

REFERENCES

- Abulohom, M. S., Shah, S. M. S., & Ghumman, A. R. (2001). Development of a Rainfall-Runoff Model, its Calibration and Validation. *Water Resources Management*, 15(3), 149–163.
- Al-Lafta, H. S., Al-Tawash, B. S., & Al-Baldawi, B. A. (2013). Applying the “abcd” Monthly Water Balance Model for Some Regions in the United States. *Advances in Physics Theories and Applications*, 25(1), 36–47.
- Bettina, Schaefli. and Hoshin, V. (2007). Do Bash Values have Value. *Institute of Geoecology, University of Potsdam, AZ 85721*.
- CALVO, J. C. (1986). An evaluation of Thornthwaite’s water balance technique in predicting stream runoff in Costa Rica. *Hydrological Sciences Journal*, 31(1), 51–60.
- Cao, G., Han, D., & Song, X. (2014). Evaluating actual evapotranspiration and impacts of groundwater storage change in the North China Plain. *Hydrological Processes*.
- Ceylon Electricity Board. (1987). Masterplan for the Electricity Supply of Sri Lanka, Water Resources Data Base.
- Chen, X., Chen, Y. D., & Xu, C. (2007). A distributed monthly hydrological model for integrating spatial variations of basin topography and rainfall. *Hydrological Processes*, 21(2), 242–252.
- Cohen, Ollington & Linga,(2013). Hydrological Model Parameter Optimization. *20th International Congress on Modelling Simulation, Aurelia, 1-6 December 2013*.
- C, Zhang, R, Wang. Q, Meng. (2013). Calibration of Conceptual Rainfall Models Using Global Optimization. *Hindawi Public Corporatiion Advances in Meteorology, Volume 2015, Article ID, 545376*.
- Deus, D., Gloaguen, R., & Krause, P. (2013). Water Balance Modeling in a Semi-Arid Environment with Limited in situ Data Using Remote Sensing in Lake Manyara, East African Rift, Tanzania. *Remote Sensing*, 5(4), 1651–1680.
- H. A. HOUGHTON-CARR (1999) Assessment criteria for simple conceptual daily rainfall- runoff models, *Hydrological Sciences Journal*, 44:2, 237- 261.
- HUGHES, D. A., & METZLER, W. (1998). Assessment of three monthly rainfall-runoff models for estimating the water resource yield of semiarid catchments in Namibia. *Hydrological Sciences Journal*, 43(2), 283–297.
- Hydrological Division. (1993/1994). Hydrological Annual. Sri Lanka, Department of Irrigation.

- Ketema Tilahun Zeleke, L. J. W. (2012). Evapotranspiration Estimation Using Soil Water Balance, Weather and Crop Data.
- Kim, S., Hong, S. J., Kang, N., Noh, H. S., & Kim, H. S. (2015). A comparative study on the simple two-parameter monthly water balance model and Kajiyama formula for monthly runoff estimation. *Hydrological Sciences Journal*, 0(ja), null.
- Krause, P., Boyle, D. P., & Bäse, F. (2005). Comparison of different efficiency criteria for hydrological model assessment. *Advances in Geosciences*, 5, 89–97.
- Lu Zhang, G. R. W. (n.d.). Water balance modelling: concepts and applications.
- Mata-Lima, H. (2008). Evaluation of the objective functions to improve production history matching performance based on fluid flow behaviour in reservoir. *Journal of Petroleum Science and Engineering* 78 (2011) 42–53.
- Madsen, H. (2000). Automatic calibration of a conceptual rainfall–runoff model using multiple objectives. *Journal of Hydrology*, 235(3–4), 276–288.
- Makhlouf, Z., & Michel, C. (1994). A two-parameter monthly water balance model for French watersheds. *Journal of Hydrology*, 162(3–4), 299–318.
- Martinez, G. F., & Gupta, H. V. (2010). Toward improved identification of hydrological models: A diagnostic evaluation of the “abcd” monthly water balance model for the conterminous United States. *Water Resources Research*, 46(8), W08507.
- McMahon, T. A., Peel, M. C., Lowe, L., Srikanthan, R., & McVicar, T. R. (2013). Estimating actual, potential, reference crop and pan evaporation using standard meteorological data: a pragmatic synthesis. *Hydrology. Earth Syst. Sci.*, 17(4), 1331–1363.
- M. H. Diskin, E. S. (1977). A procedure for selection of objective functions for hydrologic simulation models. *Journal of Hydrology*, 34(1), 129–149.
- Mouelhi, S., Michel, C., Perrin, C., & Andréassian, V. (2006). Stepwise development of a two-parameter monthly water balance model. *Journal of Hydrology*, 318(1–4), 200–214.
- Nasseri, M., Zahraie, B., Ajami, N. K., & Solomatine, D. P. (2014). Monthly water balance modeling: Probabilistic, possibilistic and hybrid methods for model combination and ensemble simulation. *Journal of Hydrology*, 511, 675–691.
- Nash, J. E. and Sutcliffe, J. (1970). River flow forecasting through conceptual models. *Part I. A discussion of principles. Journal of Hydrology*, 10, 282–290.

- Robbie M. Andrew, J. R. D. (2007). A distributed model of water balance in the Motueka catchment, New Zealand. *Environmental Modelling and Software*, 22(10), 1519–1528.
- Rwasoka, D. T., Madamombe, C. E., Gumindoga, W., & Kabobah, A. T. (2014). Calibration, validation, parameter indentifiability and uncertainty analysis of a 2 – parameter parsimonious monthly rainfall-runoff model in two catchments in Zimbabwe. *Physics and Chemistry of the Earth, Parts A/B/C*, 67–69, 36–46.
- SERVAT, E., & DEZETTER, A. (1991). Selection of calibration objective fonctions in the context of rainfall-ronoff modelling in a Sudanese savannah area. *Hydrological Sciences Journal*, 36(4), 307–330.
- Snyder, F. F.: 1963, A water yield model derived from monthly runoff data. *International Association of Scientific Hydrology Publication No. 63*, pp. 18–30.
- Thornthwaite, C. W. and Mather, J. R.: 1957, Instructions and tables for computing potential evapotranspiration and the water balance, *Publ. Climatol. Lab. Climatol. Dresel Inst. Technol* 10(3), 185–311.
- Thornthwaite, C. W. and Mather, J. R.: 1955, *The water balance*, *Publ. Climatol. Lab. Climatol Dresel Inst. Technol.* 8(8), 1–104.
- Thornthwaite, C.W.: 1948, An approach toward a rational classification of climate, *Geogr. Rev.* 38(1), 55–94.
- Tekleab, S., Uhlenbrook, S., Mohamed, Y., Savenije, H. H. G., Temesgen, M., & Wenninger, J. (2011). Water balance modeling of Upper Blue Nile catchments using a top-down approach. *Hydrology. Earth Syst. Sci.*, 15(7), 2179–2193.
- Vandewiele, G. L., & Elias, A. (1995). Monthly water balance of ungauged catchments obtained by geographical regionalization. *Journal of Hydrology*, 170(1–4), 277–291.
- VANDEWIELE, G. L., & NI-LAR-WIN. (1998). Monthly water balance models for 55 basins in 10 countries. *Hydrological Sciences Journal*, 43(5), 687–699.
- Vandewiele, G. L., Xu, C.-Y., & Ni-Lar-Win. (1992). Methodology and comparative study of monthly water balance models in Belgium, China and Burma. *Journal of Hydrology*, 134(1–4), 315–347.
- Wang, Q. J., Pagano, T. C., Zhou, S. L., Hapuarachchi, H. A. P., Zhang, L., & Robertson, D. E. (2011). Monthly versus daily water balance models in simulating monthly runoff. *Journal of Hydrology*, 404(3–4), 166–175.

- Wannirachchi, S.S, (2013), Mathematical Modelling of Watershed Runoff Coefficient for Reliable Estimation, *Journal of the Institution of Engineers, Sri Lanka, Vol.XXXXIV.03.*, pg.59-68.
- Wijesekera, N.T.S. (2001), Water Balance to Identify Lunugamwehera Reservoir Management, *Journal of the Institution of Engineers, Sri Lanka, Vol.XXXIV.02*, pg. 53-60.
- Wijesekera, N.T.S., & Rajapakse, R.L.H.L. (2013), Mathematical Modelling of Watershed Wetland Crossings for Flood Mitigation, *Journal of the Institution of Engineers, Sri Lanka, Vol.XXXXIV.03*, pg.55-67.
- Wijesekera, N.T.S., & Perera, P.R.J. (2011), Coefficients of three wet zone watersheds of Sri Lanka, *Journal of the Institution of Engineers, Sri Lanka, Vol.XXXXIV.03*, pg.1-10.
- Wijesekera N.T.S., (2000), Parameter Estimation in Watershed Model: A Case Study Using Gin Ganga Watershed, *Annual Sessions of the Institution of Engineers Sri Lanka Volume 1-Part B*, pp 26-32.
- World Meteorological Organization. (1975) *Intercomparison of conceptual models used in operational hydrological forecasting.*(Operational hydrology report no.7/WMO- No 429). Geneva, Switzerland.
- Xiong, L., & Guo, S. (1999). A two-parameter monthly water balance model and its application. *Journal of Hydrology*, 216(1–2), 111–123.
- Xu, C.-Y., Seibert, J., & Halldin, S. (1996). Regional water balance modelling in the NOPEX area: development and application of monthly water balance models. *Journal of Hydrology*, 180(1–4), 211–236.
- Xu, C.-Y., & Singh, V. P. (1998). A Review on Monthly Water Balance Models for Water Resources Investigations. *Water Resources Management*, 12(1), 20–50.

Appendix-A
Data checking

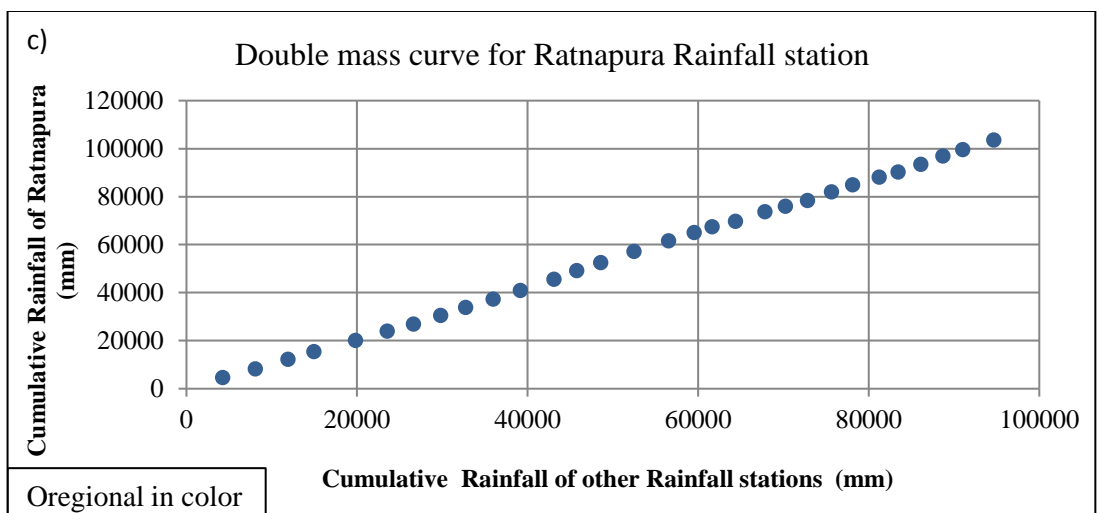
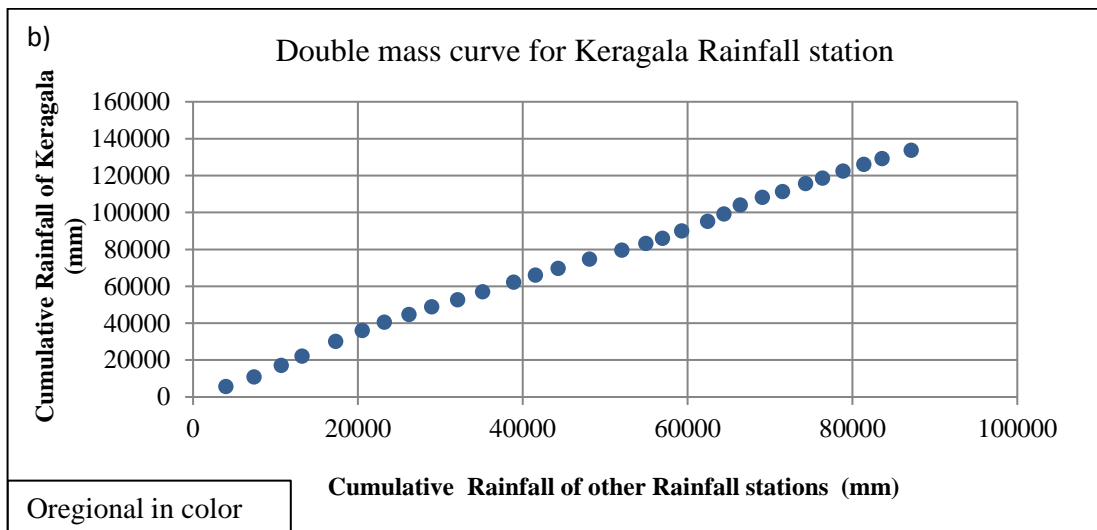
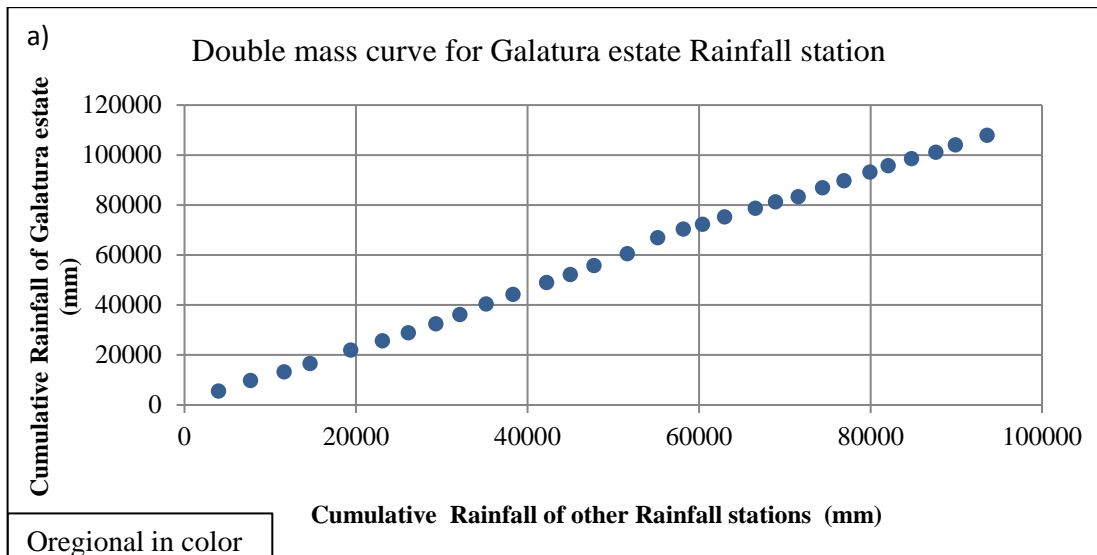


Figure A 1: Double mass curve Analysis for Rainfall Stations in Kalu Ganga (a-c)

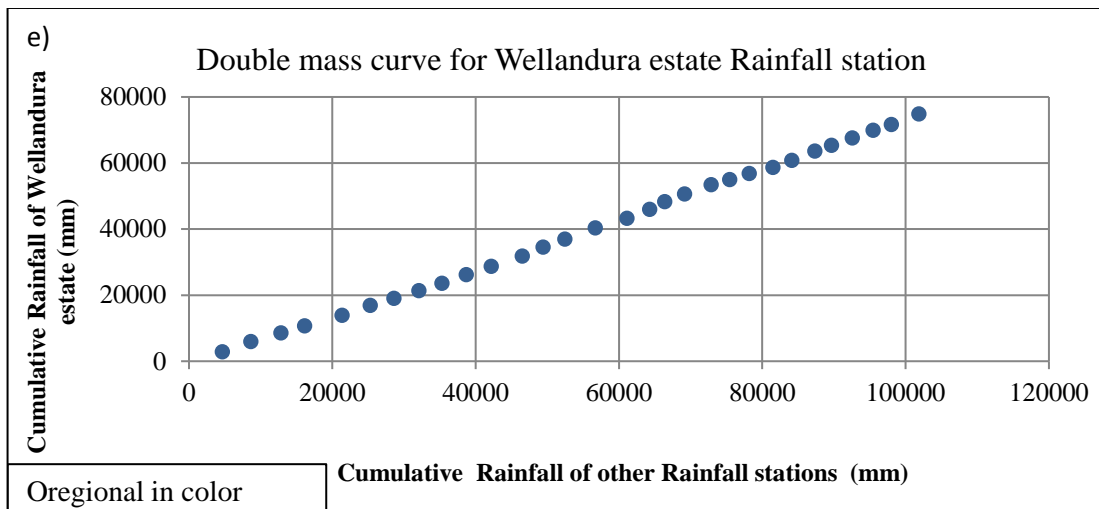
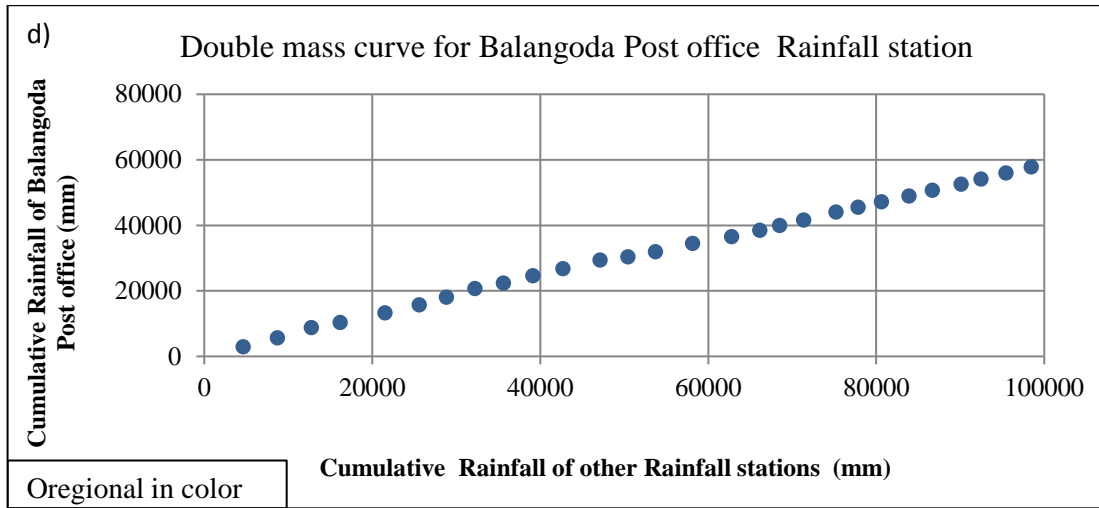


Figure A 2: Double mass curve Analysis for Rainfall Stations in Kalu Ganga (d-e)

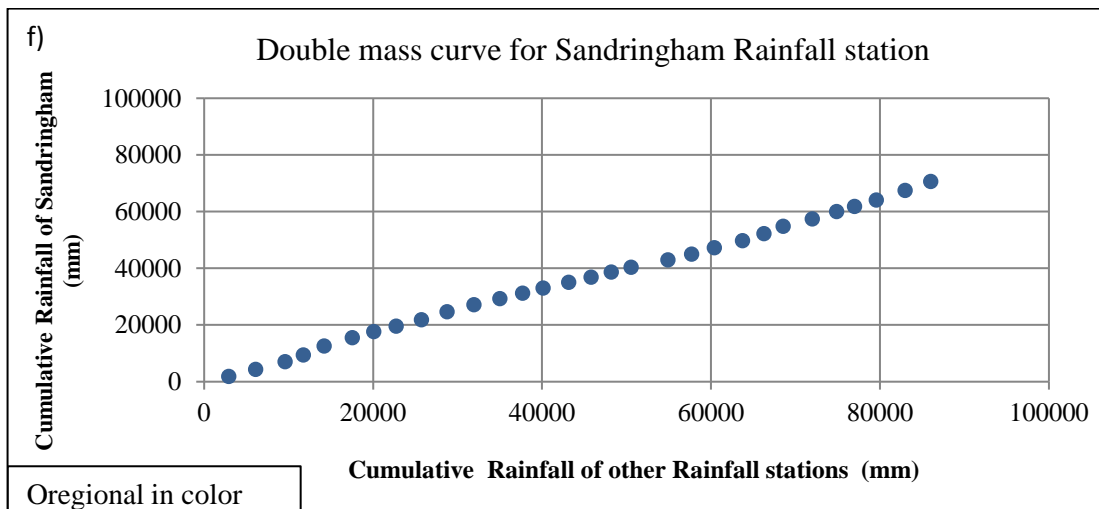


Figure A 3: Double mass curve Analysis for Rainfall stations in Mahaweli Ganga (f)

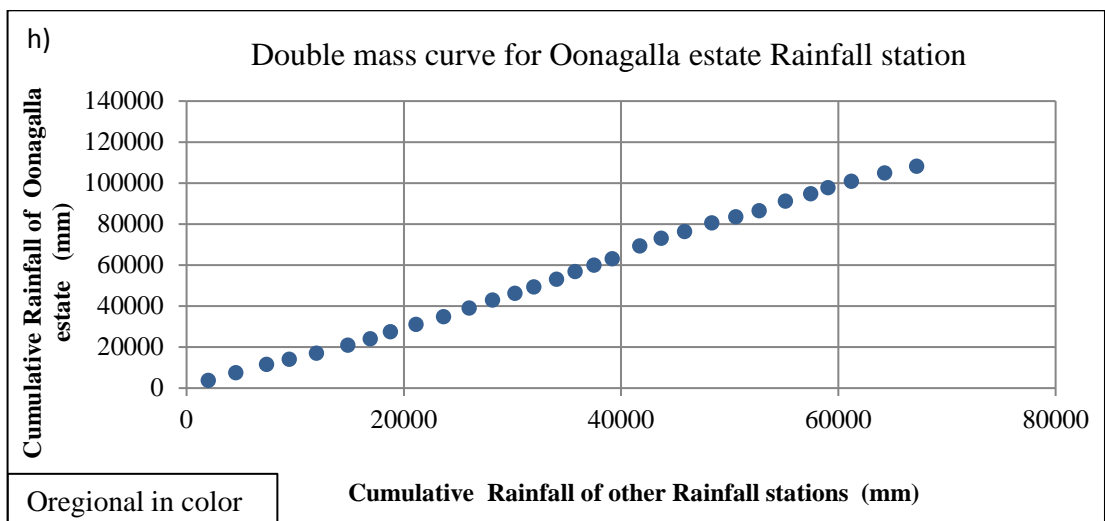
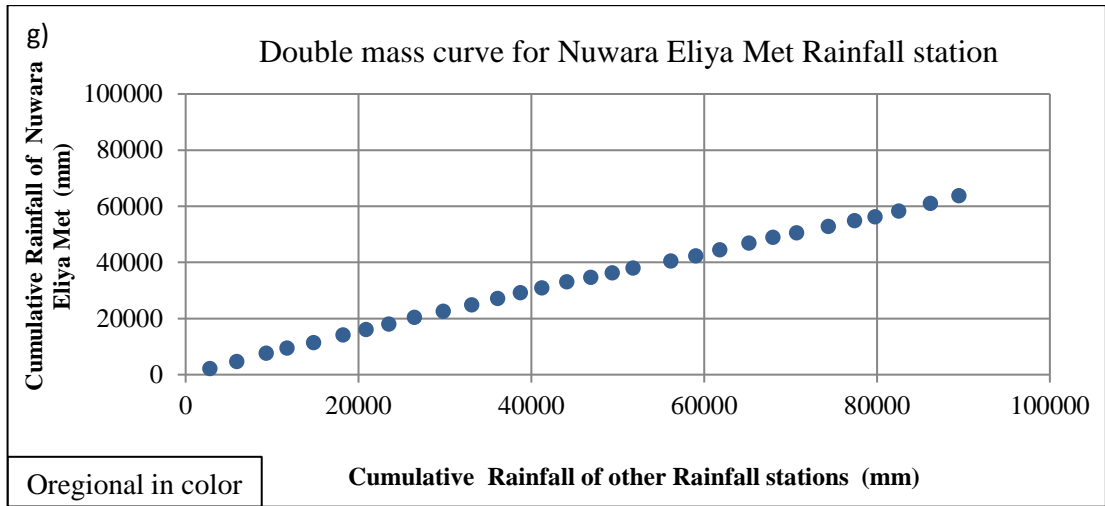


Figure A 4: Double mass curve Analysis for Rainfall stations in Mahaweli Ganga (g-h)

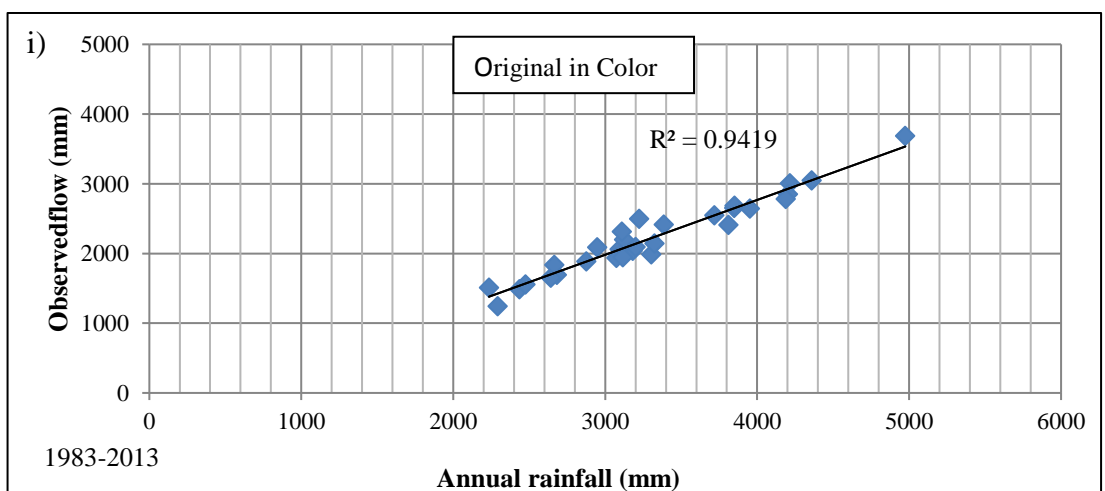


Figure A5: Annual Variation of Observedflow and Thiessen Rainfall in Kalu Ganga (i)

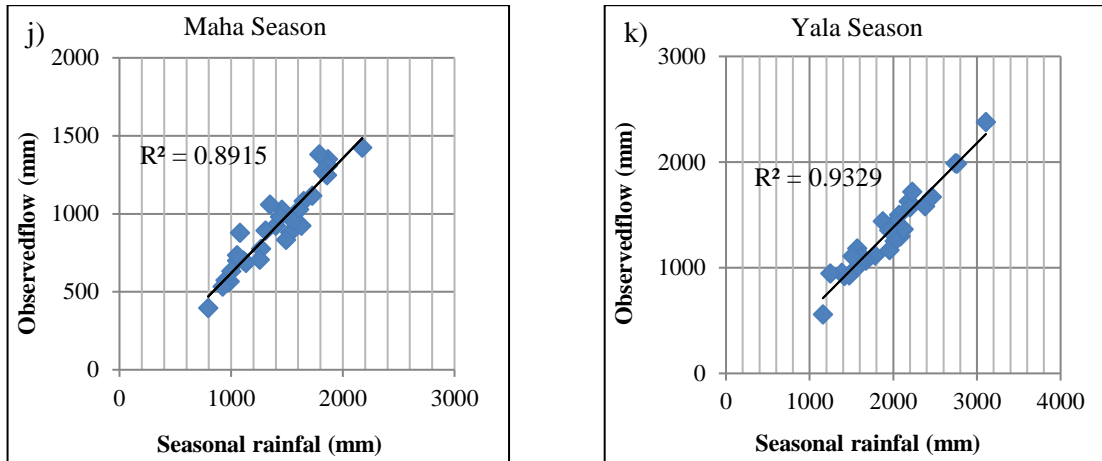


Figure A6: Seasonal Variation of Observedflow and Thiessen Rainfall–Kalu Ganga (j-k)

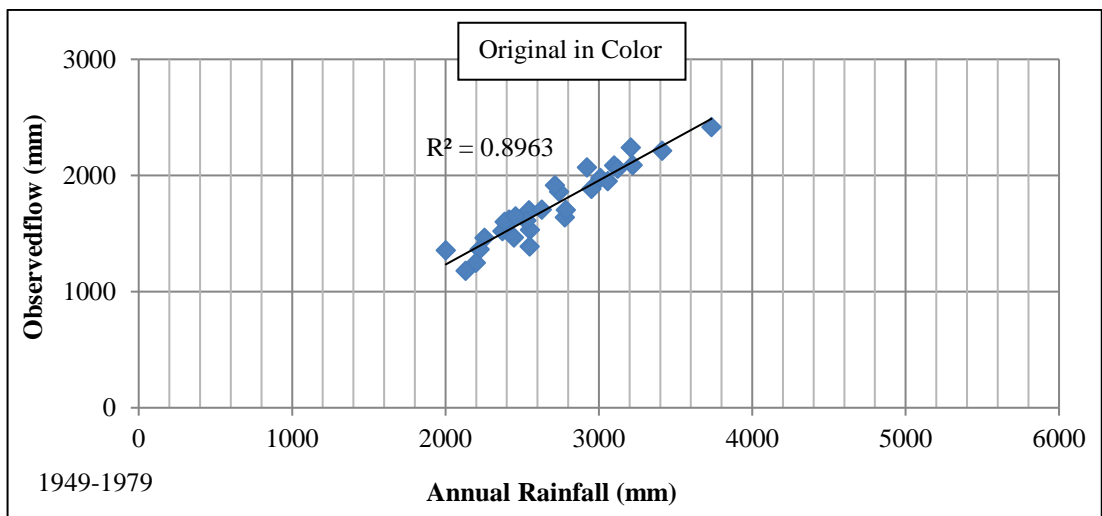


Figure A7: Annual Variation of Observedflow and Thiessen Rainfall in Mahaweli Ganga

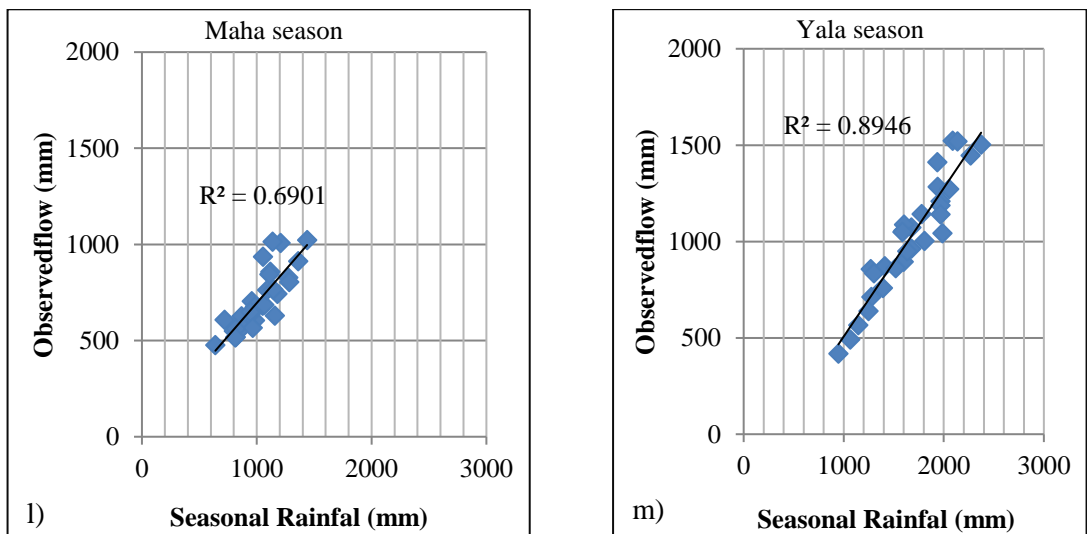


Figure A8: Seasonal Variation of Observedflow & Thiessen Rainfall –Mahaweli Ganga (l-m)

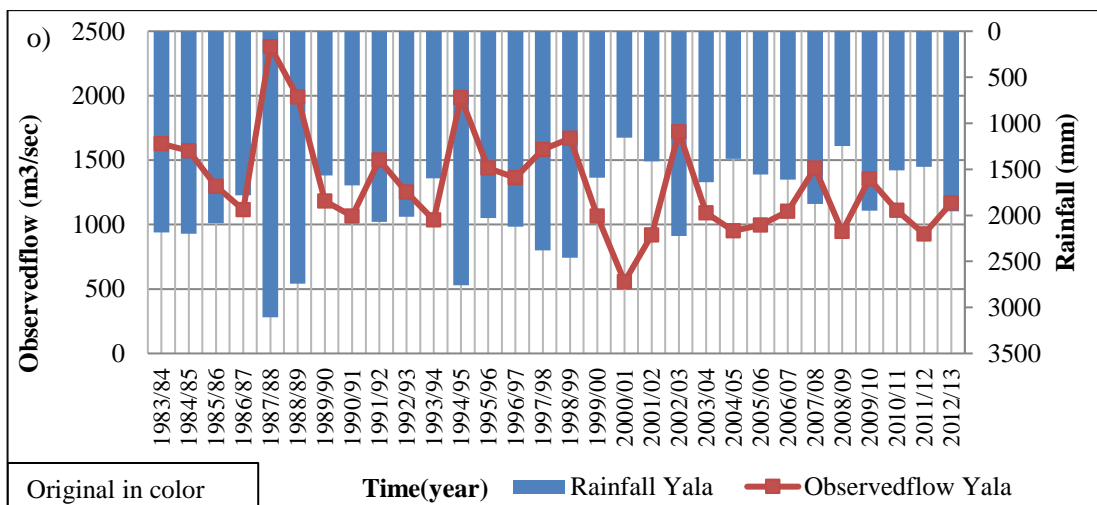
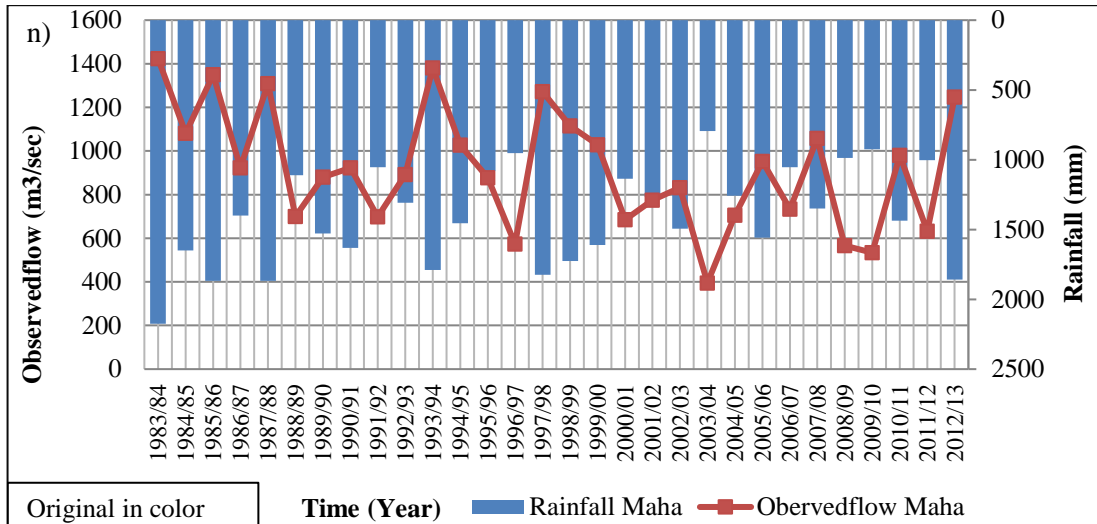


Figure A9: Variation of Seasonal Thiessen Rainfall and Observedflow in Kalu Ganga (n-o)

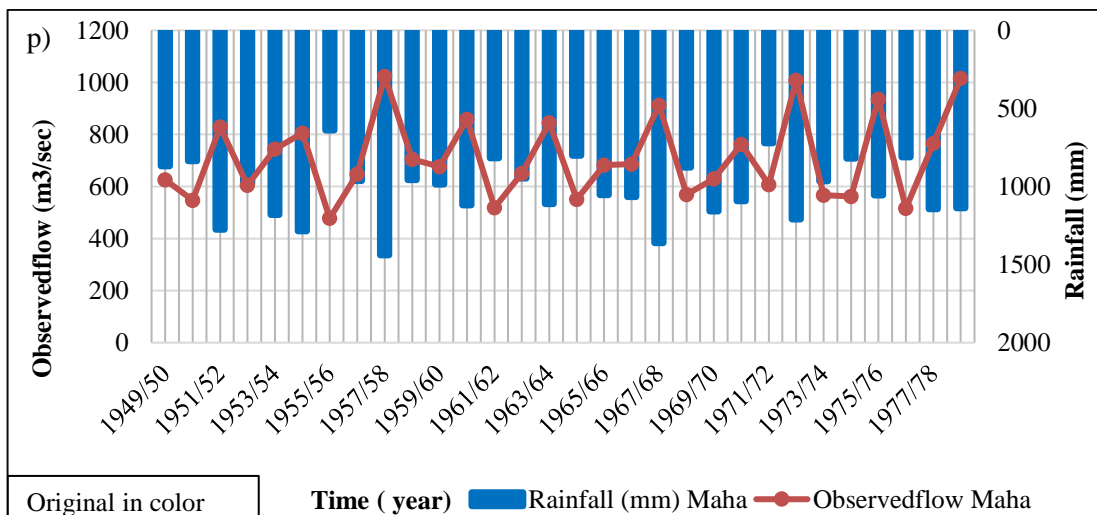


Figure A10: Variation of Seasonal Thiessen Rainfall and Observedflow in Mahaweli Ganga

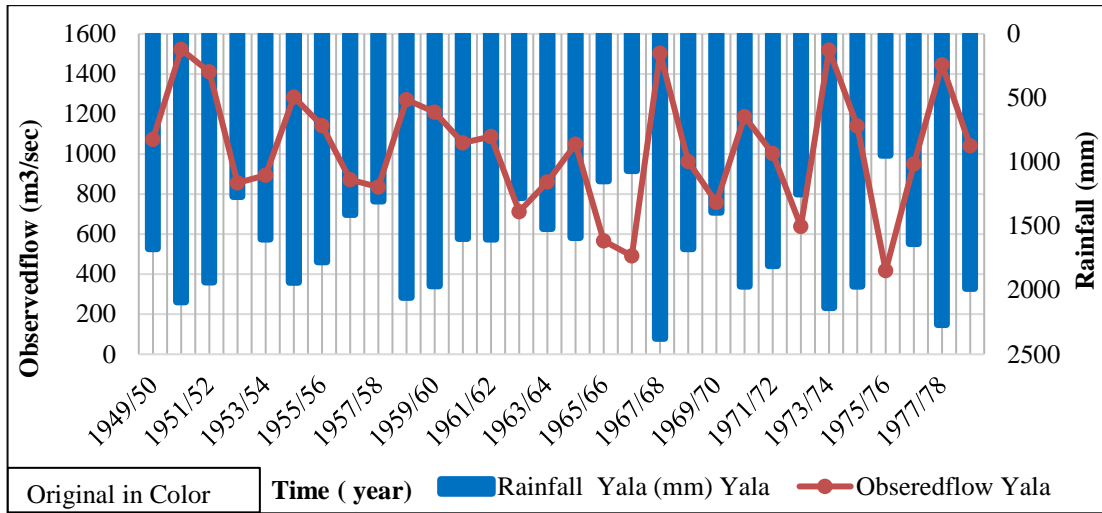


Figure A 11: Variation of Seasonal Thiessen Rainfall & Observedflow in Mahaweli Ganga

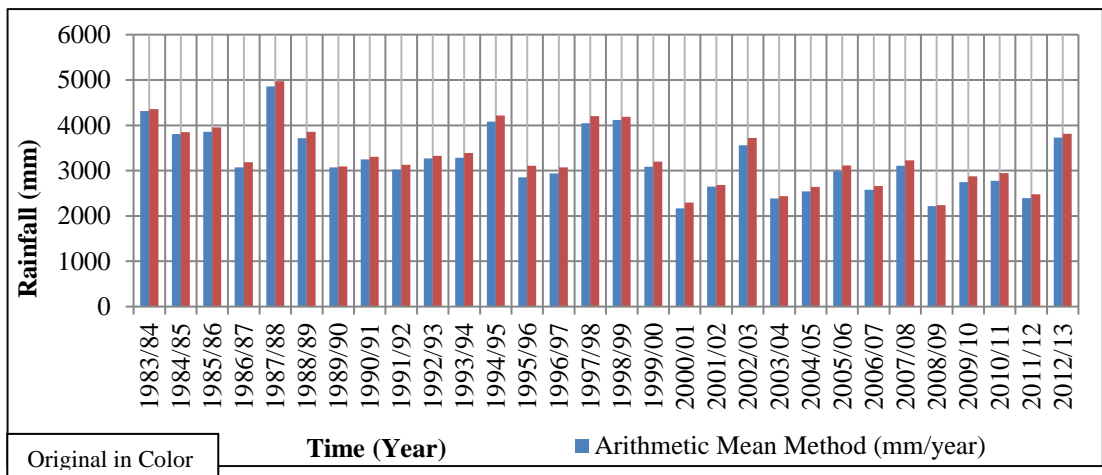


Figure A12: Comparison of Thiessen and Arithmetic Mean Rainfall in Kalu Ganga

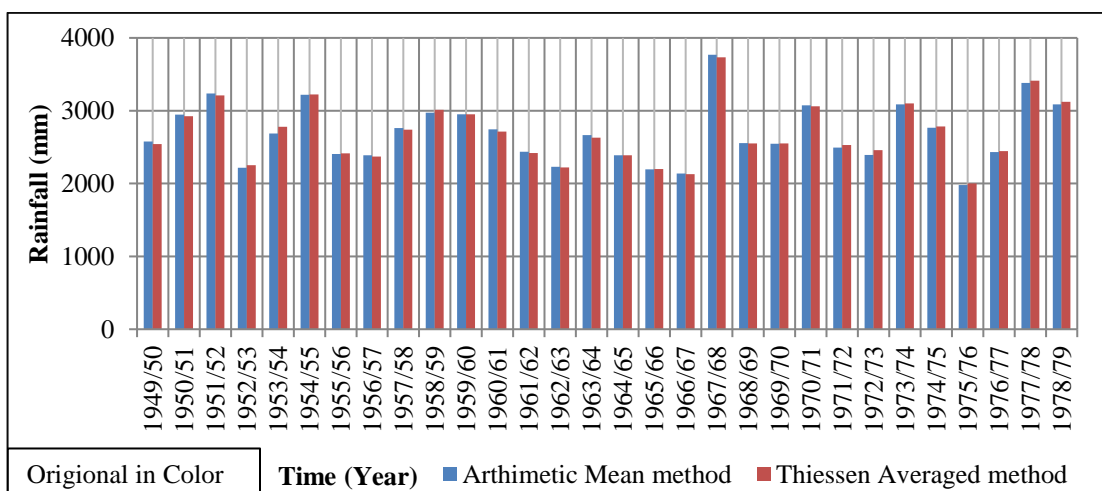


Figure A13: Comparison of Thiessen and Arithmetic Mean Rainfall in Mahaweli Ganga

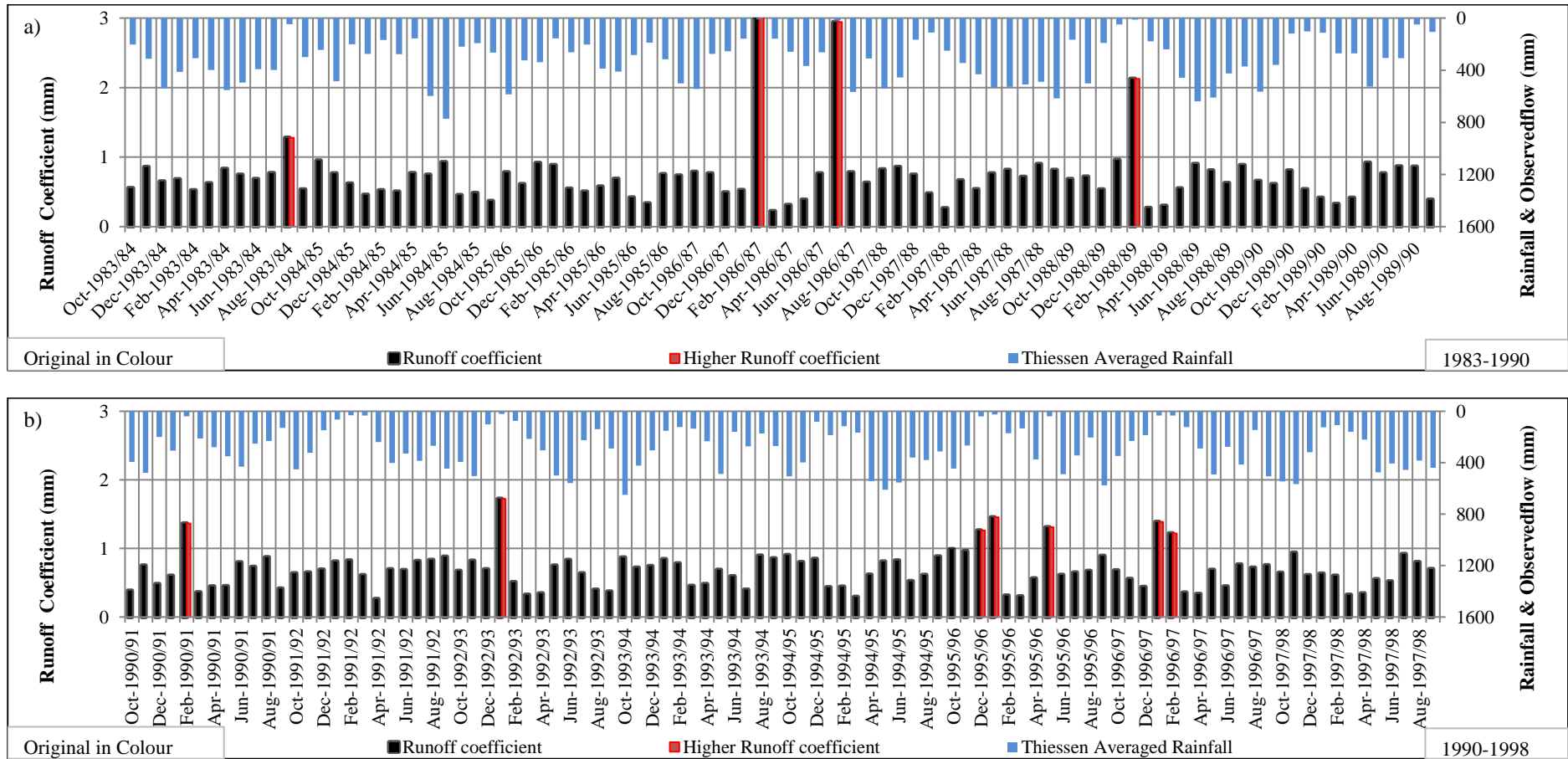


Figure A 14: Higher Runoff coefficients during the Calibration period of Kalu Ganga (a-b)

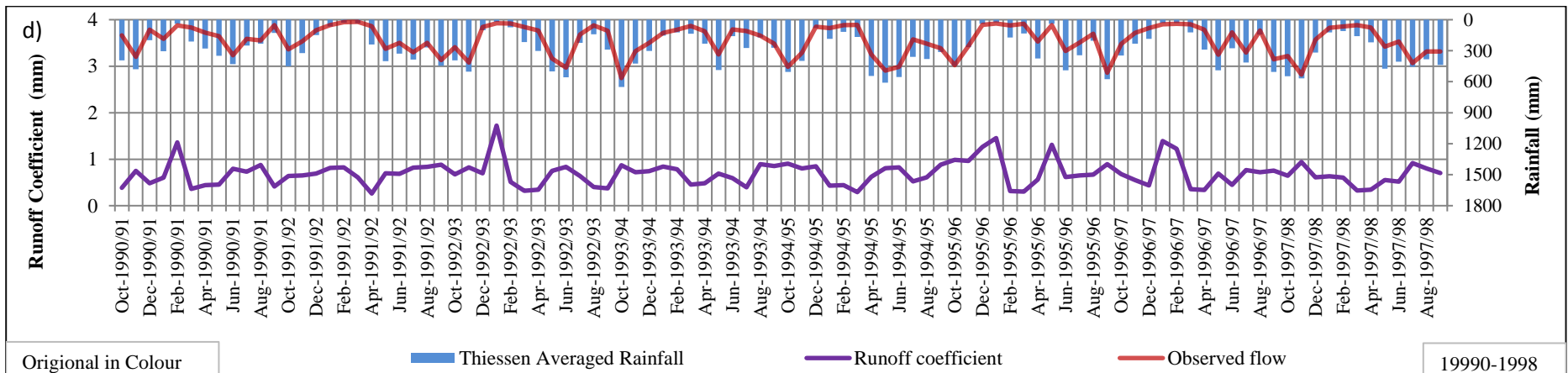
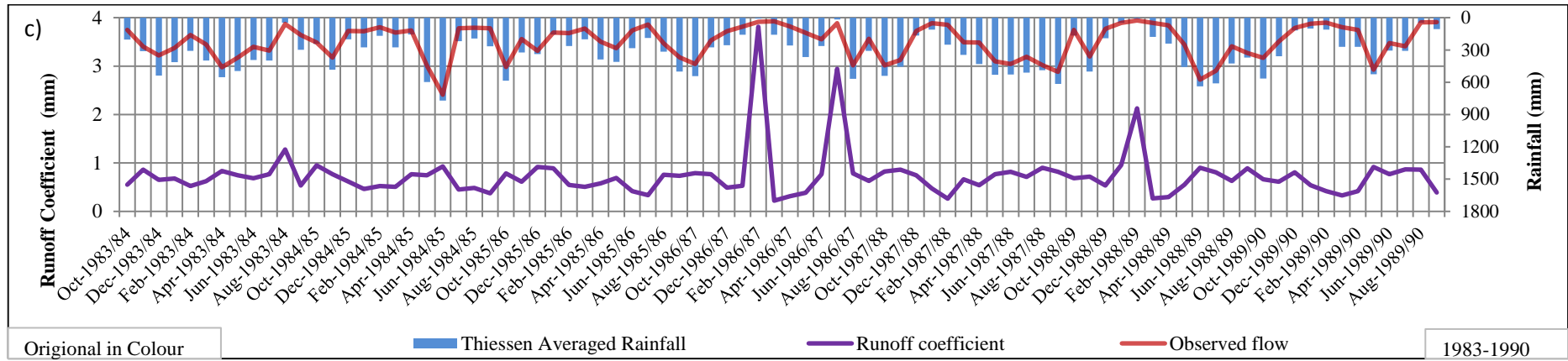


Figure A 15: Higher Runoff coefficients during the Calibration period of Kalu Ganga at Ellagawa (c-d)

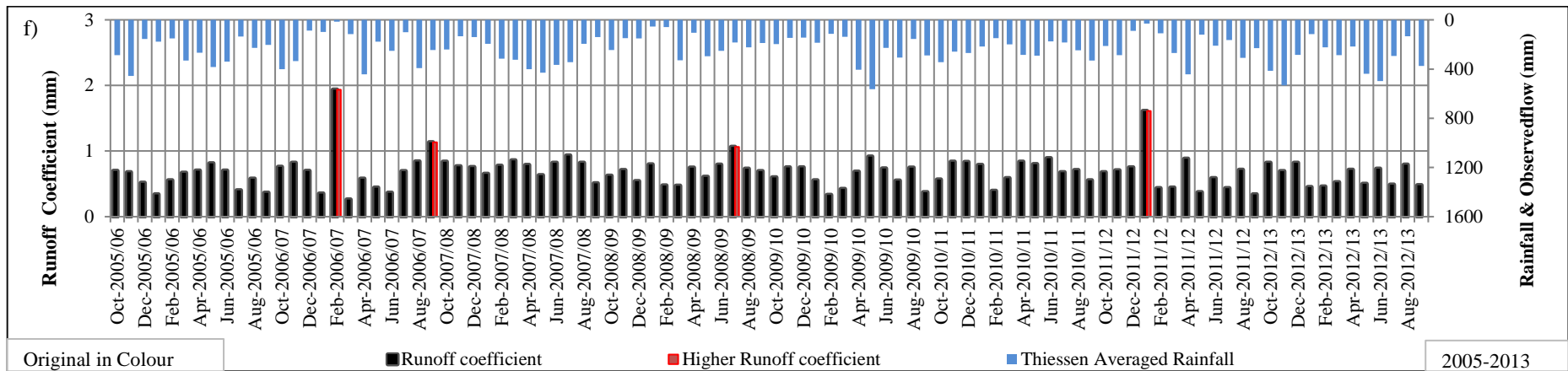
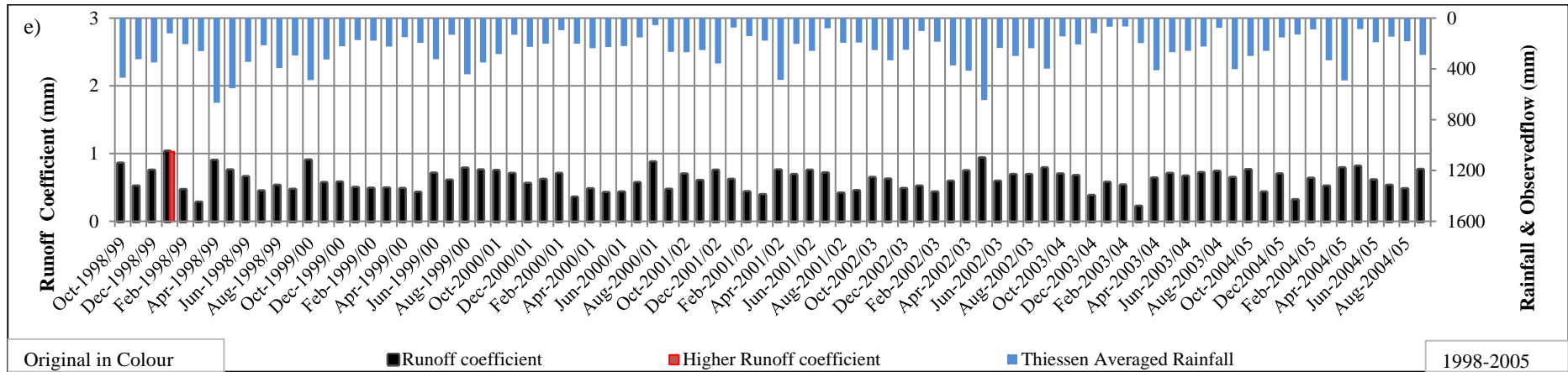


Figure A 16: Higher Runoff coefficients during Verification period of Kalu Ganga at Ellagawa (e-f)

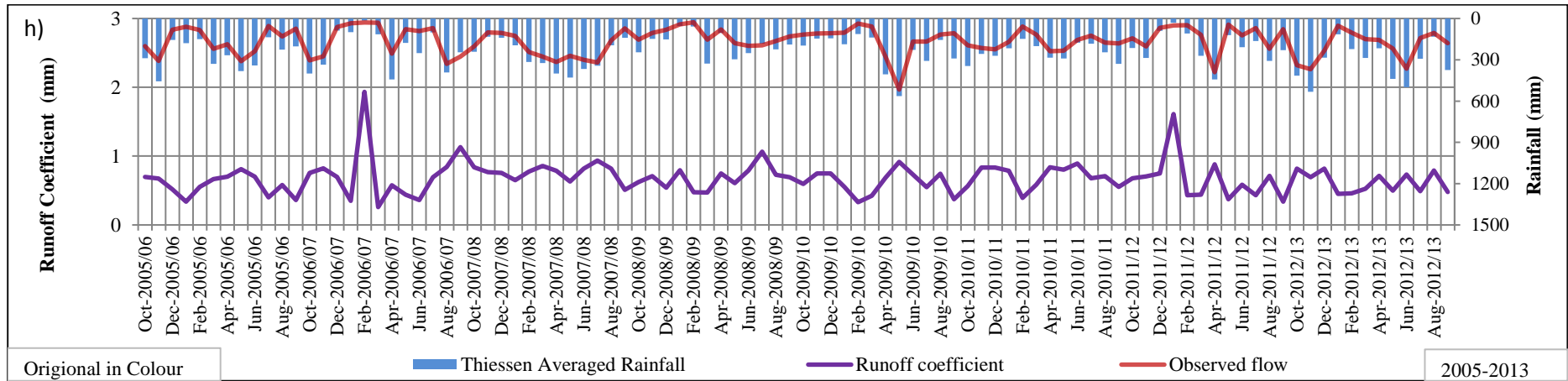
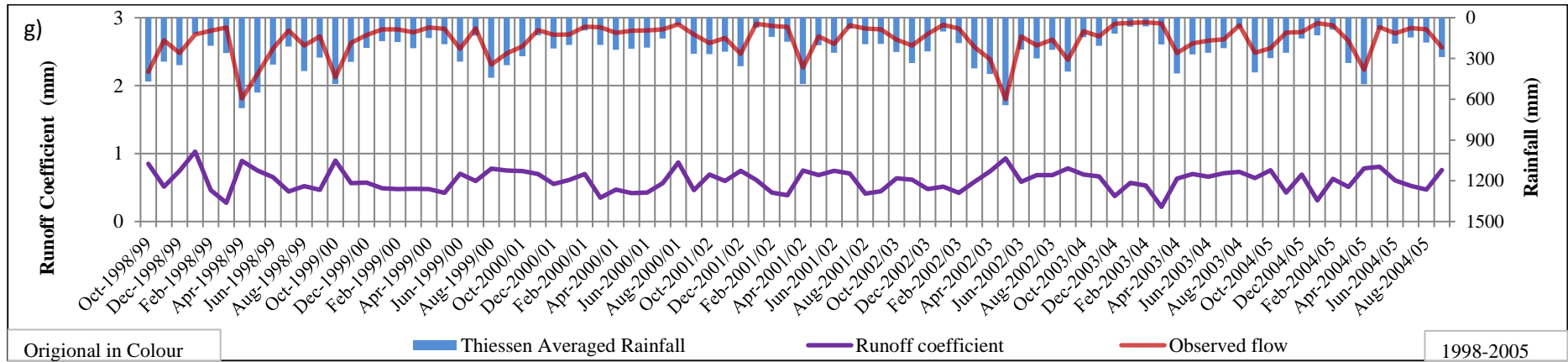


Figure A 17: Higher Runoff coefficients during Verification period of Kalu Ganga at Ellagawa (g-h)

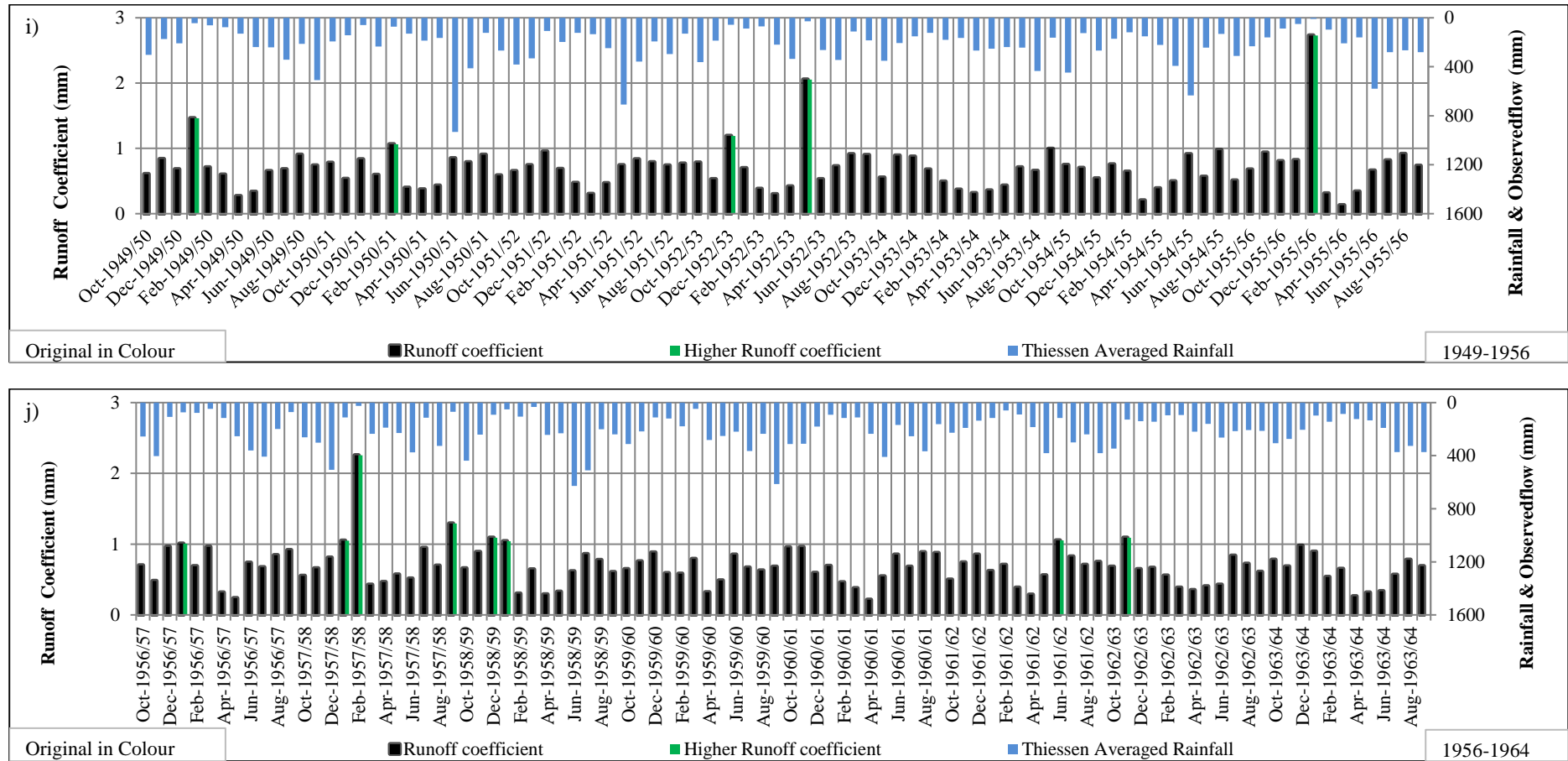


Figure A 18: Higher Runoff coefficients during Calibration period of Mahaweli Ganga at Morape (i-j)

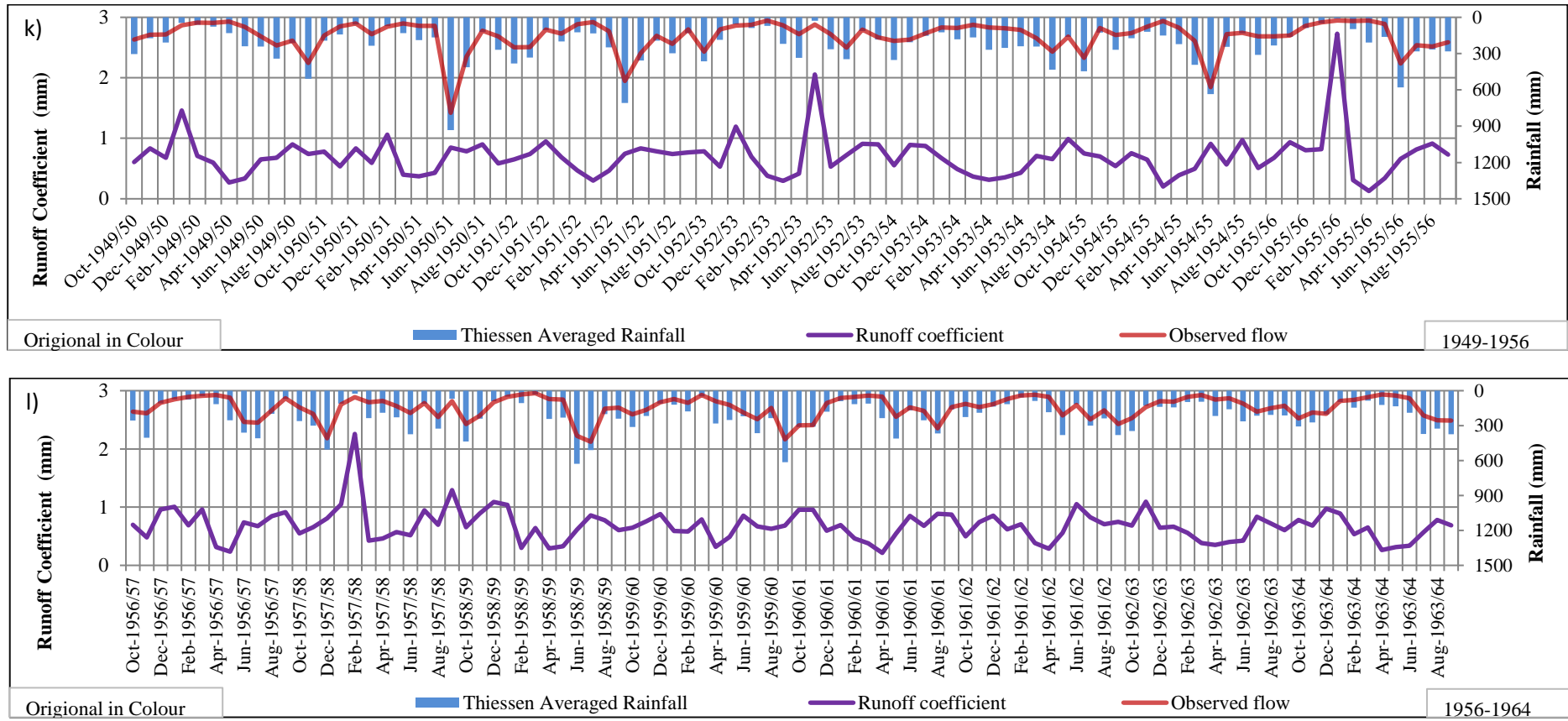


Figure A 19: Higher Runoff coefficients during Calibration period of Mahaweli Ganga at Morape (k-l)

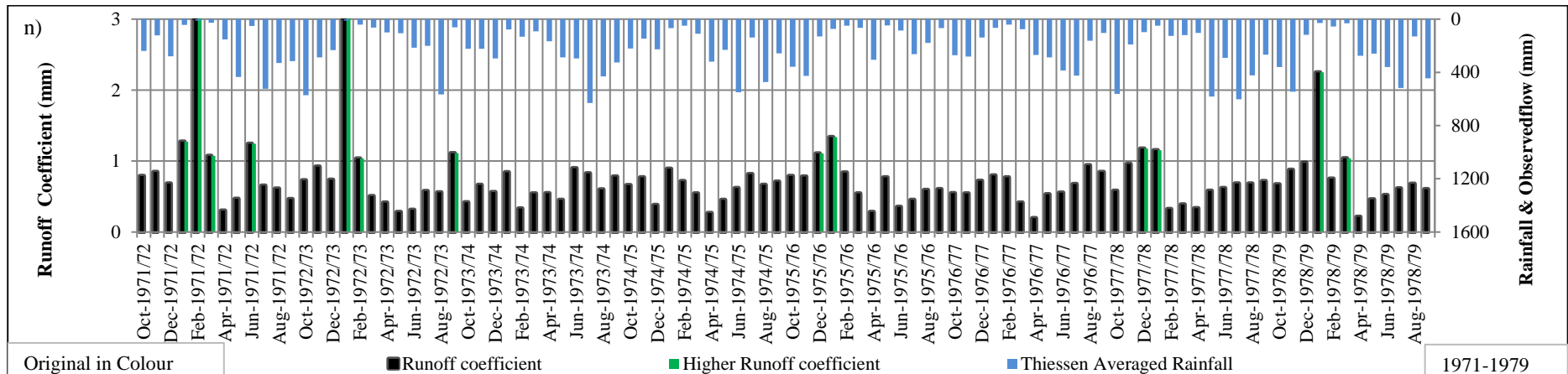
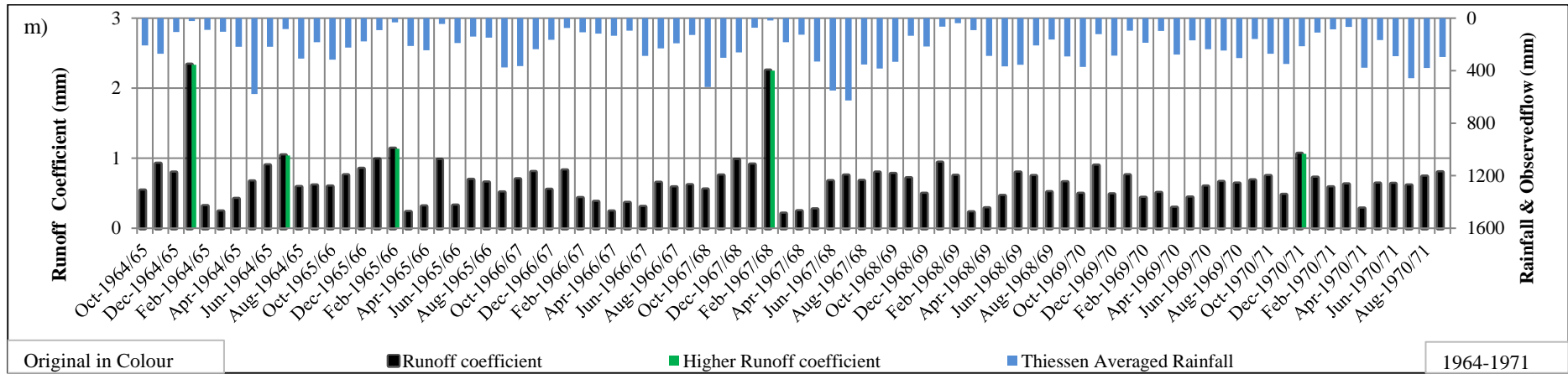


Figure A20: Higher Runoff coefficients during the Verification period of Mahaweli Ganga at Morape (m-n)

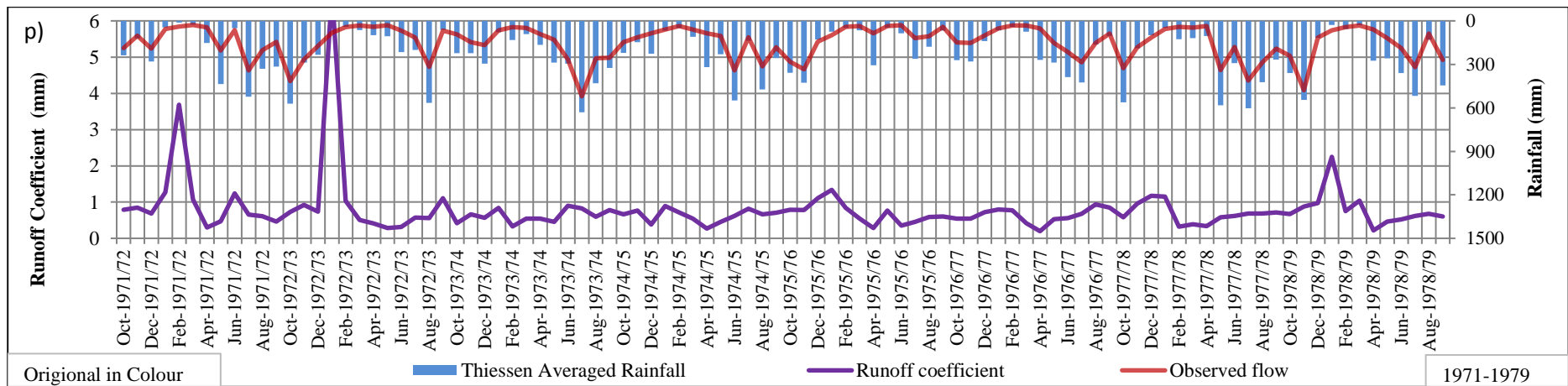
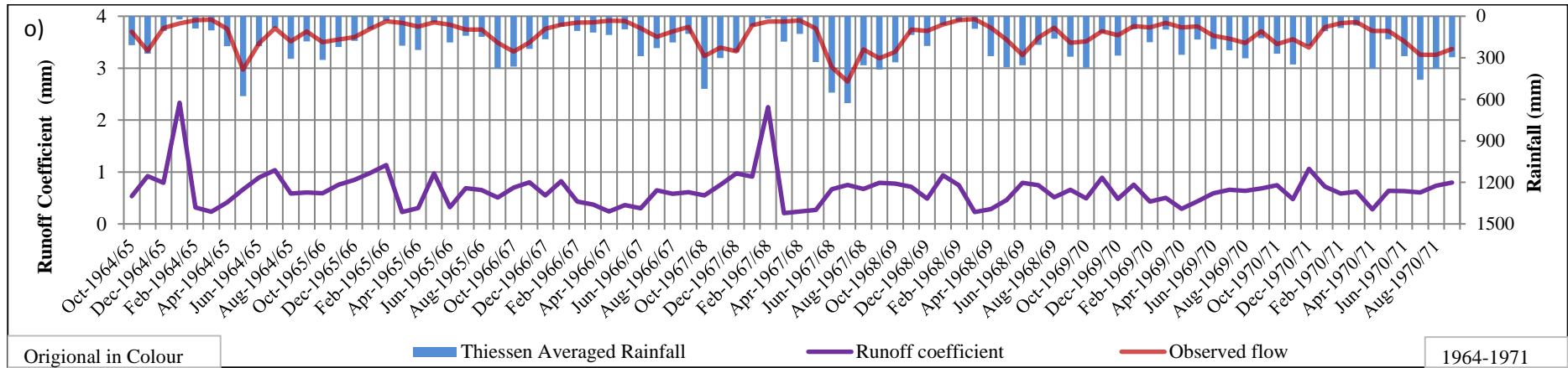


Figure A21: Higher Runoff coefficients during the Verification period of Mahaweli Ganga at Morape (o-p)

Appendix-B

Summary of Annual, Seasonal and Monthly data

1) Watershed: Kalu Ganga at Ellagawa

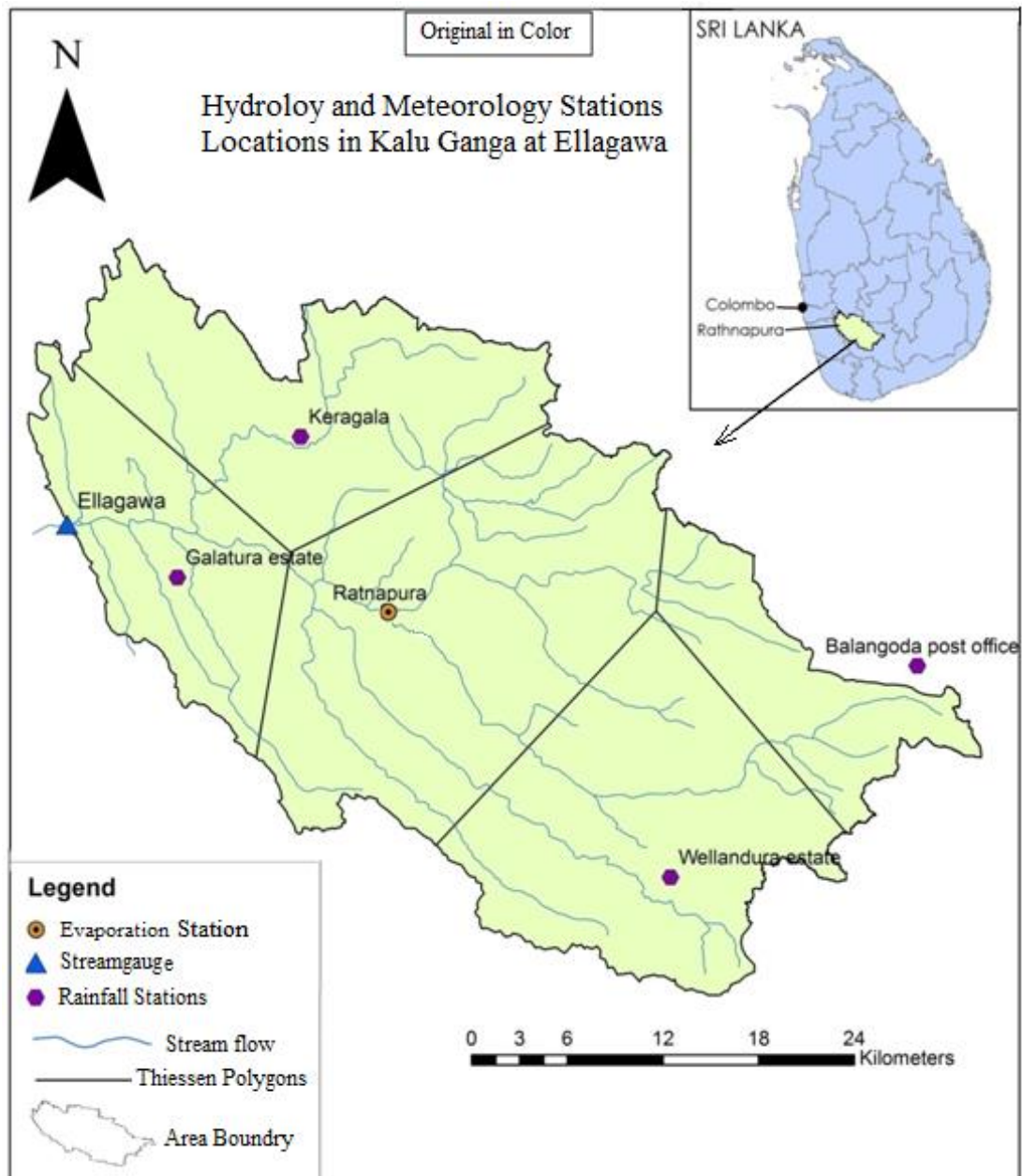


Figure B 1: Location of Used Stations in Kalu Ganga at Ellagawa

Table B 1: Galatura Estate Summary Monthly & Annual Rainfall Data in Kalu Ganga

Water Year	Galatura estate			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	56.00	466.35	1093.40	5596.25
1984/1985	106.40	352.10	851.00	4225.26
1985/1986	134.50	290.17	588.30	3482.06
1986/1987	15.01	278.38	711.00	3340.51
1987/1988	140.90	445.13	748.50	5341.60
1988/1989	5.50	304.30	793.90	3651.60
1989/1990	60.80	274.56	744.00	3294.70
1990/1991	30.23	290.78	507.90	3489.38
1991/1992	1.50	317.68	608.00	3812.20
1992/1993	20.90	346.94	705.20	4163.30
1993/1994	102.70	317.78	595.60	3813.30
1994/1995	89.90	394.18	782.40	4730.10
1995/1996	21.30	269.60	705.50	3235.18
1996/1997	35.20	297.89	627.80	3574.68
1997/1998	16.20	396.30	652.70	4755.60
1998/1999	173.40	535.60	1572.80	6427.20
1999/2000	123.00	289.23	750.00	3470.70
2000/2001	26.00	162.98	302.00	1955.80
2001/2002	36.40	244.18	649.50	2930.10
2002/2003	60.00	281.68	572.30	3380.10
2003/2004	3.00	215.23	702.00	2582.80
2004/2005	75.00	173.03	330.90	2076.40
2005/2006	137.50	294.37	541.00	3532.40
2006/2007	2.00	238.06	463.00	2856.67
2007/2008	114.0	290.71	796.00	3488.50
2008/2009	40.70	212.48	334.00	2549.80
2009/2010	62.00	234.71	439.00	2816.50
2010/2011	42.00	213.21	434.00	2558.50
2011/2012	43.00	241.25	462.00	2895.00
2012/2013	69.70	321.88	534.50	3862.60

Table B 2: Keragala Summary Monthly & Annual Rainfall Data in Kalu Ganga

Water Year	Keragala			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	53.20	466.81	897.50	5601.76
1984/1985	71.00	443.37	1009.70	5320.41
1985/1986	143.00	509.60	761.00	6115.16
1986/1987	6.20	432.07	1247.00	5184.83
1987/1988	32.30	664.56	1077.30	7974.70
1988/1989	15.30	481.31	1043.20	5775.77
1989/1990	50.30	376.41	955.30	4516.87
1990/1991	50.23	356.81	639.60	4281.68
1991/1992	25.00	347.28	715.06	4167.41
1992/1993	32.90	312.48	714.60	3749.73
1993/1994	135.40	360.01	750.40	4320.10
1994/1995	80.50	439.38	846.80	5272.55
1995/1996	11.23	310.99	689.40	3731.93
1996/1997	42.20	304.22	695.50	3650.68
1997/1998	136.70	417.60	724.40	5011.20
1998/1999	139.30	404.38	708.60	4852.58
1999/2000	132.40	311.90	582.80	3742.80
2000/2001	14.60	232.40	419.50	2788.82
2001/2002	85.00	328.42	716.00	3941.00
2002/2003	84.00	434.42	895.00	5213.00
2003/2004	28.00	333.17	811.00	3998.00
2004/2005	159.25	399.39	1081.00	4792.71
2005/2006	120.10	352.22	601.50	4226.68
2006/2007	0.00	254.88	580.90	3058.60
2007/2008	67.00	360.33	730.22	4323.92
2008/2009	70.00	246.59	470.90	2959.13
2009/2010	110.50	318.23	997.70	3818.75
2010/2011	77.10	307.11	538.20	3685.31
2011/2012	21.10	263.32	800.00	3159.80
2012/2013	85.00	375.07	611.70	4500.80

Table B 3: Ratnapura Summary Monthly & Annual Rainfall Data in Kalu Ganga

Water Year	Ratnapura			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	48.88	382.67	564.00	4591.98
1984/1985	133.20	299.61	746.20	3595.30
1985/1986	121.30	338.89	700.20	4066.63
1986/1987	11.20	256.85	660.40	3082.16
1987/1988	72.60	395.50	694.30	4746.05
1988/1989	7.80	316.95	632.20	3803.42
1989/1990	51.22	251.24	500.40	3014.90
1990/1991	50.66	294.27	511.40	3531.26
1991/1992	40.50	275.58	489.00	3307.00
1992/1993	13.40	291.23	701.50	3494.70
1993/1994	132.60	304.17	795.00	3650.00
1994/1995	54.80	384.15	665.50	4609.80
1995/1996	33.40	301.63	721.30	3619.55
1996/1997	20.20	283.73	588.90	3404.70
1997/1998	119.90	381.62	589.00	4579.40
1998/1999	118.10	369.73	708.60	4436.70
1999/2000	145.00	285.95	564.50	3431.40
2000/2001	58.00	198.38	363.10	2380.50
2001/2002	70.20	194.57	351.00	2334.80
2002/2003	71.70	329.15	718.30	3949.80
2003/2004	61.00	193.27	443.90	2319.20
2004/2005	52.20	200.49	325.00	2405.90
2005/2006	186.00	300.57	503.30	3606.80
2006/2007	9.00	244.42	460.00	2933.00
2007/2008	51.40	265.70	503.00	3188.40
2008/2009	22.20	177.63	290.10	2131.60
2009/2010	111.90	263.87	658.50	3166.50
2010/2011	174.30	287.23	436.60	3446.80
2011/2012	36.60	225.82	432.20	2709.80
2012/2013	96.30	336.61	542.80	4039.30

Table B 4: Balangoda Summary Monthly & Annual Rainfall Data in Kalu Ganga

Balangoda Post office				
Water Year	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	43.00	247.74	701.50	2972.90
1984/1985	21.40	228.12	516.00	2737.40
1985/1986	55.00	252.67	662.80	3032.00
1986/1987	5.20	136.63	312.80	1639.60
1987/1988	66.50	245.03	458.50	2940.40
1988/1989	18.23	196.98	430.36	2363.75
1989/1990	19.50	201.07	396.40	2412.85
1990/1991	10.50	218.45	433.30	2621.40
1991/1992	8.50	134.57	360.90	1614.88
1992/1993	9.90	186.74	404.40	2240.83
1993/1994	13.50	180.94	436.30	2171.30
1994/1995	37.30	223.55	733.20	2682.56
1995/1996	6.33	80.67	178.60	968.08
1996/1997	21.80	131.76	483.70	1581.17
1997/1998	63.50	210.94	616.30	2531.30
1998/1999	17.40	164.99	355.00	1979.90
1999/2000	34.30	167.33	365.40	2007.90
2000/2001	31.60	118.22	236.30	1418.60
2001/2002	21.50	145.73	536.30	1748.80
2002/2003	8.50	198.68	451.50	2384.20
2003/2004	29.60	123.78	458.60	1485.40
2004/2005	15.60	134.05	447.10	1608.60
2005/2006	44.70	146.99	345.30	1763.90
2006/2007	11.00	151.93	500.30	1823.20
2007/2008	9.40	149.25	384.50	1791.00
2008/2009	26.90	136.78	331.30	1641.40
2009/2010	61.50	149.61	413.00	1795.30
2010/2011	26.50	154.52	299.50	1854.30
2011/2012	18.58	122.02	347.40	1464.28
2012/2013	57.70	252.68	591.30	3032.20

Table B 5: Wellandura estate Summary Monthly & Annual Rainfall Data in Kalu Ganga

Water Year	Wellandura estate			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	35.00	234.69	453.20	2816.26
1984/1985	107.30	261.73	654.50	3140.70
1985/1986	63.30	213.75	412.90	2565.05
1986/1987	8.90	175.58	403.90	2107.00
1987/1988	120.50	273.33	402.40	3279.90
1988/1989	17.00	247.50	544.50	2970.04
1989/1990	26.30	177.10	390.50	2125.23
1990/1991	36.30	193.37	472.80	2320.40
1991/1992	20.01	183.28	326.00	2199.31
1992/1993	3.27	224.08	529.00	2688.97
1993/1994	46.72	206.42	591.90	2477.02
1994/1995	73.90	258.71	632.40	3104.50
1995/1996	17.26	226.05	492.90	2712.63
1996/1997	5.30	204.98	339.40	2459.78
1997/1998	49.80	280.73	702.60	3368.80
1998/1999	58.90	240.26	375.80	2883.10
1999/2000	66.80	230.27	338.80	2763.20
2000/2001	111.70	192.26	330.70	2307.10
2001/2002	56.63	190.17	470.00	2282.08
2002/2003	75.00	238.19	534.40	2858.27
2003/2004	15.30	127.66	250.00	1531.90
2004/2005	23.40	152.77	413.80	1833.28
2005/2006	36.10	151.05	298.50	1812.64
2006/2007	35.56	183.65	433.60	2203.83
2007/2008	54.00	228.94	567.00	2747.29
2008/2009	34.00	149.99	249.00	1799.93
2009/2010	94.80	179.11	310.50	2149.38
2010/2011	54.11	194.00	319.00	2328.03
2011/2012	24.50	145.47	284.96	1745.68
2012/2013	83.00	267.23	593.00	3206.75

Table B 6: Ellagawa Summary Observedflow Data in Kalu Ganga

Water Year	Ellagawa			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	60.00	254.13	460.00	3049.57
1984/1985	88.50	221.14	716.00	2653.74
1985/1986	63.31	220.51	458.00	2646.08
1986/1987	35.00	169.86	443.77	2038.29
1987/1988	52.50	307.42	504.00	3688.99
1988/1989	26.00	223.98	576.00	2687.80
1989/1990	41.00	171.74	482.76	2060.91
1990/1991	53.46	165.72	360.00	1988.60
1991/1992	20.83	183.23	391.58	2198.73
1992/1993	35.00	178.71	465.00	2144.57
1993/1994	61.28	201.46	565.00	2417.52
1994/1995	49.00	250.81	493.00	3009.73
1995/1996	37.25	192.98	513.79	2315.78
1996/1997	39.47	161.36	382.00	1936.27
1997/1998	52.28	237.84	531.19	2854.06
1998/1999	71.44	232.04	593.73	2784.49
1999/2000	71.19	174.54	438.43	2094.51
2000/2001	47.58	103.58	210.50	1242.99
2001/2002	45.01	141.24	366.00	1694.86
2002/2003	51.87	212.58	600.00	2550.90
2003/2004	33.97	123.87	260.00	1486.48
2004/2005	40.20	137.96	383.23	1655.49
2005/2006	54.45	162.43	310.58	1949.18
2006/2007	29.00	153.00	330.12	1836.04
2007/2008	71.69	208.11	320.63	2497.37
2008/2009	27.57	125.99	199.18	1511.92
2009/2010	37.43	157.21	516.63	1886.55
2010/2011	58.75	174.10	238.45	2089.20
2011/2012	45.40	129.94	390.23	1559.28
2012/2013	52.02	201.14	368.63	2413.68

Table B 7: Ratnapoura Summary Pan Evaporation Data in Kalu Ganga

Water Years	Ratnapoura			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1983/1984	81.31	109.77	134.66	1317.23
1984/1985	92.55	112.58	138.84	1350.95
1985/1986	91.30	115.28	142.06	1383.37
1986/1987	93.93	130.80	172.22	1569.56
1987/1988	86.46	114.46	137.61	1373.49
1988/1989	88.13	125.19	178.27	1502.26
1989/1990	88.86	118.55	150.33	1422.62
1990/1991	83.73	116.34	141.47	1396.10
1991/1992	95.70	122.67	186.45	1472.04
1992/1993	85.43	110.40	144.82	1324.79
1993/1994	81.45	103.58	124.46	1242.99
1994/1995	82.43	105.64	145.92	1267.71
1995/1996	87.79	104.54	153.16	1254.44
1996/1997	85.32	110.22	144.40	1322.64
1997/1998	83.60	105.82	146.72	1269.88
1998/1999	85.10	110.59	137.52	1327.13
1999/2000	65.82	100.57	124.48	1206.88
2000/2001	74.47	99.08	134.09	1188.98
2001/2002	69.96	92.83	114.97	1114.00
2002/2003	64.12	89.74	111.18	1076.83
2003/2004	64.59	89.71	107.29	1076.56
2004/2005	70.46	92.55	111.12	1110.66
2005/2006	73.08	81.93	87.62	983.22
2006/2007	52.98	79.04	105.78	948.51
2007/2008	29.30	63.20	96.36	758.45
2008/2009	55.70	76.90	120.25	922.78
2009/2010	41.74	74.49	106.18	893.89
2010/2011	45.43	66.67	94.72	800.06
2011/2012	57.50	79.07	106.13	948.82
2012/2013	43.31	82.73	128.85	992.78

Table B 8: Monthly & Annual Summary of Rainfall, Observedflow and Pan Evaporation Data in Kalu Ganga

Water Months	Thiessen Rainfall (mm/month)			Annual Total (mm/year)	Observedflow (mm/month)			Annual Total (mm/year)	Pan evaporation (mm/month)			Annual Total (mm/year)
	Min	Mean	Max		Min	Mean	Max		Min	Mean	Max	
Oct	143.5	371.3	650.2	11139.4	99.0	276.4	565.0	8291.4	44.8	93.3	137.8	2799.8
Nov	130.1	334.2	566.8	10026.0	90.9	242.4	531.2	7272.1	43.5	93.7	140.1	2811.0
Dec	40.3	206.2	538.8	6187.3	44.1	137.8	350.4	4133.2	41.7	86.6	118.3	2599.3
Jan	20.3	137.3	412.4	4118.6	34.7	85.8	280.6	2574.1	52.3	97.2	136.1	2915.5
Feb	10.0	130.4	315.0	3913.0	25.0	70.0	244.6	2100.6	61.0	118.5	171.5	3556.3
Mar	34.3	225.5	399.1	6763.8	20.8	106.0	277.0	3179.1	44.4	122.0	186.5	3659.5
Apr	105.5	339.9	665.5	10197.4	62.8	213.9	593.7	6415.8	45.4	104.4	151.1	3130.8
May	40.3	387.2	644.7	11615.0	45.4	270.6	600.0	8117.7	71.3	104.0	136.7	3121.5
Jun	160.2	351.3	771.2	10539.9	91.3	252.3	716.0	7570.1	59.8	95.1	136.5	2853.3
Jul	17.4	263.9	609.6	7915.8	51.0	181.5	493.0	5443.8	29.3	91.0	143.0	2730.9
Aug	46.9	249.1	567.4	7474.4	43.1	179.6	443.8	5387.9	46.9	90.7	131.8	2721.6
Sep	107.8	321.1	616.8	9634.4	41.0	215.3	513.8	6457.7	53.0	97.3	138.6	2920.2

Table B 9: Seasonal Rainfall, Observed flow and Evaporation Data in Kalu Ganga

Water Years	Maha Season			Yala Season		
	Thiessen Rainfall (mm)	Observed flow (mm)	Evaporation (mm)	Thiessen Rainfall (mm)	Observed flow (mm)	Evaporation (mm)
1983/1984	2174.4	1423.1	632.2	2185.5	1626.4	685.0
1984/1985	1648.9	1081.4	703.6	2201.3	1572.4	647.3
1985/1986	1867.4	1349.6	692.5	2084.8	1296.5	690.8
1986/1987	1399.7	923.4	779.6	1782.2	1114.9	789.9
1987/1988	1868.6	1309.4	711.4	3106.4	2379.6	662.1
1988/1989	1110.1	699.2	830.1	2742.5	1988.6	672.2
1989/1990	1528.4	879.6	759.3	1567.5	1181.3	663.3
1990/1991	1630.3	922.6	722.2	1673.1	1066.0	673.9
1991/1992	1054.2	698.6	793.0	2071.4	1500.1	679.0
1992/1993	1308.8	892.6	705.5	2016.5	1252.0	619.3
1993/1994	1789.5	1380.8	600.3	1597.1	1036.7	642.7
1994/1995	1454.5	1026.5	651.6	2760.8	1983.3	616.1
1995/1996	1080.9	877.3	634.4	2029.2	1438.4	620.0
1996/1997	951.8	573.6	710.3	2122.0	1362.6	612.4
1997/1998	1823.8	1272.7	645.4	2378.9	1581.4	624.5
1998/1999	1726.5	1115.2	653.3	2461.9	1669.3	673.9
1999/2000	1611.3	1028.0	626.3	1590.2	1066.5	580.5
2000/2001	1135.7	685.7	611.0	1157.6	557.3	578.0
2001/2002	1267.7	774.9	557.2	1415.0	920.0	556.8
2002/2003	1493.1	832.6	530.1	2225.3	1718.3	546.8
2003/2004	795.2	395.1	547.9	1641.1	1091.4	528.7
2004/2005	1258.1	705.5	522.3	1384.4	950.0	588.3
2005/2006	1558.5	952.9	495.7	1557.1	996.3	487.5
2006/2007	1053.1	733.5	495.4	1611.7	1102.6	453.1
2007/2008	1348.2	1058.3	336.5	1875.5	1439.0	421.9
2008/2009	986.7	565.8	516.5	1248.5	946.1	406.3
2009/2010	925.5	533.7	461.5	1949.9	1352.9	432.4
2010/2011	1436.8	979.8	385.3	1511.0	1109.4	414.8
2011/2012	1002.4	632.0	498.6	1474.1	927.3	450.2
2012/2013	1858.1	1247.2	532.3	1954.6	1166.5	460.5

Table B 10: Rainfall Average by Thiessen and Arithmetic Mean Method in Kalu Ganga

Water year	Arithmetic Mean Method (mm/year)	Thiessen Average Method (mm/year)
1983/1984	4315.83	4359.85
1984/1985	3803.81	3850.17
1985/1986	3852.18	3952.13
1986/1987	3070.82	3181.83
1987/1988	4856.53	4974.99
1988/1989	3712.92	3852.50
1989/1990	3072.91	3095.97
1990/1991	3248.82	3303.41
1991/1992	3020.16	3125.62
1992/1993	3267.51	3325.24
1993/1994	3286.34	3386.67
1994/1995	4079.90	4215.27
1995/1996	2853.47	3110.08
1996/1997	2934.20	3073.86
1997/1998	4049.26	4202.67
1998/1999	4115.90	4188.43
1999/2000	3083.20	3201.51
2000/2001	2170.16	2293.31
2001/2002	2647.36	2682.67
2002/2003	3557.07	3718.40
2003/2004	2383.46	2436.28
2004/2005	2543.38	2642.46
2005/2006	2988.48	3115.66
2006/2007	2575.06	2664.76
2007/2008	3107.82	3223.69
2008/2009	2216.37	2235.25
2009/2010	2749.29	2875.36
2010/2011	2774.59	2947.77
2011/2012	2394.91	2476.47
2012/2013	3728.33	3812.70

2) Watershed: Mahaweli at Morape

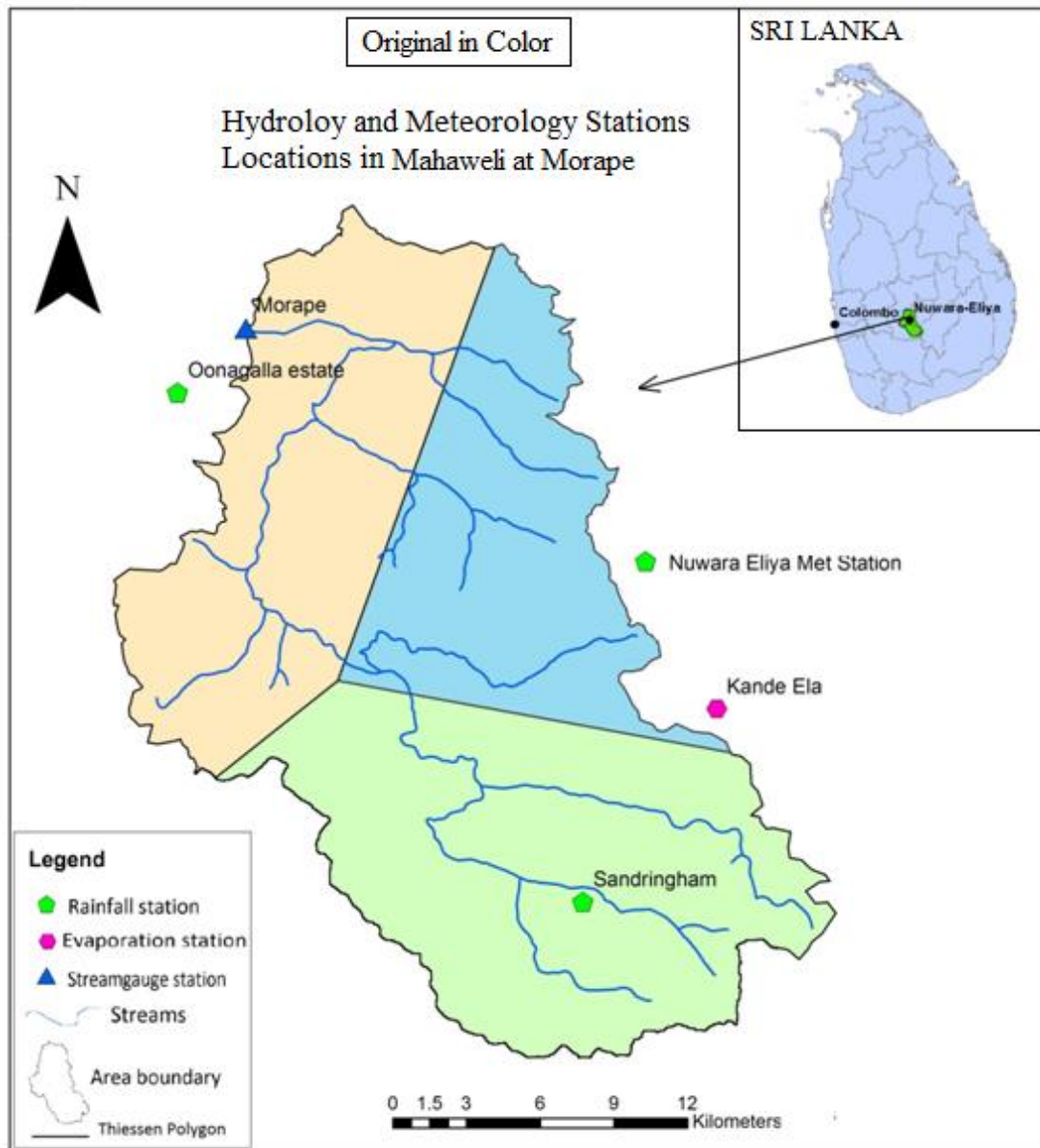


Figure B 2: Location of Stations in Mahaweli Ganga at Morape

Table B 11: Sandringham Summary Monthly & Annual Rainfall Data in Mahaweli Ganga

Water Years	Sandringham			Annual Total (mm/year)
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	
1949/1950	37.00	158.19	450.00	1898.33
1950/1951	37.00	203.84	740.00	2446.12
1951/1952	77.00	229.22	620.49	2750.61
1952/1953	53.00	194.77	479.00	2337.26
1953/1954	151.00	261.01	431.00	3132.12
1954/1955	107.00	246.83	471.00	2962.00
1955/1956	2.00	181.37	515.20	2176.44
1956/1957	31.00	155.00	414.00	1860.00
1957/1958	22.00	191.83	420.12	2301.97
1958/1959	51.00	238.17	614.00	2858.00
1959/1960	48.00	207.25	399.00	2487.00
1960/1961	79.00	172.19	280.00	2066.30
1961/1962	81.00	165.03	315.00	1980.30
1962/1963	49.00	150.83	276.00	1810.00
1963/1964	45.00	163.67	285.00	1964.00
1964/1965	9.00	152.50	423.00	1830.00
1965/1966	47.00	151.67	278.00	1820.00
1966/1967	67.00	143.42	374.00	1721.00
1967/1968	10.00	213.33	469.00	2560.00
1968/1969	30.00	171.67	321.00	2060.00
1969/1970	81.00	188.58	414.00	2263.00
1970/1971	72.00	209.83	410.00	2518.00
1971/1972	11.00	206.33	510.00	2476.00
1972/1973	5.00	215.75	900.00	2589.00
1973/1974	55.00	218.83	522.00	2626.00
1974/1975	42.00	211.77	441.00	2541.25
1975/1976	24.00	150.50	399.00	1806.00
1976/1977	44.00	192.75	520.00	2313.00
1977/1978	47.00	276.17	610.00	3314.00
1978/1979	15.80	266.00	542.00	3192.00

Table B 12: NuwaraEliya Summary Monthly & Annual Rainfall Data in Mahaweli Ganga

Water Years	Nuwara Eliya Met Station			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1949/1950	63.00	177.38	440.00	2128.50
1950/1951	67.10	217.03	830.00	2604.40
1951/1952	106.40	243.16	750.54	2917.96
1952/1953	0.30	153.46	333.80	1841.50
1953/1954	69.60	157.62	354.80	1891.42
1954/1955	93.50	234.01	475.70	2808.10
1955/1956	11.90	160.68	520.47	1928.17
1956/1957	43.40	154.38	316.70	1852.60
1957/1958	39.40	201.22	601.25	2414.61
1958/1959	12.20	184.13	464.30	2209.50
1959/1960	17.00	188.09	323.90	2257.10
1960/1961	87.90	187.16	298.40	2245.88
1961/1962	50.50	174.21	298.40	2090.50
1962/1963	82.80	143.43	236.70	1721.10
1963/1964	50.80	182.18	273.00	2186.10
1964/1965	34.50	133.99	370.60	1607.90
1965/1966	20.60	135.30	237.70	1623.60
1966/1967	81.50	136.58	280.00	1638.90
1967/1968	3.60	209.83	430.80	2518.00
1968/1969	38.90	157.38	299.70	1888.50
1969/1970	86.90	172.80	364.50	2073.60
1970/1971	19.10	207.18	370.00	2486.20
1971/1972	1.50	162.73	410.00	1952.70
1972/1973	3.80	139.17	366.00	1670.00
1973/1974	31.00	183.29	354.60	2199.50
1974/1975	49.30	179.80	403.90	2157.60
1975/1976	22.60	113.06	217.20	1356.70
1976/1977	49.90	166.64	350.00	1999.70
1977/1978	30.00	233.81	577.00	2805.70
1978/1979	16.90	224.92	558.30	2699.00

Table B 13: Oonagalla Estate Summary Monthly & Annual Rainfall Data in Mahaweli Ganga

Water Years	Oonagalla Estate			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1949/1950	26.90	309.29	640.00	3711.52
1950/1951	56.90	316.27	1260.00	3795.20
1951/1952	99.60	336.37	790.45	4036.40
1952/1953	5.10	206.37	519.70	2476.45
1953/1954	72.10	252.68	540.00	3032.16
1954/1955	93.70	324.09	971.80	3889.10
1955/1956	18.50	259.60	710.25	3115.25
1956/1957	69.90	287.54	669.80	3450.50
1957/1958	16.80	297.26	572.50	3567.06
1958/1959	14.50	320.68	778.50	3848.10
1959/1960	71.10	342.26	522.50	4107.10
1960/1961	73.20	327.05	702.60	3924.60
1961/1962	36.80	270.39	531.10	3244.62
1962/1963	80.80	263.13	524.00	3157.60
1963/1964	76.20	320.05	647.70	3840.60
1964/1965	7.60	310.82	942.80	3729.80
1965/1966	12.20	262.06	425.20	3144.70
1966/1967	79.00	254.53	559.30	3054.30
1967/1968	37.80	518.63	1156.00	6223.60
1968/1969	42.20	309.40	676.70	3712.80
1969/1970	82.00	275.08	477.30	3300.90
1970/1971	80.80	351.21	596.10	4214.50
1971/1972	0.00	254.87	630.00	3058.40
1972/1973	27.70	242.78	720.12	2913.32
1973/1974	69.00	389.73	988.60	4171.6
1974/1975	29.20	300.15	882.10	3601.80
1975/1976	38.40	243.38	667.50	2920.50
1976/1977	36.10	263.73	570.00	3164.80
1977/1978	28.20	335.29	795.00	4023.50
1978/1979	17.30	281.11	604.80	3373.30

Table B 14: Morape Summary Monthly & Annual Observedflow Data in Mahaweli Ganga

Water Years	Morape			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1949/1950	34.91	141.62	376.39	1699.50
1950/1951	50.41	172.45	789.13	2069.41
1951/1952	40.03	186.63	526.82	2239.55
1952/1953	26.78	121.81	284.17	1461.77
1953/1954	60.79	136.56	284.66	1638.67
1954/1955	30.64	174.14	577.00	2089.66
1955/1956	26.78	134.92	381.65	1619.01
1956/1957	36.35	126.62	274.78	1519.43
1957/1958	56.00	154.86	408.70	1858.32
1958/1959	21.25	164.74	438.36	1976.82
1959/1960	37.49	157.13	418.00	1885.53
1960/1961	42.01	159.50	324.20	1913.98
1961/1962	34.10	133.83	285.52	1605.90
1962/1963	36.08	113.52	235.73	1362.27
1963/1964	32.52	142.11	256.83	1705.28
1964/1965	24.22	133.30	384.49	1599.54
1965/1966	37.05	104.05	191.30	1248.59
1966/1967	32.04	98.14	254.51	1177.68
1967/1968	30.61	201.33	471.96	2416.01
1968/1969	20.76	127.69	281.22	1532.31
1969/1970	48.43	115.69	193.00	1388.24
1970/1971	41.51	162.52	279.22	1950.29
1971/1972	28.66	134.24	341.99	1610.89
1972/1973	30.15	137.23	415.13	1646.75
1973/1974	43.74	173.87	520.39	2086.47
1974/1975	56.24	141.79	340.52	1701.44
1975/1976	30.13	112.83	334.00	1353.96
1976/1977	31.13	122.15	286.64	1465.80
1977/1978	34.91	184.29	412.16	2211.54
1978/1979	31.63	171.44	478.26	2057.27

Table B 15: Kande Ela Summary Monthly & Annual Pan Evaporation Data in Mahaweli Ganga

Water Years	Kande Ela			
	Minimum (mm/month)	Mean (mm/month)	Maximum (mm/month)	Annual Total (mm/year)
1949/1950	49.00	73.01	124.50	876.10
1950/1951	49.00	73.01	124.50	876.10
1951/1952	47.00	78.74	120.90	944.90
1952/1953	59.20	74.91	115.30	898.90
1953/1954	56.40	71.66	91.70	859.90
1954/1955	42.20	69.86	93.70	838.30
1955/1956	57.40	79.25	122.90	951.00
1956/1957	62.00	88.78	144.80	1065.30
1957/1958	59.90	63.78	71.90	765.40
1958/1959	73.90	110.52	157.50	1326.20
1959/1960	88.10	96.37	142.20	1156.40
1960/1961	63.30	99.41	134.60	1192.90
1961/1962	59.90	71.41	106.40	856.90
1962/1963	59.90	86.90	114.80	1042.80
1963/1964	45.50	63.57	83.60	762.80
1964/1965	50.00	65.25	106.20	783.00
1965/1966	90.70	104.03	134.40	1248.30
1966/1967	82.60	106.01	133.60	1272.10
1967/1968	79.80	112.13	148.10	1345.50
1968/1969	88.90	109.95	165.90	1319.40
1969/1970	83.80	99.61	158.20	1195.30
1970/1971	60.20	96.26	158.20	1155.10
1971/1972	60.20	78.55	138.40	942.60
1972/1973	65.00	104.73	150.60	1256.70
1973/1974	71.90	92.15	139.40	1105.80
1974/1975	58.20	95.65	123.20	1147.80
1975/1976	48.50	97.83	145.50	1173.90
1976/1977	62.20	101.27	135.90	1215.20
1977/1978	34.10	89.02	132.00	1068.20
1978/1979	55.80	96.96	155.00	1163.50

Table B 16: Monthly & Annual Summary of Rainfall, Observedflow and Pan Evaporation Data in Mahaweli Ganga

Watere Months	Thiessen Rainfall (mm/month)			Annual Total (mm/year)	Observedflow (mm/month)			Annual Total (mm/year)	Pan evaporation (mm/month)			Annual Total (mm/year)
	Min	Mean	Max		Min	Mean	Max		Min	Mean	Max	
Oct	193.7	330.8	570.9	9922.8	93.4	215.8	415.1	5514.1	48.5	85.7	118.6	2570.0
Nov	121.7	241.6	544.8	7247.4	88.5	194.3	478.3	4752.2	52.1	78.5	124.2	2356.4
Dec	57.7	178.7	505.7	5361.8	68.7	144.6	408.7	3616.8	34.1	73.7	125.5	2210.4
Jan	12.0	88.9	235.3	2667.6	42.0	72.2	117.0	1861.6	50.0	85.0	139.4	2549.5
Feb	9.8	83.4	187.8	2502.7	26.8	47.7	104.0	1222.6	49.0	92.1	148.1	2762.7
Mar	26.7	105.6	235.1	3168.0	20.8	41.0	100.3	1013.5	59.0	115.3	165.9	3459.2
Apr	99.4	218.2	377.9	6547.5	26.8	63.2	105.7	1603.6	58.2	87.6	127.0	2626.9
May	29.3	266.2	709.1	7985.3	30.1	125.1	384.5	3198.5	63.0	91.6	136.9	2747.5
Jun	50.8	330.9	931.5	9927.5	30.1	188.4	386.9	5098.9	42.2	86.4	132.0	2593.4
Jul	83.9	329.7	629.8	9890.7	87.0	238.9	520.4	5871.2	45.2	87.7	151.9	2630.8
Aug	111.9	273.8	565.9	8213.2	83.5	197.7	324.2	4873.7	46.7	88.6	155.0	2659.1
Sep	61.3	254.3	613.8	7627.8	41.0	174.9	418.0	4356.2	57.9	88.0	129.3	2640.4

Table B 17: Seasonal Rainfall, Observedflow and Evaporation Data in Mahaweli Ganga

Water Years	Maha Season			Yala Season		
	Thiessen Rainfall (mm)	Observedflow (mm)	Evaporation (mm)	Thiessen Rainfall (mm)	Observedflow (mm)	Evaporation (mm)
1949/1950	869.66	626.28	444.10	1674.75	1073.21	432.00
1950/1951	835.11	547.05	437.20	2088.37	1522.36	438.90
1951/1952	1274.66	828.70	450.70	1935.17	1410.85	425.40
1952/1953	985.57	605.21	455.50	1268.75	856.56	420.60
1953/1954	1179.54	743.91	461.30	1599.95	894.76	414.80
1954/1955	1284.40	805.69	472.20	1937.84	1283.96	403.90
1955/1956	639.34	477.63	432.00	1776.76	1141.38	444.10
1956/1957	964.19	648.11	438.90	1408.51	871.31	437.20
1957/1958	1438.81	1023.35	425.40	1301.57	834.98	450.70
1958/1959	957.17	705.07	420.60	2053.76	1271.76	455.50
1959/1960	986.37	676.70	414.80	1965.47	1208.83	461.30
1960/1961	1118.25	858.19	403.90	1595.66	1055.79	472.20
1961/1962	817.57	518.16	444.10	1600.26	1087.74	432.00
1962/1963	947.50	650.83	437.20	1275.57	711.44	438.90
1963/1964	1110.68	844.30	450.70	1517.84	860.98	425.40
1964/1965	800.80	550.68	455.50	1586.55	1048.87	420.60
1965/1966	1053.17	682.30	461.30	1144.74	566.29	430.00
1966/1967	1066.29	686.59	472.20	1064.91	491.09	468.10
1967/1968	1361.10	912.59	432.00	2373.43	1503.42	504.70
1968/1969	876.50	568.86	438.90	1674.00	963.45	473.90
1969/1970	1158.66	629.99	425.40	1391.27	758.26	507.40
1970/1971	1092.60	762.90	420.60	1966.10	1187.39	502.30
1971/1972	722.09	607.75	430.00	1807.26	1003.13	513.00
1972/1973	1209.21	1008.59	468.10	1247.48	638.17	476.00
1973/1974	1042.69	566.90	504.70	2135.07	1519.57	440.20
1974/1975	819.30	561.72	473.90	1966.05	1139.72	434.60
1975/1976	1103.87	936.30	507.40	946.74	417.66	393.20
1976/1977	872.39	516.45	502.30	1635.33	949.35	410.00
1977/1978	1144.35	765.83	513.00	2267.99	1445.71	391.20
1978/1979	1138.46	1015.36	476.00	1984.93	1041.90	413.80

Table B 18: Rainfall Average by Thiessen and Arithmetic Mean method in Mahaweli Ganga

Water Years	Arithmetic Mean Method (mm/year)	Thiessen Average Method (mm/year)
1949/50	2579.45	2544.41
1950/51	2948.57	2923.48
1951/52	3234.99	3209.83
1952/53	2218.40	2254.31
1953/54	2685.23	2779.49
1954/55	3219.73	3222.24
1955/56	2406.62	2416.10
1956/57	2387.70	2372.70
1957/58	2761.21	2740.37
1958/59	2971.87	3010.94
1959/60	2950.40	2951.84
1960/61	2745.59	2713.92
1961/62	2438.47	2417.82
1962/63	2229.57	2223.07
1963/64	2663.57	2628.52
1964/65	2389.23	2387.35
1965/66	2196.10	2197.91
1966/67	2138.07	2131.20
1967/68	3767.20	3734.53
1968/69	2553.77	2550.49
1969/70	2545.83	2549.92
1970/71	3072.90	3058.70
1971/72	2495.70	2529.35
1972/73	2390.77	2456.69
1973/74	3165.70	3177.76
1974/75	2766.88	2785.35
1975/76	2027.73	2050.61
1976/77	2492.50	2507.72
1977/78	3381.07	3412.34
1978/79	3088.10	3123.39

Appendix-C

Parameter Optimization results

Table C 1: Parameter Optimization of Coarser Resolution for Kalu Ganga at Ellagawa

SC/C	0.1	0.2	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.9	2
sc100	0.693	0.629	0.469	0.427	0.398	0.376	0.363	0.362	0.376	0.397	0.427	0.456	0.477	0.541	0.552
sc200	0.670	0.607	0.450	0.410	0.378	0.356	0.340	0.343	0.359	0.386	0.419	0.454	0.487	0.591	0.604
sc300	0.636	0.573	0.413	0.372	0.338	0.314	0.299	0.303	0.321	0.351	0.384	0.423	0.463	0.603	0.624
sc400	0.609	0.543	0.377	0.333	0.297	0.271	0.255	0.259	0.280	0.308	0.344	0.385	0.432	0.600	0.629
sc500	0.599	0.529	0.350	0.303	0.262	0.232	0.216	0.219	0.240	0.268	0.308	0.352	0.403	0.591	0.624
sc600	0.604	0.532	0.340	0.287	0.240	0.205	0.185	0.185	0.206	0.236	0.277	0.325	0.378	0.579	0.615
sc700	0.617	0.545	0.345	0.289	0.237	0.193	0.166	0.158	0.181	0.213	0.254	0.303	0.356	0.565	0.606
sc800	0.631	0.559	0.357	0.298	0.245	0.199	0.165	0.145	0.164	0.197	0.238	0.285	0.338	0.552	0.596
sc900	0.645	0.574	0.372	0.312	0.257	0.209	0.172	0.153	0.160	0.188	0.225	0.271	0.322	0.538	0.585
sc1000	0.659	0.588	0.388	0.327	0.271	0.221	0.184	0.163	0.167	0.188	0.221	0.261	0.309	0.525	0.575
sc1100	0.673	0.602	0.404	0.343	0.288	0.237	0.198	0.177	0.176	0.194	0.220	0.257	0.302	0.512	0.565
sc1200	0.687	0.617	0.419	0.359	0.304	0.255	0.214	0.191	0.187	0.201	0.222	0.255	0.298	0.500	0.554
sc1300	0.700	0.630	0.435	0.375	0.321	0.272	0.232	0.207	0.200	0.209	0.227	0.256	0.294	0.492	0.545
sc1400	0.713	0.644	0.450	0.391	0.338	0.290	0.249	0.223	0.213	0.217	0.233	0.258	0.293	0.486	0.537
sc1500	0.726	0.658	0.465	0.407	0.354	0.307	0.267	0.239	0.227	0.228	0.240	0.261	0.293	0.480	0.531
sc1600	0.740	0.672	0.479	0.422	0.370	0.323	0.283	0.255	0.241	0.239	0.247	0.266	0.294	0.476	0.526
sc1700	0.753	0.685	0.493	0.437	0.386	0.339	0.299	0.271	0.255	0.250	0.255	0.271	0.297	0.471	0.521
sc1800	0.765	0.698	0.507	0.451	0.401	0.355	0.315	0.285	0.268	0.261	0.264	0.275	0.300	0.467	0.517
sc1900	0.777	0.710	0.520	0.465	0.415	0.370	0.330	0.299	0.281	0.272	0.272	0.281	0.303	0.464	0.513
sc2000	0.789	0.722	0.533	0.479	0.430	0.384	0.344	0.312	0.294	0.283	0.281	0.287	0.306	0.461	0.509

Table C 2: Parameter Optimization of Coarser Resolution for Mahaweli at Morape

SC/C	0.4	0.5	0.6	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2
sc100	0.628	0.589	0.558	0.512	0.505	0.502	0.502	0.506	0.509	0.517	0.530	0.542	0.571	0.581	0.590
sc200	0.623	0.582	0.544	0.489	0.476	0.470	0.470	0.472	0.481	0.497	0.520	0.552	0.606	0.623	0.634
sc300	0.588	0.543	0.501	0.440	0.424	0.416	0.417	0.422	0.434	0.456	0.492	0.530	0.593	0.618	0.637
sc400	0.554	0.504	0.459	0.391	0.374	0.364	0.364	0.372	0.388	0.417	0.458	0.497	0.571	0.601	0.626
sc500	0.523	0.471	0.424	0.349	0.329	0.317	0.318	0.329	0.349	0.383	0.423	0.465	0.547	0.583	0.615
sc600	0.499	0.444	0.395	0.315	0.290	0.277	0.277	0.292	0.315	0.351	0.393	0.436	0.526	0.567	0.604
sc700	0.484	0.426	0.374	0.289	0.259	0.244	0.244	0.259	0.286	0.323	0.365	0.412	0.508	0.552	0.593
sc800	0.479	0.418	0.362	0.269	0.236	0.216	0.217	0.232	0.261	0.298	0.343	0.392	0.491	0.538	0.582
sc900	0.480	0.416	0.357	0.257	0.220	0.195	0.195	0.210	0.239	0.278	0.325	0.376	0.476	0.525	0.571
sc1000	0.486	0.420	0.357	0.252	0.210	0.181	0.176	0.192	0.222	0.263	0.310	0.362	0.463	0.513	0.562
sc1100	0.494	0.425	0.362	0.252	0.207	0.174	0.162	0.177	0.208	0.250	0.298	0.349	0.451	0.504	0.554
sc1200	0.502	0.433	0.368	0.254	0.208	0.173	0.152	0.169	0.198	0.240	0.287	0.338	0.441	0.495	0.546
sc1300	0.509	0.441	0.376	0.258	0.210	0.175	0.154	0.163	0.191	0.231	0.278	0.329	0.433	0.487	0.539
sc1400	0.517	0.449	0.383	0.264	0.215	0.179	0.158	0.162	0.188	0.225	0.271	0.321	0.426	0.480	0.532
sc1500	0.524	0.456	0.391	0.271	0.221	0.184	0.163	0.164	0.186	0.220	0.265	0.314	0.419	0.472	0.526
sc1600	0.531	0.464	0.399	0.279	0.229	0.190	0.169	0.168	0.186	0.217	0.260	0.309	0.413	0.466	0.520
sc1700	0.531	0.464	0.399	0.279	0.229	0.190	0.169	0.168	0.186	0.217	0.260	0.309	0.413	0.466	0.520
sc1800	0.545	0.479	0.414	0.298	0.247	0.207	0.183	0.179	0.189	0.215	0.253	0.300	0.402	0.456	0.509
sc1900	0.553	0.487	0.423	0.307	0.257	0.216	0.191	0.184	0.192	0.215	0.250	0.296	0.398	0.451	0.504
sc2000	0.560	0.495	0.431	0.317	0.266	0.226	0.198	0.190	0.196	0.216	0.249	0.293	0.393	0.447	0.499

Table C 3: Parameter Optimization at Finer Resolution for Kalu Ganga a Ellagawa

MRAE	sc650	sc700	sc750	sc800	sc850	sc900	sc950
0.6	0.286	0.289	0.293	0.298	0.305	0.312	0.320
0.65	0.260	0.262	0.266	0.271	0.277	0.284	0.291
0.7	0.236	0.237	0.240	0.245	0.250	0.257	0.264
0.75	0.214	0.213	0.216	0.221	0.226	0.232	0.238
0.8	0.197	0.193	0.195	0.199	0.203	0.209	0.214
0.85	0.184	0.178	0.178	0.181	0.184	0.189	0.194
0.9	0.173	0.166	0.163	0.165	0.168	0.172	0.178
0.95	0.169	0.158	0.152	0.153	0.156	0.160	0.164
1	0.171	0.158	0.149	0.145	0.148	0.153	0.158
1.1	0.193	0.181	0.171	0.164	0.160	0.160	0.163
1.2	0.224	0.213	0.204	0.197	0.190	0.188	0.187
1.3	0.264	0.254	0.246	0.238	0.231	0.225	0.222
1.4	0.314	0.303	0.294	0.285	0.278	0.271	0.265

Table C 4: Parameter Optimization at Finer Resolution for Mahaweli at Morape

C/SC	sc1050	sc1100	sc1150	sc1200	sc1250	sc1300	1350
0.9	0.208	0.207	0.207	0.208	0.208	0.210	0.212
0.95	0.190	0.189	0.189	0.189	0.190	0.191	0.192
1	0.177	0.174	0.173	0.173	0.174	0.175	0.177
1.05	0.168	0.164	0.161	0.161	0.161	0.162	0.164
1.1	0.168	0.162	0.156	0.152	0.152	0.154	0.155
1.15	0.174	0.168	0.162	0.157	0.154	0.154	0.155
1.2	0.184	0.177	0.173	0.169	0.165	0.163	0.162
1.25	0.197	0.191	0.186	0.182	0.179	0.176	0.174
1.3	0.215	0.208	0.203	0.198	0.194	0.191	0.190

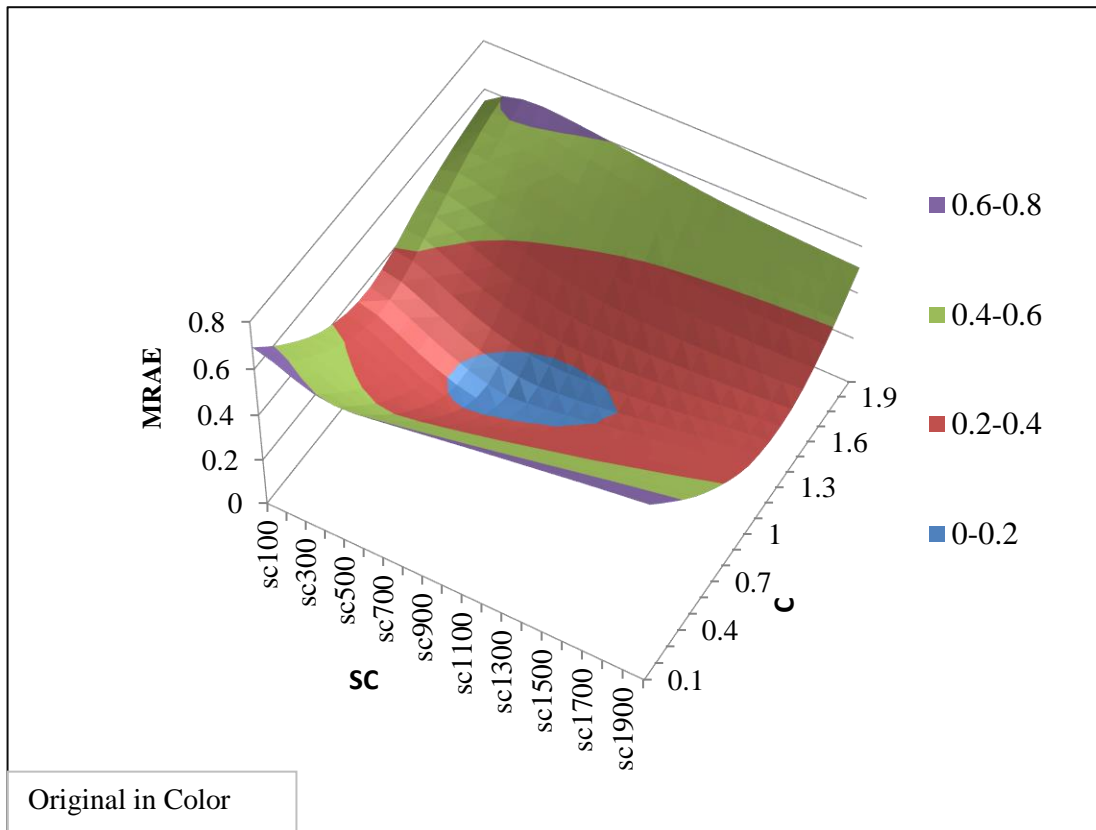


Figure C 1: Coarser Resolution Surface for Kalu Ganga at Ellagawa

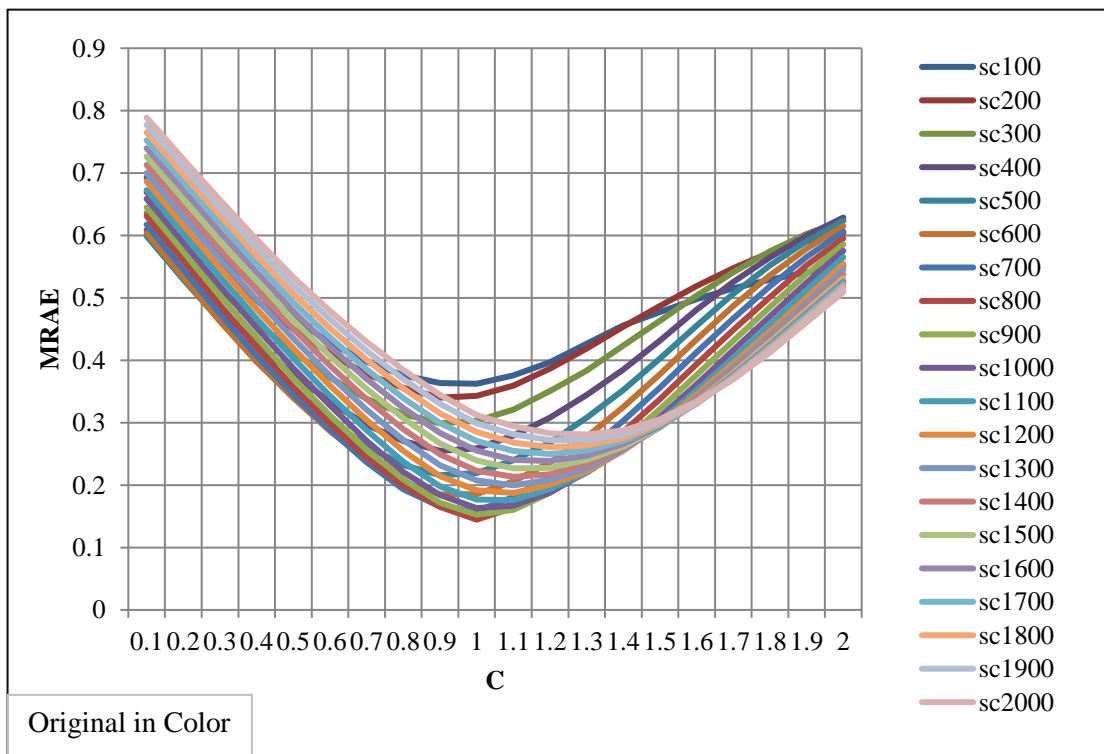


Figure C 2: Coarser Resolution Optimization of Parameter C for Kalu Ganga at Ellagawa

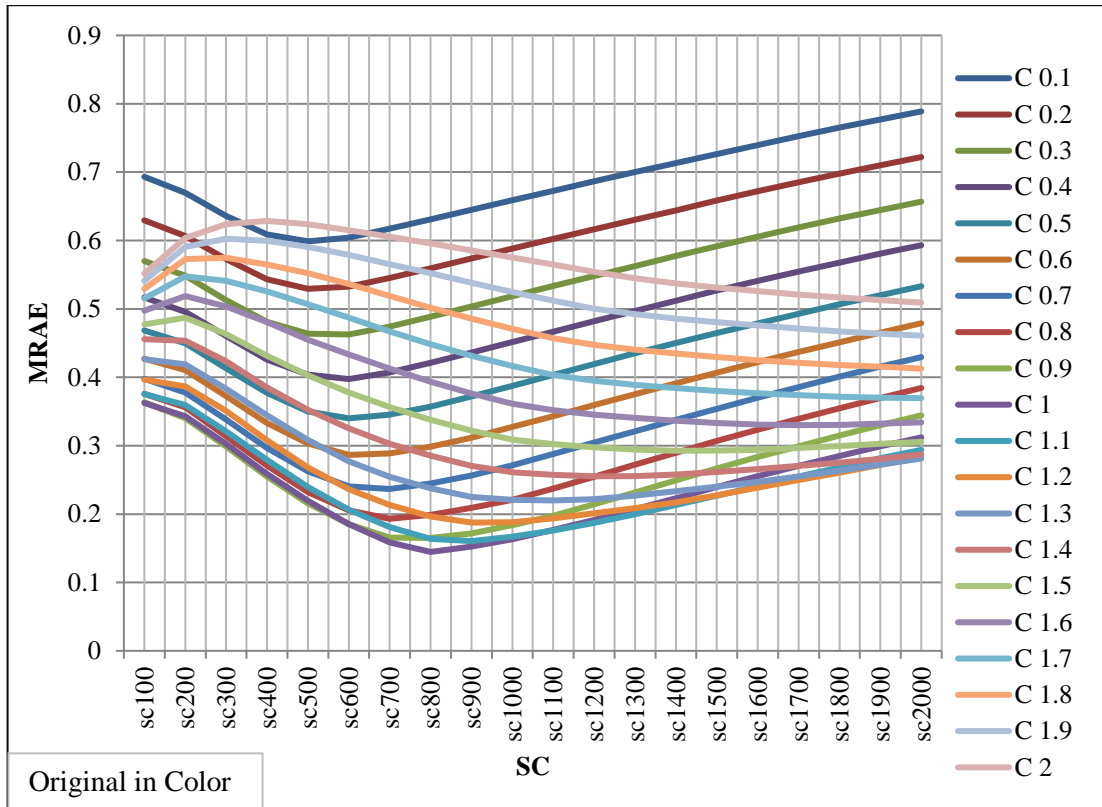


Figure C 3: Coarser Resolution Optimization of Parameter SC in Kalu Ganga at Ellagawa

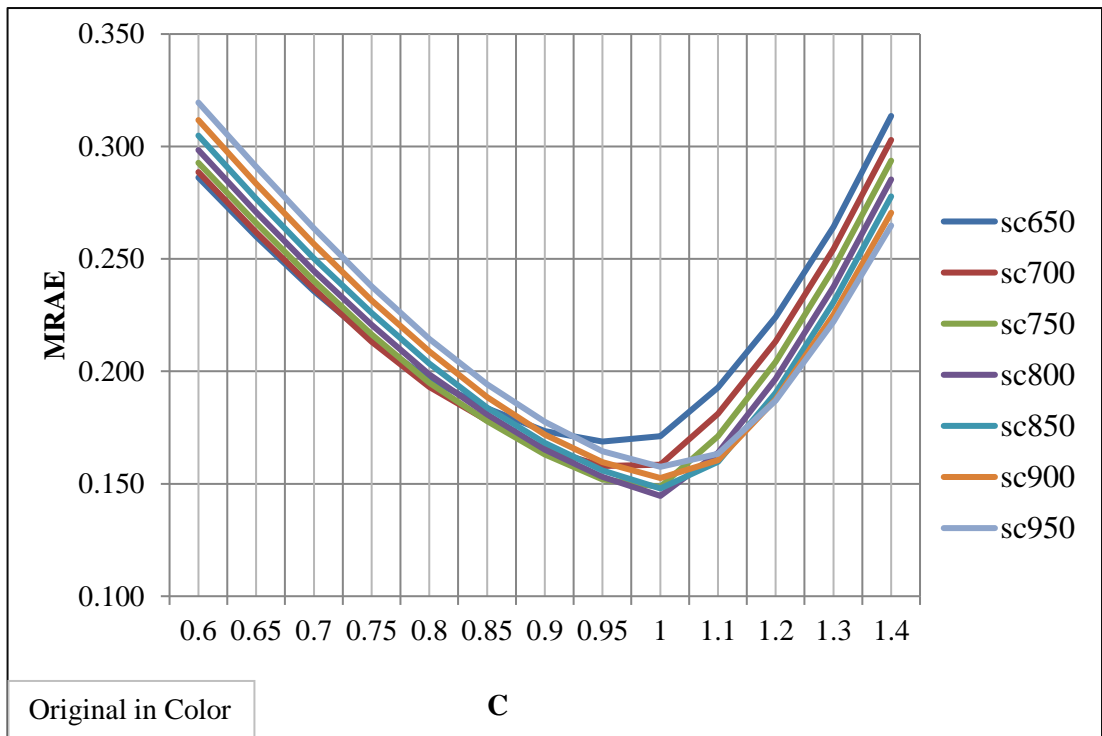


Figure C 4: Optimization of Parameter C at Finer Resolution for Kalu Ganga at Ellagawa

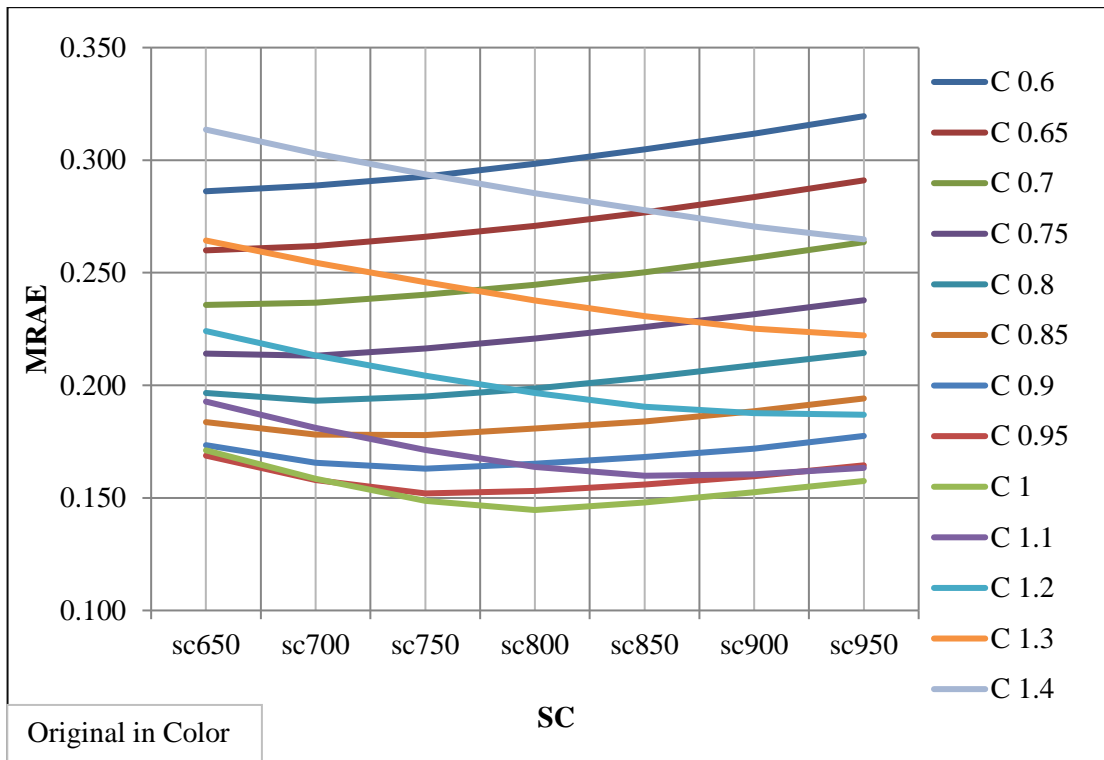


Figure C 5: Optimization of Parameter SC at Finer Resolution for Kalu Ganga at Ellagawa

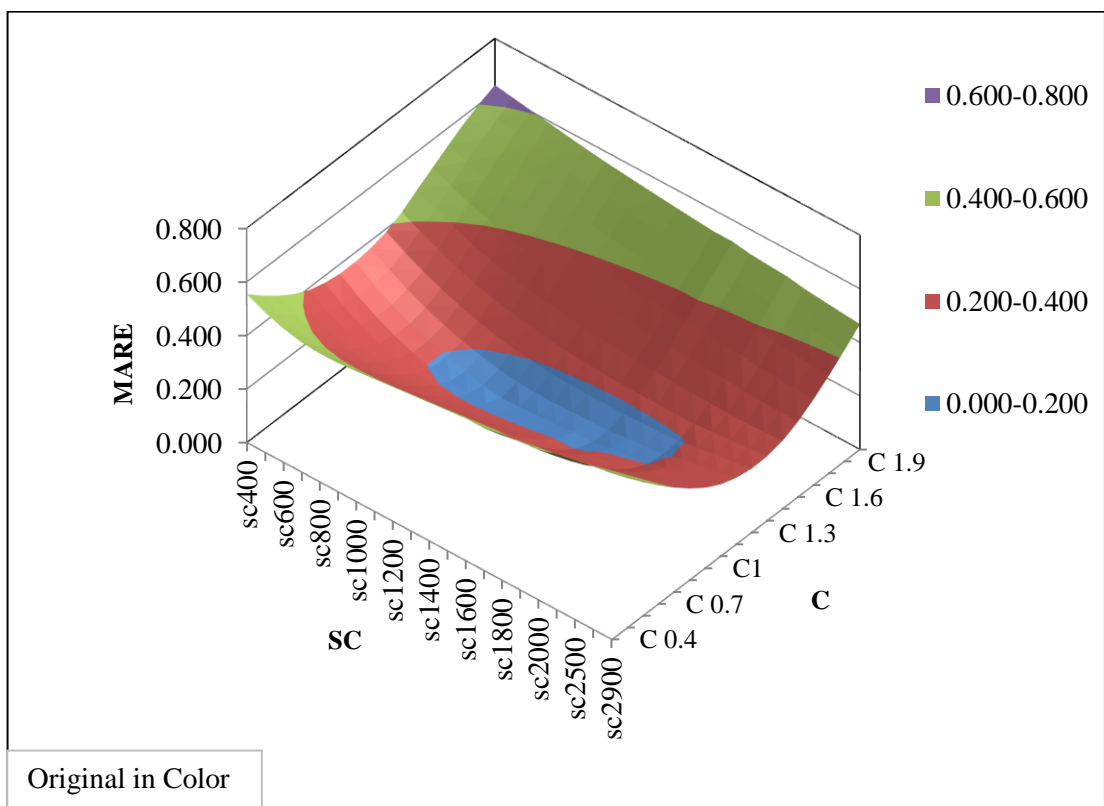


Figure C 6: Coarser Resolution Surface for Mahaweli Ganga at Morape

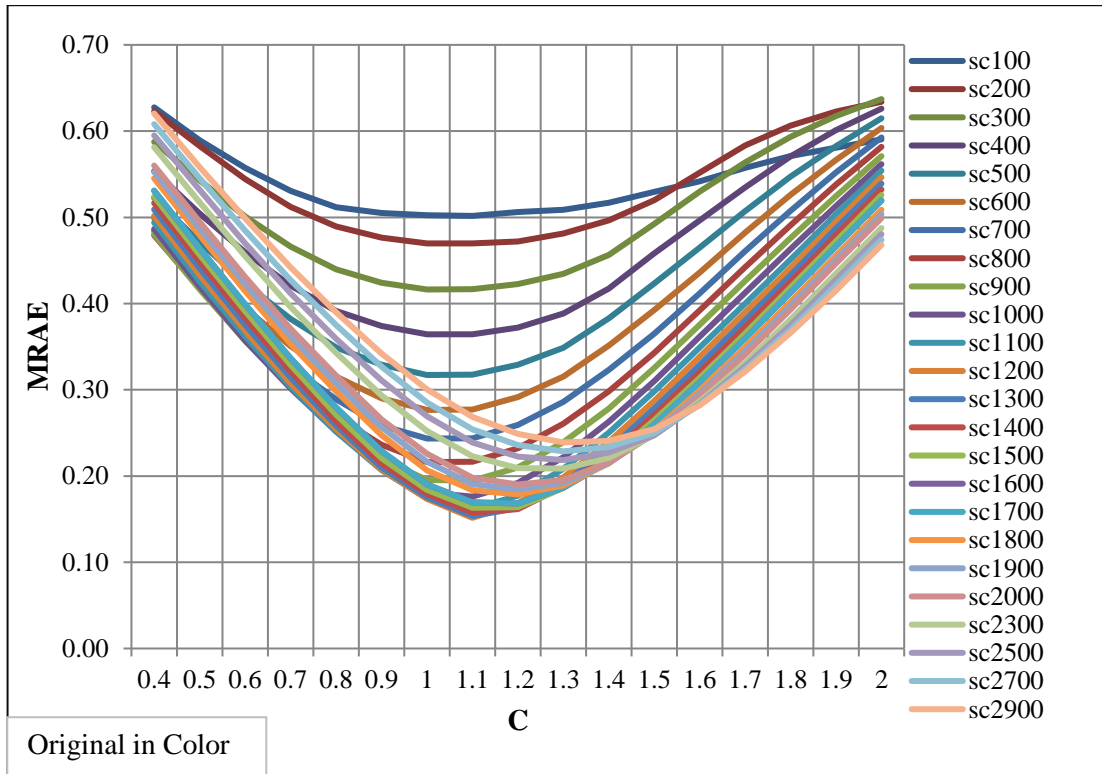


Figure C 7: Coarser Resolution Optimization of Parameter C for Mahaweli Ganga at Morape

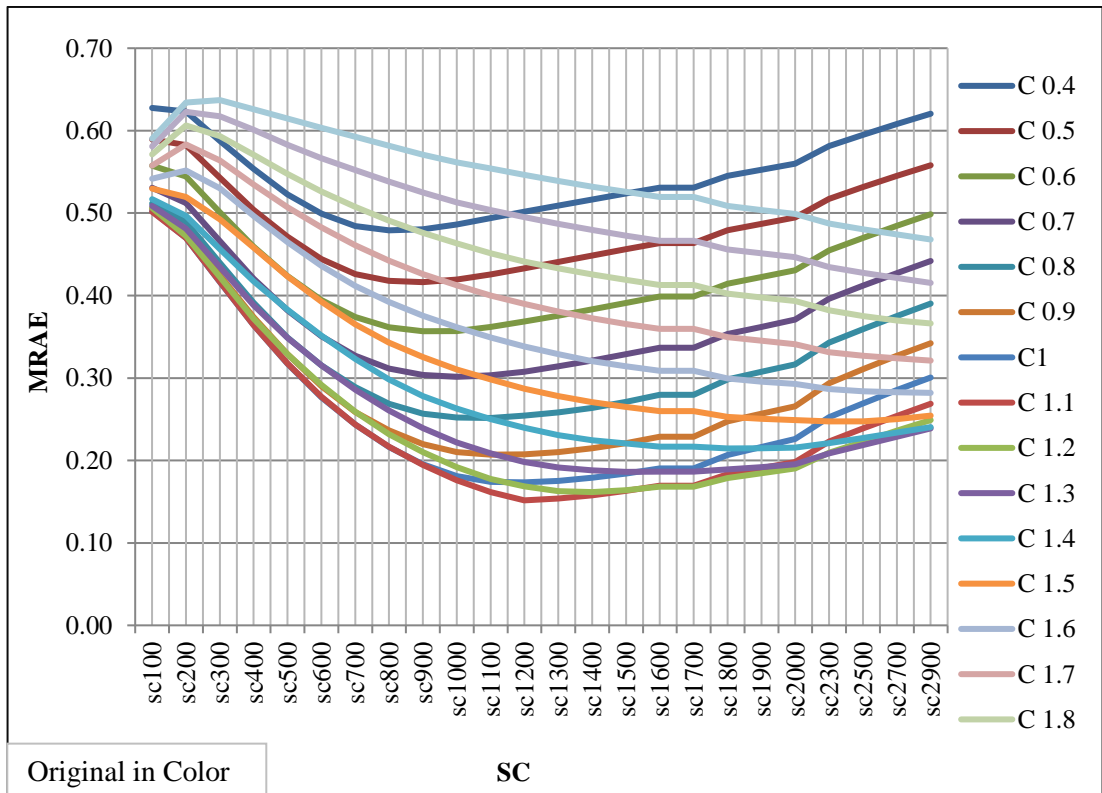


Figure C 8: Coarser Resolution Optimization of Parameter SC for Mahaweli Ganga

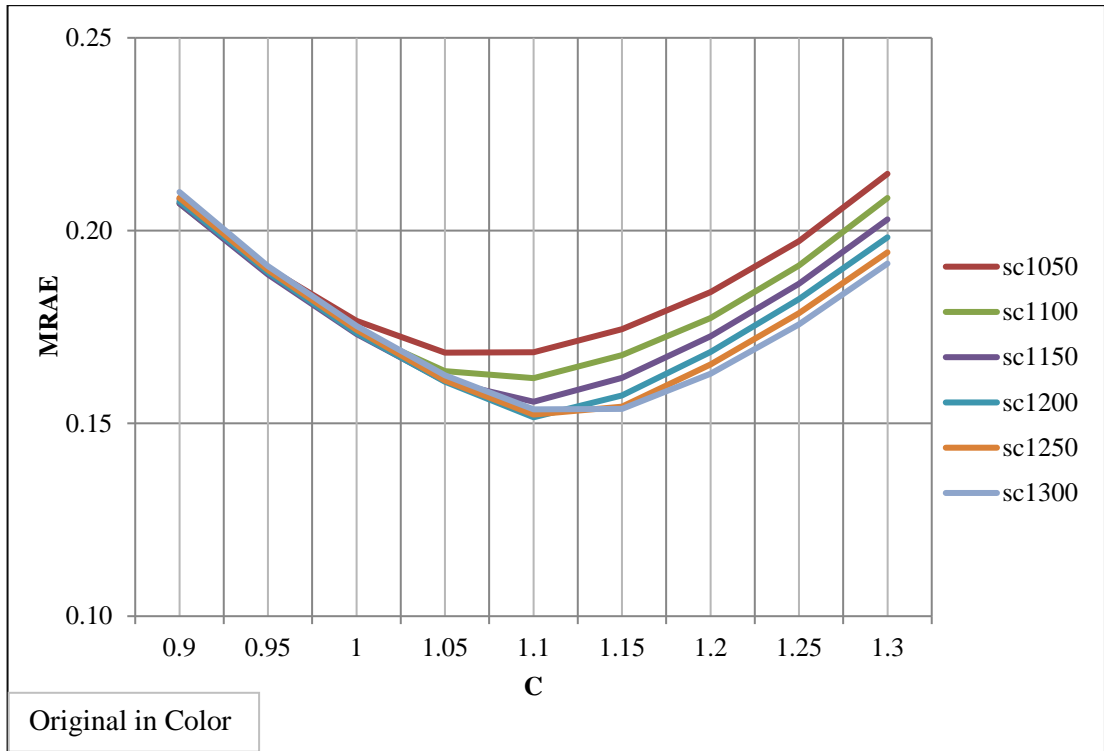


Figure C 9: Optimization of Parameter C at Finer Resolution for Mahaweli Ganga at Morape

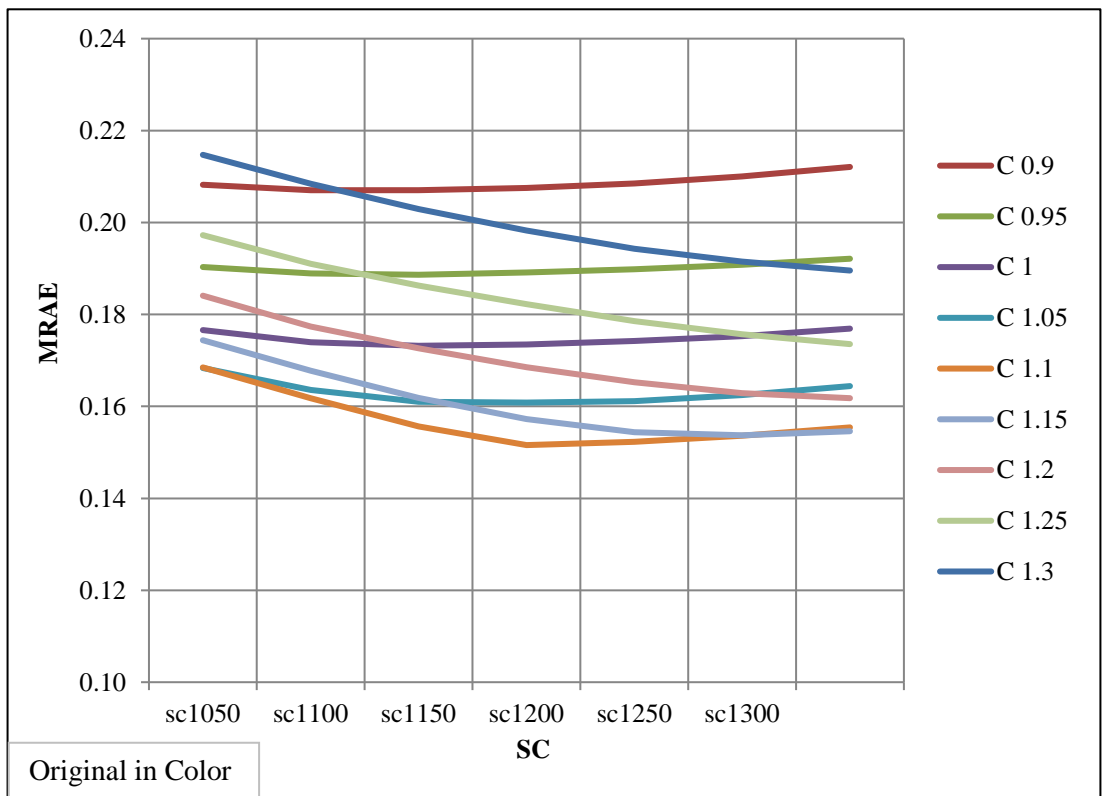


Figure C 10: Optimization of Parameter SC at Finer Resolution for Mahaweli Ganga at Morape

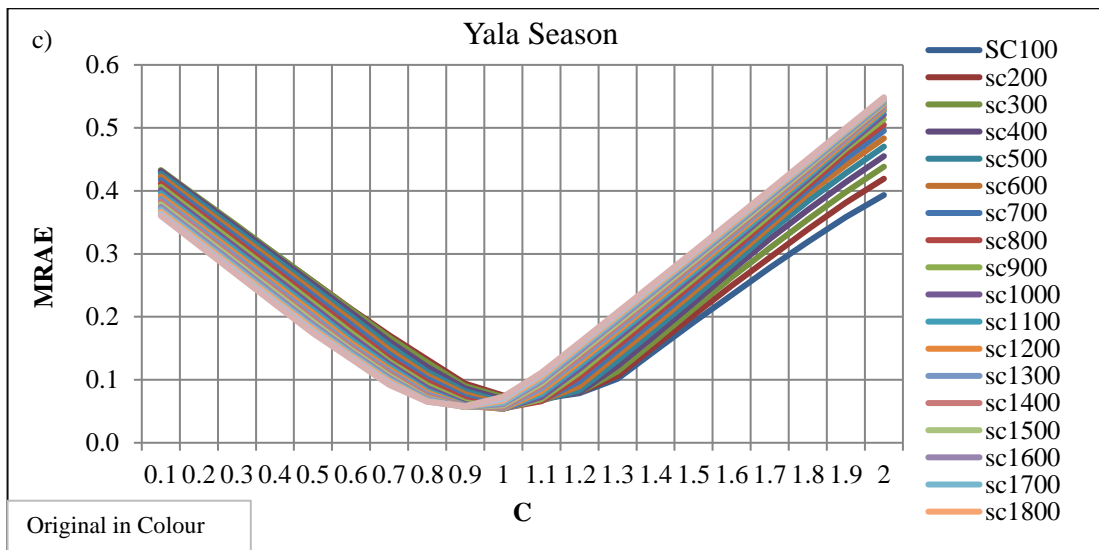
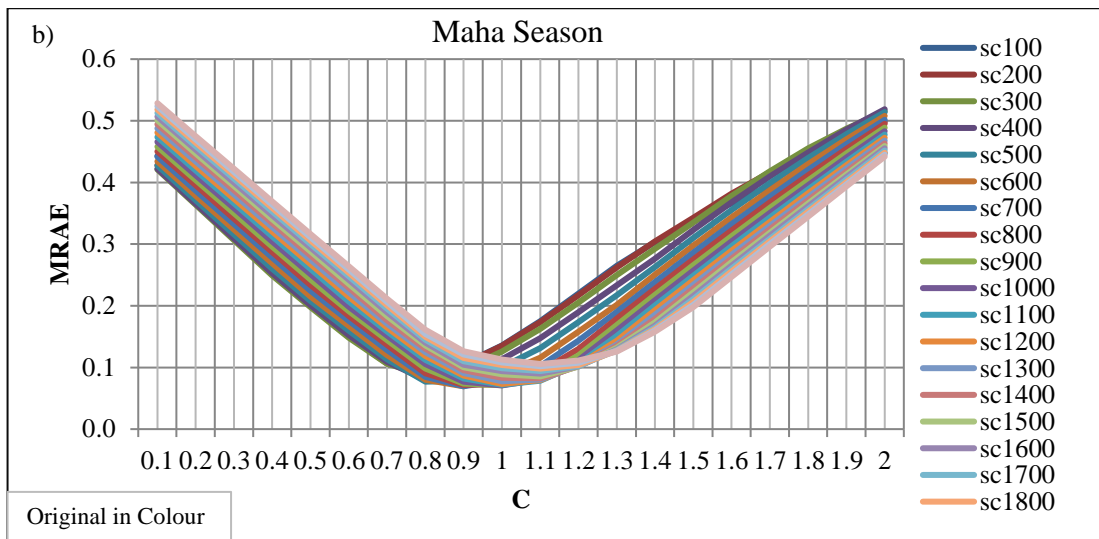
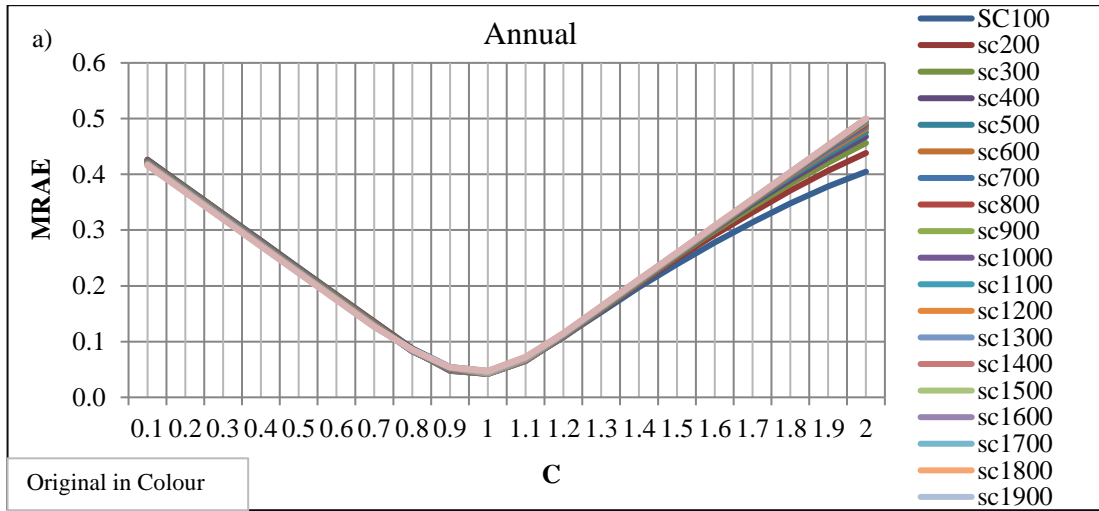


Figure C 11: Optimization of Parameter C in Annual and Seasonal time scale for Kalu Ganga (a-c)

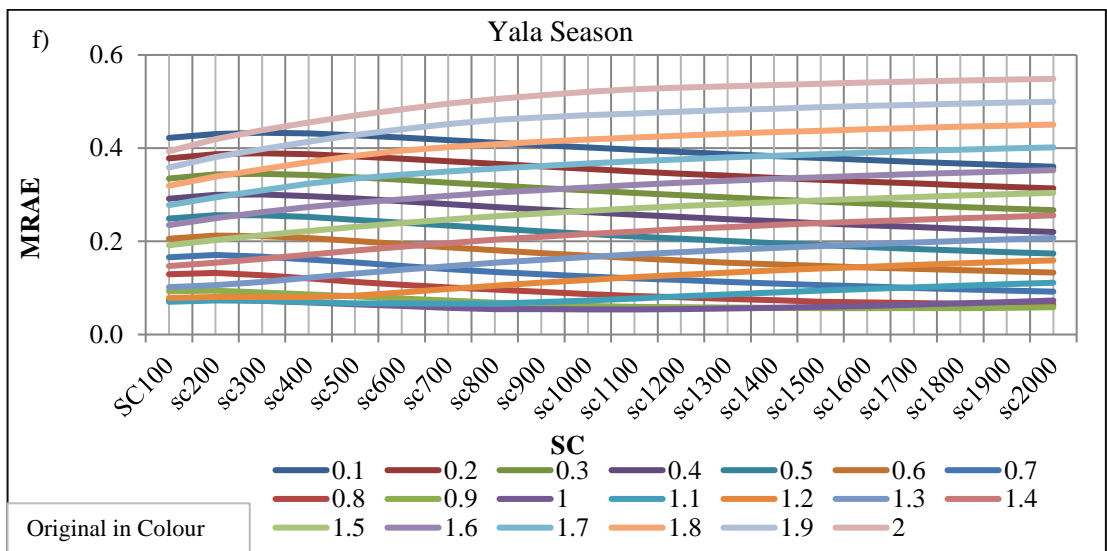
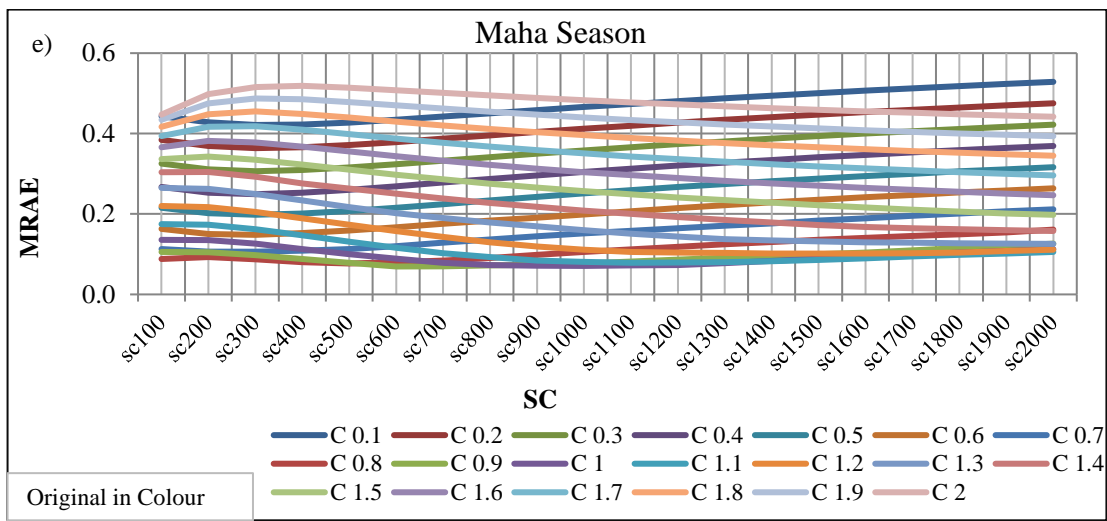
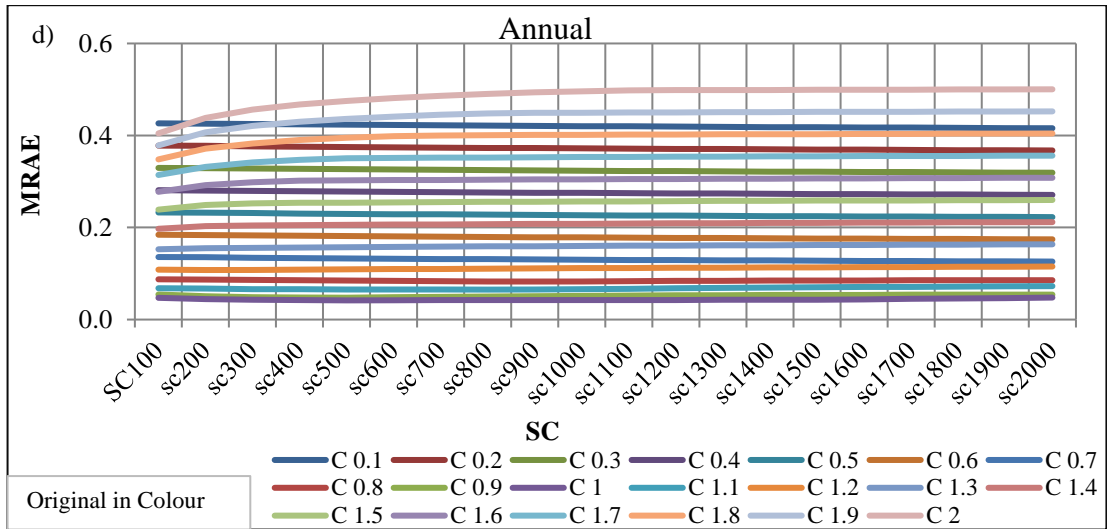


Figure C 12: Optimization of Parameter SC in Annual and Seasonal time scale for Kalu Ganga (d-f)

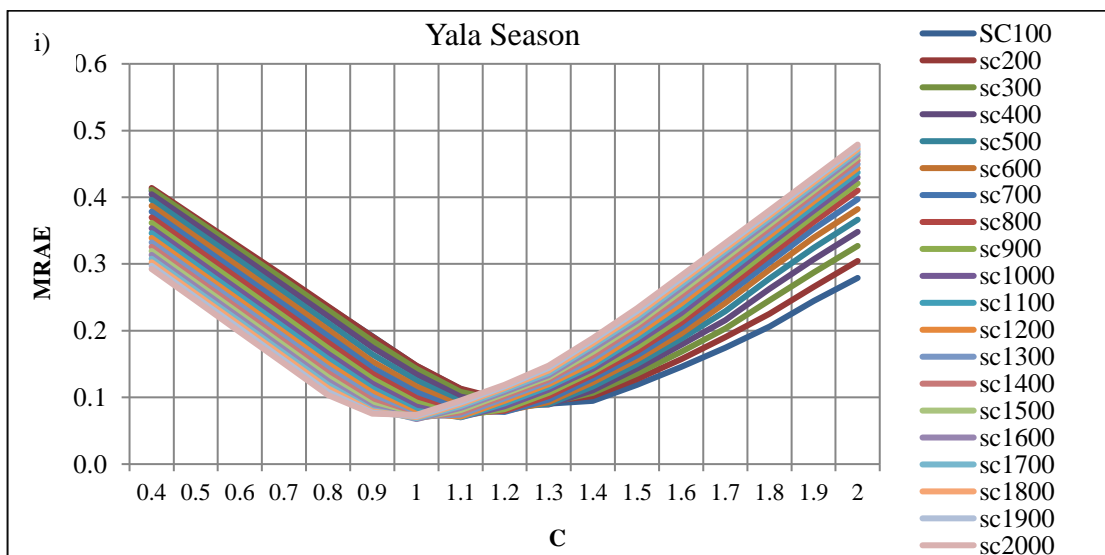
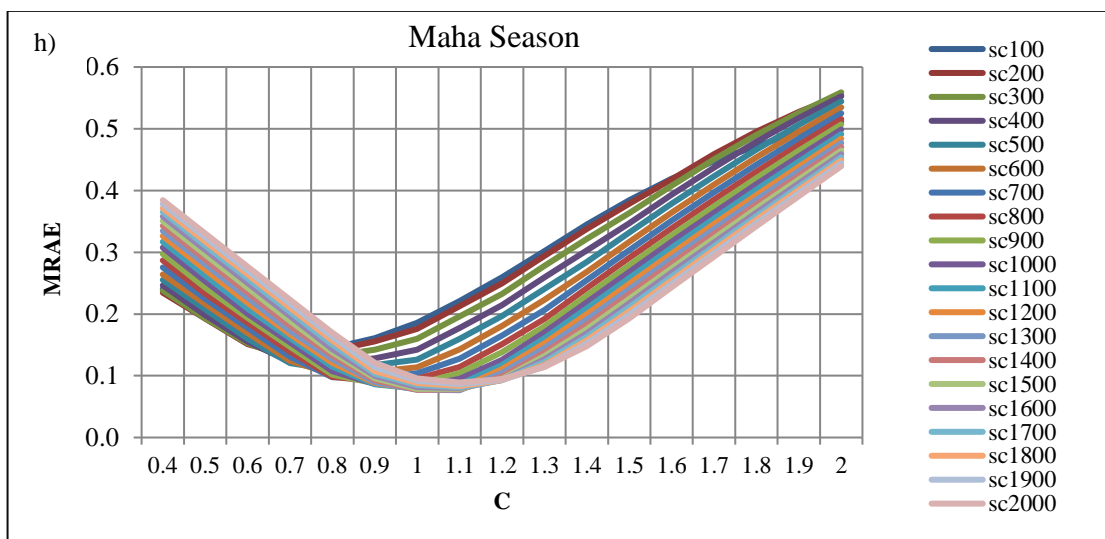
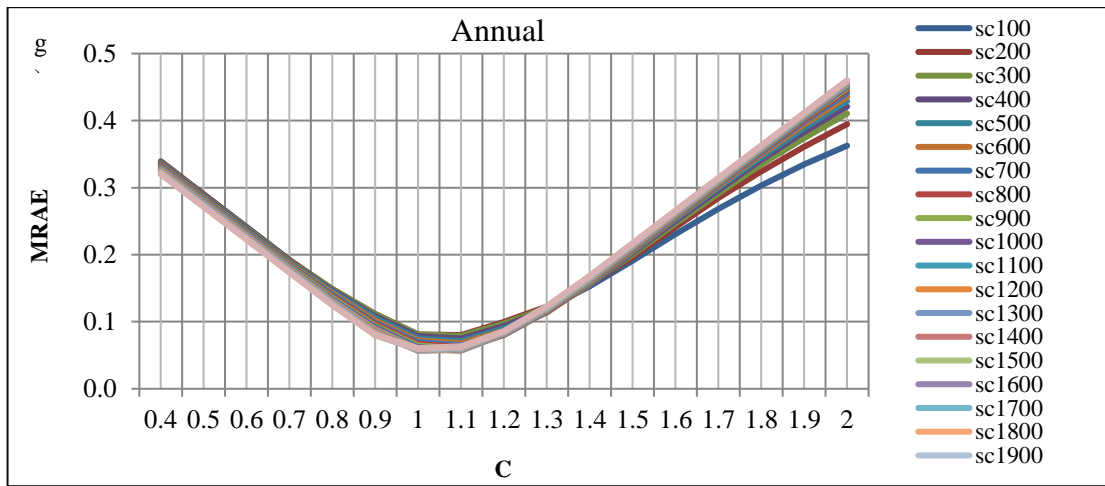


Figure C 13: Optimization of Parameter C in Annual and Seasonal time scale for Mahaweli Ganga (g-i)

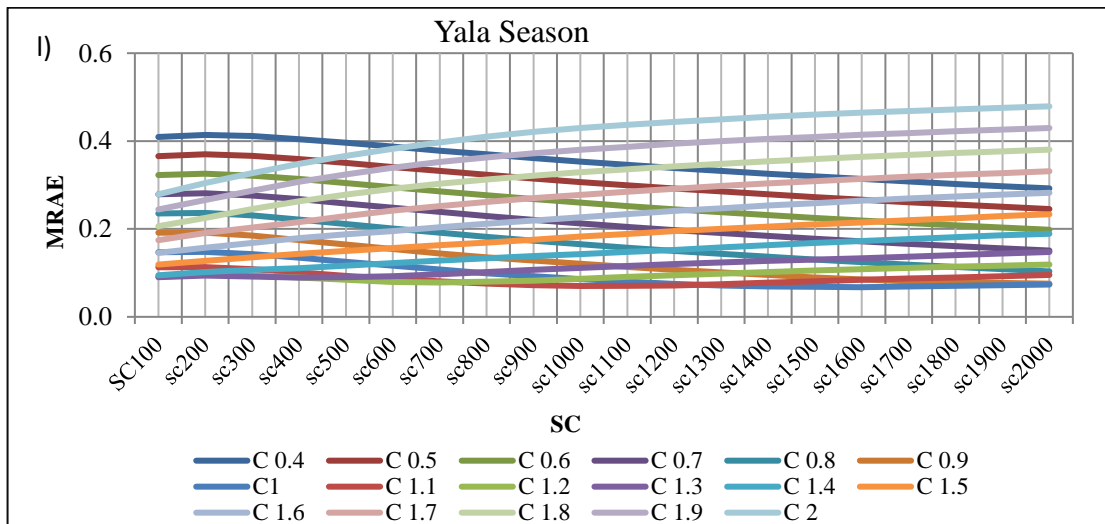
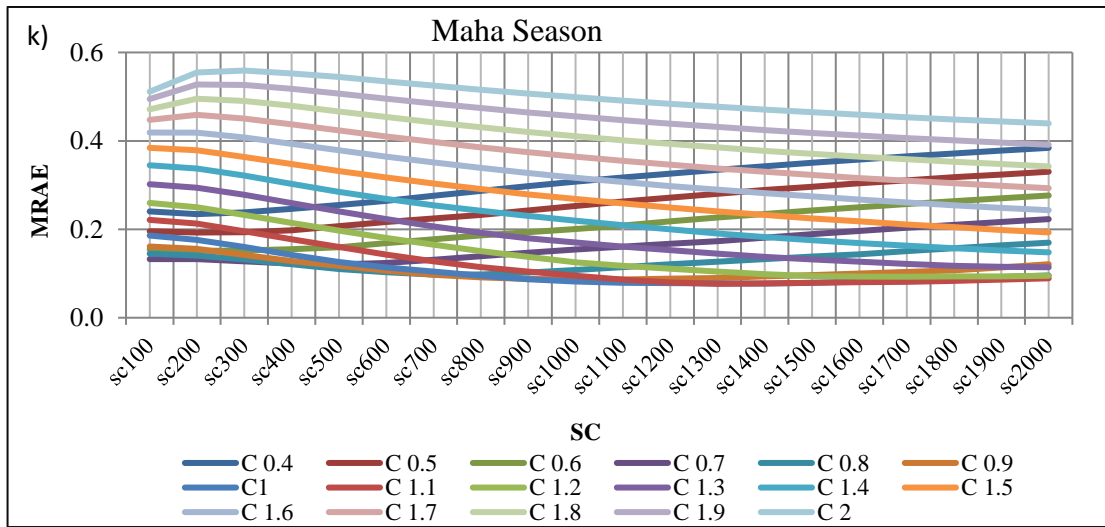
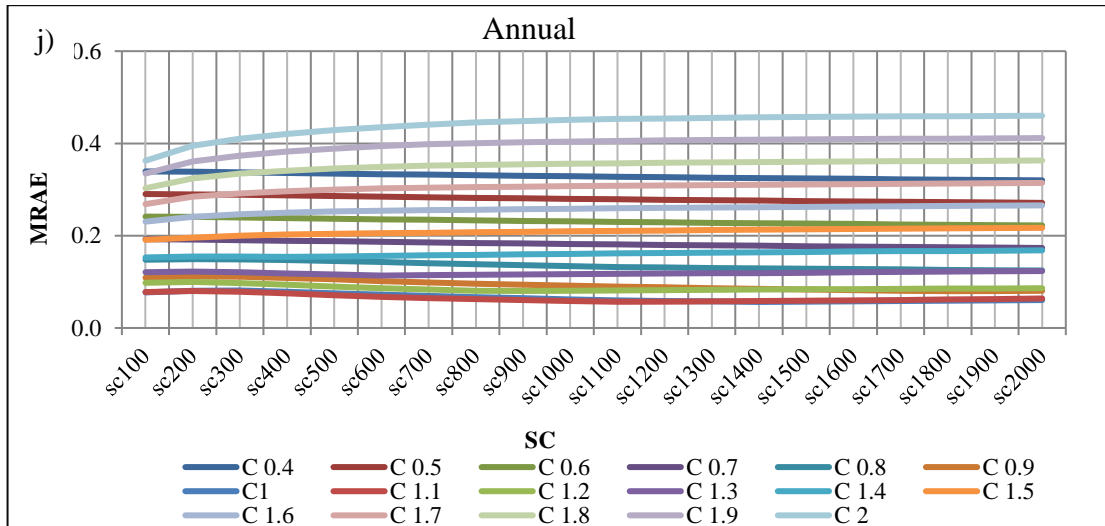


Figure C 14: Optimization of Parameter SC in Annual and Seasonal time scale for Mahaweli Ganga (j-l)

Appendix-D

Calibration and verification Results

Table D 1: Estimated and Observed flow of Kalu Ganga in Annual and seasonal time scale

Year	Calibration Period						Year	Verification Period					
	Annal		Maha Season		Yala Season			Annal		Maha Season		Yala Season	
	Estimat ed flow (mm)	Observed flow (mm)	Estimat ed flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)		Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)
1983-84	3162.2	3049.6	1550.2	1423.1	1612.0	1626.4	1998-99	2902.2	2784.5	1126.0	1115.2	1776.2	1669.3
1984-85	2554.5	2653.7	977.1	1081.4	1577.4	1572.4	1999-00	2049.5	2094.5	1029.6	1028.0	1019.8	1066.5
1985-86	2592.6	2646.1	1215.4	1349.6	1377.2	1296.5	2000-01	1249.4	1243.0	640.4	685.7	609.0	557.3
1986-87	1980.6	2038.2	921.9	923.3	1058.7	1114.9	2001-02	1656.4	1694.9	780.8	774.9	875.7	920.0
1987-88	3664.5	3689.0	1211.3	1309.4	2453.2	2379.6	2002-03	2629.5	2550.9	951.9	832.6	1677.6	1718.3
1988-89	2609.1	2687.8	621.0	699.2	1988.1	1988.6	2003-04	1506.3	1486.5	430.4	395.1	1075.9	1091.4
1989-90	1983.8	2060.9	948.4	879.6	1035.3	1181.3	2004-05	1641.1	1655.5	790.8	705.5	850.4	950.0
1990-91	2040.5	1988.6	1000.0	922.6	1040.5	1066.0	2005-06	2157.2	1949.2	1063.1	952.9	1094.0	996.3
1991-92	1972.8	2198.7	686.8	698.6	1286.0	1500.1	2006-07	1835.8	1836.0	757.2	733.5	1078.6	1102.6
1992-93	2232.5	2144.6	870.1	892.6	1362.4	1252.0	2007-08	2510.2	2497.4	1010.0	1058.3	1500.2	1439.0
1993-94	2222.1	2417.5	1304.4	1380.8	917.7	1036.7	2008-09	1421.6	1511.9	561.9	565.8	859.7	946.1
1994-95	3025.3	3009.7	947.2	1026.5	2078.1	1983.3	2009-10	2001.8	1886.6	541.0	533.7	1460.8	1352.9
1995-96	2131.5	2315.8	702.7	877.3	1428.8	1438.4	2010-11	2150.8	2089.2	1076.4	979.8	1074.5	1109.4
1996-97	2017.8	1936.3	588.9	573.6	1429.0	1362.6	2011-12	1639.7	1559.3	611.6	632.0	1028.1	927.3
1997-98	3030.2	2854.1	1341.3	1272.7	1688.9	1581.4	2012-13	2840.3	2413.7	1360.3	1247.2	1480.0	1166.5

Table D 2: Estimated and Observed flow of Mahaweli Ganga in Annual and seasonal time scale

Year	Calibration Period						Year	Verification Period					
	Annal		Maha Season		Yala Season			Annal		Maha Season		Yala Season	
	Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)		Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)	Estimated flow (mm)	Observed flow (mm)
1949/50	1672.7	1699.5	634.0	626.3	1038.7	1073.2	1964/65	1676.5	1599.5	624.4	550.7	1052.1	1048.9
1950/51	2067.1	2069.4	536.2	547.0	1530.9	1522.4	1965/66	1050.9	1248.6	530.4	682.3	520.5	566.3
1951/52	2260.0	2239.5	851.0	828.7	1409.0	1410.9	1966/67	1026.8	1177.7	642.2	686.6	384.5	491.1
1952/53	1425.8	1461.8	604.9	605.2	820.9	856.6	1967/68	2378.7	2416.0	871.7	912.6	1507.0	1503.4
1953/54	1823.4	1638.7	715.2	743.9	1108.2	894.8	1968/69	1440.0	1532.3	557.9	568.9	882.1	963.5
1954/55	2305.8	2089.7	896.3	805.7	1409.5	1284.0	1969/70	1386.8	1388.2	680.1	630.0	706.8	758.3
1955/56	1562.9	1619.0	435.1	477.6	1127.8	1141.4	1970/71	1910.9	1950.3	715.5	762.9	1195.4	1187.4
1956/57	1544.7	1519.4	695.2	648.1	849.5	871.3	1971/72	1687.6	1610.9	594.6	607.8	1093.0	1003.1
1957/58	1942.3	1858.3	1033.7	1023.3	908.7	835.0	1972/73	1516.8	1646.8	916.8	1008.6	600.0	638.2
1958/59	1836.0	1976.8	620.4	705.1	1215.6	1271.8	1973/74	2037.7	2086.5	526.7	566.9	1511.0	1519.6
1959/60	1766.9	1885.5	554.6	676.7	1212.3	1208.8	1974/75	1753.7	1639.4	473.8	499.7	1279.8	1139.7
1960/61	1628.1	1914.0	657.8	858.2	970.2	1055.8	1975/76	1280.6	1354.0	880.1	936.3	400.4	417.7
1961/62	1467.9	1605.9	433.1	518.2	1034.8	1087.7	1976/77	1366.6	1465.8	473.5	516.5	893.1	949.3
1962/63	1224.2	1362.3	658.2	650.8	566.0	711.4	1977/78	2216.8	2211.5	748.9	765.8	1467.9	1445.7
1963/64	1745.7	1705.3	757.4	844.3	988.3	861.0	1978/79	2051.9	2017.1	941.4	975.2	1110.5	1041.9

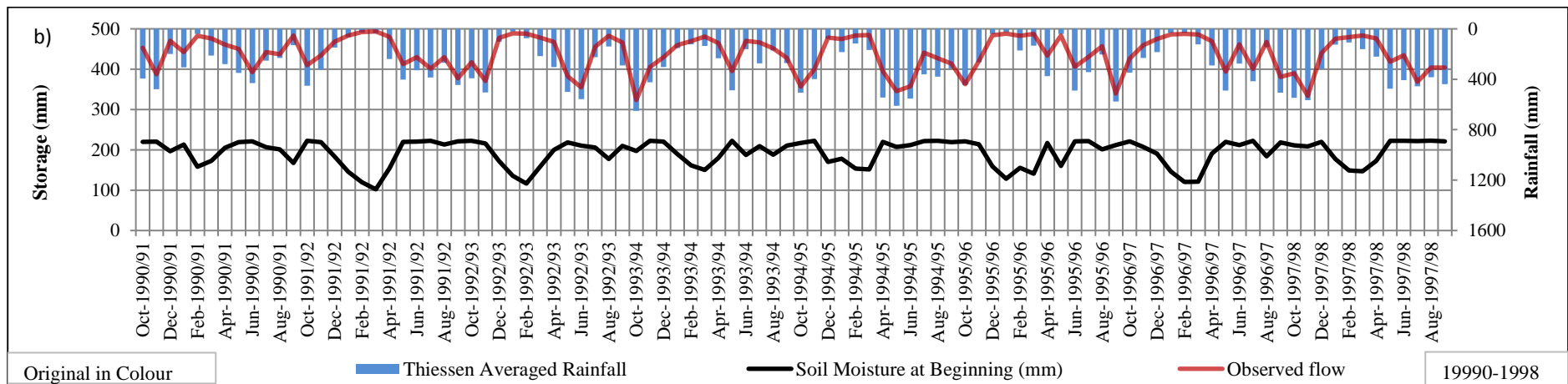
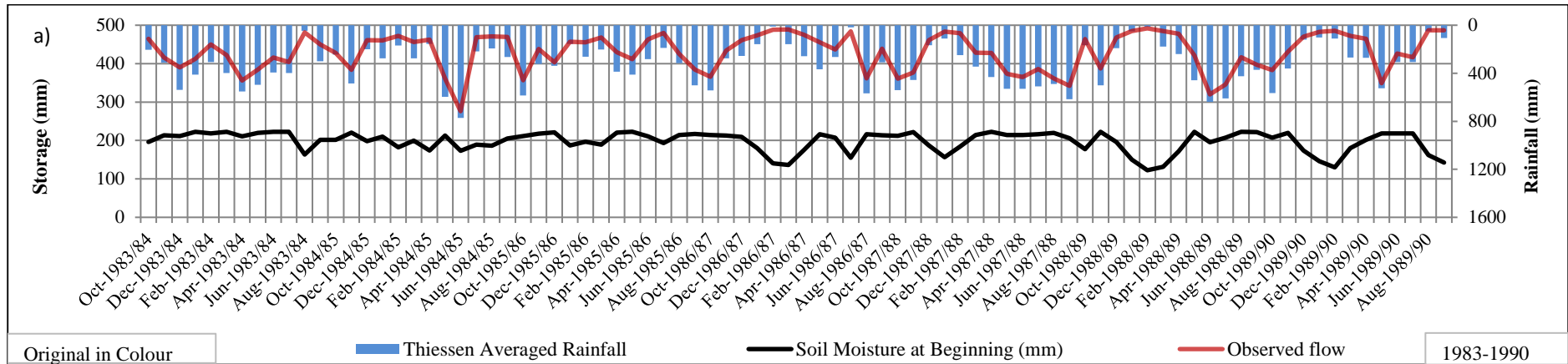


Figure D 1: Simulated Soil water content in Calibration period of Kalu Ganga (a-b)

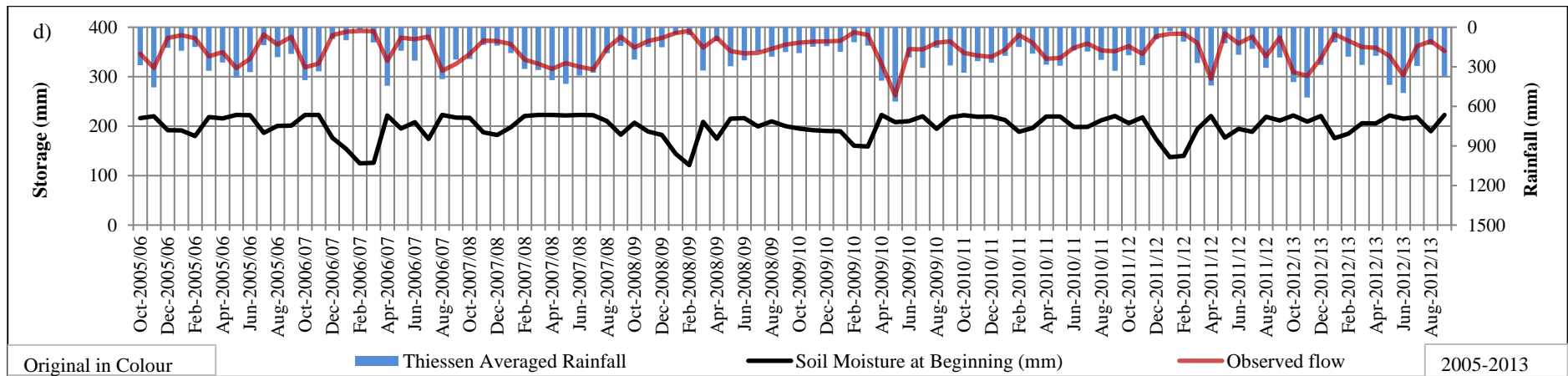
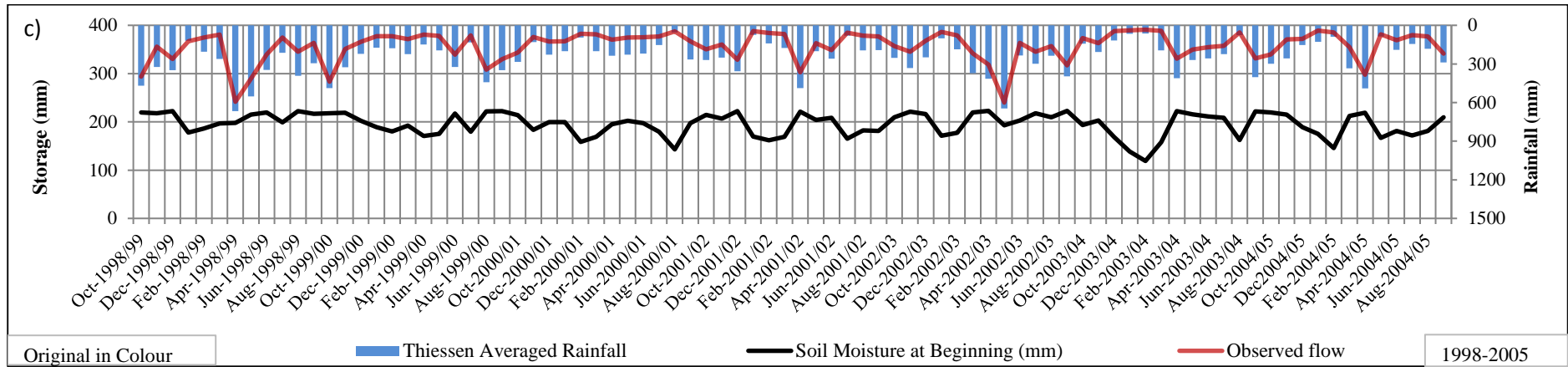


Figure D 2: Simulated Soil water content in Verification period of Kalu Ganga (c-d)

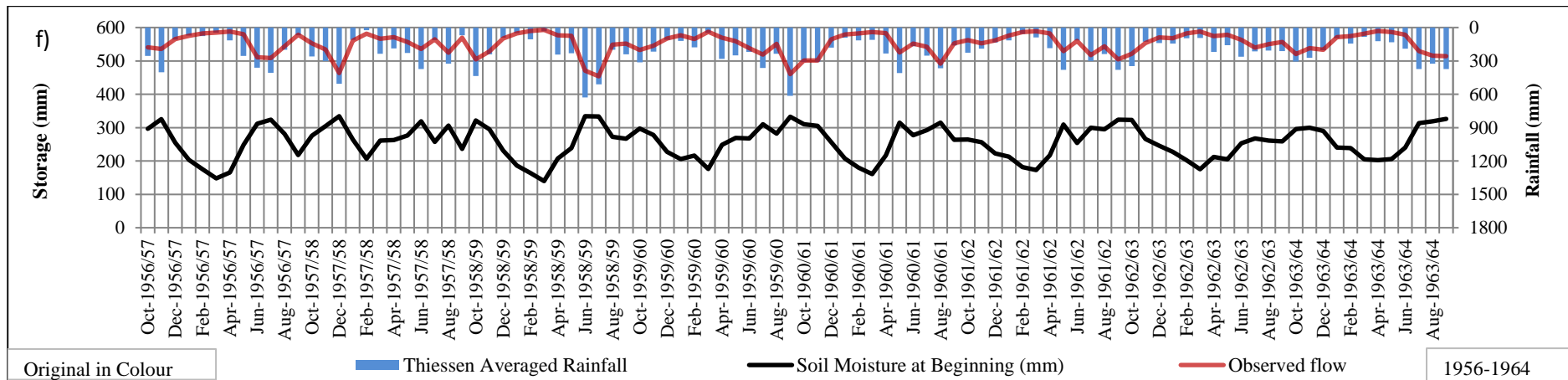
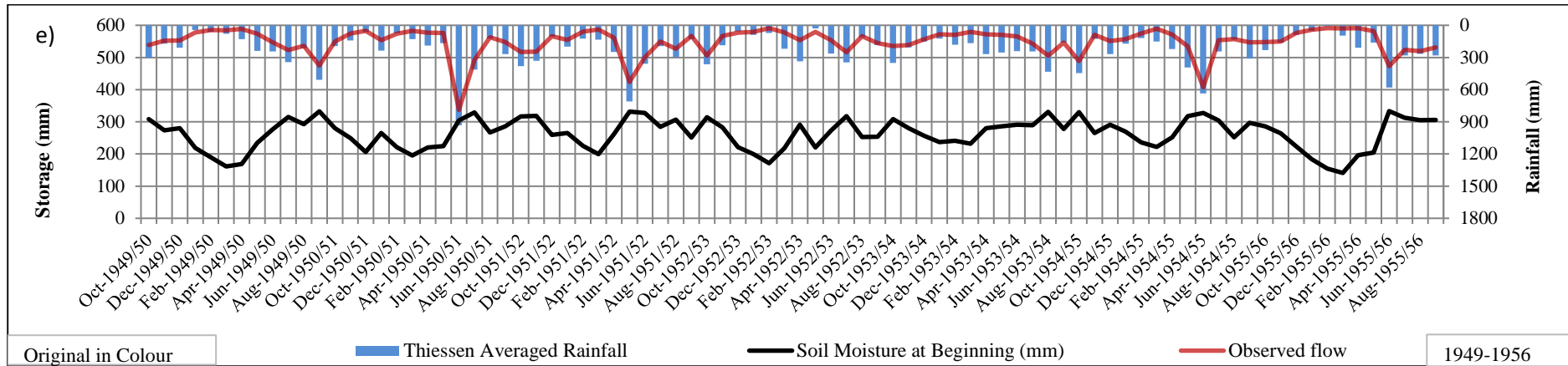


Figure D 3: Simulated Soil water content in Calibration period of Mahaweli Ganga (e-f)

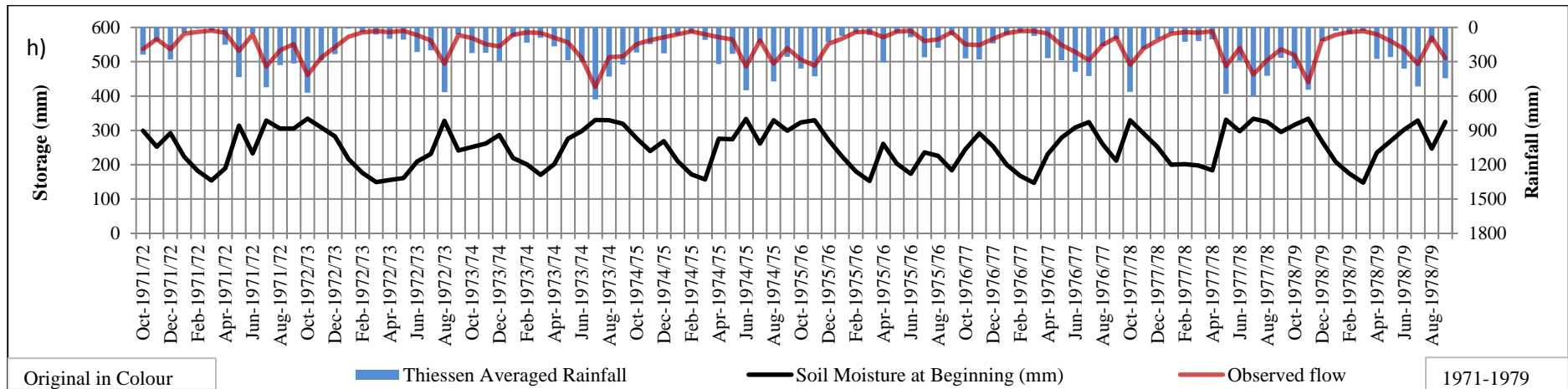
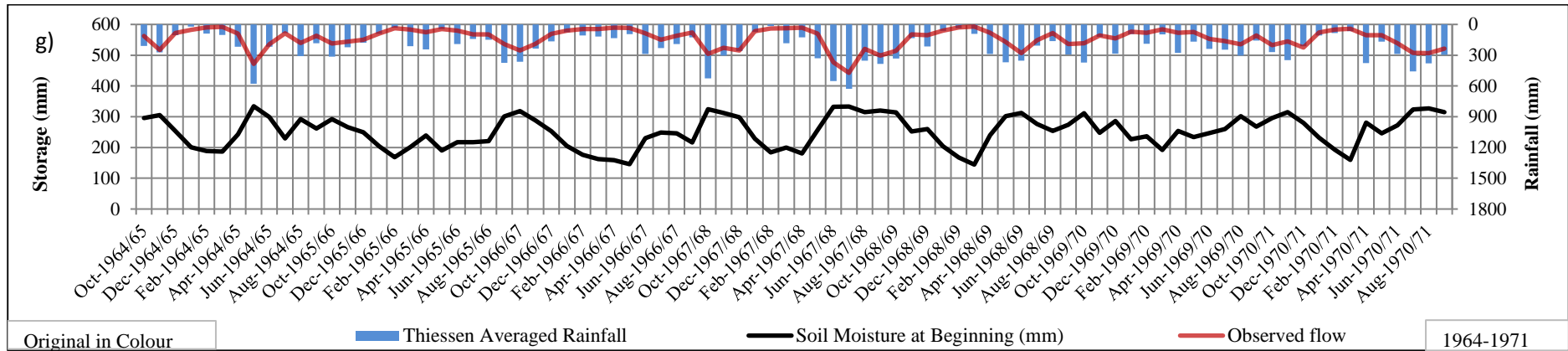


Figure D 4: Simulated Soil water content in Verification period of Mahaweli Ganga (g-h)

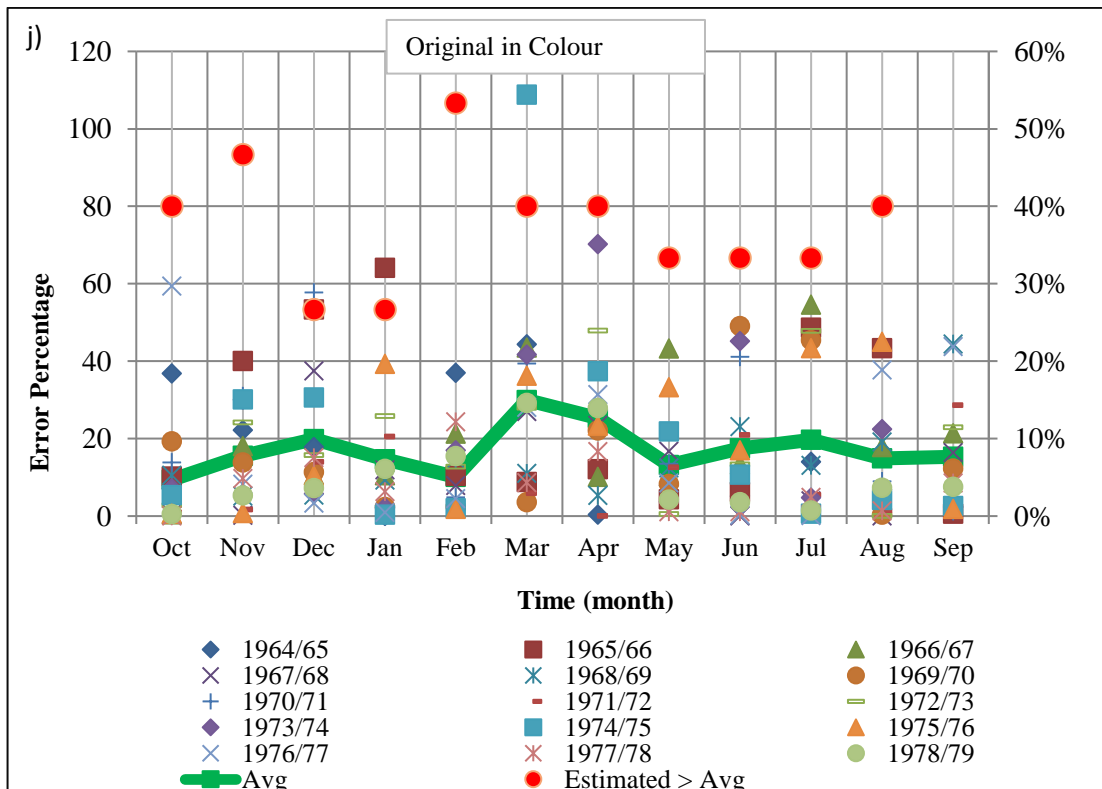
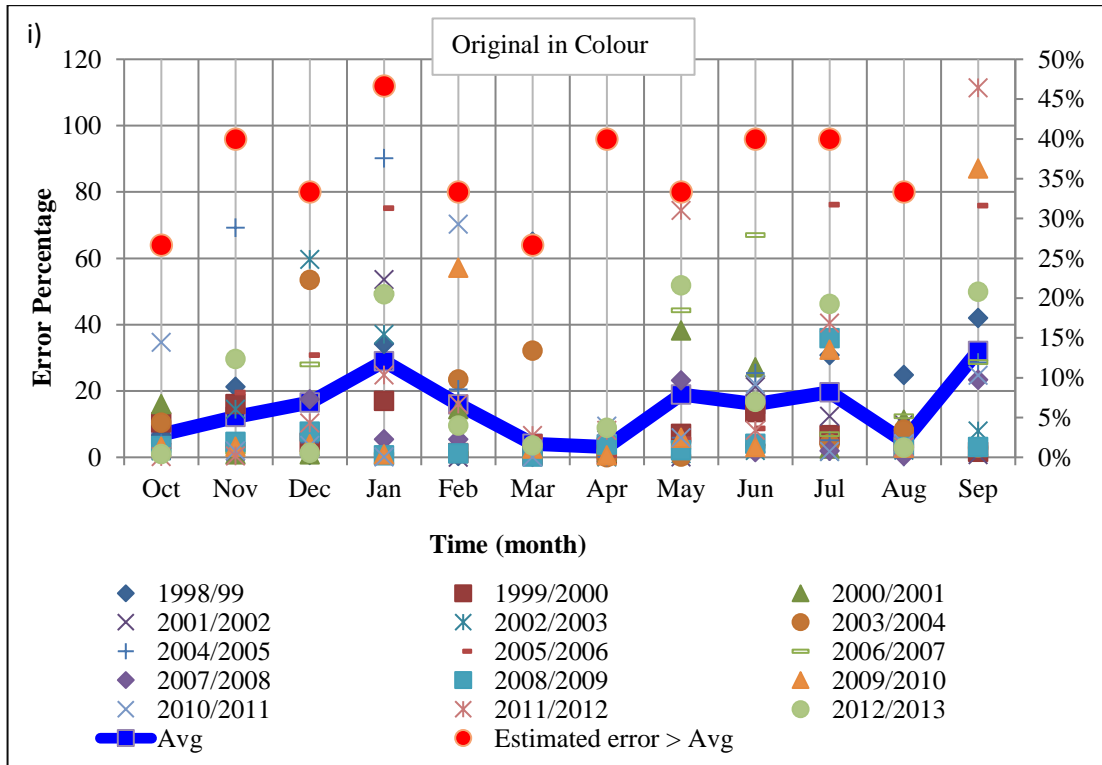


Figure D 5: Simulated Error during Verification of Kalu Ganga and Mahaweli Ganga (i-j)

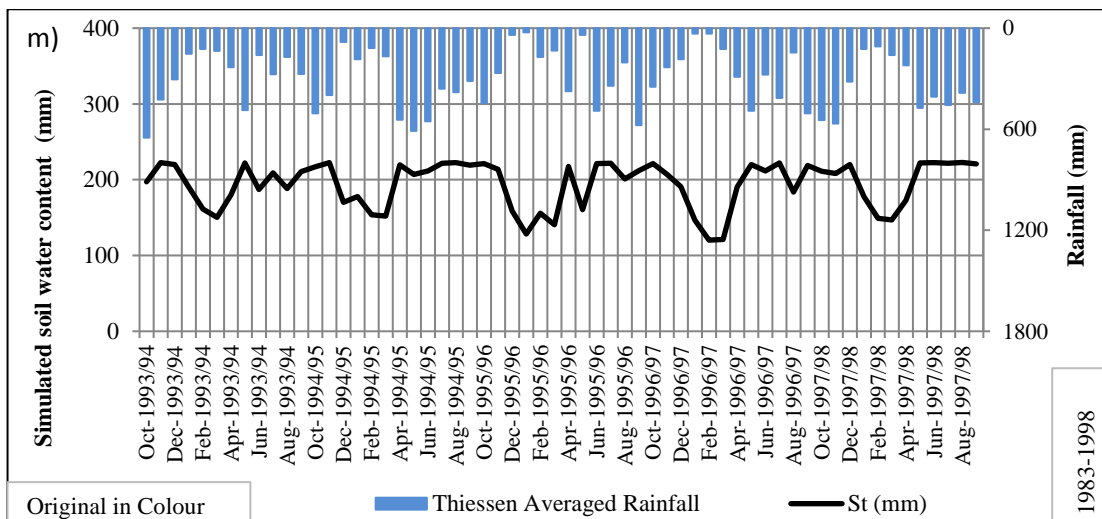
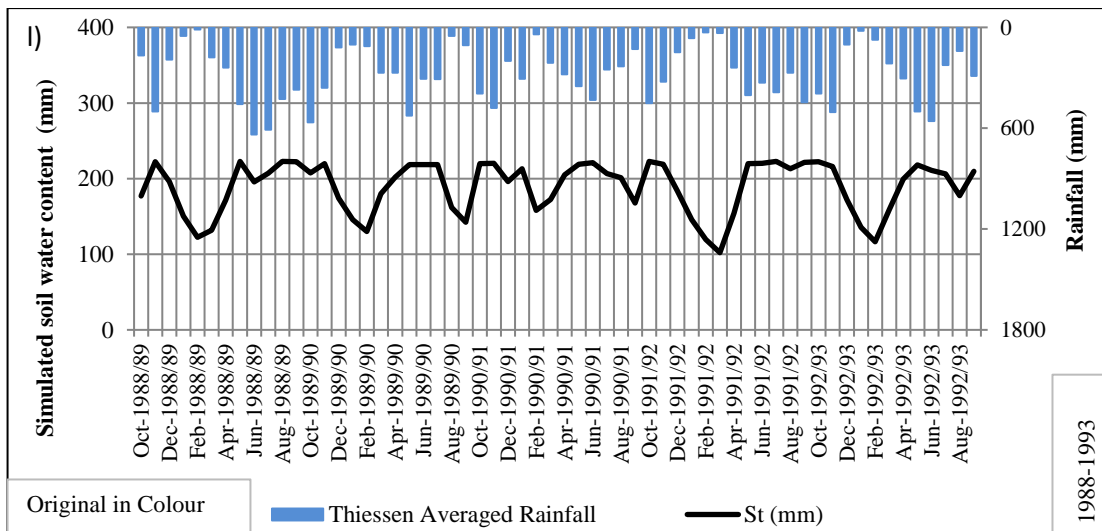
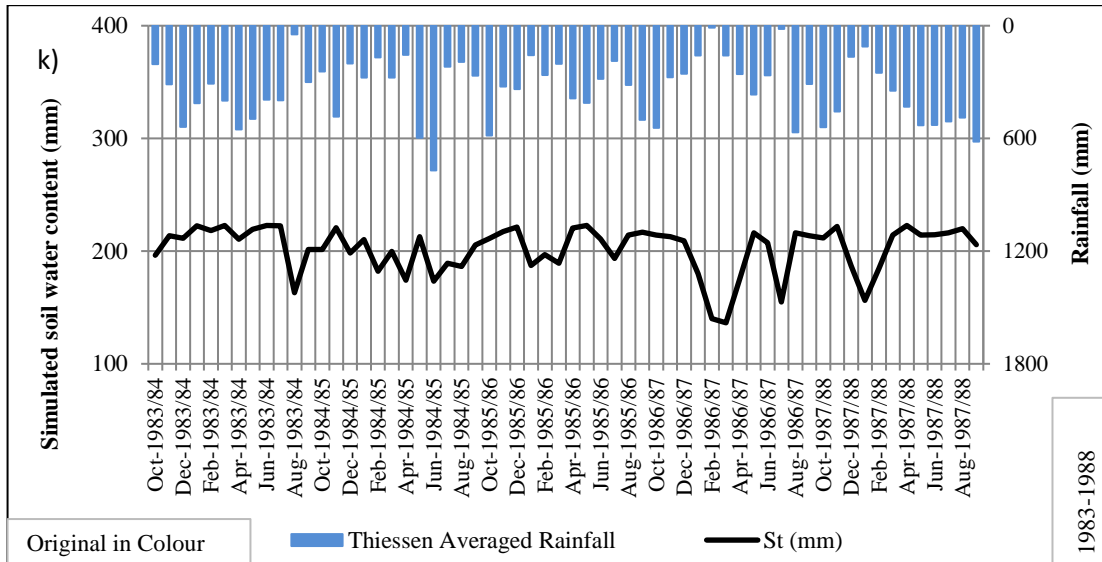


Figure D 6: Simulated Soil water content in Calibration period of Kalu Ganga (k-m)

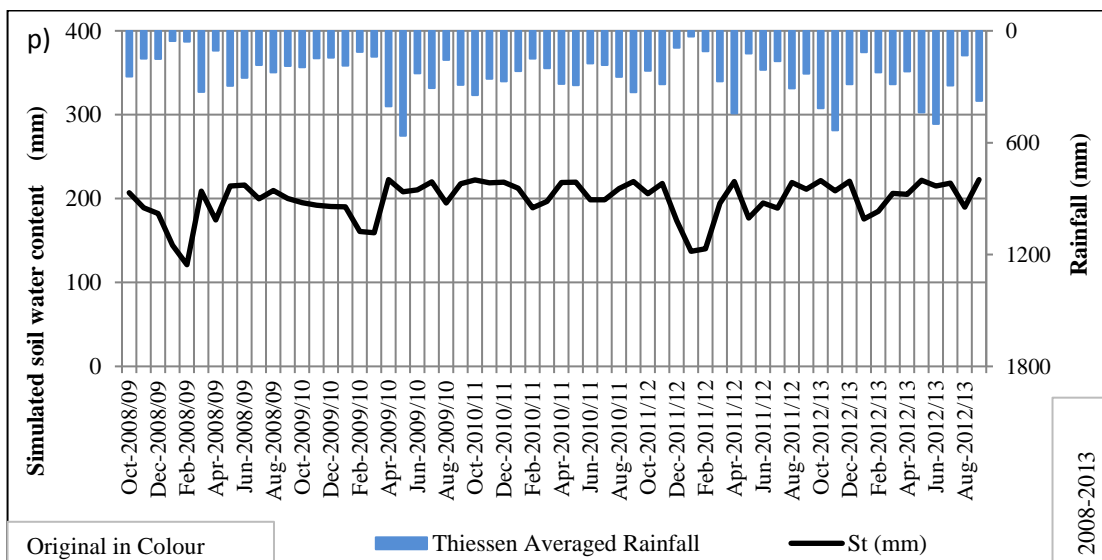
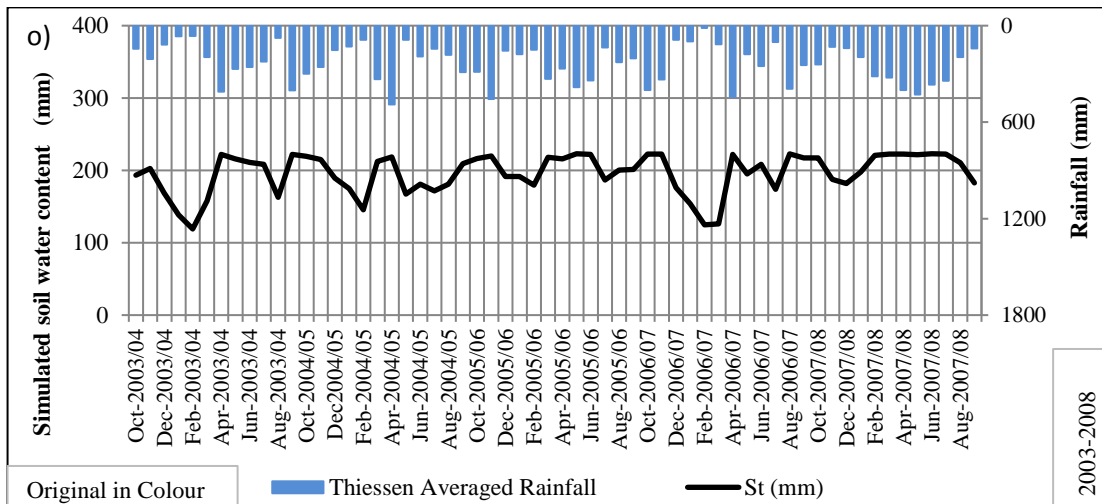
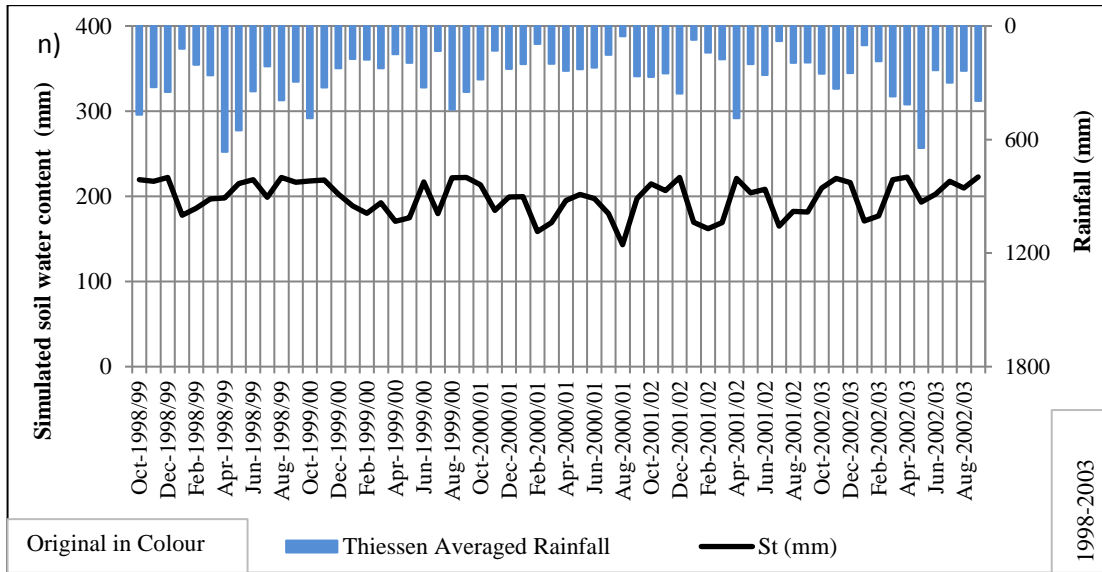


Figure D 7: Simulated Soil water content in Verification period of Kalu Ganga (n-p)

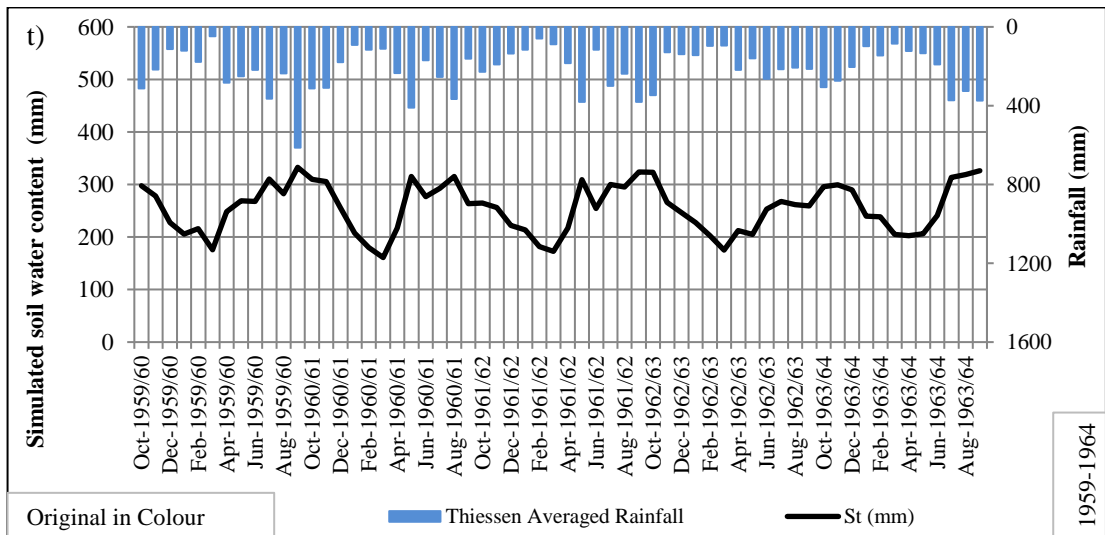
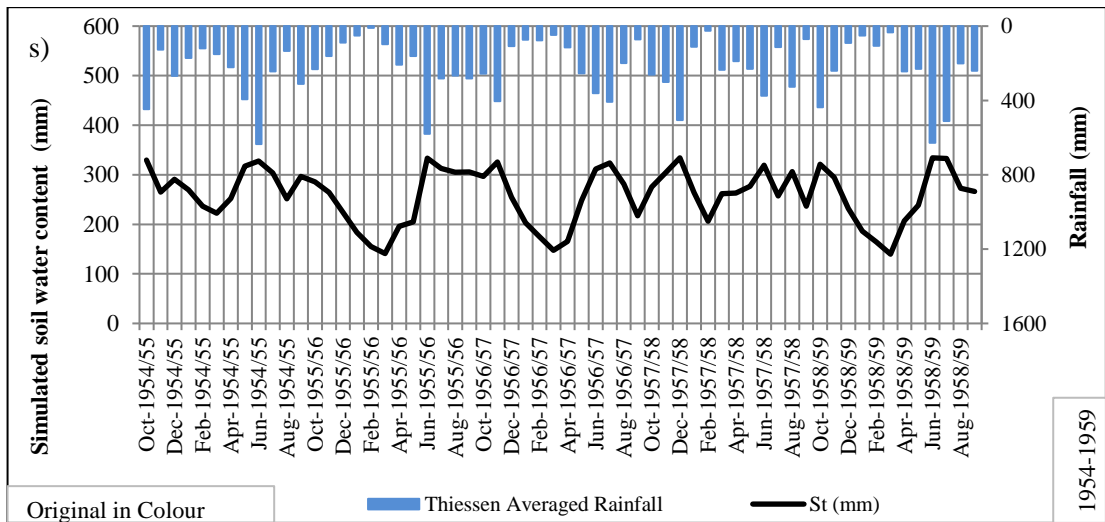
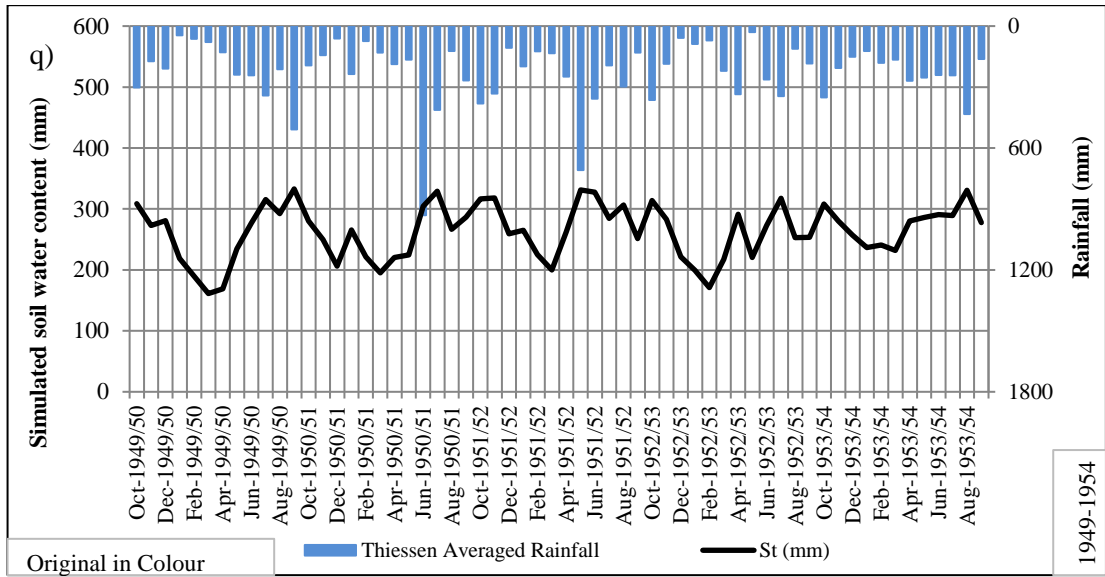


Figure D8: Simulated Soil water content in Calibration period of Mahaweli Ganga (q-t)

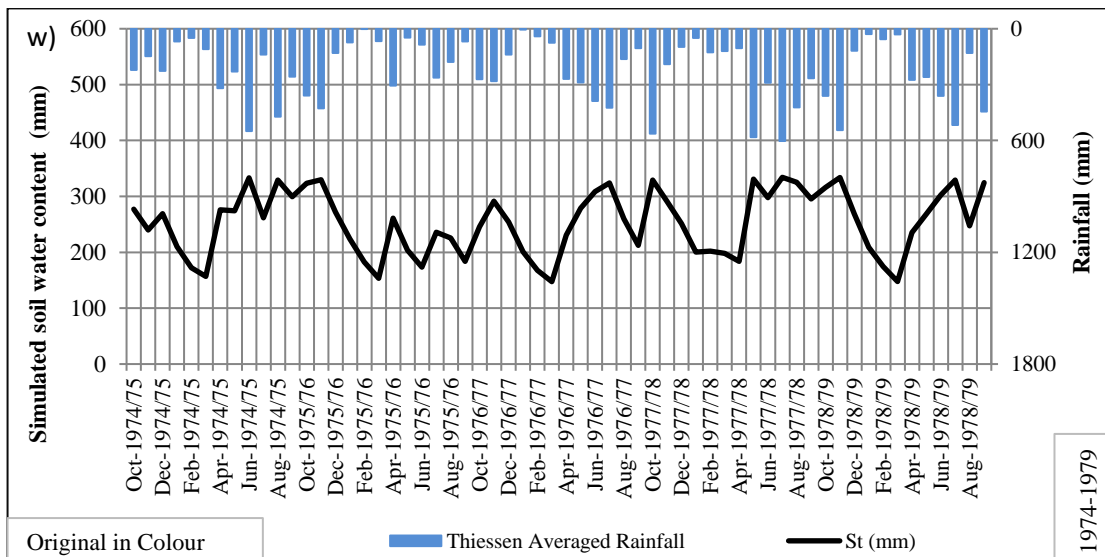
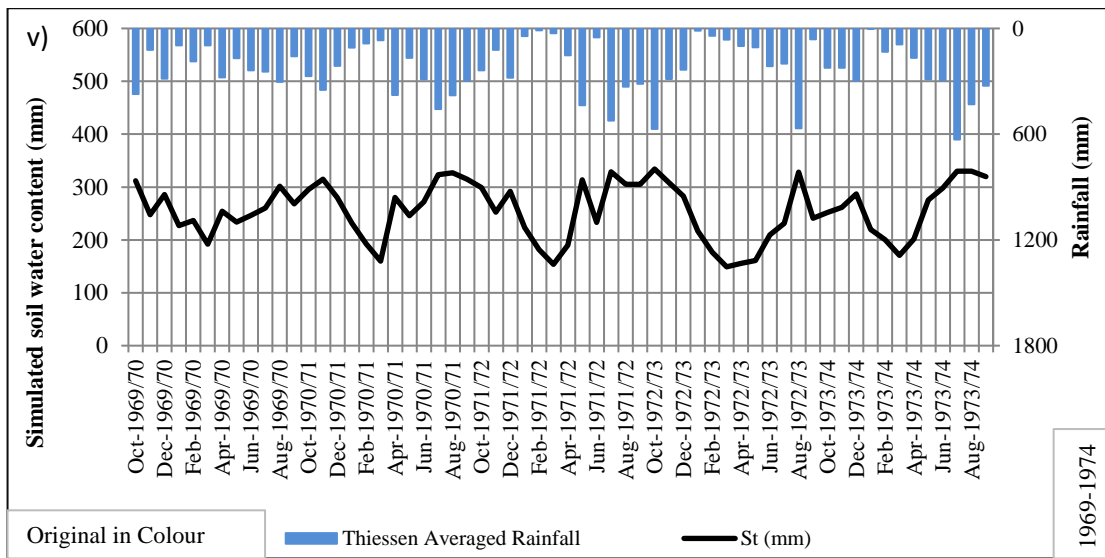
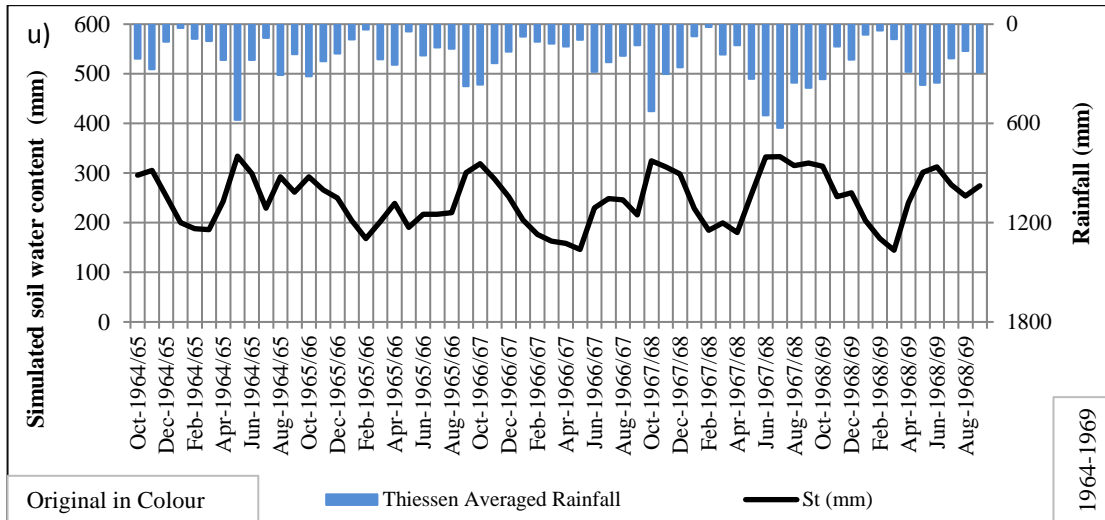


Figure D 9: Simulated Soil water content in verification period of Mahaweli Gang (u-w)