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Rain-Rate Data Base Development and Rain-Rate Climate Analysis

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Abstract

The single-year rain-rate distribution data available within the archives of CCIR Study Group 5 have been compiled into a data base for use in rain-rate climate modeling and for the preparation of predictions of attenuation statistics. The four year set of tip-time sequences provided by J. Goldhirsh for locations near Wallops Island were processed to compile monthly and annual distributions of rain rate and of event durations for intervals above and below preset thresholds. A four-year data set of tropical rain-rate tip-time sequences were acquired from the NASA TRMM program for 30 gauges near Darwin, Australia. They have also been processed for inclusion in the CCIR data base and the expanded data base for monthly observations at the University of Oklahoma.

The empirical rain-rate distributions (edfs) accepted for inclusion in the CCIR data base were used to estimate parameters for several rain-rate distribution models: the lognormal model, the Crane two-component model, and the three parameter model proposed by Moupfuma. The intent of this segment of the study is to obtain a limited set of parameters that can be mapped globally for use in rain attenuation predictions. If the form of the distribution can be established, then perhaps available climatological data can be used to estimate the parameters rather than requiring years of rain-rate observations to set the parameters. The two-component model provided the best fit to the Wallops Island data but the Moupfuma model provided the best fit to the Darwin data.

Rain-Rate Data Base Development and

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1. The data banks

Rain-rate observations from the CCIR data banks, the measurements made by J. Goldhirsh at Wallops Island, and the archives of the TRMM observation program for Darwin, Australia were combined to compile a new rain-rate data base. The format of this data base is displayed in Table 1 for observations from Wallops Island. The categories indicated in the headings for each column were agreed by Study Group 5 at their last set of meetings in Geneva. It is noted that no observers have as yet provided all the data that are requested. An output from the ACTS Propagation Experiment should be complete entries for the data base.

Table 2 displays information stored in the OU data base that are used for rain-rate climate analysis but go beyond the requests of the CCIR. They include the model parameters for several different models employed to represent the empirical distribution function (edfs) and the errors that result from using the models.

Summary plots are available for each gauge site. Figures 1 and 2 display the summary data for Wallops Island Gauge #1 and for the Darwin data from Annaburro. The columns G and C give the root-mean-square difference in the natural logarithms between predictions, for the Global and CCIR rain-rate climate zones. From the figure for Wallops Island, it is evident that the climate zone models fit the observations quite closely and only a small seasonal variation is present. For Annaburro, the climate zone models do not fit very well and a large seasonal variation is present.

The new data bank includes both annual and worst month edfs and monthly data at 0.01%, 0.1% and 1% of a month for displaying seasonal variations. These data can be readily compared with models as illustrated in Figure 3. Two plots are given, one for the annual distribution and the other for the worst month. For the Crane "Global" model and the expected year-to-year and location-to-location variability of observations relative to that model, the annual data fit well within the expected distribution bounds. For the worst month observations, the rain-rate values are larger than expected but still within the expected bounds for a single year of observation (a single sample).

The data from Wallops Island and from Australia were also used to prepare empirical distributions of times above and below selected rain rate thresholds. These data were fit to exponential distributions by month to explore their dependence on year, season, etc. The exponential model was used instead of the lognormal model that is often quoted in the literature because, if the correlation time for the rain process is fixed and the process is assumed stationary, theory predicts the exponential form. Empirically, it also provides a good fit to the observations. As with most statistical problems, insufficient data are available to select one model over the other, but the theoretical argument is compelling. Sample results from monthly exponential distribution fits are displayed in Figures 4 and 5 for Wallops Island Gauge #1. The average duration of intervals with rain rates in excess of 10 mm/h is 6 minutes and the distribution of average durations may be approximated as normal. The average duration of a rain event (above 0.1 mm/h) is 5 hours (300 minutes).

2. Models for observed rain-rate distributions

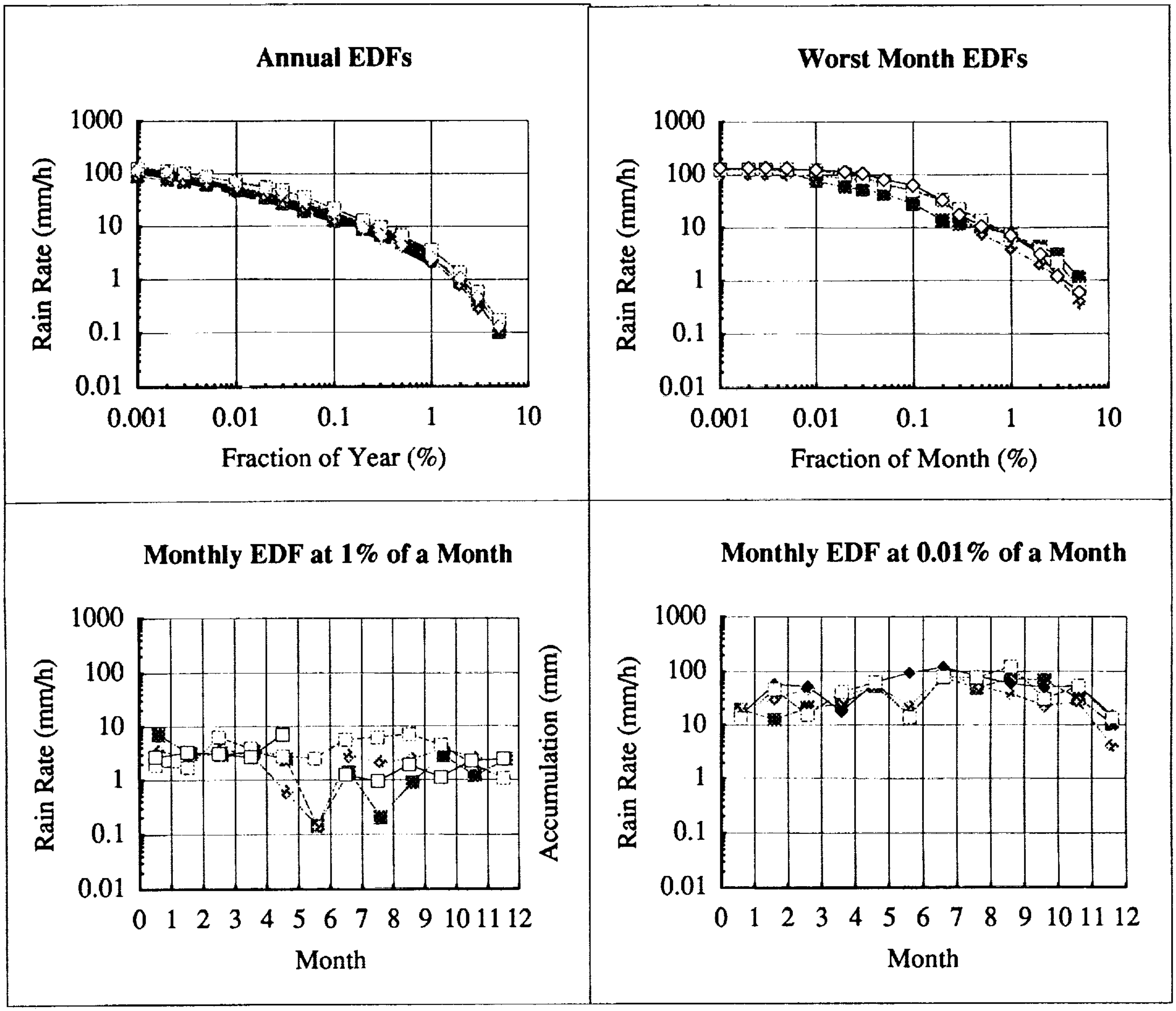
The observed rain-rate distributions are samples from a random process. Figure 3 displays two such samples and model predictions that bound the expected range (5% to 95%) for the observed distributions. The expected distributions are shown to be smooth functions of percent time (or of rain rate). The observed random variables are only constrained to be monotonically increasing with decreasing percentage of time. A model to represent the observed distribution should depend on few parameters to provide a maximum of smoothing (or averaging) to reduce the statistical variations. Three such models were employed to represent the observed distributions, the Crane two-component model (5 parameters), the lognormal model (3 parameters), and the Moupfuma model (3 parameters). The latter is a function that performs well in least squares curve fitting over a partial range of the reported distributions. The two component model is constrained to mimic weather radar observations. It often performs less well than the simpler lognormal model. In this case, more parameters do not automatically provide for a better fit.

The results of the use of these models on the Wallops Island observations, the Darwin observations and the entire CCIR data base are presented in Table 3. For the data from Wallops Island, the two-component model performed best with a root-mean-square fitting error in the natural logarithm of the rain rate of 0.06 (-> 6.2%). For the data from Australia the Moupfuma model performed the best with an error of 0.17 (-> 18.5%). For all the other data in the CCIR data banks the lognormal model did the best (-> 17.5%) followed by the two-component model then the Moupfuma model.

Currently, the CCIR is intent on selecting a model to be used to parameterize rain-rate observations. Study Group 5 is pushing the use of the Moupfuma model. It works better than the other models for data from the tropics but works less well at mid-latitudes. It has the advantage over the two-component model of using only three parameters. However, the Moupfuma model is strictly a curve fitting procedure and does not provide a probability distribution. The other two models are constrained to provide probability distributions.

Although the physically based two-component model performs well at mid-latitudes, an improved model is needed for tropical regions. Work at OU continues to find a model that performs well in both tropical and mid-latitude regions, produces a probability distribution, and has integral constraints such that the parameters of the model can be readily estimated from climatological data. For the lognormal and two-component model, one of the parameters can be set using the total annual accumulation of rain fall. It should be possible to set a second parameter based on the statistics of the monthly accumulations. Finally, extreme value information may be useful in setting a third parameter. The intent is not to find a statistical relationship between the parameters and climatological data but to find integral constraints that directly determine the parameters. The parameters can then be mapped based on the available mappings of climatological data.

Wallops Is_VA-1



	Year (%	0.001	0.002	0.003	0.005	0.01	0.02	0.03	0.05	0.1	0.2	0.3	0.5	1	2	3	5	G	C
RWI0101	87_01	86	76	70	60	48	34	26	19	13	8.9	7.1	5.0	2.7	0.9	0.4	0.1	0.22	0.22
RWI0102	88_01	94	87	80	66	54	39	32	24	15	8.7	6.3	4.2	2.3	0.8	0.3		0.21	0.21
RWI0103	89_01	126	111	101	86	69	56	47	36	22	12.8	9.6	6.7	3.6	1.4	0.6	0.2	0.27	0.27
RWI0104	90_01	120	109	102	87	68	54	43	31	18	9.6	6.8	4.5	2.5	1.1	0.5	0.1	0.23	0.23

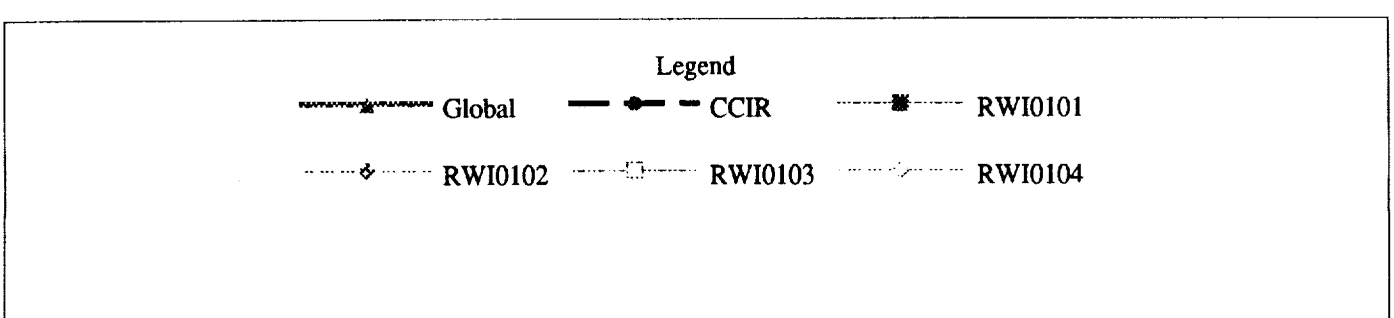
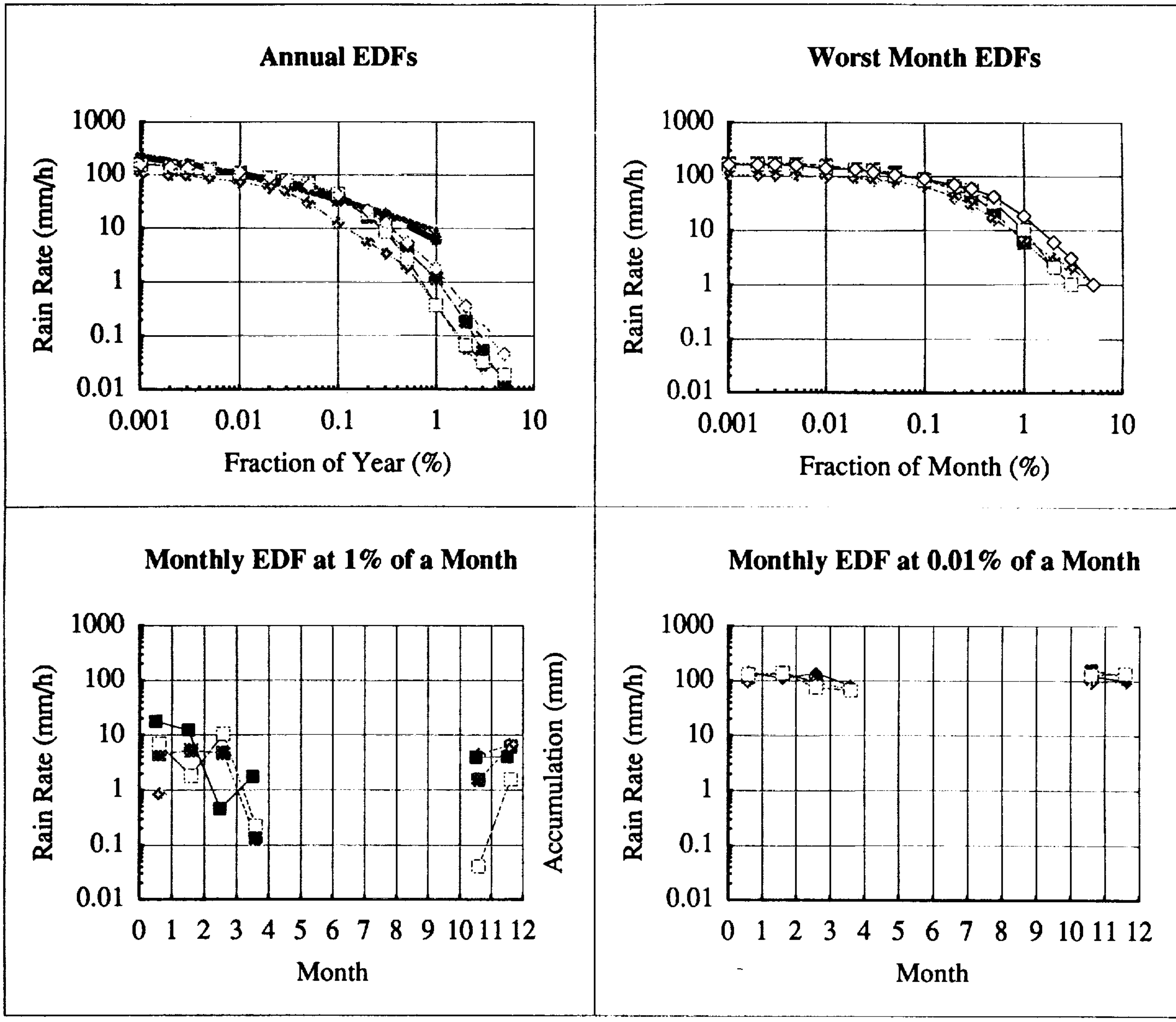


Figure 1

Annaburroo_AU



	Year	0.001	0.002	0.003	0.005	0.01	0.02	0.03	0.05	0.1	0.2	0.3	0.5	1	2	3	5	G	C
XAU0101	87_11	160	145	139	129	108	89	79	63	37	16	9	4	1.2	0.2	0.1	0.0	0.87	0.71
XAU0102	88_11	103	96	93	85	71	57	46	29	13	6	3	2	0.4	0.1	0.0		0.98	0.97
XAU0103	89_11	152	143	135	125	103	88	79	68	44	19	9	3	0.4	0.1	0.0	0.0	0.39	0.34
XAU0104	90_11	153	141	136	128	112	89	76	62	41	21	13	5	1.8	0.4	0.1	0.0	0.65	0.48

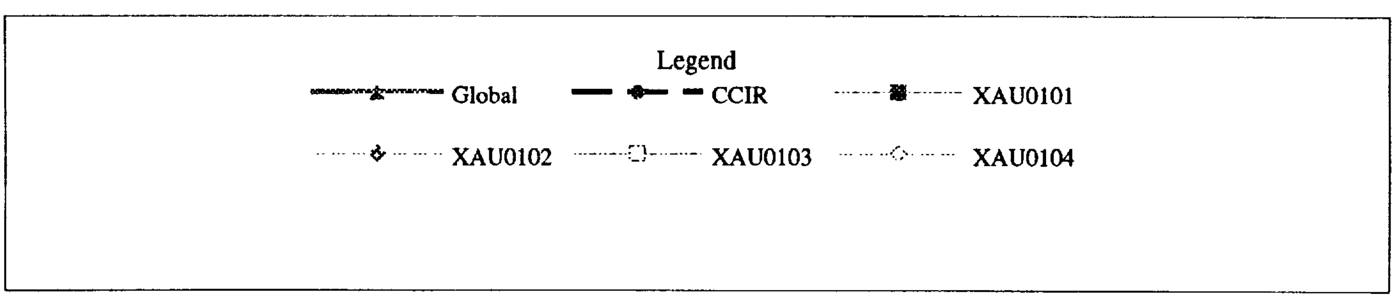
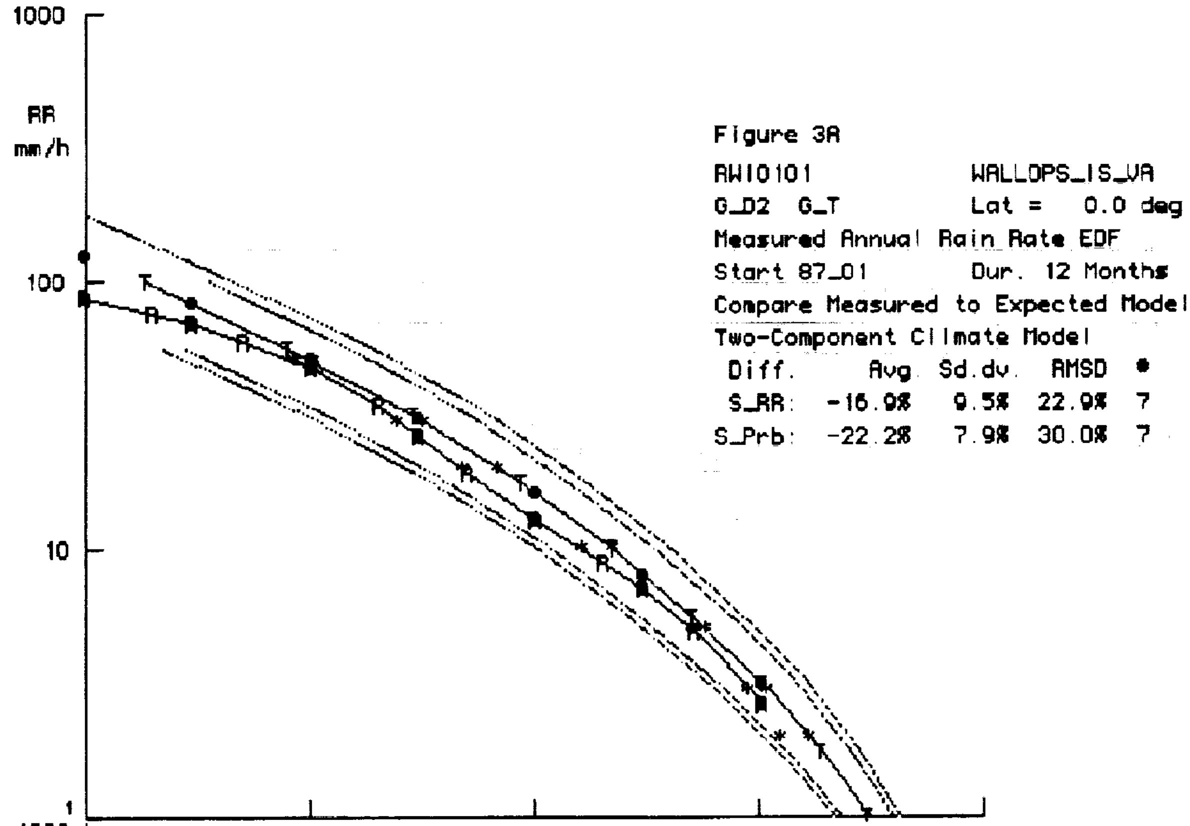
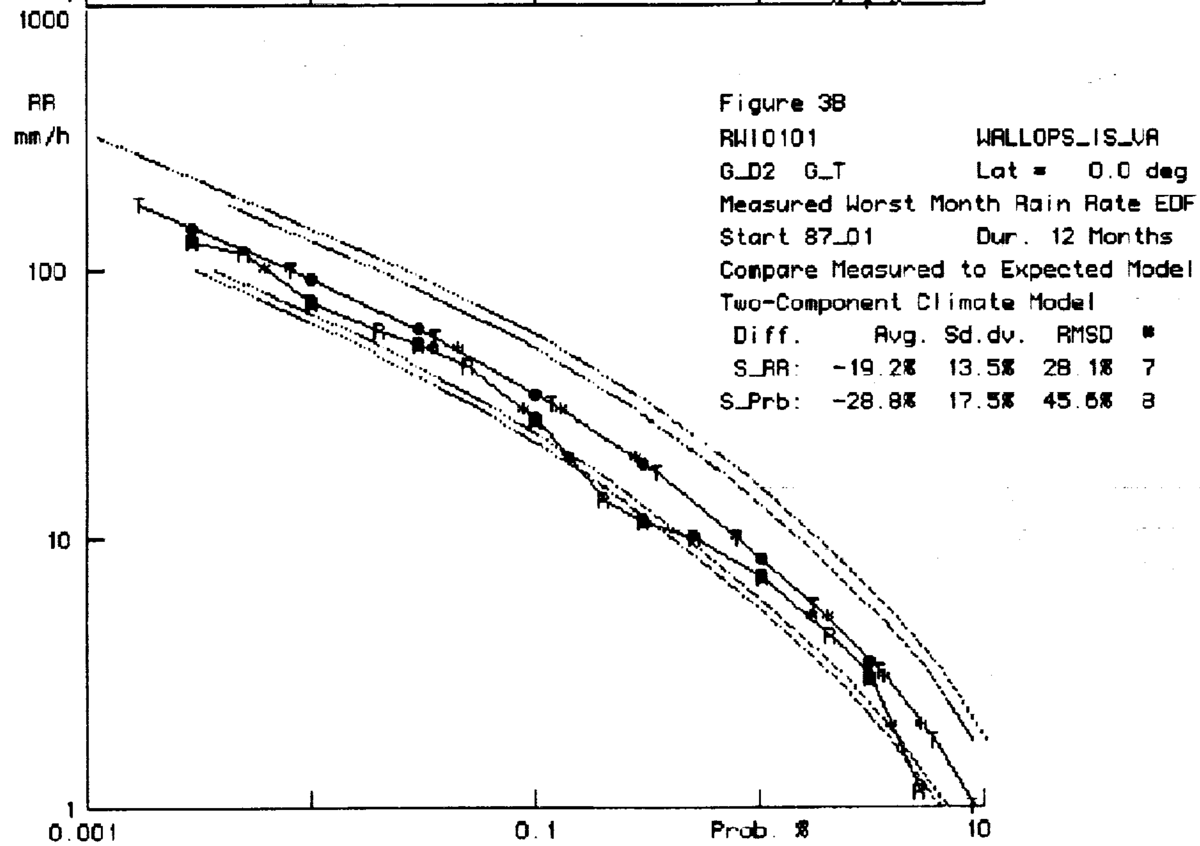


Figure 2


1000
RR
mm/h
100
10
1
Figure 3A
RWI0101 WALLOPS_IS_VA
G_D2 G_T Lat = 0.0 deg
Measured Annual Rain Rate EDF
Start 87_01 Dur. 12 Months
Compare Measured to Expected Model
Two-Component Climate Model
Diff. Avg. Sd.dv. RMSD #
S_RR: -16.9% 9.5% 22.9% 7
S_Prb: -22.2% 7.9% 30.0% 7


1000
RR
mm/h
100
10
1
0.001
0.1
Prob. %
10
Figure 3B
RWI0101 WALLOPS_IS_VA
G_D2 G_T Lat = 0.0 deg
Measured Worst Month Rain Rate EDF
Start 87_01 Dur. 12 Months
Compare Measured to Expected Model
Two-Component Climate Model
Diff. Avg. Sd.dv. RMSD #
S_RR: -19.2% 13.5% 28.1% 7
S_Prb: -28.8% 17.5% 45.6% 8

WIGauge1_60_Avg_Dur_10.0

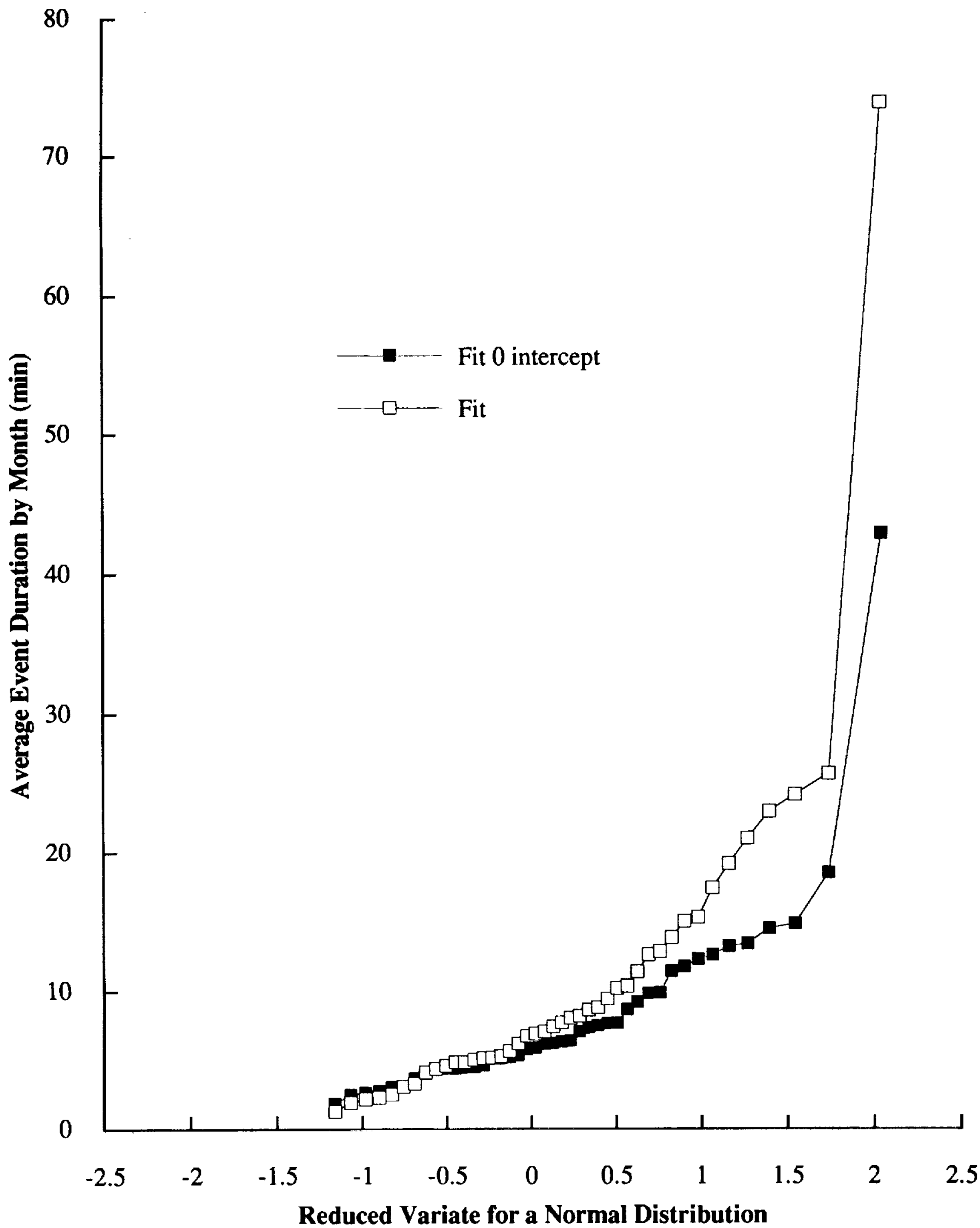


Figure 4

WIGauge1_60_Avg_Dur_0.1

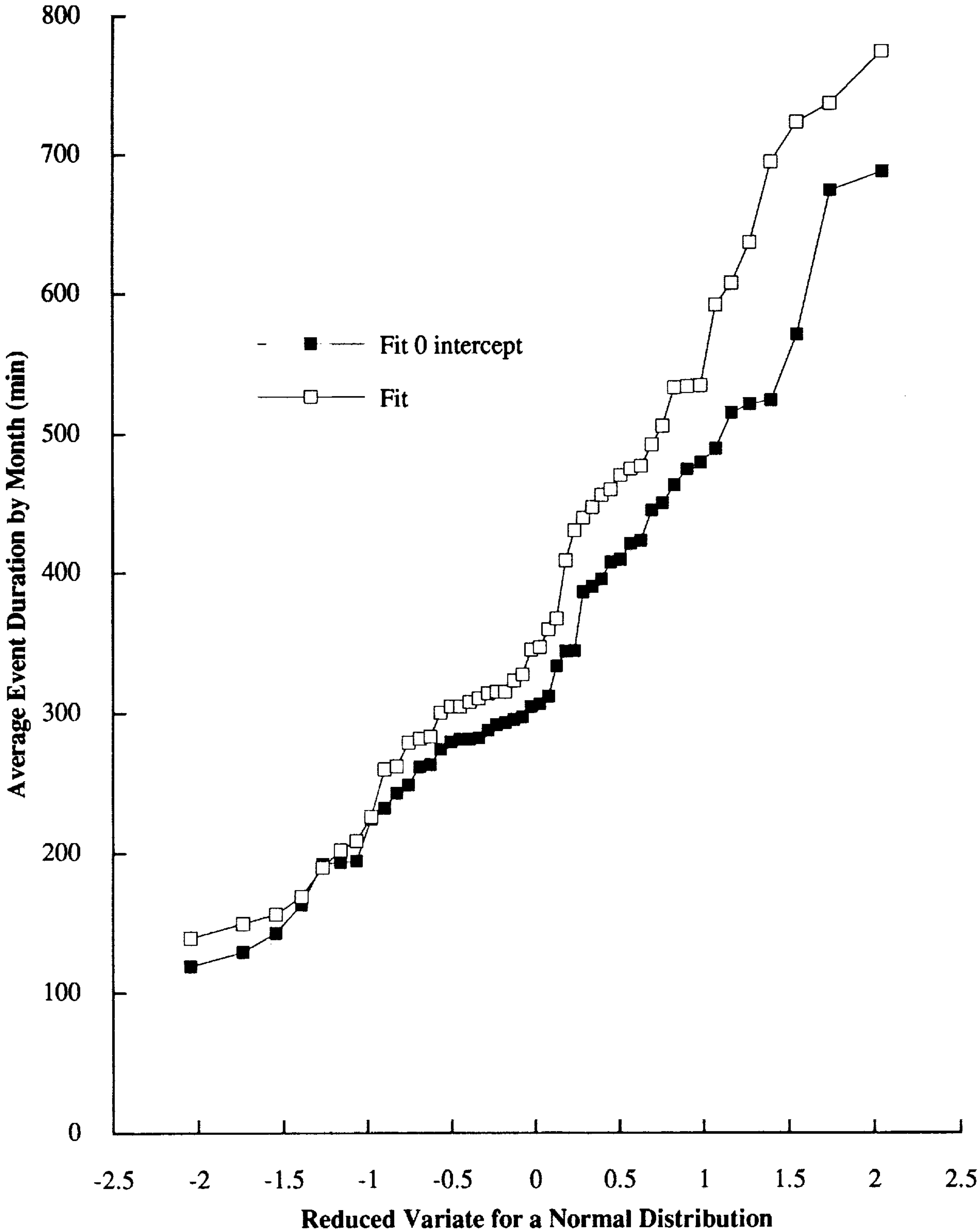


Figure 5

Table 1 WI RR dBase.2

Experiment Number	RG Site Name	RG Country	RG Latitude [deg] N	RG Longitude [deg] E	RG Altitude amsl [m]	CCIR Rain Zone	Rain Gauge Type	RG Resolution [mm/h]	RG Integration Time [s]	RG Accumulation [mm/tip]	RG Aperture [cm^2]	Start Date	End Date	Duration [days]	Fraction of Year R > 0.5 mm/h [%]
RWI0101	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0102	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0103	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0104	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0201	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0202	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0203	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0204	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0301	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0302	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0303	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0304	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0402	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	365	
RWI0403	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	366	
RWI0404	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0501	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0502	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0503	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0504	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0601	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0602	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0701	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0702	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0703	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0704	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0801	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0802	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0803	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0804	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI0901	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI0902	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI0903	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI0904	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	
RWI1001	WALLOPS_IS_VA	US	0	0	0	K						87_01	87_12	365	
RWI1002	WALLOPS_IS_VA	US	0	0	0	K						88_01	88_12	366	
RWI1003	WALLOPS_IS_VA	US	0	0	0	K						89_01	89_12	365	
RWI1004	WALLOPS_IS_VA	US	0	0	0	K						90_01	90_12	365	

Table 1 WI RR dBase.2

Experiment Number	% year 0.001 RR >	% year 0.002 RR >	% year 0.003 RR >	% year 0.005 RR >	% year 0.01 RR >	% year 0.02 RR >	% year 0.03 RR >	% year 0.05 RR >	% year 0.1 RR >	% year 0.2 RR >	% year 0.3 RR >	% year 0.5 RR >	% year 1 RR >	% year 2 RR >	% year 3 RR >	% year 5 RR >
RWI0101	86.23	75.55	70.06	59.67	47.68	34.02	26.47	19.27	12.75	8.86	7.07	4.97	2.66	0.9	0.37	0.1
RWI0102	93.99	87.45	79.78	66.24	53.82	39.18	32.21	23.59	14.56	8.73	6.3	4.2	2.29	0.78	0.29	
RWI0103	125.65	110.66	101.23	86.07	69.26	55.94	46.98	35.81	21.73	12.83	9.57	6.65	3.63	1.35	0.58	0.17
RWI0104	120.49	108.97	102.28	86.6	68	53.5	43.47	30.93	18.27	9.57	6.81	4.52	2.52	1.07	0.47	0.13
RWI0201	83.63	73.66	67.6	59.34	46.42	30.15	22.5	15.62	9.76	6.71	5.37	3.93	2.08	0.65	0.24	
RWI0202	77.02	72	69.38	62.86	49.4	35.31	28.71	20.74	12.91	7.49	5.58	3.79	1.89	0.66	0.21	
RWI0203	99.57	88.12	77.92	64.84	52.04	40.49	34.77	25.84	17.68	10.14	7.52	5.22	2.86	1.23	0.57	0.16
RWI0204	115.32	90.72	82.3	72.86	62.52	47.36	36.21	25.16	14.91	8.17	6.06	4.22	2.37	1.01	0.48	0.13
RWI0301	110.97	92.95	84.96	76.02	62.49	41.85	29.53	18.36	10.67	7.34	5.86	4.24	2.18	0.71	0.3	
RWI0302	96.81	87.45	77.83	63.19	49.54	38.66	31.71	22.94	13	8.15	6.3	4.3	2.28	0.83	0.34	
RWI0303	132.12	115.04	107.76	100.06	79.36	57.42	45.73	33.46	19.47	11.03	8.44	6.05	3.15	1.27	0.48	0.12
RWI0304	120.49	100.44	78.7	67.84	54.16	38.68	31.97	22.48	13.08	7.55	5.55	3.91	2.1	0.94	0.44	
RWI0402	119.8	104.36	89.95	77.2	63.23	46.1	35.62	23.4	13.61	8.09	6.1	4.13	2.08	0.68	0.28	
RWI0403	127.01	117	106.03	86.16	66.37	50.37	44.27	32.62	21.15	12.03	8.34	5.68	2.97	0.87	0.33	0.1
RWI0404	102.91	94.56	87.33	72.44	53.37	35.9	27.73	19.95	12.11	7.34	5.84	4.09	2.16	0.83	0.32	
RWI0501	108.81	82.74	76.65	69.29	53.88	36.74	27.71	18.9	12.18	8.56	6.64	4.57	2.36	0.76	0.33	
RWI0502	84.52	75.51	71.49	64.91	56.93	43.73	33.53	21.85	12.29	7.89	6.11	4.24	2.34	0.79	0.34	
RWI0503	163.46	134.33	110.45	84.94	65.77	49.86	41.6	32.77	18.59	10.63	7.81	4.9	2.57	1.09	0.57	0.16
RWI0504	118.55	91.39	81.06	67.16	45.16	33.01	25.01	18.28	11.25	7.32	5.73	4.01	2.07	0.81	0.33	
RWI0601	109.21	94.77	82.3	72.86	58	42.16	34.66	24.6	14.25	9.33	6.85	4.5	2.09	0.67	0.28	
RWI0602	50.68	44.1	41.34	35.98	27.23	20.19	16.65	12.85	9.3	6.41	5.15	3.74	1.99	0.59	0.22	
RWI0701	114.48	94.97	90.12	75.62	58.13	33.03	24.98	18.06	12.09	8.13	6.29	4.21	2.17	0.7	0.28	
RWI0702	76.92	70.68	62.02	52.47	40.26	29.59	23.59	18.08	12.06	7.67	5.94	4.23	2.21	0.71	0.3	
RWI0703	136.3	121.36	116.49	100.89	85.24	67.7	55.54	42.42	27.65	14.63	9.79	6.51	3.43	1.44	0.7	0.19
RWI0704	93.21	79.6	64.54	58.34	46.33	35.82	29.95	23.34	14.14	7.33	5.24	3.82	2.24	0.93	0.4	
RWI0801	108.81	98.27	82.58	62.52	48.77	33.65	28.28	20.49	12.51	8.1	6.18	4.29	2.19	0.78	0.25	
RWI0802	81.53	74.42	68.51	64.11	50.35	35.04	27.43	18.45	11.92	7.61	5.7	3.85	1.96	0.56	0.23	
RWI0803	134.44	127.49	109.01	101.35	81.21	68.9	59.73	46.42	27.21	14.39	9.5	5.95	2.82	1.01	0.43	
RWI0804	77.04	68.17	62.37	53.98	44.11	34.46	28.7	20.92	12.07	7.24	5.4	3.71	2.26	1.01	0.49	0.13
RWI0901	109.29	96.62	85.6	71.34	57.5	40.45	31.24	21.93	12.86	8.25	6.33	4.41	2.33	0.8	0.28	
RWI0902	72.58	66.25	61.51	52.47	41.73	30.32	24.26	17.56	11.13	7.21	5.73	4.15	2.23	0.74	0.31	
RWI0903	98.79	88.64	82.3	70.65	61.87	49.62	41.8	31.67	17.34	9.88	7.19	4.76	2.43	1.05	0.47	0.13
RWI0904	87.95	79.77	73.52	62.84	50.17	34.77	27.55	19.06	10.36	6.3	4.67	3.22	1.71	0.58	0.2	
RWI1001	74.45	62.94	58.13	51.11	38.87	28.11	21.95	15.57	10.62	7.01	5.3	3.73	1.9	0.58	0.2	
RWI1002	74.42	65.54	59.55	50.68	37.03	27.81	22.4	16.95	10.77	7.19	5.44	3.7	1.94	0.65	0.23	
RWI1003	108.01	94.56	87.33	79.05	66.67	49.51	38.67	29.81	18.52	11.15	8.21	5.57	2.78	0.95	0.39	
RWI1004	91.39	79.53	73.97	64.66	48.09	36.33	29.39	20.55	12.87	7.84	5.86	3.98	2.33	1.02	0.42	

Table 1 WI RR dBase.2

Experiment Number	% wM 0.001 RR >	% wM 0.002 RR >	% wM 0.003 RR >	% wM 0.005 RR >	% wM 0.01 RR >	% wM 0.02 RR >	% wM 0.03 RR >	% wM 0.05 RR >	% wM 0.1 RR >	% wM 0.2 RR >	% wM 0.3 RR >	% wM 0.5 RR >	% wM 1 RR >	% wM 2 RR >	% wM 3 RR >	% wM 5 RR >
RWI0101	127.5	127.5	127.5	114.5	75.24	59.07	52.64	43.68	27.53	13.72	11.43	10.04	7.16	4.32	2.98	1.13
RWI0102	101.93	101.93	101.93	101.93	94.5	85.25	79.09	63.72	50.19	32.23	17.85	7.49	3.92	1.96	1.16	0.38
RWI0103	129.47	129.47	129.47	129.47	119.8	101.5	87.91	67.12	49.24	32.9	22.6	13.38	7.08	3.72	2.21	0.69
RWI0104	136.6	136.6	136.6	132.96	122.5	114	104.9	80.6	62.4	32.93	17.56	10.43	7.11	3.14	1.21	0.6
RWI0201	101.96	101.96	101.96	99.24	85.62	75.89	68.1	48.43	25.17	9.13	8.12	6.73	4.93	3.06	2.21	1.42
RWI0202	89.95	89.95	89.95	86.37	82.65	70.21	64.82	60.96	42.67	25.17	19.06	9.77	3.77	1.63	0.87	0.25
RWI0203	102.14	102.14	102.14	99.41	84.52	64.32	56.74	49.17	38.74	23.17	19.37	10.85	5.24	2.96	1.82	0.71
RWI0204	151.8	151.8	151.8	145.43	134.6	89.58	74.29	64.41	40.08	24.6	17.45	10.56	6.19	2.86	1.38	0.62
RWI0301	129.23	129.23	129.23	129.23	111.6	88.74	73.22	63.87	39.88	21.67	12.32	6.86	5.53	3.47	2.36	1.3
RWI0302	108.06	108.06	108.06	105.18	94.95	82.21	64.49	49.24	34.19	23.68	16.12	9.05	3.16	1.79	0.99	0.4
RWI0303	143.23	143.23	143.23	137.22	127	110	105.8	91.58	61.6	34.21	19.89	12.53	8.43	4.75	2.2	0.65
RWI0304	170.52	170.52	170.52	144.49	106.7	66.98	60.62	44.59	30.85	15.5	9.62	6.06	3.46	1.85	1.37	0.64
RWI0402	135.13	135.13	135.13	128.62	108	93.9	85.39	72.75	52.93	27.9	16.64	8.53	3.45	1.72	0.85	0.35
RWI0403	144.53	144.53	144.53	140.67	128.6	104	78.88	61.81	47.09	30.39	22.92	11.7	6.88	3.85	1.1	0.39
RWI0404	102.6	102.6	102.6	102.6	96.59	80.43	66.13	48.31	25.45	15.37	11.43	8.51	5.81	2.79	1.24	0.56
RWI0501	136.97	136.97	136.97	136.97	85.25	73.14	65.73	50.62	24.71	11.91	10.62	9.54	7	3.8	2.49	1.19
RWI0502	101.04	101.04	101.04	96.17	84.12	76.22	71.73	62.85	49.94	27.47	14.71	8.2	3.88	2.05	1.07	0.4
RWI0503	173.15	173.15	173.15	173.15	162.3	116.5	82.9	63.12	44.2	26.29	19.02	12.99	6.79	2.59	1.61	0.79
RWI0504	143.23	143.23	143.23	122.15	91.14	80.43	68.48	59.25	30.85	17.21	12.55	9.29	6.37	3.12	1.35	0.4
RWI0601	120.3	120.3	120.3	114.5	100.6	82.16	70.99	48.16	29.99	15.61	12.1	10.37	7.33	4.64	3.34	1.56
RWI0602	71.48	71.48	71.48	68.17	50.51	28.93	25.09	21.74	13.89	9.57	8.5	5.8	3.69	1.94	0.86	0.34
RWI0701	151.8	151.8	151.8	128.62	113	87.32	72.45	56.81	23.85	15.28	10.18	8.72	6.39	3.92	2.75	1.45
RWI0702	80.52	80.52	80.52	72.54	69.42	54.84	47.51	36.01	23.89	13.64	8.75	6.41	3.81	1.66	0.86	0.38
RWI0703	162.35	162.35	162.35	158.02	122.3	116.4	103.1	93.86	76.92	55.84	40.5	26.76	10.07	4.08	1.99	1
RWI0704	96.63	96.63	96.63	96.63	85.25	63.74	55.21	46.44	37.9	28.47	22.66	15.39	6.79	2.35	1.48	0.68
RWI0801	160.89	160.89	160.89	121.36	101.9	82.84	58.87	49.24	29.01	13.49	8.94	7.56	5.57	3.59	2.57	1.35
RWI0802	80.94	80.94	80.94	78.78	68.29	61.6	55.21	44.96	29.01	16.51	10.26	5.76	3.32	1.47	0.54	0.19
RWI0803	143.23	143.23	143.23	137.22	124.2	105.6	101.7	90.66	71.9	57.79	46.37	30.09	10.28	3.86	1.62	0.39
RWI0804	101.04	101.04	101.04	75.21	73.35	58.12	52.41	46.56	37.9	27.13	21.27	13.51	6.9	2.86	1.47	0.79
RWI0901	135.13	135.13	135.13	109.3	105.4	87.8	68.97	49.91	37.06	20.5	11.74	7.72	5.61	3.79	2.83	1.61
RWI0902	143.23	143.23	143.23	136.32	84.52	58.12	44.82	31.13	18.72	11.48	7.78	6.32	4.2	1.93	1.01	0.26
RWI0903	96.2	96.2	96.2	93.63	87.6	78.87	70.09	64.32	55.31	43.44	35.31	22.8	7.04	2.46	1.67	0.62
RWI0904	135.51	135.51	135.51	86.18	81.42	77.47	65.73	56.38	42.24	26.07	17.5	9.77	4.91	1.95	1.21	0.68
RWI1001	101.32	101.32	101.32	76.58	64.32	55.14	40.93	30.43	19.28	11.21	9.92	8.16	5.51	3.58	2.59	1.53
RWI1002	85.1	85.1	85.1	72.38	67.85	51.74	42.29	35.76	25.82	18.32	12.59	6.05	3.33	1.61	0.94	0.36
RWI1003	160.89	160.89	160.89	128.62	93.73	71.91	67.85	61.8	45.22	33.48	26.87	17.12	9	3.6	1.47	0.56
RWI1004	128.66	128.66	128.66	125.23	89.58	74.41	63.2	51.04	37.6	20.39	15.79	11.47	6.62	2.87	1.59	0.69

Table 1 WI RR dBase.2

Experiment Number	Jan R 0.01 mm/h	Feb R 0.01 mm/h	Mar R 0.01 mm/h	Apr R 0.01 mm/h	May R 0.01 mm/h	Jun R 0.01 mm/h	Jul R 0.01 mm/h	Aug R 0.01 mm/h	Sep R 0.01 mm/h	Oct R 0.01 mm/h	Nov R 0.01 mm/h	Dec R 0.01 mm/h
RWI0101	19.75	12.75	21.21	24.43	53.08	14.90	75.24	49.26	73.73	66.98	31.72	10.25
RWI0102	19.75	31.17	47.87	31.05	56.99	21.91	94.50	53.77	38.11	23.13	26.65	4.05
RWI0103	15.40	57.77	52.21	17.74	63.20	93.73	119.81	81.13	58.86	50.08	53.54	14.77
RWI0104	13.32	45.78	15.65	41.06	63.20	14.06	78.43	75.24	122.49	30.93	52.40	13.15
RWI0201	15.58	15.18	18.64	32.01	46.47	59.51	85.62	5.7	56.74	23.13	20.67	10.02
RWI0202	6.97	50.96	40.2	31.72	24.93	14.06	82.65	42.07	29.93	50.08	29.93	6.63
RWI0203	10.56	24.15	84.52	40.52	33.34	70.85	56.99	21.21	35.96	34.64	71.6	2.05
RWI0204	17.81	18.07	15.86	39.18	134.6	51.21	64.02	79.85	23.72	20.94	32.91	23.52
RWI0301	19.48	13.51	26.88	17.9	29.68	111.6	5.11	80.78	83.5	29.19	20.1	11.24
RWI0302	18.64	44.62	49.39	25.14	23.13	63.74	94.95	56.26	25.14	23.52	40.03	3.43
RWI0303	16.59	43.2	51.06	21.37	26.42	101.5	127	64.02	50.51	40.2	80.43	9.28
RWI0304	17.81	26.29	18.33	85.25	106.7	33.93	72.38	55.99	23.72	44.59	41.98	13.87
RWI0402	13.71	36.13	67.85	22.58	71.91	58.86	108	60.4	29.93	46.47	39.18	13.15
RWI0403	13.94	30.47	60.4	16.39	75.24	108.9	128.6	63.2	19.92	35.33	44.97	2.9
RWI0404	18.64	16.10	10.37	56.74	96.59	66.12	63.20	78.43	50.51	26.88	38.89	9.96
RWI0501	28	13.52	24.93	19.71	35.79	85.25	80.78	56.26	58.86	25.05	37.58	12.2
RWI0502	13.15	37.48	60.66	24.43	47.25	31.72	84.12	39.69	26.08	33.34	66.12	3.73
RWI0503	17.59	45.78	63.2	16.38	69.82	120.8	162.3	48.07	66.12	32.79	29.93	8.26
RWI0504	14.12	17.04	13.09	42.43	91.14	40.39	53.08	35.33	80.43	13.15	37.77	9.12
RWI0601	37.27	3.16	38.1	29.93	48.18	76.81	39.5	100.6	57.26	69.82	60.14	17.59
RWI0602	14.96	25.36	16.59	42.43	14.53	5.12	33.77	30.94	50.51	30.06	18.8	8.26
RWI0701	18.96	6.14	25.98	26.37	31.86	80.43	113	89.58	22.65	51.75	13.26	25.25
RWI0702	17.78	40.59	47.25	22.38	44.59	42.43	31.45	69.42	47.66	35.33	31.72	4.34
RWI0703	13.94	55.78	79.75	23.22	70.99	114	122.3	83.13	46.31	33.34	85.25	28
RWI0704	24.93	37.26	28	50.51	70.99	85.25	31.86	27.3	8.83	46.47	19.92	18.96
RWI0801	16.59	19.14	33.77	31.05	29.68	99.34	101.9	26.42	52.02	49.85	31.05	25.25
RWI0802	16.94	26.88	34.75	26.65	64.02	63.74	66.67	68.29	52.4	35.33	28.5	6.17
RWI0803	12.41	36.32	84.52	21.12	63.2	55.54	124.2	119.8	66.12	47.25	56.74	13.15
RWI0804	21.82	37.26	24.93	44.01	73.35	8.16	50.08	45.16	40.03	44.59	18.4	26.42
RWI0901	16.81	28.75	25.25	29.93	44.59	70.85	83.13	23.82	105.4	26.42	37.77	23.52
RWI0902	14.18	24.09	29.68	14.06	35.95	44.01	49.85	84.52	50.51	42.61	39.18	17.59
RWI0903	13.63	35.03	60.4	18.8	69.82	51.13	87.6	39.69	66.12	15.86	54.02	18.64
RWI0904	28.36	32.3	17.43	14.06	81.42	47.66	46.47	39.04	29.93	63.2	18.4	15.4
RWI1001	20.84	15.32	23.82	14.9	43.85	60.14	26.42	21.82	64.32	57.36	25.37	27.54
RWI1002	17.3	27.75	23.52	12.51	33.34	11.14	67.85	54	35.96	26.76	23.22	5.19
RWI1003	9.46	34.78	80.78	23.72	50.08	93.73	76.55	79.75	79.59	31.45	42.43	35.33
RWI1004	25.98	27.13	20.59	25.37	89.58	3.89	75.24	39.5	16.89	15.86	16.89	42.07

Table 1 WI RR dBase.2

Experiment Number	Jan R 0.1 mm/h	Feb R 0.1 mm/h	Mar R 0.1 mm/h	Apr R 0.1 mm/h	May R 0.1 mm/h	Jun R 0.1 mm/h	Jul R 0.1 mm/h	Aug R 0.1 mm/h	Sep R 0.1 mm/h	Oct R 0.1 mm/h	Nov R 0.1 mm/h	Dec R 0.1 mm/h
RWI0101	13.70	8.53	10.48	11.66	15.95	2.02	21.81	7.87	19.67	27.53	14.72	6.42
RWI0102	12.61	12.50	19.31	6.58	15.49	1.63	50.19	21.27	13.01	13.67	7.47	2.70
RWI0103	5.64	6.82	21.72	9.28	15.61	38.42	49.24	31.73	27.10	25.28	13.88	4.27
RWI0104	7.06	11.49	5.76	19.50	24.57	6.15	22.99	20.75	62.40	9.45	34.22	6.98
RWI0201	10.81	7.66	7.71	12.23	10.8	15.17	25.17	3.19	17.31	9.92	7.05	6.08
RWI0202	3.34	15.24	15.49	11.04	6.96	2.28	42.67	20.07	10.35	10.43	10.38	2.92
RWI0203	5.84	7.17	19.95	16.23	6.11	38.74	31.36	10.39	20.18	14.83	23.36	1.4
RWI0204	7.4	8.59	6.5	12.29	39.57	10.66	27.76	40.08	9.22	5.37	15.55	7.53
RWI0301	12.3	8.92	7.92	9.47	9.3	28.48	1.71	23.07	39.88	9.67	8.67	7.02
RWI0302	8.96	12.1	18.28	8.99	8.83	19.47	34.19	20.88	8.81	12.09	9.8	2.68
RWI0303	6.47	6.41	24.64	9.92	8.7	38.31	61.6	32.47	14	19.23	18.37	2.02
RWI0304	8.92	9.51	7.67	16.21	23.43	5.33	30.85	20.47	5.42	8.94	23.18	8.18
RWI0402	7.58	11.4	20.39	10.26	11.95	7.92	52.93	9.73	8.2	15.78	9.41	6.68
RWI0403	5.64	5.79	22.42	11.1	9.24	47.09	39.85	20.47	9.62	11.51	11.2	2.33
RWI0404	8.17	9.52	6.27	16.67	25.45	7.43	10.78	13.38	6.15	6.21	24.13	6.49
RWI0501	13.5	9.17	10.17	8.85	12.52	24.1	24.71	12.13	14.28	13.74	11.35	7.04
RWI0502	7.31	13.38	23.73	10.62	8.23	2.2	49.94	13.44	9.53	11.07	12.25	2.82
RWI0503	6.95	6.17	19.31	10.3	6.88	40.76	44.2	15.14	34.69	14.06	13.37	3.5
RWI0504	7.64	6.47	7.63	20.09	30.85	6.28	10.02	10.55	6.79	4.58	21.13	5.85
RWI0601	16.42	2.2	14.2	12.95	14.52	29.99	8.14	17.87	8.4	26.97	13.74	7.9
RWI0602	10.91	6.75	6.31	10.82	7.74	0.89	13.89	12.82	7.37	13.44	9.3	2.82
RWI0701	13.01	2.47	7.59	14.02	11.75	23.85	22.55	5.39	10.29	18.57	7.17	8.58
RWI0702	11.95	9.77	10.48	8.23	18.19	7.39	8.83	23.89	11	16.02	12.29	2.87
RWI0703	5.57	9.3	24.32	11.82	17.19	18.73	76.92	47.65	21.22	12.69	8.46	3.39
RWI0704	9.36	11.99	7.21	14.71	37.9	20.56	7.76	9.59	2.77	9.73	8.88	6.78
RWI0801	11.85	8.09	8.66	14.31	12.81	21.29	29.01	4.15	14.93	22.41	9.32	8.73
RWI0802	10.51	7.97	9.8	9.6	11.11	6.69	10.22	29.01	10.97	16.69	13.43	2.99
RWI0803	5.72	9.12	20.43	9.43	16.31	11.32	71.9	61.47	20.74	15.48	10.6	2.2
RWI0804	8.86	11.31	7.33	12.49	37.9	2.31	14.64	7.64	2.59	11.49	7.9	7.3
RWI0901	12.57	9.48	7.71	11.07	11.28	37.06	18.72	4.69	29.82	13.58	10.68	9.21
RWI0902	8.38	8.95	10.15	8.1	12.82	4.98	17.52	18.72	12.91	16.65	13.37	3.42
RWI0903	5.55	10.02	21.44	10.75	15.91	11.54	55.31	15.05	12.36	9.84	11.16	4.01
RWI0904	9.67	14.56	9.33	5.79	42.24	1.75	4.99	11.26	3.04	11.09	6.72	3.9
RWI1001	13.61	10.16	9.05	2.89	14.4	14.5	2.26	6.02	12.72	19.28	7.42	8.53
RWI1002	10.43	7.36	8.59	7.56	11.58	1.44	20.64	25.82	10.59	12.61	10.24	2.51
RWI1003	5.36	9.73	16.94	10.78	14.06	26.25	12.08	45.22	24.84	15.28	8.7	5.85
RWI1004	8.45	9.96	7.85	9.19	32.2	2.35	37.6	15.72	4.28	8.12	8.72	9.14

Table 1 WI RR dBase.2

Experiment Number	Jan R 1 mm/h	Feb R 1 mm/h	Mar R 1 mm/h	Apr R 1 mm/h	May R 1 mm/h	Jun R 1 mm/h	Jul R 1 mm/h	Aug R 1 mm/h	Sep R 1 mm/h	Oct R 1 mm/h	Nov R 1 mm/h	Dec R 1 mm/h
RWI0101	7.16	3.10	2.96	3.45	2.44	0.14	1.41	0.20	0.90	2.85	1.19	2.42
RWI0102	3.57	2.67	3.92	2.68	0.59	0.14	2.84	2.13	2.46	3.75	2.53	
RWI0103	1.86	1.71	6.40	3.84	2.83	2.58	5.71	6.18	7.08	4.48	2.00	1.06
RWI0104	2.68	3.26	3.10	2.69	7.11		1.23	0.94	1.89	1.12	2.27	2.46
RWI0201	4.93	3.27	2.05	3.23	1.02	0.72	0.3	0.25	1.03	0.72	1.14	2.13
RWI0202	1.5	3.05	2.94	3.48	1.28	0.17	3.77	1.27	2.05	1.64	2.83	0.15
RWI0203	1.67	2.23	5.24	4.27	1.56	2.3	2.75	4.84	2.68	3.53	2.45	0.3
RWI0204	2.67	3.55	2.82	2.91	6.19	0.36	1.56	1.82	0.41	0.45	1.28	2.53
RWI0301	5.53	3.18	2.19	3.42	1.14	1.37	0.1	0.02	2.42	1.09	1.28	2.55
RWI0302	2.33	3.16	3.02	3.07	2.44	0.37	2.46	1.37	2.43	2.81	2.89	
RWI0303	1.51	1.9	6.1	4.02	2.49	1.4	2.56	8.43	3.03	4.28	2.18	0.05
RWI0304	2.92	3.46	2.7	2.82	2.67		0.78	1.65	0.86	0.72	2.08	2.73
RWI0402	1.51	2.91	3	3.45	1.77	0.24	3.33	0.12	0.62	1.81	1.51	2.72
RWI0403	0.88	0.96	4.97	3.51	1.84	2.81	2.98	1.45	2.25	2.46	3.11	
RWI0404	3.08	2.71	1.92	2.97	5.81		0.65	1.20	0.65	0.65	2.06	2.79
RWI0501	7	2.79	2.36	2.03	1.8	0.82	0.63	0.16	1.34	1.01	2.3	2.97
RWI0502	3.15	3.09	2.75	3.88	1.33	0.22	3.36	1.34	1.95	2.61	3.34	
RWI0503	1.29	1.94	4.96	2.51	1.42	0.63	3.38	2.28	6.79	3.36	2.48	1.09
RWI0504	3	1.88	2.31	3.8	6.37	0.06	0.62	0.96	0.72	0.33	1.85	2.39
RWI0601	7.33	0.18	2.17	1.96	2.39	0.42	0.85	0.24	0.76	1.47	1.04	2.17
RWI0602	3.69	1.75	0.57	3.4	1.3	0.11	0.91	1.76	2.26	3.03	3.19	0.4
RWI0701	6.39	0.17	1.61	2.97	2.05	1.62	1.54	0.14	1.13	1.47	1.34	2.46
RWI0702	2.91	2.49	1.07	3.44	3.56	0.58	0.8	2.06	2.24	2.78	3.81	
RWI0703	0.89	1.85	5.99	4.83	2.16	1.75	7.06	10.07	3.9	3.53	2.92	1.13
RWI0704	3.18	2.1	3.23	2.33	6.79	0.15	0.78	1.9		0.91	1.48	2.64
RWI0801	5.57	2	1.75	2.45	2.18	1.51	1.6	0.16	1.71	1.35	0.91	2.23
RWI0802	2.59	2.25	1.63	1.97	2.34	0.64	0.9	2.69	2.27	2.49	3.32	0.21
RWI0803	1.08	0.99	5.15	3.52	1.71	0.25	9.03	10.28	3.14	2.98	2.93	0.73
RWI0804	3.19	2.18	2.92	2.62	6.9		1.09	1.93	0.51	1.07	1.42	2.74
RWI0901	5.61	1.76	1.72	2.49	2.05	2.07	0.18	0.16	0.58	1.56	2.12	2.64
RWI0902	2.09	2.57	1.62	3.73	4.2	0.52	0.75	2.02	2.21	2.93	3.45	0.68
RWI0903	1.18	1.78	4.75	3.74	1.77	0.68	7.04	4.11	1.67	2.3	2.94	1.3
RWI0904	2.91	2.18	3.08	1.53	4.91		0.07	2.15	0.28	0.9	0.98	0.31
RWI1001	5.51	2.43	2	0.09	2.19	1.34		0.18	0.61	0.22	1.27	2.07
RWI1002	2.81	2.35	1.54	3.23	2.1	0.18	0.44	2.18	1.99	2.9	3.33	0.16
RWI1003	1.17	1.51	4.44	4.08	1.76	0.87	0.68	9	5.23	3.1	3.51	0.28
RWI1004	3.12	2.44	3.01	1.67	6.62		1.9	0.93	0.55	0.84	1.86	2.92

Table 1 WI RR dBase.2

Experiment Number	Jan Rain [mm]	Feb Rain [mm]	Mar Rain [mm]	Apr Rain [mm]	May Rain [mm]	Jun Rain [mm]	Jul Rain [mm]	Aug Rain [mm]	Sep Rain [mm]	Oct Rain [mm]	Nov Rain [mm]	Dec Rain [mm]
RWI0101												
RWI0102												
RWI0103												
RWI0104												
RWI0201												
RWI0202												
RWI0203												
RWI0204												
RWI0301												
RWI0302												
RWI0303												
RWI0304												
RWI0402												
RWI0403												
RWI0404												
RWI0501												
RWI0502												
RWI0503												
RWI0504												
RWI0601												
RWI0602												
RWI0701												
RWI0702												
RWI0703												
RWI0704												
RWI0801												
RWI0802												
RWI0803												
RWI0804												
RWI0901												
RWI0902												
RWI0903												
RWI0904												
RWI1001												
RWI1002												
RWI1003												
RWI1004												

Table 1 WI RR dBase.2

Experiment Number	Jan Snow ?	Feb Snow ?	Mar Snow ?	Apr Snow ?	May Snow ?	Jun Snow ?	Jul Snow ?	Aug Snow ?	Sep Snow ?	Oct Snow ?	Nov Snow ?	Dec Snow ?
RWI0101												
RWI0102												
RWI0103												
RWI0104												
RWI0201												
RWI0202												
RWI0203												
RWI0204												
RWI0301												
RWI0302												
RWI0303												
RWI0304												
RWI0402												
RWI0403												
RWI0404												
RWI0501												
RWI0502												
RWI0503												
RWI0504												
RWI0601												
RWI0602												
RWI0701												
RWI0702												
RWI0703												
RWI0704												
RWI0801												
RWI0802												
RWI0803												
RWI0804												
RWI0901												
RWI0902												
RWI0903												
RWI0904												
RWI1001												
RWI1002												
RWI1003												
RWI1004												

Table 1 WI RR dBase.2

Experiment Number	Jan Uptime [%]	Feb Uptime [%]	Mar Uptime [%]	Apr Uptime [%]	May Uptime [%]	Jun Uptime [%]	Jul Uptime [%]	Aug Uptime [%]	Sep Uptime [%]	Oct Uptime [%]	Nov Uptime [%]	Dec Uptime [%]
RWI0101												
RWI0102												
RWI0103												
RWI0104												
RWI0201												
RWI0202												
RWI0203												
RWI0204												
RWI0301												
RWI0302												
RWI0303												
RWI0304												
RWI0402												
RWI0403												
RWI0404												
RWI0501												
RWI0502												
RWI0503												
RWI0504												
RWI0601												
RWI0602												
RWI0701												
RWI0702												
RWI0703												
RWI0704												
RWI0801												
RWI0802												
RWI0803												
RWI0804												
RWI0901												
RWI0902												
RWI0903												
RWI0904												
RWI1001												
RWI1002												
RWI1003												
RWI1004												

Table 2 WI RR dBase.2

Experiment Number	References	Comments	Update	Global Rain Zone	Annual Rain [mm]	Jan Rain [mm]	Feb Rain [mm]	Mar Rain [mm]	Apr Rain [mm]	May Rain [mm]	Jun Rain [mm]	Jul Rain [mm]	Aug Rain [mm]	Sep Rain [mm]	Oct Rain [mm]	Nov Rain [mm]	Dec Rain [mm]
RWI0101	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0102	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0103	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0104	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0201	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0202	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0203	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0204	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0301	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0302	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0303	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0304	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0402	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0403	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0404	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0501	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0502	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0503	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0504	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0601	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0602	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0701	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0702	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0703	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0704	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0801	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0802	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0803	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0804	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0901	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0902	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0903	Goldhirsh	Gauge	6/11/93	G_D2													
RWI0904	Goldhirsh	Gauge	6/11/93	G_D2													
RWI1001	Goldhirsh	Gauge	6/11/93	G_D2													
RWI1002	Goldhirsh	Gauge	6/11/93	G_D2													
RWI1003	Goldhirsh	Gauge	6/11/93	G_D2													
RWI1004	Goldhirsh	Gauge	6/11/93	G_D2													

Table 2 WI RR dBase.2

Experiment Number	Jan Ex 5 [mm]	Feb Ex 5 [mm]	Mar Ex 5 [mm]	Apr Ex 5 [mm]	May Ex 5 [mm]	Jun Ex 5 [mm]	Jul Ex 5 [mm]	Aug Ex 5 [mm]	Sep Ex 5 [mm]	Oct Ex 5 [mm]	Nov Ex 5 [mm]	Dec Ex 5 [mm]
RWI0101												
RWI0102												
RWI0103												
RWI0104												
RWI0201												
RWI0202												
RWI0203												
RWI0204												
RWI0301												
RWI0302												
RWI0303												
RWI0304												
RWI0402												
RWI0403												
RWI0404												
RWI0501												
RWI0502												
RWI0503												
RWI0504												
RWI0601												
RWI0602												
RWI0701												
RWI0702												
RWI0703												
RWI0704												
RWI0801												
RWI0802												
RWI0803												
RWI0804												
RWI0901												
RWI0902												
RWI0903												
RWI0904												
RWI1001												
RWI1002												
RWI1003												
RWI1004												

Table 2 WI RR dBase.2

Experiment Number	Error G_Climate	Error C_Climate	Error T-C fit	Error LN fit	Error Mpf fit	T C [1]	T C [2]	T C [3]	T C [4]	T C [5]	LN [1]	LN [2]	LN [3]	Rrate01	Rrate1	Mpf [1]	Mpf [2]	Mpf [3]
RWI0101	0.46078	0.17661	0.06507	0.07522	0.14077	0.04849	19.41876	3.49305	1.27686	1.18391	3.66989	1.1496	1.29609	47.7	12.7	0.38027	-0.71169	-0.04749
RWI0102	0.37858	0.17413	0.06455	0.10375	0.11254	0.05677	22.45515	2.68284	1.51253	1.17215	2.96135	1.30758	1.32617	53.8	14.6	0.42235	-0.74966	-0.03917
RWI0103	0.39378	0.54762	0.05888	0.11051	0.06782	0.11085	23.37817	3.95207	1.40242	1.25567	3.76164	1.62043	1.32238	69.3	21.7	0.69838	-0.66885	-0.03464
RWI0104	0.43137	0.41003	0.06206	0.14992	0.08455	0.209	22.88533	4.36234	0.83335	1.15121	4.58319	0.80647	1.51497	68	18.3	0.47003	-0.69574	-0.03168
RWI0201	0.49333	0.12504	0.06325	0.11695	0.17717	0.05575	21.49345	2.68284	1.3292	1.07146	2.96135	1.07404	1.3207	46.4	9.8	0.27007	-0.84529	-0.03898
RWI0202	0.5018	0.13714	0.05901	0.12513	0.12545	0.15416	16.594	2.88913	1.11994	1.05456	1.99484	1.72053	1.24229	49.4	12.9	0.2667	-0.6845	-0.04878
RWI0203	0.29374	0.35218	0.03379	0.08604	0.05632	0.11052	18.75558	4.58319	0.95591	1.26394	4.15214	1.18939	1.32063	52	17.7	0.61643	-0.737	-0.04197
RWI0204	0.38854	0.30682	0.06165	0.13588	0.08983	0.11169	22.08683	5.86687	0.54313	1.37599	4.93559	0.68056	1.50851	62.5	14.9	0.43875	-0.75264	-0.034
RWI0301	0.4144	0.20219	0.09131	0.1565	0.17312	0.0648	26.94233	3.43426	1.0552	1.16675	2.96135	1.10374	1.39776	62.5	10.7	0.35429	-0.84941	-0.02819
RWI0302	0.33725	0.16868	0.06587	0.10089	0.10579	0.0446	22.80532	2.88913	1.34447	1.2165	2.96135	1.31552	1.3128	49.5	13	0.48163	-0.81955	-0.03646
RWI0303	0.46666	0.512	0.06264	0.1287	0.11091	0.10052	28.86915	3.85568	1.28083	1.22287	3.95207	1.25351	1.41685	79.4	19.5	0.5393	-0.66512	-0.03053
RWI0304	0.30059	0.232	0.08131	0.10961	0.06894	0.03764	29.36974	1.99484	1.65269	1.19506	1.99484	1.66032	1.31864	54.2	13.1	0.56469	-0.96208	-0.02465
RWI0402	0.43492	0.24612	0.07527	0.1198	0.12495	0.04095	28.27268	2.88913	1.15348	1.3193	2.96135	1.12588	1.42612	63.2	13.6	0.3378	-0.78003	-0.02886
RWI0403	0.52342	0.42696	0.07744	0.11221	0.07973	0.08679	23.56835	3.58038	1.22652	1.3287	3.58038	1.27059	1.41285	66.4	21.2	0.43325	-0.64427	-0.03244
RWI0404	0.36917	0.16407	0.04345	0.09233	0.12517	0.05824	26.42555	3.60812	1.00481	1.19346	4.39615	0.66167	1.50193	53.4	12.1	0.42882	-0.89341	-0.02833
RWI0501	0.34973	0.15681	0.05303	0.08961	0.14851	0.06052	24.70998	2.74991	1.49594	1.10452	2.96135	1.28507	1.32087	53.9	12.2	0.47074	-0.87449	-0.03166
RWI0502	0.36764	0.19988	0.09411	0.1601	0.15768	0.21441	15.92008	1.94619	1.83961	0.74853	2.96135	1.29053	1.31448	56.9	12.3	0.4407	-0.72308	-0.0446
RWI0503	0.38546	0.46889	0.06409	0.08598	0.09062	0.03339	34.02688	4.93559	0.74464	1.48539	4.93559	0.77157	1.54171	65.8	18.6	0.56222	-0.83889	-0.02107
RWI0504	0.37365	0.12999	0.03613	0.11163	0.12407	0.05279	28.40248	2.61741	1.53411	1.01457	1.99484	1.59938	1.29774	45.2	11.2	0.44405	-0.98883	-0.02362
RWI0601	0.41066	0.21717	0.04078	0.08651	0.10553	0.09109	23.05816	2.88913	1.22708	1.20155	1.99484	1.96605	1.2695	58	14.3	0.38133	-0.74389	-0.03472
RWI0602	0.67882	0.37417	0.04015	0.04587	0.15062	0.02251	14.15361	2.43052	1.55312	1.00714	2.55357	1.41613	1.09305	27.2	9.3	0.29629	-0.76322	-0.08312
RWI0701	0.41864	0.16138	0.05014	0.11507	0.17954	0.0503	30.21863	2.43052	1.76067	1.0044	2.96135	1.13299	1.38061	58.1	12.1	0.35219	-0.88924	-0.02587
RWI0702	0.4192	0.11002	0.03219	0.05619	0.12379	0.05405	18.87779	2.68284	1.4773	1.08453	2.96135	1.25843	1.25391	40.3	12.1	0.42382	-0.82601	-0.04718
RWI0703	0.46976	0.67272	0.05492	0.16806	0.12259	0.2582	25.2026	4.58319	1.09631	1.13343	4.15214	1.43497	1.40385	85.2	27.7	0.74923	-0.63184	-0.03171
RWI0704	0.32177	0.18317	0.08667	0.12686	0.09426	0.08493	20.19956	2.81866	1.37573	1.07734	1.99484	1.80694	1.23451	46.3	14.1	0.52955	-0.8563	-0.03912
RWI0801	0.4133	0.1149	0.04237	0.0778	0.14871	0.05964	26.76718	2.55357	1.65499	1.02513	2.96135	1.22689	1.33832	48.8	12.5	0.36633	-0.8691	-0.02934
RWI0802	0.50207	0.13469	0.0667	0.11114	0.14748	0.07467	19.5917	2.61741	1.28737	1.13618	2.74991	1.19271	1.32488	50.3	11.9	0.25104	-0.72475	-0.04475
RWI0803	0.49756	0.60879	0.07901	0.17465	0.09889	0.2487	25.52555	2.96135	1.60346	1.02403	1.80723	3.28116	1.24076	81.2	27.2	0.61694	-0.58627	-0.03249
RWI0804	0.41325	0.23406	0.05018	0.12471	0.08303	0.15356	15.70376	3.66989	1.14105	0.96143	4.93559	0.69846	1.40074	44.1	12.1	0.43639	-0.74028	-0.05217
RWI0901	0.38362	0.1881	0.05204	0.08868	0.13881	0.05467	26.21303	3.52012	1.04904	1.25003	3.88555	0.84202	1.45744	57.5	12.9	0.40977	-0.81625	-0.03108
RWI0902	0.42407	0.13632	0.04909	0.08648	0.12857	0.08799	16.44335	2.81866	1.34551	1.0653	2.96135	1.25039	1.24899	41.7	11.1	0.4247	-0.81045	-0.05007
RWI0903	0.39572	0.35867	0.06028	0.16874	0.10331	0.20915	18.86593	4.36234	0.84457	1.18736	4.05087	1.05212	1.39973	61.9	17.3	0.52284	-0.63287	-0.04366
RWI0904	0.56335	0.17931	0.07517	0.13839	0.14519	0.11347	19.68048	2.25698	1.58159	0.8221	2.96135	0.91183	1.41147	50.2	10.4	0.13976	-0.75917	-0.03855
RWI1001	0.56372	0.16425	0.03998	0.06624	0.15209	0.05644	17.48039	2.68284	1.25005	1.11721	2.88913	1.10262	1.28063	38.9	10.6	0.21833	-0.77013	-0.05132
RWI1002	0.51817	0.13463	0.02746	0.05654	0.13332	0.06045	17.06933	2.88913	1.16109	1.14312	2.96135	1.12083	1.27394	37	10.8	0.28404	-0.80118	-0.04966
RWI1003	0.3243	0.36815	0.05058	0.10758	0.09582	0.13727	21.93354	2.96135	1.58634	1.11545	1.85241	2.87417	1.1719	66.7	18.5	0.60922	-0.69776	-0.03794
RWI1004	0.28391	0.19773	0.05811	0.11203	0.09064	0.11097	20.05514	2.37124	2.05007	0.82802	1.99484	1.87127	1.22817	48.1	12.9	0.58565	-0.88827	-0.03641

Table 3 Model Compare

	Global Climate	CCIR Climate	Two Component	Lognormal	Moupfuma
All					
Average	1.09	0.70	0.37	0.29	0.13
Standard Deviation	0.78	0.51	0.25	0.20	0.22
Root-Mean-Square-Error	1.33	0.86	0.45	0.35	0.26
Number of EDFs	207	207	182	195	201
Sample Dispersion					
Wallops Island					
Average	0.42	0.26	0.06	0.11	0.12
Standard Deviation	0.08	0.15	0.02	0.03	0.03
Root-Mean-Square-Error	0.43	0.30	0.06	0.11	0.12
Number of EDFs	37	37	37	37	37
Sample Dispersion					
Darwin. Australia					
Average	1.83	1.09	0.58	0.45	0.16
Standard Deviation	0.34	0.44	0.11	0.10	0.06
Root-Mean-Square-Error	1.87	1.18	0.59	0.46	0.17
Number of EDFs	100	100	100	100	100
Sample Dispersion					
All from CCIR					
Average	0.37	0.36	0.18	0.11	0.10
Standard Deviation	0.23	0.21	0.12	0.11	0.38
Root-Mean-Square-Error	0.43	0.42	0.22	0.16	0.39
Number of EDFs	70	70	45	58	64
Sample Dispersion					

Table 3 Model Compare

	Two-Component P cell	R cell	P debris	R debris	StDev debris
All					
Average	0.224	39.7	2.41	2.45	1.35
Standard Deviation	0.211	77.5	1.22	3.63	0.40
Root-Mean-Square-Error					
Number of EDFs	182	182	182	182	182
Sample Dispersion	0.94	1.95	0.51	1.48	0.30
Wallops Island					
Average	0.097	22.5	3.20	1.31	1.13
Standard Deviation	0.062	4.7	0.87	0.32	0.15
Root-Mean-Square-Error					
Number of EDFs	37	37	37	37	37
Sample Dispersion	0.64	0.21	0.27	0.24	0.13
Darwin. Australia					
Average	0.359	24.4	2.91	1.03	1.63
Standard Deviation	0.192	13.7	0.70	0.89	0.26
Root-Mean-Square-Error					
Number of EDFs	100	100	100	100	100
Sample Dispersion	0.54	0.56	0.24	0.87	0.16
All from CCIR					
Average	0.027	87.8	0.65	6.55	0.89
Standard Deviation	0.047	145.3	0.35	5.43	0.21
Root-Mean-Square-Error					
Number of EDFs	45	45	45	45	45
Sample Dispersion	1.72	1.65	0.53	0.83	0.24

Table 3 Model Compare

	Lognormal P rain	R rain	StDev rain
All			
Average	2.24	3.33	1.48
Standard Deviation	1.31	5.47	0.45
Root-Mean-Square-Error			
Number of EDFs	195	195	195
Sample Dispersion	0.58	1.64	0.31
Wallops Island			
Average	3.17	1.33	1.34
Standard Deviation	0.92	0.53	0.10
Root-Mean-Square-Error			
Number of EDFs	37	37	37
Sample Dispersion	0.29	0.40	0.07
Darwin. Australia			
Average	2.87	0.91	1.83
Standard Deviation	0.73	1.11	0.24
Root-Mean-Square-Error			
Number of EDFs	100	100	100
Sample Dispersion	0.25	1.21	0.13
All from CCIR			
Average	0.55	8.76	0.94
Standard Deviation	0.44	7.52	0.24
Root-Mean-Square-Error			
Number of EDFs	58	58	58
Sample Dispersion	0.79	0.86	0.25

Table 3 Model Compare

	CCIR RR 0.01%	RR 0.1%	Moupfuma LnA	Bex	Uex
All					
Average	72.1	23.7	0.25	-0.67	-0.034
Standard Deviation	30.6	13.4	1.04	0.49	0.020
Root-Mean-Square-Error					
Number of EDFs	207	200	201	201	201
Sample Dispersion	0.42	0.57	4.08	0.73	0.59
Wallops Island					
Average	55.2	14.5	0.44	-0.78	-0.038
Standard Deviation	12.5	4.5	0.13	0.09	0.011
Root-Mean-Square-Error					
Number of EDFs	37	37	37	37	37
Sample Dispersion	0.23	0.31	0.31	0.12	0.30
Darwin. Australia					
Average	97.9	33.3	0.00	-0.35	-0.033
Standard Deviation	13.3	10.6	0.46	0.06	0.006
Root-Mean-Square-Error					
Number of EDFs	100	100	100	100	100
Sample Dispersion	0.14	0.32	343.11	0.17	0.18
All from CCIR					
Average	44.2	13.7	0.55	-1.10	-0.033
Standard Deviation	23.4	9.4	1.69	0.63	0.034
Root-Mean-Square-Error					
Number of EDFs	70	63	64	64	64
Sample Dispersion	0.53	0.69	3.09	0.57	1.02