CHAPTER 8

USING THE DISAGGREGATION MODEL WITH SYNTHETIC DATA

As discussed in the earlier chapters, fine timescale data are not available for all stations throughout Australia. Also, the data lengths vary quite substantially among the stations where fine timescale data are available. Synthetically produced data can provide uniform data lengths throughout the stations in a region. A source of such synthetic rainfall data is the SILO Data Drill maintained by the Queensland Department of Natural Resources and Water (http://www.nrw.qld.gov.au/silo/datadrill/index.html). The SILO Data Drill is a database that generates long term (1889 to date) synthetic daily rainfall data at any location within the Australian continent. This database facilitates extraction of data from an archive of interpolated rainfall surfaces. These surfaces were constructed by spatially interpolating observational data collected by BOM. The SILO data are all synthetic; no original BOM station data are left after the spatial interpolation.

With the confidence that the model predictions of intensities are not worse at higher ARIs than the ARR method and the model predictions of other statistics (mean, variances etc.) are improved to a certain extent with the introduction of seasonality, the model is used to disaggregate the synthetic SILO data. The same BOM stations that were used in earlier chapters (i.e., Rockhampton, Dingo and Brisbane in Queensland) for the disaggregation of daily rainfall have been selected to demonstrate model applicability to the SILO data. The experimental Gregory site (Latitude 23.55 S, and Longitude 148.70 E) which does not have any BOM fine timescale data will also be used in a similar way. The input parameters are the same as shown in Table 6.2 of chapter 6. The dry probabilities,

variances, autocorrelations and intensities are discussed under the corresponding station-names in the following sub-sections.

8.1 Rockhampton

The BOM station of Rockhampton (ID 39083) is situated in the BOM rainfall region 39. The SILO Data Drill has generated the daily rainfall synthetic data for Rockhampton from 1889 to 2006. This daily rainfall data has been disaggregated into 6-minute timescale. The following figures show variances of Rockhampton SILO data at different aggregation levels:

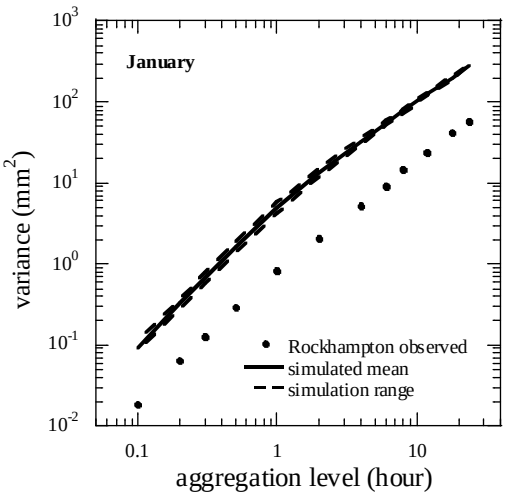

Figure 8.1 Rockhampton variance in January at 6 minute disaggregated SILO data

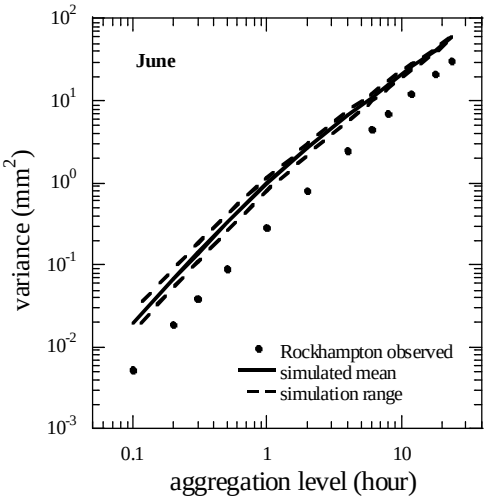

Figure 8.2 Rockhampton variance in June at 6 minute disaggregated SILO data

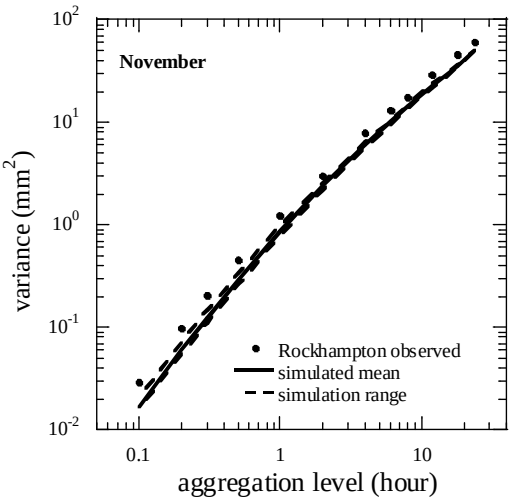

Figure 8.3 Rockhampton variance in November at 6 minute disaggregated SILO data

The SILO data set (118 years) and the Rockhampton observed data set (Table 7.1) have been compared in Figures 8.1 to 8.3. It is obvious from these figures that the simulated SILO mean is not close to the observed data for all months. The stochastic disaggregation model preserves the means of the observed data in the simulated fine timescale storm profile. There are two separate data sets shown in Figures 8.1 to 8.3, and the months which have nearly equal mean rainfall at all durations in both sets showed close matches (Figure 8.3), but the months which did not fulfil this criterion displayed the simulation means falling apart from the observed (Figures 8.1 & 8.2). Table 8.1 shows the detailed monthly mean rainfall depths in these two data sets for January and November.

Table 8.1 Comparison of mean rainfall depths at different durations for January and November between SILO data and observed data

Duration (hr)	January		November	
	SILO mean (mm)	Observed mean (mm)	SILO mean (mm)	Observed mean (mm)
0.1	0.02243	0.010547	0.009041	0.008804
0.2	0.04486	0.021094	0.01808	0.017607
0.3	0.06728	0.031641	0.02712	0.026411
0.5	0.1121	0.052735	0.0452	0.044018
1	0.2243	0.10547	0.09041	0.088036
2	0.4486	0.21094	0.1808	0.17607
4	0.8971	0.42188	0.3616	0.35214
6	1.346	0.63282	0.5424	0.52822
8	1.794	0.84375	0.7233	0.70429
12	2.691	1.2656	1.085	1.0564
18	4.005	1.9039	1.627	1.5847
24	5.383	2.5313	2.17	2.1129

Table 8.1 shows that the monthly means are very different in January whereas the monthly means are nearly equal in November. Hence a comparison between any observed data and the SILO simulated data is not reliable. Therefore, no observed data (either BOM or experimental) are shown hereafter. It also needs to be highlighted that because the datasets are of different calender periods, the statistics are not expected to be the same. The user has to select the daily data for disaggregation. The selection process is beyond the scope of this research.

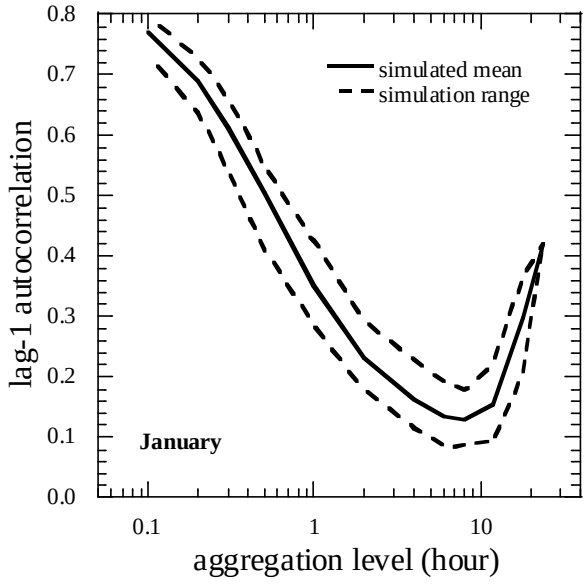

Figure 8.4 January lag-1 autocorrelation of Rockhampton from the disaggregated SILO data

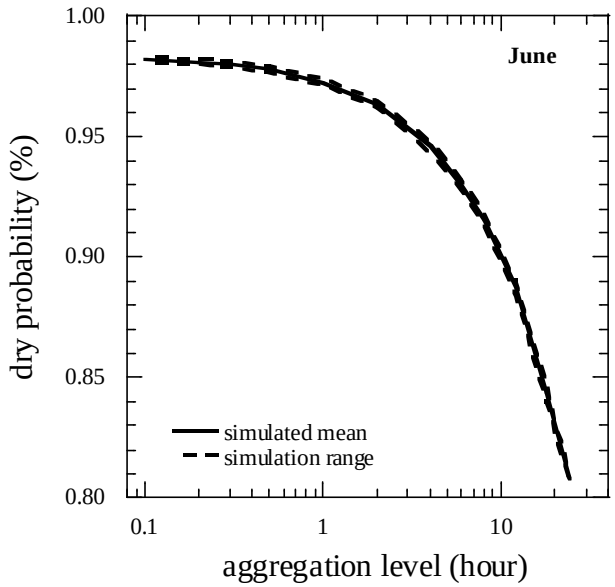

Figure 8.5 June dry probability of Rockhampton from the disaggregated SILO data

Figures 8.4 & 8.5 show the simulated lag-1 autocorrelations and dry probabilities at Rockhampton from the disaggregated SILO data respectively.

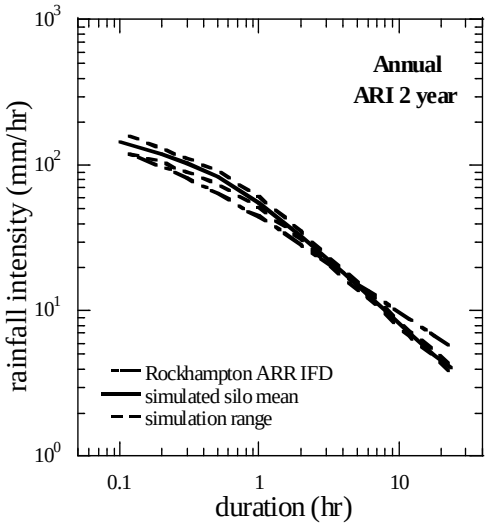

Figure 8.6 Comparison between ARR IFD and simulated SILO IFD at Rockhampton for ARI 2 years

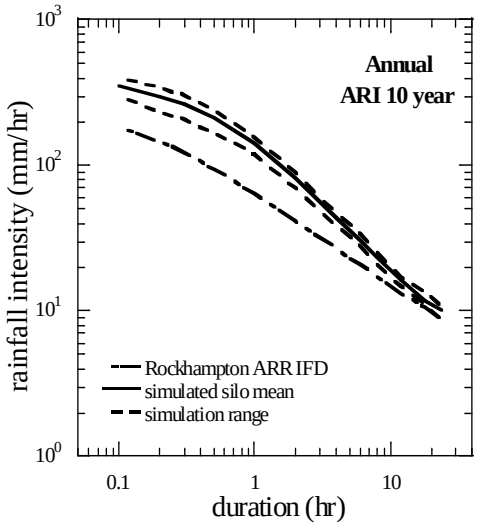

Figure 8.7 Comparison between ARR IFD and simulated SILO IFD at Rockhampton for ARI 10 years

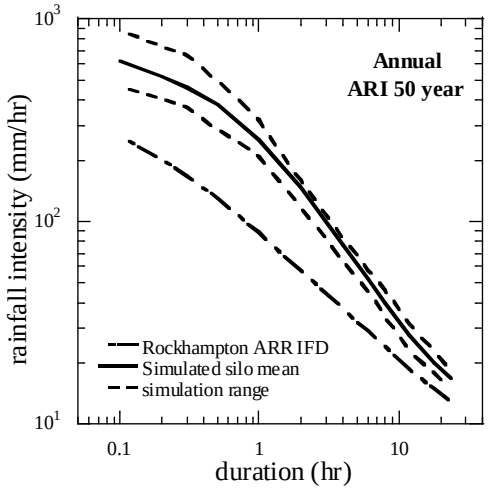

Figure 8.8 Comparison between ARR IFD and simulated SILO IFD at Rockhampton for ARI 50 years

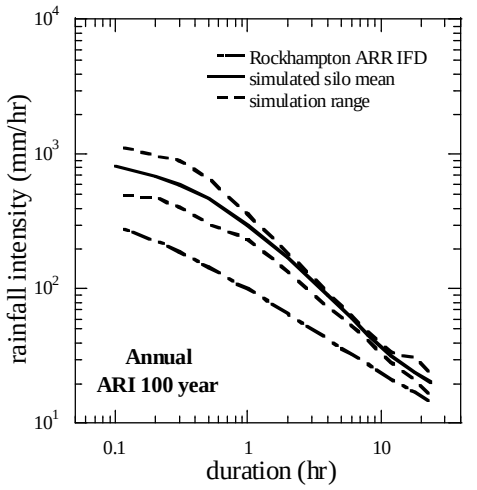

Figure 8.9 Comparison between ARR IFD and simulated SILO IFD at Rockhampton for ARI 100 years

The Australian Rainfall and Runoff (ARR) is another set of synthetic data, and it is observed in Figures 8.6 to 8.9 that the ARR IFDs are lower than the simulated SILO IFDs at higher ARIs for all durations in Rockhampton.

8.2 Dingo

The BOM station ID for Dingo is 35025 and it is situated in the BOM rainfall region 35. The SILO Data Drill has generated the daily rainfall synthetic data for Dingo from 1889 to 2006. This daily rainfall data has been disaggregated into 6-minute timescale. The following figures show variances, dry probabilities and autocorrelations of Dingo SILO data at different aggregation levels:

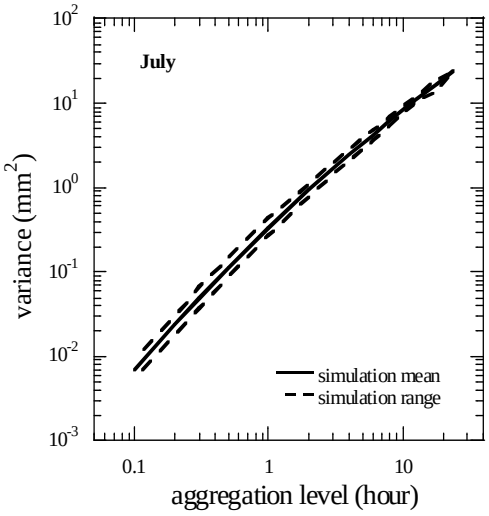

Figure 8.10 July variance at Dingo from the disaggregated SILO data

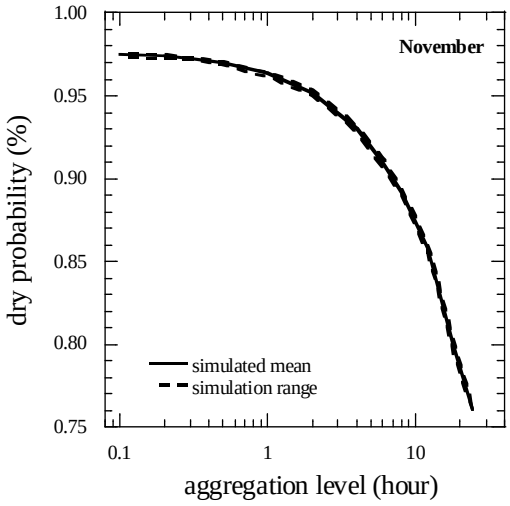

Figure 8.11 November dry probability at Dingo from the disaggregated SILO data

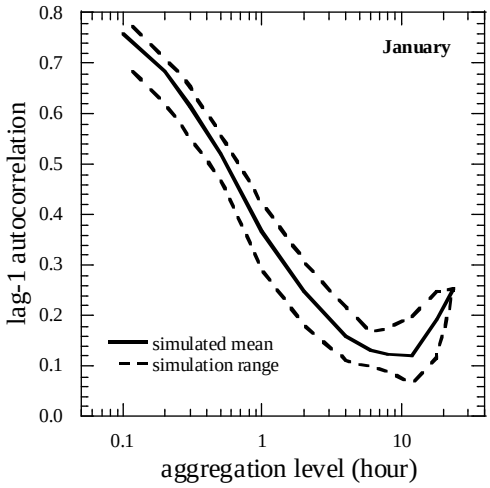

Figure 8.12 January lag-1 autocorrelation at Dingo from the disaggregated SILO data

Figures 8.10 to 8.12 show the disaggregated SILO data statistics for different months at Dingo without comparing with any observed data for the same reasons described earlier in section 8.1. The comparisons of SILO IFDs and the ARR are described in the following figures:

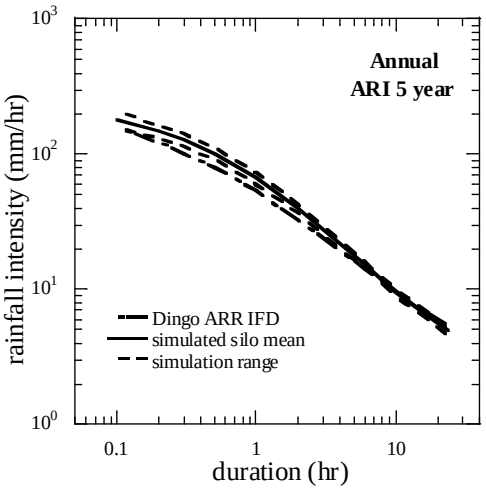

Figure 8.13 Comparison between ARR IFD and simulated SILO IFD at Dingo for ARI 5 years

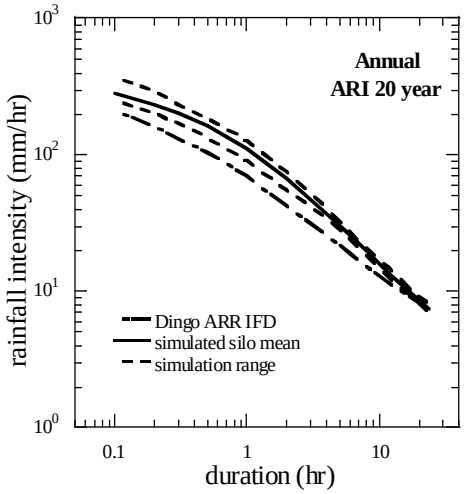

Figure 8.14 Comparison between ARR IFD and simulated SILO IFD at Dingo for ARI 20 years

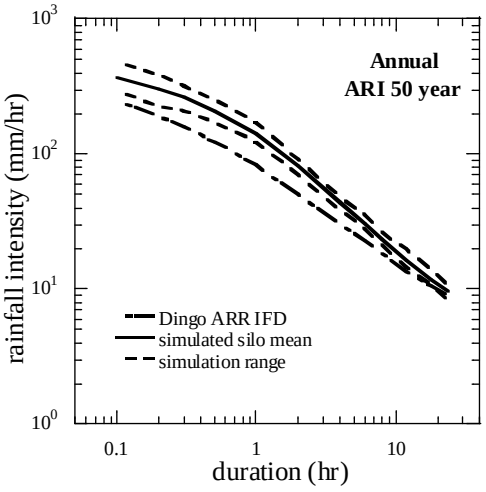

Figure 8.15 Comparison between ARR IFD and simulated SILO IFD at Dingo for ARI 50 years

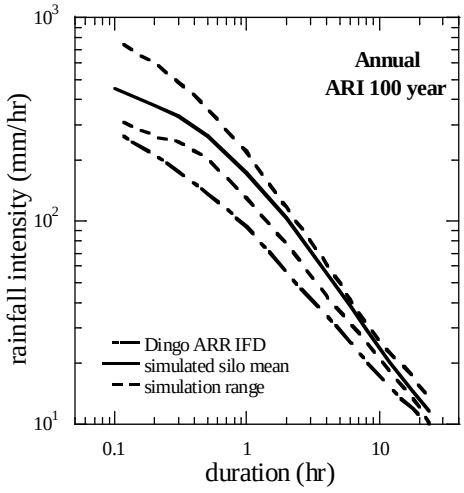

Figure 8.16 Comparison between ARR IFD and simulated SILO IFD at Dingo for ARI 100 years

As observed for Rockhampton, the Dingo ARR IFDs are generally lower than the simulated SILO IFDs at higher ARIs for all durations (Figures 8.13 to 8.16).

8.3 Brisbane

The BOM station of Brisbane (ID 40214) is situated in the BOM rainfall region 40. The SILO Data Drill has generated the daily rainfall synthetic data for Brisbane from 1889 to 2006. This daily rainfall data has been disaggregated into 6-minute timescale. The following figures show variances, dry probabilities and autocorrelations of Brisbane SILO data at different aggregation levels:

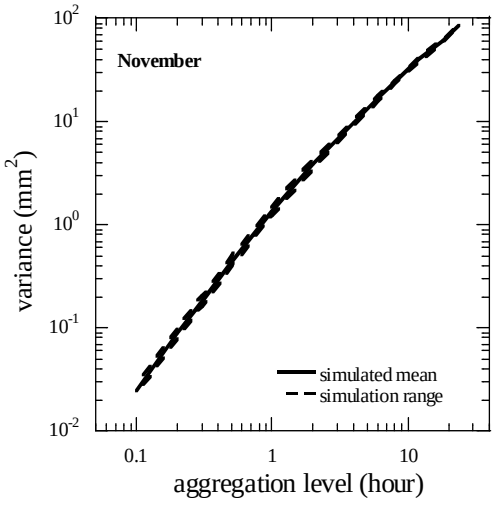

Figure 8.17 November variance at Brisbane from the disaggregated SILO data

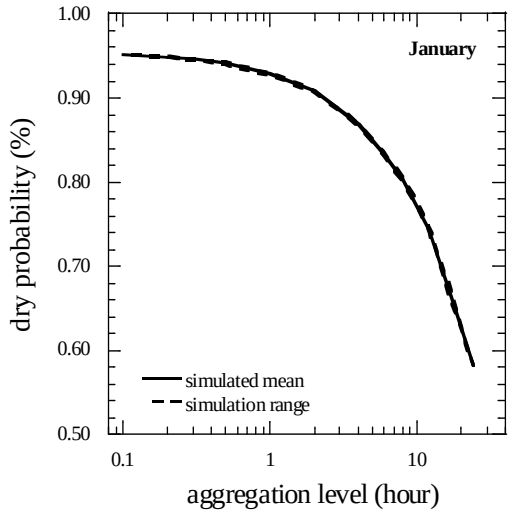

Figure 8.18 January dry probability at Brisbane from the disaggregated SILO data

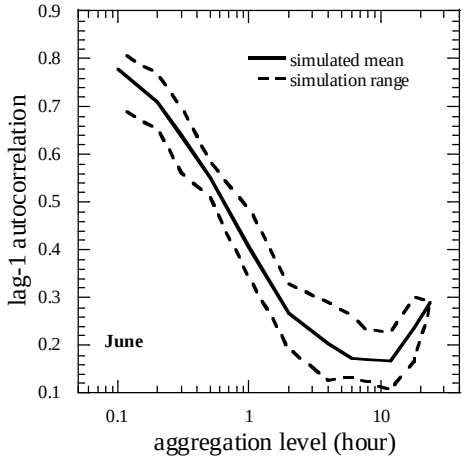

Figure 8.19 June lag-1 autocorrelation at Brisbane from the disaggregated SILO data

Figures 8.17 to 8.19 show the simulations of various statistics at Brisbane for the disaggregated SILO data.

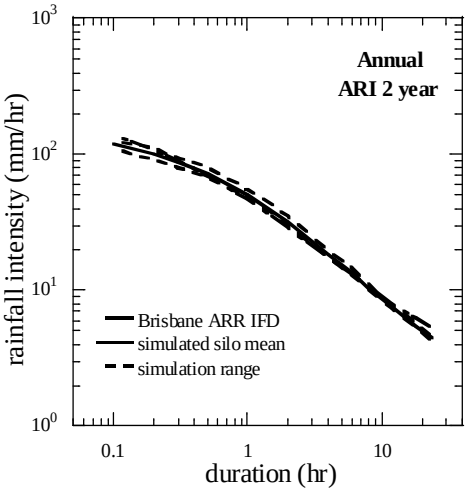

Figure 8.20 Comparison between ARR IFD and simulated SILO IFD at Brisbane for ARI 2 yr

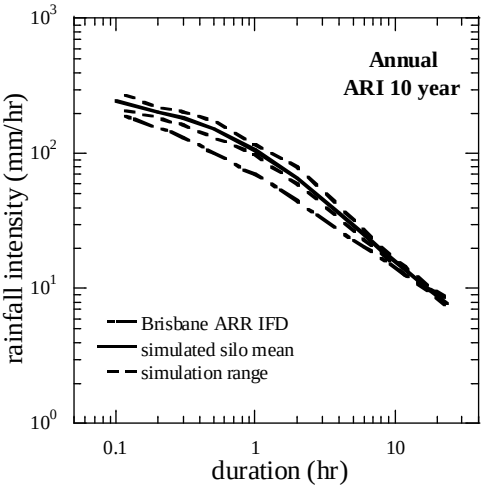

Figure 8.21 Comparison between ARR IFD and simulated SILO IFD at Brisbane for ARI 10 yr

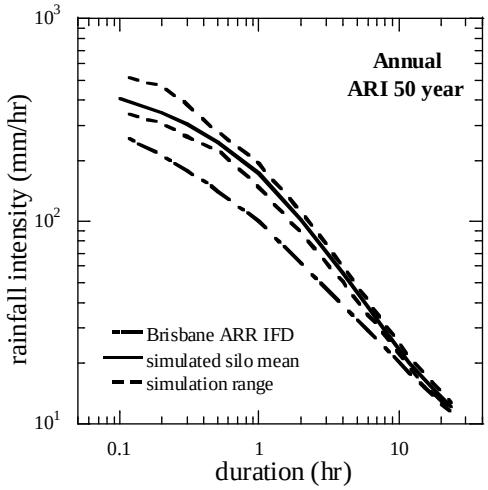

Figure 8.22 Comparison between ARR IFD and simulated SILO IFD at Brisbane for ARI 50 yr

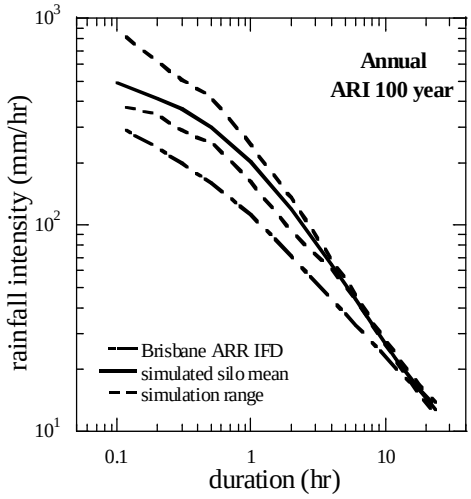

Figure 8.23 Comparison between ARR IFD and simulated SILO IFD at Brisbane for ARI 100 yr

Again it is observed in Figures 8.20 to 8.23 that the ARR IFDs are generally lower than the simulated SILO IFDs at higher ARIs for all durations in Brisbane.

8.4 Gregory

Gregory is not a BOM station and hence it does not have any long term fine timescale rainfall data. It is an experimental railway embankment erosion control field trial site (Gyasi-Agyei, 2005, 2006; Gyasi-Agyei et al., 2001). It is situated at Latitude 23.55 S and Longitude 148.70 E in the BOM Central Queensland rainfall region 35. Capping parameters of Gregory site were derived from Dingo rainfall station which is the nearest BOM rainfall station to the experimental Gregory site. All other parameters are the same as Table 6.2 of chapter 6. The SILO Data Drill has generated the daily rainfall synthetic data for Gregory from 1889 to 2006. This daily rainfall dataset has been disaggregated into 6-minute timescale. The following figures show autocorrelations, dry probabilities and variances of Gregory SILO data at different aggregation levels.

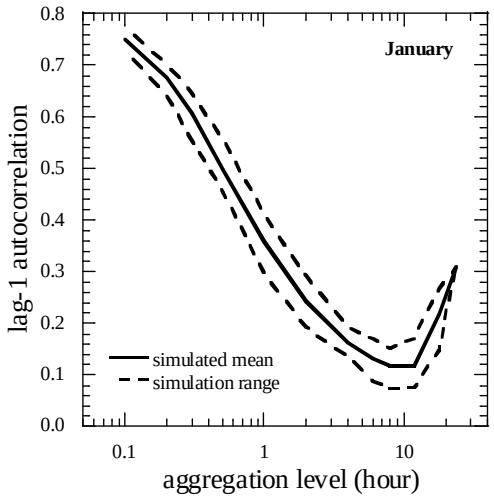

Figure 8.24 January lag-1 autocorrelation at Gregory from the disaggregated SILO data

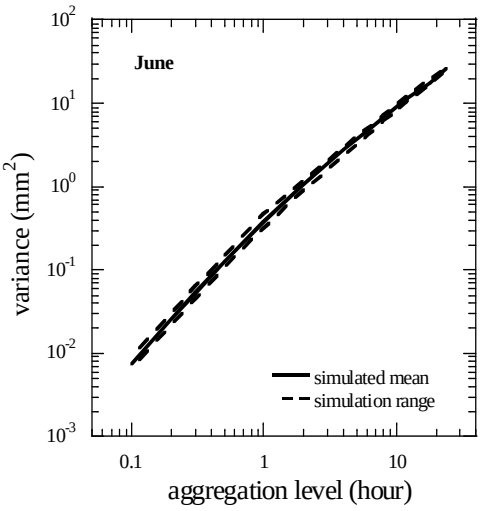

Figure 8.25 June variance at Gregory from the disaggregated SILO data

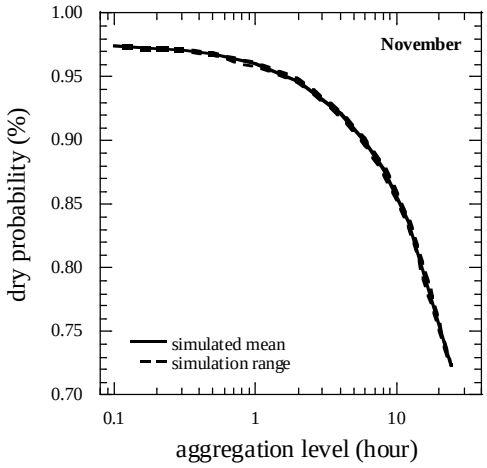

Figure 8.26 November dry probability at Gregory from the disaggregated SILO data

The IFDs are also simulated at durations from 6-minute to 24-hour. The following figures show the comparison of Gregory IFDs with the corresponding ARR IFDs.

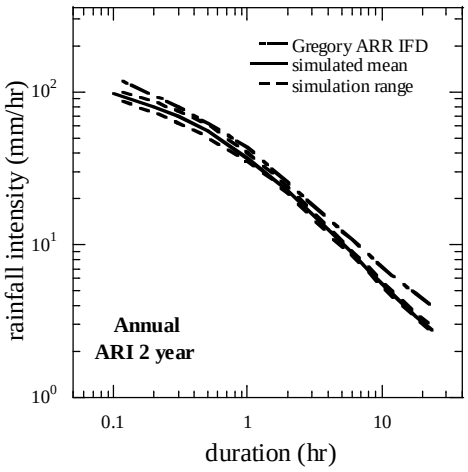

Figure 8.27 Comparison between ARR IFD and simulated SILO IFD at Gregory for ARI 2 yr

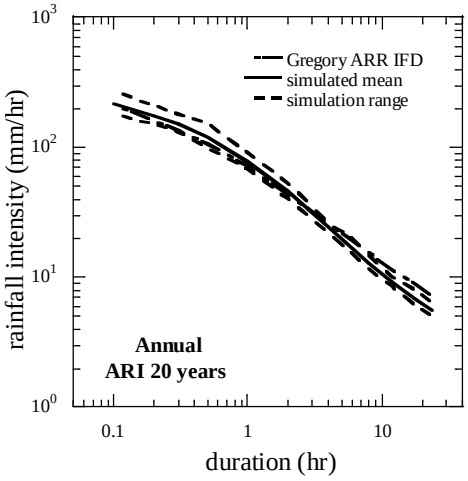

Figure 8.28 Comparison between ARR IFD and simulated SILO IFD at Gregory for ARI 20 yr

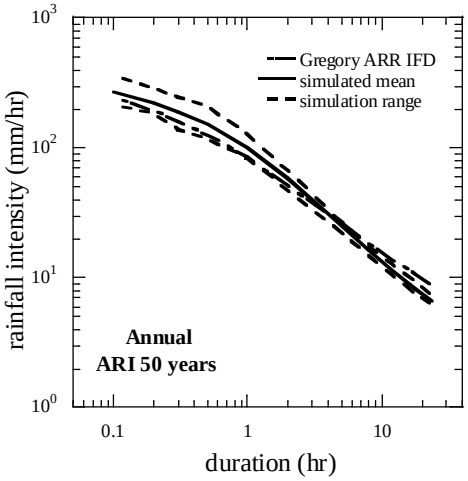

Figure 8.29 Comparison between ARR IFD and simulated SILO IFD at Gregory for ARI 50 yr

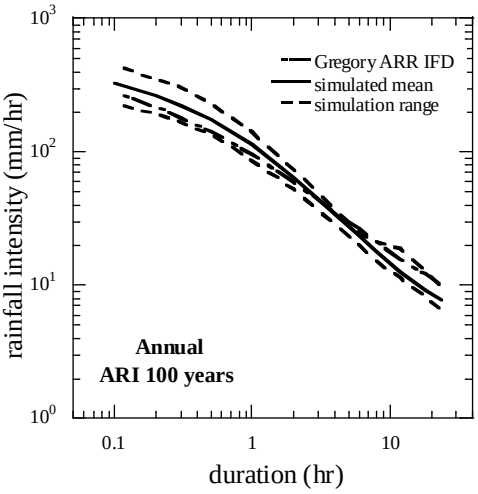

Figure 8.30 Comparison between ARR IFD and simulated SILO IFD at Gregory for ARI 100 yr

It is observed in Figures 8.27 to 8.30 that both ARR and the simulated IFDs at Gregory are within the simulation ranges even though the ARR approach slightly underestimated the intensities at higher ARIs up to 3 hour durations.

In conclusion, it is established that the model can be used to disaggregate long term synthetic rainfall data in Queensland regions. It can also be used with sufficient confidence in stations which do not have long term fine timescale rainfall data to establish their own capping parameters.