, though further investigation would be required to understand whether it would be possible to use this for predictive purposes.
## Appendix H  Adopted routing and baseflow parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>$c_{ua}$</th>
<th>$d_{ua}$</th>
<th>Baseflow separation</th>
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<td></td>
<td></td>
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<td>NSW</td>
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<td>1.63</td>
<td>12.5</td>
</tr>
</tbody>
</table>
Currambene Ck @ Falls Ck (NSW) - 24 hour bursts

**Burst Rainfall (mm)**

\[ y = 0.2582x - 23.556 \]

**Preburst Rainfall (mm)**

\[ y = -0.6655x + 27.925 \]

**Initial Moisture (mm)**

\[ y = -0.2822x + 65.789 \]

**Skill Score**

\[ y = 0.5066x - 37.479 \]

**Burst Initial Loss (mm)**

\[ y = -0.2822x + 65.789 \]

**Initial Moisture (mm)**

\[ y = -0.6655x + 27.925 \]

**Storm Initial Loss (mm)**

\[ y = -0.2822x + 65.789 \]
Currambene Ck @ Falls Ck (NSW) - 24 hour bursts

- Storm Initial Loss (mm)
- Continuing Loss (mm/h)
- Initial Moisture (mm)
- Capacity Factor

Charts showing the relationship between Storm Initial Loss, Continuing Loss, Initial Moisture, and Capacity Factor with respect to Burst ARI (years) and Month.
Ourimbah Ck @ U/S Weir (NSW) - 24 hour bursts

\[ y = 0.2035x + 10.365 \]
\[ R^2 = 0.0306 \]

![Graph showing the relationship between Preburst Rainfall and Burst Rainfall with the equation and R^2 value.](image1)

\[ y = -0.5728x + 63.174 \]
\[ R^2 = 0.4868 \]

![Graph showing the relationship between Initial Moisture and Storm Initial Loss with the equation and R^2 value.](image2)

\[ y = -0.3775x + 82.285 \]
\[ R^2 = 0.1853 \]

![Graph showing the relationship between Storm Initial Loss and API with the equation and R^2 value.](image3)

\[ y = 0.2605x + 13.011 \]
\[ R^2 = 0.1309 \]

![Graph showing the relationship between Initial Moisture and API with the equation and R^2 value.](image4)
Ourimbah Ck @ U/S Weir (NSW) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Swan River @ Harding Falls (Tas) - 24 hour bursts

\[ y = -0.3047x + 79.062 \]
\[ R^2 = 0.0277 \]

\[ y = -0.8709x + 10.793 \]
\[ R^2 = 0.6904 \]

\[ y = -0.614x + 77.465 \]
\[ R^2 = 0.3383 \]

\[ y = 0.5557x - 57.714 \]
\[ R^2 = 0.2522 \]
Swan River @ Harding Falls (Tas) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Aire @ Wyelangta (VIC) - 24 hour bursts

\[ y = 0.0618x + 5.844 \]
\[ R^2 = 0.0248 \]

\[ y = -0.3781x + 35.123 \]
\[ R^2 = 0.1679 \]

\[ y = -0.1838x + 36.296 \]
\[ R^2 = 0.2024 \]

\[ y = 0.1096x + 18.102 \]
\[ R^2 = 0.0846 \]
Aire @ Wyelangta (VIC) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
McMahons Ck @ Upstreams Weir (VIC) - 24 hour bursts

**Preburst Rainfall vs Burst Rainfall**

\[ y = 0.0247x + 11.423 \]

\[ R^2 = 0.0005 \]

**Skill Score**

![Skill Score Graph]

**Initial Moisture vs Storm Initial Loss**

\[ y = 0.1942x + 44.047 \]

\[ R^2 = 0.0728 \]

**Burst Initial Loss vs Storm Initial Loss**

\[ y = -0.043x + 27.293 \]

\[ R^2 = 0.0052 \]

**API vs Initial Moisture**

\[ y = -0.0262x + 50.496 \]

\[ R^2 = 0.0037 \]
McMahons Ck @ Upstreams Weir (VIC) - 24 hour bursts

- **Storm Initial Loss (mm)** vs. Month
- **Continuing Loss (mm/h)** vs. Month
- **Initial Moisture (mm)** vs. Month
- **Capacity Factor** vs. Month
- **Storm Initial Loss (mm)** vs. Burst ARI (years)
- **Continuing Loss (mm/h)** vs. Burst ARI (years)
- **Initial Moisture (mm)** vs. Burst ARI (years)
- **Capacity Factor** vs. Burst ARI (years)
Tarago @ Neerim (VIC) - 24 hour bursts

- **Preburst Rainfall** vs **Burst Rainfall**
  - Equation: $y = 0.0029x + 4.2028$
  - $R^2 = 5 \times 10^{-5}$

- **Initial Moisture** vs **Storm Initial Loss**
  - Equation: $y = -0.1256x + 67.066$
  - $R^2 = 0.0065$

- **Storm Initial Loss** vs **Burst Initial Loss**
  - Equation: $y = 0.0602x + 19.164$
  - $R^2 = 0.0168$

- **Initial Moisture** vs **API**
  - Equation: $y = 0.0523x + 60.163$
  - $R^2 = 0.0053$
Tarago @ Neerim (VIC) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Toomuc Ck @ Pakenham (VIC) - 24 hour bursts

\[ y = -0.0407x + 10.563 \]
\[ R^2 = 0.0028 \]

\[ y = -0.6769x + 21.71 \]
\[ R^2 = 0.7667 \]

\[ y = -0.5067x + 55.786 \]
\[ R^2 = 0.1822 \]

\[ y = 0.5531x - 26.696 \]
\[ R^2 = 0.3632 \]
Toomuc Ck @ Pakenham (VIC) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Jerrabomberra Ck @ Four Mile Creek (ACT) - 24 hour bursts

- **Preburst Rainfall vs. Burst Rainfall**
  
  \[ y = -0.0385x + 6.4217 \]
  \[ R^2 = 0.0106 \]

- **Skill Score**
  
  - IL/CL
  - SWMOD

- **Storm Initial Loss vs. Burst Initial Loss**
  
  \[ y = -0.8922x + 25.813 \]
  \[ R^2 = 0.8402 \]

- **Storm Initial Loss vs. API**
  
  \[ y = -0.2474x + 38.208 \]
  \[ R^2 = 0.2694 \]

- **Initial Moisture vs. API**
  
  \[ y = 0.2108x - 7.7053 \]
  \[ R^2 = 0.2064 \]
Jerrabomberra Ck @ Four Mile Creek (ACT) - 24 hour bursts

- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month

- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
Butmaroo Ck @ Butmaroo (NSW) - 24 hour bursts

- Preburst Rainfall vs. Burst Rainfall
  \[ y = 0.1215x - 3.8026 \]
  \[ R^2 = 0.1253 \]

- Skill Score vs. IL/CL and SWMOD

- Initial Moisture vs. Storm Initial Loss
  \[ y = -0.5773x + 19.091 \]
  \[ R^2 = 0.3948 \]

- Storm Initial Loss vs. API
  \[ y = -0.1454x + 44.625 \]
  \[ R^2 = 0.0422 \]

- Initial Moisture vs. API
  \[ y = 0.1627x - 10.032 \]
  \[ R^2 = 0.0627 \]
Echunga Ck @ U/S Mt Bold Res. (SA) - 24 hour bursts

\[
y = -0.1987x + 18.835 \\
R^2 = 0.0904
\]

\[
y = -0.9849x + 56.524 \\
R^2 = 0.5425
\]

\[
y = -0.2869x + 41.458 \\
R^2 = 0.6726
\]

\[
y = 0.3278x + 12.906 \\
R^2 = 0.4912
\]
Echunga Ck @ U/S Mt Bold Res. (SA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Hindmarsh @ Hindmarsh Vy Res Offtake W (SA) - 24 hour bursts

$y = -0.0575x + 13.032$
$R^2 = 0.0029$

$y = -0.3071x + 61.415$
$R^2 = 0.1051$

$y = -0.1538x + 27.584$
$R^2 = 0.0894$

$y = 0.2873x + 38.799$
$R^2 = 0.3477$
Hindmarsh @ Hindmarsh Vy Res Offtake W (SA) - 24 hour bursts

- Storm Initial Loss (mm)
- Continuing Loss (mm/h)
- Initial Moisture (mm)
- Capacity Factor

Plots showing the relationship between these variables and Burst ARI (years).
Myponga @ U/S Dam and Rd Br (SA) - 24 hour bursts

- **Preburst Rainfall (mm)** vs. **Burst Rainfall (mm)**
  - Equation: $y = -0.1052x + 12.05$
  - $R^2 = 0.0327$

- **Initial Moisture (mm)** vs. **Storm Initial Loss (mm)**
  - Equation: $y = -0.8095x + 32.908$
  - $R^2 = 0.7297$

- **Storm Initial Loss (mm)** vs. **API (mm)**
  - Equation: $y = -0.7633x + 65.995$
  - $R^2 = 0.7016$

- **Initial Moisture (mm)** vs. **API (mm)**
  - Equation: $y = 0.6499x - 22.044$
  - $R^2 = 0.5663$
Myponga @ U/S Dam and Rd Br (SA) - 24 hour bursts

Graphs showing:
- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
Sixth Ck @ Castambul (SA) - 24 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - \( y = -0.0048x + 12.562 \)
  - \( R^2 = 1E-05 \)

- Skill Score
- Initial Moisture vs Storm Initial Loss
  - \( y = -0.5901x + 53.758 \)
  - \( R^2 = 0.692 \)

- Burst Initial Loss vs Storm Initial Loss
- Storm Initial Loss vs API
  - \( y = -0.1324x + 26.951 \)
  - \( R^2 = 0.1114 \)

- Initial Moisture vs API
  - \( y = 0.1292x + 33.788 \)
  - \( R^2 = 0.2107 \)
Sixth Ck @ Castambul (SA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Axe Ck @ Sedgwick (VIC) - 24 hour bursts

**Preburst Rainfall vs. Burst Rainfall**

\[ y = -0.3288x + 35.546 \]

\[ R^2 = 0.0329 \]

**Skill Score Boxplot**

**Initial Moisture vs. Storm Initial Loss**

\[ y = -0.8533x + 26.848 \]

\[ R^2 = 0.7422 \]

**Storm Initial Loss vs. API**

\[ y = -0.3215x + 59.999 \]

\[ R^2 = 0.277 \]

**Initial Moisture vs. API**

\[ y = 0.174x - 16.937 \]

\[ R^2 = 0.0827 \]
Axe Ck @ Sedgwick (VIC) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Celia Ck @ U/S Darwin R Dam (NT) - 24 hour bursts

- Preburst Rainfall vs. Burst Rainfall:
  \[ y = 0.3984x - 22.685 \]
  \[ R^2 = 0.0973 \]

- Skill Score:

- Initial Moisture vs. Storm Initial Loss:
  \[ y = -0.9361x + 103.5 \]
  \[ R^2 = 0.1751 \]

- Burst Initial Loss vs. Storm Initial Loss

- Storm Initial Loss vs. API:
  \[ y = 0.0053x + 31.861 \]
  \[ R^2 = 0.0003 \]

- Initial Moisture vs. API:
  \[ y = 0.4763x - 23.428 \]
  \[ R^2 = 0.421 \]
Celia Ck @ U/S Darwin R Dam (NT) - 24 hour bursts

- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
Coomalie Ck @ Stuart HWY (NT) - 24 hour bursts

- **Preburst Rainfall vs. Burst Rainfall**
  - Equation: $y = 0.3477x - 20.799$
  - $R^2 = 0.097$

- **Skill Score**
  - Box plots for IL/CL and SWMOD

- **Initial Moisture vs. Storm Initial Loss**
  - Equation: $y = -0.2387x + 47.574$
  - $R^2 = 0.0905$

- **Burst Initial Loss vs. Storm Initial Loss**
  - Equation: $y = -0.1018x + 90.487$
  - $R^2 = 0.0137$

- **API vs. Initial Moisture**
  - Equation: $y = 0.2747x - 18.916$
  - $R^2 = 0.1579$
Manton R @ Manton Dam (NT) - 24 hour bursts

- **Pre-burst Rainfall** vs **Burst Rainfall**
  - Equation: $y = 0.0092x + 18.288$
  - $R^2 = 0.0001$

- **Initial Moisture** vs **Storm Initial Loss**
  - Equation: $y = -0.4502x + 27.697$
  - $R^2 = 0.2585$

- **Storm Initial Loss** vs **API**
  - Equation: $y = -0.0014x + 46.19$
  - $R^2 = 7E-06$

- **Burst Initial Loss** vs **API**
  - Equation: $y = 0.1592x - 18.273$
  - $R^2 = 0.1175$
Tennant Ck @ Old Telegraph Stn (NT) - 24 hour bursts

\[ y = -0.0172x + 6.1311 \]
\[ R^2 = 0.0048 \]

0 5 10 15 20 25 30 35 40
0 100 200 300

Preburst Rainfall (mm)
Burst Rainfall (mm)

\[ y = -1.9835x + 37.597 \]
\[ R^2 = 0.2188 \]

0 100 200 300
-20 0 20 40 60

Initial Moisture (mm)
Storm Initial Loss (mm)

\[ y = -0.0072x + 4.7272 \]
\[ R^2 = 0.0029 \]

0 100 200 300
0 5 10 15 20

Storm Initial Loss (mm)
API (mm)

\[ y = 0.2287x + 12.656 \]
\[ R^2 = 0.1668 \]

-20 0 50 100 150 200 250
0 50 100 150 200 250

Initial Moisture (mm)
API (mm)
**Broken @ Old Racecourse (Qld) - 24 hour bursts**

**Skill Score**
- IL/CL vs. SWMOD

**Graphs and Equations**

1. **Preburst Rainfall vs. Burst Rainfall**
   - Equation: $y = 0.1247x + 62.969$
   - $R^2 = 0.0081$

2. **Initial Moisture vs. Storm Initial Loss**
   - Equation: $y = -0.9373x + 47.801$
   - $R^2 = 0.4848$

3. **Storm Initial Loss vs. API**
   - Equation: $y = -0.0688x + 87.79$
   - $R^2 = 0.2217$

4. **API vs. Initial Moisture**
   - Equation: $y = 0.1268x - 54.169$
   - $R^2 = 0.4157$
Broken @ Old Racecourse (Qld) - 24 hour bursts

- **Storm Initial Loss (mm)**: Plotted against Month, showing variation throughout the year.
- **Continuing Loss (mm/h)**: Plotted against Month, with values decreasing over time.
- **Initial Moisture (mm)**: Plotted against Month, indicating moisture levels at the start.
- **Capacity Factor**: Plotted against Month, showing a fluctuating pattern.

- **Storm Initial Loss (mm)** vs. **Burst ARI (years)**: Scatter plot showing no clear correlation.
- **Continuing Loss (mm/h)** vs. **Burst ARI (years)**: Scatter plot also showing no clear correlation.
- **Initial Moisture (mm)** vs. **Burst ARI (years)**: Scatter plot showing a slight trend.
- **Capacity Factor** vs. **Burst ARI (years)**: Scatter plot showing a weak correlation.
Caboolture @ Upper Caboolture (Qld) - 24 hour bursts

\[ y = 0.4616x - 55.326 \]
\[ R^2 = 0.3883 \]

\[ y = -2.0168x + 119.43 \]
\[ R^2 = 0.3724 \]

\[ y = -0.2257x + 72.882 \]
\[ R^2 = 0.4561 \]

\[ y = 0.7341x - 64.05 \]
\[ R^2 = 0.4417 \]
Caboolture @ Upper Caboolture (Qld) - 24 hour bursts

- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
Carmila Ck @ Carmila (Qld) - 24 hour bursts

- Preburst Rainfall vs. Burst Rainfall
  \[ y = -0.1679x + 160.06 \]
  \[ R^2 = 0.0061 \]

- Skill Score
  - IL/CL vs. SWMOD

- Initial Moisture vs. Storm Initial Loss
  \[ y = -0.9448x + 26.202 \]
  \[ R^2 = 0.9404 \]

- Burst Initial Loss vs. Storm Initial Loss
  - Linear relationship

- Storm Initial Loss vs. API
  \[ y = -0.1439x + 103.14 \]
  \[ R^2 = 0.3888 \]

- Initial Moisture vs. API
  \[ y = 0.1493x - 73.727 \]
  \[ R^2 = 0.4411 \]
Carmila Ck @ Carmila (Qld) - 24 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Finch Hatton Ck @ Dam Site (Qld) - 24 hour bursts

- Preburst Rainfall vs. Burst Rainfall
  - Equation: $y = -0.0458x + 152.88$  
  - $R^2 = 0.0013$

- Initial Moisture vs. Initial Loss
  - Equation: $y = -0.867x + 98.393$  
  - $R^2 = 0.7036$

- Storm Initial Loss vs. API
  - Equation: $y = 0.0287x + 24.119$  
  - $R^2 = 0.0691$

- Burst Initial Loss vs. Storm Initial Loss
  - Equation: $y = -0.0192x + 74.98$  
  - $R^2 = 0.0292$
Finch Hatton Ck @ Dam Site (Qld) - 24 hour bursts

- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
North Maroochy River @ Eumundi (Qld) - 24 hour bursts

\[ y = 0.5855x - 92.314 \]
\[ R^2 = 0.2878 \]

\[ y = -0.8416x + 36.062 \]
\[ R^2 = 0.7169 \]

\[ y = -0.1036x + 47.495 \]
\[ R^2 = 0.1538 \]

\[ y = 0.1329x - 10.027 \]
\[ R^2 = 0.2564 \]
North Maroochy River @ Eumundi (Qld) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
South Maroochy @ Kiamba (QLD) - 24 hour bursts

\[ y = -0.005x + 29.449 \]
\[ R^2 = 0.0002 \]

\[ y = -1.3684x + 72.451 \]
\[ R^2 = 0.8161 \]

\[ y = -0.1679x + 66.155 \]
\[ R^2 = 0.382 \]

\[ y = 0.2609x - 22.582 \]
\[ R^2 = 0.4018 \]
South Maroochy @ Kiamba (QLD) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Spring Ck @ Killarney (Qld) - 24 hour bursts

Preburst Rainfall (mm) vs. Burst Rainfall (mm)

\[ y = 0.0481x + 11.992 \]
\[ R^2 = 0.0027 \]

Initial Moisture (mm) vs. Storm Initial Loss (mm)

\[ y = -0.766x + 26.41 \]
\[ R^2 = 0.6314 \]

Storm Initial Loss (mm) vs. API (mm)

\[ y = -0.2089x + 60.225 \]
\[ R^2 = 0.2863 \]

Burst Initial Loss (mm) vs. Storm Initial Loss (mm)

\[ y = 0.2259x - 26.588 \]
\[ R^2 = 0.3602 \]
Spring Ck @ Killarney (Qld) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Fletcher Ck @ Frog Hollow (WA) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - $y = -0.0905x + 8.8548$
  - $R^2 = 0.0184$

- Skill Score vs IL/CL vs SWMOD

- Initial Moisture vs Storm Initial Loss
  - $y = -1.1626x + 67.796$
  - $R^2 = 0.3236$

- Burst Initial Loss vs Storm Initial Loss
  - $y = 0.2036x + 13.817$
  - $R^2 = 0.3222$

- Initial Moisture vs API
Harding @ Marmurrina Pool U-South (WA) - 24 hour bursts

\[ y = -0.1594x + 27.889 \]
\[ R^2 = 0.0472 \]

-20 0 20 40 60 80 100 120
Preburst Rainfall (mm)

-20 0 20 40 60 80 100 120
Burst Rainfall (mm)

\[ y = -0.9881x + 46.455 \]
\[ R^2 = 0.6926 \]

0 50 100 150 200
Preburst Rainfall (mm)

0 50 100 150
Initial Moisture (mm)

0 50 100 150
Storm Initial Loss (mm)

\[ y = -0.1782x + 69.331 \]
\[ R^2 = 0.1168 \]

0 100 200 300
API (mm)

0 100 200 300
Burst Initial Loss (mm)

\[ y = 0.3317x - 33.995 \]
\[ R^2 = 0.287 \]

0 100 200 300
API (mm)

-80 -60 -40 -20 0 20 40 60 80
Initial Moisture (mm)

0 20 40 60 80 100 120
Storm Initial Loss (mm)

0 50 100 150
API (mm)

Skill Score

IL/CL SWMOD
Kanjenjie Ck Trib. @ Fish Pool (WA) - 24 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - Equation: $y = -0.0125x + 11.287$
  - $R^2 = 0.0021$

- Skill Score for IL/CL vs SWMOD

- Initial Moisture vs Storm Initial Loss
  - Equation: $y = -1.0577x + 34.065$
  - $R^2 = 0.8984$

- Burst Initial Loss vs Storm Initial Loss

- Storm Initial Loss vs API
  - Equation: $y = -0.1771x + 49.655$
  - $R^2 = 0.4079$

- API vs Initial Moisture
  - Equation: $y = 0.2169x - 20.989$
  - $R^2 = 0.4911$
Balgarup @ Mandelup Pool (WA) - 24 hour bursts

**Preburst Rainfall vs. Burst Rainfall**

- Equation: $y = 0.538x - 20.036$
- $R^2 = 0.7825$

**Initial Moisture vs. Storm Initial Loss**

- Equation: $y = -0.9835x + 30.193$
- $R^2 = 0.967$

**Storm Initial Loss vs. Burst Initial Loss**

- Equation: $y = -1.0615x + 74.256$
- $R^2 = 0.3471$

**Storm Initial Loss vs. API**

- Equation: $y = 1.2274x - 48.016$
- $R^2 = 0.464$
Balgarup @ Mandelup Pool (WA) - 24 hour bursts

Storm Initial Loss (mm)

Month

Continuing Loss (mm/h)

Month

Initial Moisture (mm)

Month

Capacity Factor

Month

Storm Initial Loss (mm)

Burst ARI (years)

Continuing Loss (mm/h)

Burst ARI (years)

Initial Moisture (mm)

Burst ARI (years)

Capacity Factor

Burst ARI (years)
Buller @ Buller (WA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month

- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Carey Brook @ Staircase Rd (WA) - 24 hour bursts

\[ y = -0.1947x + 23.313 \]
\[ R^2 = 0.0072 \]

\[ y = -1.3331x + 86.891 \]
\[ R^2 = 0.2364 \]

\[ y = 0.0188x + 18.112 \]
\[ R^2 = 0.007 \]

\[ y = 0.2161x + 28.678 \]
\[ R^2 = 0.1239 \]
Carey Brook @ Staircase Rd (WA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Davis Brook @ Murray Valley Plntn (WA) - 24 hour bursts

- Preburst Rainfall vs. Burst Rainfall
  \[ y = -0.0837x + 10.579 \]
  \[ R^2 = 0.0272 \]

- Skill Score
  - IL/CL
  - SWMOD

- Initial Moisture vs. Storm Initial Loss
  \[ y = -0.6661x + 59.911 \]
  \[ R^2 = 0.2477 \]

- Burst Initial Loss vs. Storm Initial Loss

- Storm Initial Loss vs. API
  \[ y = -0.1823x + 49.75 \]
  \[ R^2 = 0.3029 \]

- Initial Moisture vs. API
  \[ y = 0.3094x + 2.8604 \]
  \[ R^2 = 0.4869 \]
Davis Brook @ Murray Valley Pltn (WA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Dirk Brook @ Kentish Farm (WA) - 24 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - \( y = 0.1351x - 6.6399 \)
  - \( R^2 = 0.0768 \)

- Skill Score vs Initial Moisture
  - \( y = -0.3776x + 71.362 \)
  - \( R^2 = 0.0913 \)

- Burst Initial Loss vs Storm Initial Loss
  - \( y = -0.1938x + 27.99 \)
  - \( R^2 = 0.2503 \)

- Initial Moisture vs API
  - \( y = 0.1735x + 54.344 \)
  - \( R^2 = 0.1285 \)
Dirk Brook @ Kentish Farm (WA) - 24 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month

- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Goodga @ Black Cat (WA) - 24 hour bursts

Preburst Rainfall (mm) vs Burst Rainfall (mm)

\[ y = 0.2301x - 5.5337 \]
\[ R^2 = 0.1938 \]

Skill Score

Initial Moisture (mm) vs Storm Initial Loss (mm)

\[ y = -0.1433x + 16.241 \]
\[ R^2 = 0.0856 \]

Burst Initial Loss (mm) vs Storm Initial Loss (mm)

\[ y = -0.5595x + 64.295 \]
\[ R^2 = 0.2043 \]

API (mm) vs Initial Moisture (mm)

\[ y = 0.1957x + 1.7333 \]
\[ R^2 = 0.1043 \]
Goodga @ Black Cat (WA) - 24 hour bursts

- Storm Initial Loss (mm)
- Continuing Loss (mm/h)
- Initial Moisture (mm)
- Capacity Factor

Graphs showing the relationship between burst ARI (years) and various parameters such as Storm Initial Loss, Continuing Loss, Initial Moisture, and Capacity Factor.
Hamilton @ Worsley (WA) - 24 hour bursts

\[ y = 0.0743x + 9.5205 \]
\[ R^2 = 0.0015 \]

\[ y = -0.6767x + 75.592 \]
\[ R^2 = 0.2232 \]

\[ y = -0.131x + 52.234 \]
\[ R^2 = 0.1894 \]

\[ y = 0.2393x + 27.591 \]
\[ R^2 = 0.3082 \]
Hamilton @ Worsley (WA) - 24 hour bursts

- **Storm Initial Loss (mm) vs. Month**
- **Continuing Loss (mm/h) vs. Month**
- **Initial Moisture (mm) vs. Month**
- **Capacity Factor vs. Month**

- **Storm Initial Loss (mm) vs. Burst ARI (years)**
- **Continuing Loss (mm/h) vs. Burst ARI (years)**
- **Initial Moisture (mm) vs. Burst ARI (years)**
- **Capacity Factor vs. Burst ARI (years)**
Marrinup Bk @ Brookdale Siding (WA) - 24 hour bursts

\[ y = 0.0326x + 0.2275 \]
\[ R^2 = 0.0152 \]

\[ y = -0.5091x + 68.01 \]
\[ R^2 = 0.2696 \]

\[ y = -0.1072x + 28.705 \]
\[ R^2 = 0.1102 \]

\[ y = 0.171x + 43.802 \]
\[ R^2 = 0.2917 \]
Yates Flat Ck @ Woonanup (WA) - 24 hour bursts

\[
y = 0.5409x - 22.86 \\
R^2 = 0.4835
\]

**Preburst Rainfall (mm) vs. Burst Rainfall (mm)**

\[
y = -0.8241x + 36.061 \\
R^2 = 0.7789
\]

**Initial Moisture (mm) vs. Storm Initial Loss (mm)**

\[
y = -0.2755x + 48.415 \\
R^2 = 0.1132
\]

**API (mm) vs. Initial Moisture (mm)**

\[
y = 0.383x - 11.56 \\
R^2 = 0.2507
\]

**Skill Score**

- IL/CL
- SWMOD
Yates Flat Ck @ Woonanup (WA) - 24 hour bursts

**Storm Initial Loss (mm)**

- Month vs. Storm Initial Loss (mm)
- Burst ARI (years) vs. Storm Initial Loss (mm)

**Continuing Loss (mm/h)**

- Month vs. Continuing Loss (mm/h)
- Burst ARI (years) vs. Continuing Loss (mm/h)

**Initial Moisture (mm)**

- Month vs. Initial Moisture (mm)
- Burst ARI (years) vs. Initial Moisture (mm)

**Capacity Factor**

- Month vs. Capacity Factor
- Burst ARI (years) vs. Capacity Factor
Appendix J  Loss summaries for 3h bursts
Currambene Ck @ Falls Ck (NSW) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - Equation: $y = 1.3634x + 6.7551$
  - $R^2 = 0.1562$

- Initial Moisture vs Storm Initial Loss
  - Equation: $y = -0.6406x + 27.584$
  - $R^2 = 0.3409$

- Storm Initial Loss vs API
  - Equation: $y = -0.3111x + 70.653$
  - $R^2 = 0.2078$

- Skill Score for IL/CL and SWMOD

- Burst Initial Loss vs Storm Initial Loss
  - Equation: $y = 0.4457x - 36.998$
  - $R^2 = 0.3544$
Currambene Ck @ Falls Ck (NSW) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
O'Hares Ck @ Wedderburn (NSW) - 3 hour bursts

- **Preburst Rainfall (mm)** vs **Burst Rainfall (mm)**: $y = 1.8223x - 37.464$, $R^2 = 0.2016$

- **Skill Score** comparison between IL/CL and SWMOD

- **Initial Moisture (mm)** vs **Storm Initial Loss (mm)**: $y = -0.7996x + 46.741$, $R^2 = 0.7854$

- **Storm Initial Loss (mm)** vs **Burst Initial Loss (mm)**

- **API (mm)** vs **Initial Moisture (mm)**: $y = -0.4247x + 81.997$, $R^2 = 0.5113$

- **API (mm)** vs **Initial Moisture (mm)**: $y = 0.3891x - 22.555$, $R^2 = 0.5273$
O'Hares Ck @ Wedderburn (NSW) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Ourimbah Ck @ U/S Weir (NSW) - 3 hour bursts

\[ y = 2.7657x - 60.569 \]
\[ R^2 = 0.1349 \]

\[ y = -0.3605x + 57.741 \]
\[ R^2 = 0.2228 \]

\[ y = -0.2314x + 70.555 \]
\[ R^2 = 0.041 \]

\[ y = 0.344x + 14.532 \]
\[ R^2 = 0.1554 \]
Ourimbah Ck @ U/S Weir (NSW) - 3 hour bursts

- Storm Initial Loss vs Month
- Storm Initial Loss vs Burst ARI (years)
- Continuing Loss vs Month
- Continuing Loss vs Burst ARI (years)
- Initial Moisture vs Month
- Initial Moisture vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Swan River @ Harding Falls (Tas) - 3 hour bursts

- **Preburst Rainfall vs. Burst Rainfall**
  - Equation: $y = 0.4332x + 44.816$
  - $R^2 = 0.0071$

- **Initial Moisture vs. Storm Initial Loss**
  - Equation: $y = -1.2812x + 40.83$
  - $R^2 = 0.6959$

- **Storm Initial Loss vs. API**
  - Equation: $y = -0.9528x + 89.839$
  - $R^2 = 0.477$

- **Burst Initial Loss vs. Storm Initial Loss**
  - Equation: $y = 0.7681x - 52.893$
  - $R^2 = 0.1314$
Aire @ Wyelangta (VIC) - 3 hour bursts

**Preburst Rainfall vs Burst Rainfall**

\[ y = -0.5091x + 61.398 \]

\[ R^2 = 0.0083 \]

**Initial Moisture vs Storm Initial Loss**

\[ y = -0.2577x + 32.968 \]

\[ R^2 = 0.1773 \]

**Storm Initial Loss vs API**

\[ y = -0.1186x + 30.671 \]

\[ R^2 = 0.0868 \]

**Initial Moisture vs API**

\[ y = 0.0065x + 26.703 \]

\[ R^2 = 0.0007 \]
Aire @ Wyelangta (VIC) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
McMahons Ck @ Upstreams Weir (VIC) - 3 hour bursts

\[ y = 1.1193x - 11.067 \]
\[ R^2 = 0.038 \]

\[ y = -0.1913x + 57.141 \]
\[ R^2 = 0.0073 \]

\[ y = -0.0926x + 22.42 \]
\[ R^2 = 0.0635 \]

\[ y = 0.4693x + 26.427 \]
\[ R^2 = 0.3259 \]
Tarago @ Neerim (VIC) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Toomuc Ck @ Pakenham (VIC) - 3 hour bursts

\[ y = 4.1926x - 102.56 \]

\[ R^2 = 0.2822 \]

\[ y = -0.7806x + 25.235 \]

\[ R^2 = 0.868 \]

\[ y = -0.4455x + 52.987 \]

\[ R^2 = 0.3662 \]

\[ y = 0.3687x - 17.285 \]

\[ R^2 = 0.3573 \]
Toomuc Ck @ Pakenham (VIC) - 3 hour bursts

- Storm Initial Loss vs Month
- Storm Initial Loss vs Burst ARI (years)
- Continuing Loss vs Month
- Continuing Loss vs Burst ARI (years)
- Initial Moisture vs Month
- Initial Moisture vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Jerrabomberra Ck @ Four Mile Ck (ACT) - 3 hour bursts

\[ y = 0.0324x + 26.277 \]
\[ R^2 = 8 \times 10^{-5} \]

\[ y = -1.1429x + 33.026 \]
\[ R^2 = 0.8565 \]

\[ y = -0.2133x + 34.345 \]
\[ R^2 = 0.078 \]

\[ y = 0.1898x - 3.0433 \]
\[ R^2 = 0.0405 \]
Jerrabomberra Ck @ Four Mile Ck (ACT) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Butmaroo Ck @ Butmaroo (NSW) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall:
  - \[ y = -0.3254x + 30.578 \]
  - \[ R^2 = 0.0077 \]

- Skill Score vs IL/CL vs SWMOD:

- Initial Moisture vs Storm Initial Loss:
  - \[ y = -0.6798x + 21.69 \]
  - \[ R^2 = 0.3734 \]

- Storm Initial Loss vs Burst Initial Loss:

- Storm Initial Loss vs API:
  - \[ y = -0.2026x + 44.945 \]
  - \[ R^2 = 0.0744 \]

- Initial Moisture vs API:
  - \[ y = 0.1723x - 10.377 \]
  - \[ R^2 = 0.0435 \]
Butmaroo Ck @ Butmaroo (NSW) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Echunga Ck @ U/S Mt Bold Res. (SA) - 3 hour bursts

\[ y = -0.0578x + 14.389 \]
\[ R^2 = 0.0003 \]

Preburst Rainfall (mm) vs Burst Rainfall (mm)

\[ y = -1.2894x + 63.776 \]
\[ R^2 = 0.8642 \]

Initial Moisture (mm) vs Storm Initial Loss (mm)

\[ y = -0.1847x + 36.263 \]
\[ R^2 = 0.3808 \]

Storm Initial Loss (mm) vs API (mm)

\[ y = 0.3123x + 12.633 \]
\[ R^2 = 0.5658 \]

Initial Moisture (mm) vs API (mm)
Echunga Ck @ U/S Mt Bold Res. (SA) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Hindmarsh @ Hindmarsh Vy Res Offtake W (SA) - 3 hour bursts

\[ y = 0.4333x + 13.547 \]
\[ R^2 = 0.0113 \]

\[ y = -0.2804x + 60.604 \]
\[ R^2 = 0.1062 \]

\[ y = -0.4125x + 32.952 \]
\[ R^2 = 0.1066 \]

\[ y = 0.627x + 38.569 \]
\[ R^2 = 0.3329 \]
Myponga @ U/S Dam and Rd Br (SA) - 3 hour bursts

\[ y = -0.0351x + 23.196 \]
\[ R^2 = 0.0003 \]

\[ y = -0.6401x + 26.963 \]
\[ R^2 = 0.5081 \]

\[ y = -0.4777x + 52.709 \]
\[ R^2 = 0.3038 \]

\[ y = 0.5668x - 17.197 \]
\[ R^2 = 0.5305 \]
Myponga @ U/S Dam and Rd Br (SA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Sixth Ck @ Castambul (SA) - 3 hour bursts

\[ y = 2.9119x - 55.218 \]
\[ R^2 = 0.1398 \]

\[ y = -0.305x + 51.848 \]
\[ R^2 = 0.1424 \]

\[ y = -0.1323x + 27.855 \]
\[ R^2 = 0.2419 \]

\[ y = 0.0357x + 43.713 \]
\[ R^2 = 0.0269 \]
Sixth Ck @ Castambul (SA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Axe Ck @ Sedgwick (VIC) - 3 hour bursts

\[ y = -0.7835x + 52.69 \]
\[ R^2 = 0.064 \]

0 20 40 60 80
Preburst Rainfall (mm)

Burst Rainfall (mm)

\[ y = -0.7363x + 23.05 \]
\[ R^2 = 0.604 \]

-80 -60 -40 -20 0 20 40 60 80
Initial Moisture (mm)

Storm Initial Loss (mm)

\[ y = -0.2627x + 51.203 \]
\[ R^2 = 0.2651 \]

0 100 200
Storm Initial Loss (mm)

API (mm)

\[ y = 0.1438x - 10.928 \]
\[ R^2 = 0.0885 \]

-60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60
Initial Moisture (mm)

API (mm)
Axe Ck @ Sedgwick (VIC) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Celia Ck @ U/S Darwin R Dam (NT) - 3 hour bursts

**Graph 1:**
- **Preburst Rainfall (mm)** vs. **Burst Rainfall (mm)**
- Equation: \( y = -0.49x + 71.881 \)
- \( R^2 = 0.0215 \)

**Graph 2:**
- **Initial Moisture (mm)** vs. **Storm Initial Loss (mm)**
- Equation: \( y = -0.8133x + 98.754 \)
- \( R^2 = 0.2044 \)

**Graph 3:**
- **Storm Initial Loss (mm)** vs. **API (mm)**
- Equation: \( y = 0.1006x + 10.911 \)
- \( R^2 = 0.0831 \)

**Graph 4:**
- **Initial Moisture (mm)** vs. **API (mm)**
- Equation: \( y = 0.1999x + 30.802 \)
- \( R^2 = 0.1015 \)

**Graph 5:**
- **Burst Initial Loss (mm)** vs. **Storm Initial Loss (mm)**
- **Skill Score** box plot

Additional notes:
- **IL/CL SWMOD**
- **IL/CL SWMOD**
Celia Ck @ U/S Darwin R Dam (NT) - 3 hour bursts
Coomalie Ck @ Stuart HWY (NT) - 3 hour bursts

**Boxplot**: Comparing Skill Scores with IL/CL and SWMOD models.

**Graph 1**: Preburst Rainfall vs. Burst Rainfall (mm)
- Equation: \( y = -0.6362x + 75.729 \)
- \( R^2 = 0.0554 \)

**Graph 2**: Initial Moisture vs. Storm Initial Loss (mm)
- Equation: \( y = 0.1148x + 32.099 \)
- \( R^2 = 0.0136 \)

**Graph 3**: Storm Initial Loss vs. API (mm)
- Equation: \( y = -0.1094x + 78.884 \)
- \( R^2 = 0.0753 \)

**Graph 4**: API vs. Initial Moisture (mm)
- Equation: \( y = 0.1548x + 10.999 \)
- \( R^2 = 0.1562 \)
Coomalie Ck @ Stuart HWY (NT) - 3 hour bursts

1. Storm Initial Loss (mm) vs Month
2. Continuing Loss (mm/h) vs Month
3. Initial Moisture (mm) vs Month
4. Capacity Factor vs Month
5. Storm Initial Loss (mm) vs Burst ARI (years)
6. Continuing Loss (mm/h) vs Burst ARI (years)
7. Initial Moisture (mm) vs Burst ARI (years)
8. Capacity Factor vs Burst ARI (years)
Manton R @ Manton Dam (NT) - 3 hour bursts

- **Preburst Rainfall** vs **Burst Rainfall**:
  - Equation: $y = -0.6793x + 91.074$
  - $R^2 = 0.0352$

- **Initial Moisture** vs **Storm Initial Loss**:
  - Equation: $y = -0.1957x + 29.933$
  - $R^2 = 0.0781$

- **Storm Initial Loss** vs **Burst Initial Loss**:
  - Equation: $y = 0.1296x + 13.324$
  - $R^2 = 0.0973$

- **API** vs **Initial Moisture**:
  - Equation: $y = 0.0526x + 13.765$
  - $R^2 = 0.0327$
Manton R @ Manton Dam (NT) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Tennant Ck @ Old Telegraph Stn (NT) - 3 hour bursts

**Graph 1:**
- **Equation:** \( y = 0.0883x + 13.173 \)
- **\( R^2 \):** 0.0038
- **X-axis:** Preburst Rainfall (mm)
- **Y-axis:** Burst Rainfall (mm)

**Graph 2:**
- **Equation:** \( y = -2.5837x + 43.664 \)
- **\( R^2 \):** 0.1336
- **X-axis:** Initial Moisture (mm)
- **Y-axis:** Storm Initial Loss (mm)

**Graph 3:**
- **Equation:** \( y = 0.0023x + 1.1184 \)
- **\( R^2 \):** 0.0011
- **X-axis:** Burst Initial Loss (mm)
- **Y-axis:** Storm Initial Loss (mm)

**Graph 4:**
- **Equation:** \( y = 0.1633x + 29.835 \)
- **\( R^2 \):** 0.1042
- **X-axis:** Initial Moisture (mm)
- **Y-axis:** API (mm)
Tennant Ck @ Old Telegraph Stn (NT) - 3 hour bursts

Storm Initial Loss (mm)

Continuing Loss (mm/h)

Initial Moisture (mm)

Capacity Factor

Burst ARI (years)
Broken @ Old Racecourse (Qld) - 3 hour bursts

- **Preburst Rainfall** vs **Burst Rainfall**
  - Equation: \( y = 3.2855x - 78.647 \)
  - \( R^2 = 0.2364 \)

- **Initial Moisture** vs **Storm Initial Loss**
  - Equation: \( y = -1.0212x + 55.682 \)
  - \( R^2 = 0.6337 \)

- **Storm Initial Loss** vs **API**
  - Equation: \( y = -0.096x + 105.32 \)
  - \( R^2 = 0.4111 \)

- **Initial Moisture** vs **API**
  - Equation: \( y = 0.161x - 70.964 \)
  - \( R^2 = 0.7033 \)

- **Skill Score** comparison between IL/CL and SWMOD models.
Broken @ Old Racecourse (Qld) - 3 hour bursts

Graphs showing:
- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
**Caboolture @ Upper Caboolture (Qld) - 3 hour bursts**

- **Preburst Rainfall (mm) vs. Burst Rainfall (mm)**
  
  \[ y = 0.3076x + 62.676 \]
  
  \[ R^2 = 0.0083 \]

- **Initial Moisture (mm) vs. Storm Initial Loss (mm)**
  
  \[ y = -2.7871x + 162.04 \]
  
  \[ R^2 = 0.4629 \]

- **Storm Initial Loss (mm) vs. API (mm)**
  
  \[ y = -0.17x + 66.091 \]
  
  \[ R^2 = 0.3757 \]

- **API (mm) vs. Initial Moisture (mm)**
  
  \[ y = 0.774x - 57.551 \]
  
  \[ R^2 = 0.4642 \]
Caboolture @ Upper Caboolture (Qld) - 3 hour bursts

Storm Initial Loss (mm)

Continuing Loss (mm/h)

Initial Moisture (mm)

Capacity Factor
Carmila Ck @ Carmila (Qld) - 3 hour bursts

\[ y = 2.6801x - 185.36 \]
\[ R^2 = 0.2966 \]

\[ y = -0.9633x + 30.98 \]
\[ R^2 = 0.9289 \]

\[ y = -0.1153x + 96.768 \]
\[ R^2 = 0.4331 \]

\[ y = 0.1252x - 65.882 \]
\[ R^2 = 0.5111 \]
Carmila Ck @ Carmila (Qld) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Month
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Month
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Finch Hatton Ck @ Dam Site (Qld) - 3 hour bursts

\[ y = 0.3568x + 231.97 \]
\[ R^2 = 0.0031 \]

![Graph showing Preburst Rainfall vs Burst Rainfall](image)

\[ y = -0.5002x + 91.566 \]
\[ R^2 = 0.625 \]

![Graph showing Initial Moisture vs Initial Loss](image)

\[ y = -0.0541x + 57.106 \]
\[ R^2 = 0.1607 \]

![Graph showing Storm Initial Loss vs API](image)

\[ y = 0.0567x + 54.67 \]
\[ R^2 = 0.4414 \]

![Graph showing Initial Moisture vs API](image)
Finch Hatton Ck @ Dam Site (Qld) - 3 hour bursts

- Storm Initial Loss (mm)
- Continuing Loss (mm/h)
- Initial Moisture (mm)
- Capacity Factor

[Variation plots for different parameters over time and burst ARI (years)]
North Maroochy River @ Eumundi (Qld) - 3 hour bursts

\[ y = -0.7232x + 160.81 \quad R^2 = 0.0627 \]

\[ y = -0.7794x + 35.735 \quad R^2 = 0.6438 \]

\[ y = -0.1043x + 47.441 \quad R^2 = 0.1732 \]

\[ y = 0.1628x - 14.036 \quad R^2 = 0.4576 \]
North Maroochy River @ Eumundi (Qld) - 3 hour bursts

- Storm Initial Loss (mm)
  - Month
  - Burst ARI (years)

- Continuing Loss (mm/h)
  - Month
  - Burst ARI (years)

- Initial Moisture (mm)
  - Month
  - Burst ARI (years)

- Capacity Factor
  - Month
  - Burst ARI (years)
South Maroochy @ Kiamba (QLD) - 3 hour bursts

\[ y = 0.7012x + 47.35 \]
\[ R^2 = 0.0336 \]

- Preburst Rainfall (mm) vs. Burst Rainfall (mm)

\[ y = -1.2173x + 68.763 \]
\[ R^2 = 0.7823 \]

- Initial Moisture (mm) vs. Storm Initial Loss (mm)

\[ y = -0.1917x + 75.184 \]
\[ R^2 = 0.5649 \]

- Storm Initial Loss (mm) vs. API (mm)

\[ y = 0.2607x - 27.582 \]
\[ R^2 = 0.5518 \]

- Initial Moisture (mm) vs. API (mm)
South Maroochy @ Kiamba (QLD) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month

- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Spring Ck @ Killarney (Qld) - 3 hour bursts

- **Preburst Rainfall (mm)** vs **Burst Rainfall (mm)**:
  
  \[ y = -0.5561x + 66.344 \]
  \[ R^2 = 0.0418 \]

- **Initial Moisture (mm)** vs **Storm Initial Loss (mm)**:
  
  \[ y = -0.7792x + 30.14 \]
  \[ R^2 = 0.4343 \]

- **Storm Initial Loss (mm)** vs **API (mm)**:
  
  \[ y = -0.1246x + 44.023 \]
  \[ R^2 = 0.2207 \]

- **Storm Initial Loss (mm)** vs **API (mm)**:
  
  \[ y = 0.1873x - 14.437 \]
  \[ R^2 = 0.3564 \]
Spring Ck @ Killarney (Qld) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Loss Summary - Fletcher Ck @ Frog Hollow (WA) - 3 hour bursts

\[ y = -0.0905x + 8.8548 \]
\[ R^2 = 0.0184 \]

- **Preburst Rainfall (mm)** vs **Burst Rainfall (mm)**
  - \[ y = -0.0905x + 8.8548 \]
  - \[ R^2 = 0.0184 \]

- **Initial Moisture (mm)** vs **Storm Initial Loss (mm)**
  - \[ y = -1.1626x + 67.796 \]
  - \[ R^2 = 0.3236 \]

- **Storm Initial Loss (mm)** vs **Burst Initial Loss (mm)**
  - \[ y = -0.0872x + 38.094 \]
  - \[ R^2 = 0.2468 \]

- **Initial Moisture (mm)** vs **API (mm)**
  - \[ y = 0.2036x + 13.817 \]
  - \[ R^2 = 0.3222 \]
Harding @ Marmurrina Pool U-South (WA) - 3 hour bursts

- Preburst Rainfall vs. Burst Rainfall:
  - Equation: $y = -0.5501x + 60.992$
  - $R^2 = 0.0503$

- Initial Moisture vs. Storm Initial Loss:
  - Equation: $y = -0.912x + 46.81$
  - $R^2 = 0.6506$

- Storm Initial Loss vs. Burst Initial Loss:
  - Linear relationship

- Initial Moisture vs. API:
  - Equation: $y = -0.1556x + 64.488$
  - $R^2 = 0.1004$

- API vs. Initial Moisture:
  - Equation: $y = 0.2912x - 23.502$
  - $R^2 = 0.2749$
Harding @ Marmurrina Pool U-South (WA) - 3 hour bursts
Kanjenjie Ck Trib. @ Fish Pool (WA) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall:
  \[ y = -0.7803x + 91.313 \]
  \[ R^2 = 0.0246 \]

- Skill Score for IL/CL vs SWMOD:

- Initial Moisture vs Storm Initial Loss:
  \[ y = -0.7411x + 22.736 \]
  \[ R^2 = 0.8426 \]

- Storm Initial Loss vs API:
  \[ y = -0.0925x + 37.202 \]
  \[ R^2 = 0.109 \]

- API vs Initial Moisture:
  \[ y = 0.0862x - 5.7752 \]
  \[ R^2 = 0.1451 \]
Balgarup @ Mandelup Pool (WA) - 3 hour bursts

- **Preburst Rainfall vs. Burst Rainfall**:
  
  \[ y = -2.7831x + 122.19 \]
  
  \[ R^2 = 0.1553 \]

- **Initial Moisture vs. Storm Initial Loss**:
  
  \[ y = -0.9629x + 29.059 \]
  
  \[ R^2 = 0.9864 \]

- **Storm Initial Loss vs. Burst Initial Loss**:

- **Initial Moisture vs. API**:
  
  \[ y = -3.0737x + 113.08 \]
  
  \[ R^2 = 0.367 \]

- **API vs. Initial Moisture**:
  
  \[ y = 3.2469x - 82.989 \]
  
  \[ R^2 = 0.4357 \]
Balgarup @ Mandelup Pool (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Continuing Loss (mm/h) vs Month
- Initial Moisture (mm) vs Month
- Capacity Factor vs Month

- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
**Buller @ Buller (WA) - 3 hour bursts**

- **Preburst Rainfall (mm) vs. Burst Rainfall (mm)**
  - Equation: $y = -0.3267x + 30.722$
  - $R^2 = 0.0309$

- **Initial Moisture (mm) vs. Storm Initial Loss (mm)**
  - Equation: $y = -0.2486x + 4.3871$
  - $R^2 = 0.0731$

- **Storm Initial Loss (mm) vs. API (mm)**
  - Equation: $y = 0.0538x + 32.961$
  - $R^2 = 0.0068$

- **Storm Initial Loss (mm) vs. API (mm)**
  - Equation: $y = 0.2565x - 14.036$
  - $R^2 = 0.1831$
Buller @ Buller (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Carey Brook @ Staircase Rd (WA) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - Equation: $y = -0.406x + 23.732$
  - $R^2 = 0.0379$

- Skill Score vs IL/CL and SWMOD

- Initial Moisture vs Storm Initial Loss
  - Equation: $y = 1.037x + 25.301$
  - $R^2 = 0.1894$

- Storm Initial Loss vs Burst Initial Loss
  - Equation: $y = 0.0323x + 19.478$
  - $R^2 = 0.0333$

- Storm Initial Loss vs API
  - Equation: $y = 0.106x + 36.655$
  - $R^2 = 0.0632$
Carey Brook @ Staircase Rd (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Burst ARI (years)
Davis Brook @ Murray Valley Plntn (WA) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall
  - Equation: $y = 0.7583x - 13.77$
  - $R^2 = 0.1068$

- Skill Score
  - Comparing IL/CL and SWMOD

- Initial Moisture vs Storm Initial Loss
  - Equation: $y = -0.8551x + 62.573$
  - $R^2 = 0.5353$

- Burst Initial Loss vs Storm Initial Loss
  - Linear relationship

- Storm Initial Loss vs API
  - Equation: $y = -0.2145x + 50.217$
  - $R^2 = 0.4262$

- Initial Moisture vs API
  - Equation: $y = 0.1859x + 19.333$
  - $R^2 = 0.2344$
Davis Brook @ Murray Valley Pltn (WA) - 3 hour bursts

- Storm Initial Loss vs Month
- continuing Loss vs Month
- Initial Moisture vs Month
- Capacity Factor vs Month
- Storm Initial Loss vs Burst ARI (years)
- continuing Loss vs Burst ARI (years)
- Initial Moisture vs Burst ARI (years)
- Capacity Factor vs Burst ARI (years)
Dirk Brook @ Kentish Farm (WA) - 3 hour bursts

- Storm Initial Loss (mm)
- Continuing Loss (mm/h)
- Initial Moisture (mm)
- Capacity Factor

Graphs showing correlations between various storm metrics and Burst ARI (years).
Goodga @ Black Cat (WA) - 3 hour bursts

\[ y = -1.2175x + 77.813 \]

\[ R^2 = 0.0382 \]

\[ y = -0.2532x + 24.027 \]

\[ R^2 = 0.1228 \]

\[ y = -0.7004x + 67.716 \]

\[ R^2 = 0.211 \]

\[ y = 0.4895x - 6.3285 \]

\[ R^2 = 0.1974 \]
Goodga @ Black Cat (WA) - 3 hour bursts

- Storm Initial Loss vs. Month
- Storm Initial Loss vs. Burst ARI (years)
- Continuing Loss vs. Month
- Continuing Loss vs. Burst ARI (years)
- Initial Moisture vs. Month
- Initial Moisture vs. Burst ARI (years)
- Capacity Factor vs. Month
- Capacity Factor vs. Burst ARI (years)
Hamilton @ Worsley (WA) - 3 hour bursts

**Preburst Rainfall (mm) vs Burst Rainfall (mm)**

- Equation: $y = -4.8659x + 195$
- $R^2 = 0.0993$

**Skill Score vs IL/CL SWMOD**

**Initial Moisture (mm) vs Storm Initial Loss (mm)**

- Equation: $y = -1.0977x + 87.764$
- $R^2 = 0.4534$

**Burst Initial Loss (mm) vs Storm Initial Loss (mm)**

**Storm Initial Loss (mm) vs API (mm)**

- Equation: $y = -0.1477x + 48.758$
- $R^2 = 0.3413$

**Initial Moisture (mm) vs API (mm)**

- Equation: $y = 0.2518x + 25.792$
- $R^2 = 0.3729$
Hamilton @ Worsley (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs Month
- Storm Initial Loss (mm) vs Burst ARI (years)
- Continuing Loss (mm/h) vs Month
- Continuing Loss (mm/h) vs Burst ARI (years)
- Initial Moisture (mm) vs Month
- Initial Moisture (mm) vs Burst ARI (years)
- Capacity Factor vs Month
- Capacity Factor vs Burst ARI (years)
Marrinup Bk @ Brookdale Siding (WA) - 3 hour bursts

Preburst Rainfall (mm) vs Burst Rainfall (mm)

\[ y = 0.3781x + 2.9362 \]
\[ R^2 = 0.0183 \]

Skill Score vs IL/CL SWMOD

Initial Moisture (mm) vs Storm Initial Loss (mm)

\[ y = -0.5511x + 71.938 \]
\[ R^2 = 0.2589 \]

Storm Initial Loss (mm) vs API (mm)

\[ y = -0.0804x + 33.288 \]
\[ R^2 = 0.0576 \]

API (mm) vs Initial Moisture (mm)

\[ y = 0.2492x + 33.831 \]
\[ R^2 = 0.472 \]
Marrinup Bk @ Brookdale Siding (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Yates Flat Ck @ Woonanup (WA) - 3 hour bursts

- Preburst Rainfall vs Burst Rainfall:
  
  \[ y = 3.6043x - 70.655 \]
  
  \[ R^2 = 0.3096 \]

- Skill Score of IL/CL and SWMOD:
  
  - IL/CL: 4 ± 1
  - SWMOD: 6 ± 2

- Initial Moisture vs Storm Initial Loss:
  
  \[ y = -1.0254x + 41.725 \]
  
  \[ R^2 = 0.8427 \]

- Storm Initial Loss vs API:
  
  \[ y = -0.6381x + 59.93 \]
  
  \[ R^2 = 0.432 \]

- API vs Initial Moisture:
  
  \[ y = 0.7574x - 24.109 \]
  
  \[ R^2 = 0.4879 \]
Yates Flat Ck @ Woonanup (WA) - 3 hour bursts

- Storm Initial Loss (mm) vs. Month
- Continuing Loss (mm/h) vs. Month
- Initial Moisture (mm) vs. Month
- Capacity Factor vs. Month
- Storm Initial Loss (mm) vs. Burst ARI (years)
- Continuing Loss (mm/h) vs. Burst ARI (years)
- Initial Moisture (mm) vs. Burst ARI (years)
- Capacity Factor vs. Burst ARI (years)
Appendix K  Non-parametric loss distributions

GSAM Coastal

Exceedance percentile (%)

Standardised IL (mm)

Currambene
O’Hares
Ourimbah
Swan
Aire
McMahons
Tarago
Toomuc
Average

Exceedance percentile (%)

Standardised CL (mm/h)

Currambene
O’Hares
Ourimbah
Swan
Aire
McMahons
Tarago
Toomuc
Average
GTSMR Coastal

Exceedance percentile (%)

Standardised IL (mm)

Exceedance percentile (%)

Standardised CL (mm/h)

Celia
Coomalie
Manton
Tennant
Broken
Caboolture
Carmila
Finch Hatton
North Maroochy
South Maroochy
Spring
Fletcher
Harding
Kanjenjie
Average
Appendix L  Variation of loss values with ARI
y = 0.007x + 1.1774  
$R^2 = 0.0051$

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5  
0.1 1 10 100

Standardised IL$_s$ (mm)

y = 0.0048x + 1.1327  
$R^2 = 0.0013$

0 1 2 3 4 5 6  
0.1 1 10 100

Standardised IL$_b$ (mm)
y = 0.0148x + 1.1847
R² = 0.0104

\begin{align*}
\text{Standardised CL (mm/h)} & \quad \text{ARI} \\
0 & \quad 1 & \quad 10 & \quad 100 \\
0 & \quad 2 & \quad 4 & \quad 6 & \quad 8 & \quad 10 & \quad 12 & \quad 14 \\
\end{align*}

y = -0.3432x + 20.481
R² = 0.0061

\begin{align*}
\text{IM (mm)} & \quad \text{ARI} \\
-100 & \quad -50 & \quad 0 & \quad 50 & \quad 100 & \quad 150 \\
0.1 & \quad 1 & \quad 10 & \quad 100 \\
\end{align*}

y = 0.0013x + 1.8101
R² = 4E-05

\begin{align*}
\text{CF} & \quad \text{ARI} \\
0 & \quad 2 & \quad 4 & \quad 6 & \quad 8 & \quad 10 & \quad 12 & \quad 14 \\
0.1 & \quad 1 & \quad 10 & \quad 100 \\
\end{align*}
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

\[ y = 0.0018x + 1.1149 \]
\[ R^2 = 0.0144 \]

\[ y = 0.0044x + 1.1572 \]
\[ R^2 = 0.0461 \]
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

- Standardised CL (mm/h)
  \[ y = 0.0003x + 1.1271 \]
  \[ R^2 = 0.0004 \]

- IM (mm)
  \[ y = 0.0077x + 24.821 \]
  \[ R^2 = 0.0002 \]

- CF
  \[ y = -0.0004x + 1.5224 \]
  \[ R^2 = 0.0002 \]
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

GTSMR Coastal

\[ y = 0.0055x + 1.0857 \]
\[ R^2 = 0.0043 \]

\[ y = -0.0063x + 1.2789 \]
\[ R^2 = 0.0014 \]
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

y = 0.0123x + 1.2371
R² = 0.0122

y = 0.3177x + 14.357
R² = 0.0048

y = 0.0034x + 2.1917
R² = 0.0002
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

\[ y = 0.0229x + 1.0184 \]
\[ R^2 = 0.2084 \]

\[ y = 0.0143x + 1.0138 \]
\[ R^2 = 0.0776 \]
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

\[ y = 0.0247x + 1.0522 \]
\[ R^2 = 0.1434 \]

![Graph 1: Standardised CL (mm/h) vs ARI](image1)

\[ y = -0.4918x + 35.563 \]
\[ R^2 = 0.0668 \]

![Graph 2: IM vs ARI](image2)

\[ y = 0.0277x + 3.5825 \]
\[ R^2 = 0.0168 \]

![Graph 3: CF vs ARI](image3)
Appendix M  Prediction equation diagnostics
GSAM Coastal and Inland

Dependent Variable: IL_S
N: 15
Multiple R: 0.886
Squared Multiple R: 0.784
Adjusted Squared Multiple R: 0.749
Standard Error of Estimate: 6.179

Regression Coefficients $B = (X'X)^{-1}X'Y$

<table>
<thead>
<tr>
<th>Effect</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
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Analysis of Variance

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<tr>
<th>Source</th>
<th>SS</th>
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<th>Mean Squares</th>
<th>F-Ratio</th>
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<tr>
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<td>2</td>
<td>833.781</td>
<td>21.838</td>
<td>0.000</td>
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<tr>
<td>Residual</td>
<td>458.170</td>
<td>12</td>
<td>38.181</td>
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WARNING

Case 1 is an Outlier (Studentized Residual: -2.902)
Case 5 has large Leverage (Leverage: 0.656)

Durbin-Watson D-Statistic: 2.265
First Order Autocorrelation: -0.309

Information Criteria

| AIC             | 101.856 |
| AIC (Corrected) | 105.856 |
| Schwarz's BIC   | 104.688 |
Fitted Model Plot

Plot of Residuals vs. Predicted Values
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>IM</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>15</td>
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<tr>
<td>Multiple R</td>
<td>0.656</td>
</tr>
<tr>
<td>Squared Multiple R</td>
<td>0.430</td>
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<td>Adjusted Squared Multiple R</td>
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<td>Standard Error of Estimate</td>
<td>21.413</td>
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Regression Coefficients $B = (X'X)^{-1}X'Y$

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<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
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<tbody>
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<td>0.000</td>
<td>-0.473</td>
<td>0.644</td>
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<td>0.073</td>
<td>0.656</td>
<td>1.000</td>
<td>3.135</td>
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</table>

Analysis of Variance

<table>
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<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
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WARNING

Case 6 has large Leverage (Leverage : 0.506)

Durbin-Watson D-Statistic: 2.584
First Order Autocorrelation: -0.300

Information Criteria

| AIC        | 138.342 |
| AIC (Corrected) | 140.524 |
| Schwarz's BIC | 140.466 |
Confidence Interval and Prediction Interval

Plot of Residuals vs. Predicted Values
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

Dependent Variable: CF
N: 15
Multiple R: 0.760
Squared Multiple R: 0.577
Adjusted Squared Multiple R: 0.544
Standard Error of Estimate: 0.446

Regression Coefficients $B = (X'X)^{-1}X'Y$

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<td>0.000</td>
<td>1.000</td>
<td>2.591</td>
<td>0.022</td>
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<td>A_KSAT</td>
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<td>0.002</td>
<td>0.760</td>
<td>1.000</td>
<td>4.210</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>3.524</td>
<td>1</td>
<td>3.524</td>
<td>17.721</td>
<td>0.001</td>
</tr>
<tr>
<td>Residual</td>
<td>2.585</td>
<td>13</td>
<td>0.199</td>
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</tr>
</tbody>
</table>

WARNING

Case 6 has large Leverage (Leverage: 0.506)

Durbin-Watson D-Statistic: 2.755
First Order Autocorrelation: 0.426

Information Criteria

AIC: 22.195
AIC (Corrected): 24.376
Schwarz’s BIC: 24.319
Confidence Interval and Prediction Interval

Plot of Residuals vs. Predicted Values
### GTSMR Coastal

**Dependent Variable**  
IM

<table>
<thead>
<tr>
<th>Effect</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>108.404</td>
<td>24.871</td>
<td>0.000</td>
<td>0.495</td>
<td>0.000</td>
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<tr>
<td>ELEVRANGE_SQRTCA6222</td>
<td>622.208</td>
<td>146.744</td>
<td>1.061</td>
<td>0.495</td>
<td>0.000</td>
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<tr>
<td>A_FCP</td>
<td>-393.526</td>
<td>91.601</td>
<td>-1.075</td>
<td>0.495</td>
<td>-0.000</td>
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</tbody>
</table>

**Analysis of Variance**

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>6,843.297</td>
<td>2</td>
<td>3,421.649</td>
<td>10.650</td>
<td>0.003</td>
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<tr>
<td>Residual</td>
<td>3,533.935</td>
<td>11</td>
<td>321.267</td>
<td>10.650</td>
<td>0.003</td>
</tr>
</tbody>
</table>

**WARNING**

Case 8 has large Leverage (Leverage : 0.834)

**Durbin-Watson D-Statistic**  
2.138

**First Order Autocorrelation**  
-0.228

**Information Criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>AIC</td>
<td>125.166</td>
</tr>
<tr>
<td>AIC (Corrected)</td>
<td>129.610</td>
</tr>
<tr>
<td>Schwarz's BIC</td>
<td>127.722</td>
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</table>
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

Fitted Model Plot

Plot of Residuals vs. Predicted Values

P6/S3/016B : 23 October 2014
Dependent Variable CL
N 9
Multiple R 0.738
Squared Multiple R 0.544
Adjusted Squared Multiple R 0.479
Standard Error of Estimate 1.727

Regression Coefficients $B = (X'X)^{-1}X'Y$

<table>
<thead>
<tr>
<th>Effect</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>-10.695</td>
<td>5.314</td>
<td>0.000</td>
<td>1.000</td>
<td>2.013</td>
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<tr>
<td>DES_RAIN_12HR</td>
<td>0.159</td>
<td>0.055</td>
<td>0.738</td>
<td>1.000</td>
<td>2.889</td>
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</table>

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>24.912</td>
<td>1</td>
<td>24.912</td>
<td>8.348</td>
<td>0.023</td>
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<tr>
<td>Residual</td>
<td>20.888</td>
<td>7</td>
<td>2.984</td>
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</tr>
</tbody>
</table>

Durbin-Watson D-Statistic 1.819
First Order Autocorrelation 0.056

Information Criteria

<table>
<thead>
<tr>
<th>AIC</th>
<th>39.119</th>
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</thead>
<tbody>
<tr>
<td>AIC (Corrected)</td>
<td>43.919</td>
</tr>
<tr>
<td>Schwarz's BIC</td>
<td>39.710</td>
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</table>
Confidence Interval and Prediction Interval

Plot of Residuals vs. Predicted Values
Dependent Variable: IM

<table>
<thead>
<tr>
<th>Effect</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
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</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>-36.122</td>
<td>9.334</td>
<td>0.000</td>
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<td>0.006</td>
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<tr>
<td>TOP_2PC_API</td>
<td>0.472</td>
<td>0.061</td>
<td>0.946</td>
<td>1.000</td>
<td>7.688</td>
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</tbody>
</table>

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>4,296.629</td>
<td>1</td>
<td>4,296.629</td>
<td>59.098</td>
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<tr>
<td>Residual</td>
<td>508.927</td>
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<td>72.704</td>
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</tbody>
</table>

WARNING

Case 5 is an Outlier (Studentized Residual: 2.254)

Durbin-Watson D-Statistic: 2.397
First Order Autocorrelation: -0.254

Information Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>AIC</td>
<td>67.857</td>
</tr>
<tr>
<td>AIC (Corrected)</td>
<td>72.657</td>
</tr>
<tr>
<td>Schwarz's BIC</td>
<td>68.448</td>
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</table>
Confidence Interval and Prediction Interval

Plot of Residuals vs. Predicted Values
### Regression Coefficients

\( B = (X'X)^{-1}X'Y \)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Std. Coefficient</th>
<th>Tolerance</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>0.881</td>
<td>0.960</td>
<td>0.000</td>
<td>0.918</td>
<td>0.389</td>
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<tr>
<td>B_KSAT</td>
<td>0.012</td>
<td>0.005</td>
<td>0.703</td>
<td>1.000</td>
<td>0.261</td>
</tr>
</tbody>
</table>

### Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Squares</th>
<th>F-Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>19.821</td>
<td>1</td>
<td>19.821</td>
<td>6.822</td>
<td>0.035</td>
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<tr>
<td>Residual</td>
<td>20.339</td>
<td>7</td>
<td>2.906</td>
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</tr>
</tbody>
</table>

**WARNING**

Case 4 is an Outlier (Studentized Residual : 2.726)

- Durbin-Watson D-Statistic: 0.907
- First Order Autocorrelation: 0.413

### Information Criteria

- AIC: 38.879
- AIC (Corrected): 43.679
- Schwarz's BIC: 39.470
Loss models for catchment simulation: Phase 4 Analysis of Rural Catchments

Confidence Interval and Prediction Interval

Plot of Residuals vs. Predicted Values