

BASELINE BIOPHYSICAL INFORMATION ABOUT THE TULANG BAWANG WATERSHED AREA, NORTH LAMPUNG

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EXPERIMENT SITES

The proposed experiment sites are located in the Tulang Bawang watershed, Lampung Province, which is situated in the southern part of Sumatera Island (Figure 1). As shown in Figure 1, at present three locations of experimental units are available, i.e. Krui (ICRAF), Sumber Jaya (University of Lampung) and Ketapang (ASB, BMSF).

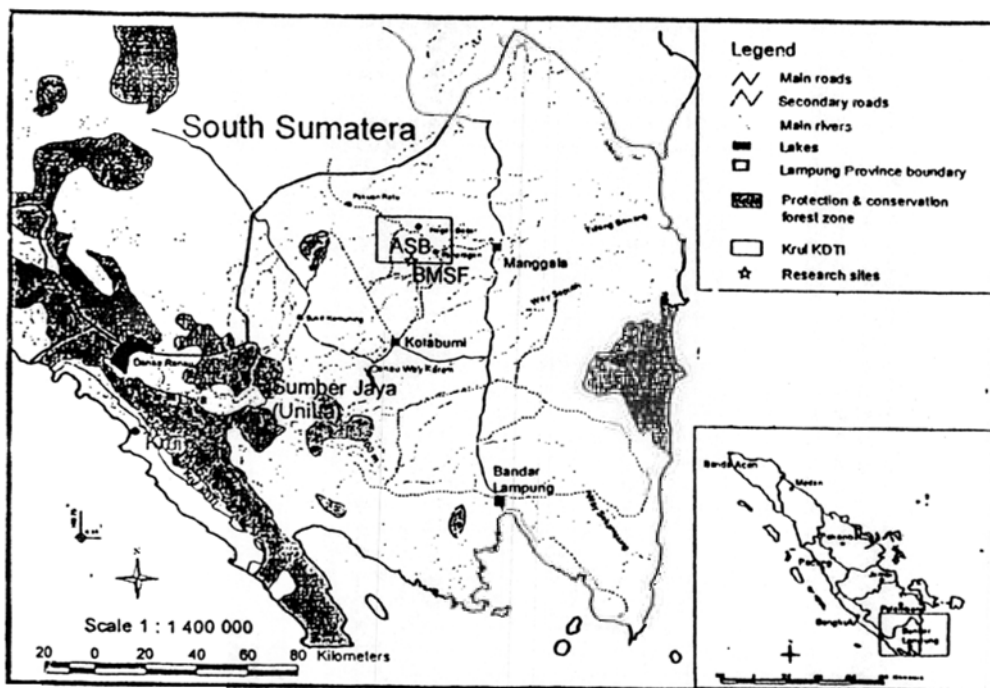


Figure Location map of experiment sites.

CLIMATIC SITUATION

Regional

Rainfall in Lampung region is controlled by the monsoonal system comprising two monsoon seasons each year. In general terms the temporal variation of rainfall may be characterized by two seasons, i.e. wet season lasting from November to about May which is followed by dry season from June to October.

Oldeman *et al.* (1979) made an agroclimatic zone for Lampung and South Sumatra based on the following definitions: (a) a wet month has a long term average rainfall of 200 mm or more, (b) a dry month has a long term average rainfall of 100 mm or less. Based on that criteria, Lampung region was dominated by four agroclimatic zones, i.e (a) Zone A (more than 9 wet month) is found along the southeast coast, (b) Zone B1 (7-9 wet months) is found east of the watershed of Bukit Barisan, (c) Zone C1 (5-6 wet months and less than two dry months) occurs along the Souht cost and at the centre of Lampung region, and (d) Zone C2 (5-6 wet months and 2-3 dry month)s is found at the eastern part on this region (Figure 2).

Local

As reported by Binnie and Partners (1994a), the mean annual rainfall of Tulang Bawang subwatershed is around 2700 mm in the central part of the basin, but reduces to values below 2500 mm in the low lying eastern part as well as in its north western corner. The isohyetal map of the basin is shown in Figure 3. Utomo *et al.* (1999) reported the local climate of Way Besai catchment which at the upper Tulang Bawang watershed (Tables 1-5).

SOIL TYPES

Regional

Based on national soil classification (Centre for Soil Research, 1983), four main soil types were found along the Tulang Bawang Basin, i.e. Latosol, Podzolic, Alluvial, and Gleysol (Binnie and Partners, 1994b). In the FAO or USDA soil taxonomy system, the soils have the following names (Table 6).

Latosol was usually found at the upper watershed, in the hilly areas. The Latosol was characterized by deep, uniform, friable, red or brown clays derived from volcanic matetrials of basic-intermediate composition. This soil was cultivated by the indegenous people with coffee, pepper, cloves, and dryland arable crops. Podzolic is the largest soil type found in the Tulang Bawang watershed, usually situated in peneplain areas. The Podzolic soils are derived from acid tuffs and sedimentary rocks, and characterized by sandy surface soils overlying a poorly structured clayey subsoil, with both the physical and chemical properties are

inferior. Alluvial and Gleysol are found at the lower part of the basin. Alluvial soils are young soils, and generally slightly better drained than Gleysol. Some chemical soil properties from several sites in Tulang Bawang watershed were shown in Table 7.

Local

Tim Studi Universitas Lampung (1982) found two soil types at Way Besai subwatershed, i.e. Brown Podzolic (Orthic Acrisols/Typic Tropudults) and Red Yellow Podzolic (Orthic Acrisol/Typic Tropudults/Typic Dystropepts). The areas are occupied by the Brown Podzolic (66,9%), the rest (33,1%) is occupied by the Red Yellow Podzolic. Salam *et al.* (1998) reported some of the soil properties in the Way Besai subwatershed (Table 8).

WATER RESOURCES

Regional

The province of Lampung comprises five big rivers and about 25 smaller ones forming eight watersheds with five watersheds, Mesuji, Tulang Bawang, Seputih, Sekampung and Way Semangka, as the main ones. About 80 % of the rivers flow to the east side ending in Java Sea (Mesuji, Tulang Bawang, Seputih, and Sekampung) and Teluk Semangka (Way Semangka) (Wiryawan *et al.*, 1999). The size of catchment and discharge of the main rivers is presented in Table 9.

Local

Binnie and Partners (1994a) reported that the mean annual runoff within the Tulang Bawang watershed is within the range of 1100-2300 mm/year, which clearly displays the joint effects of rainfall and evapotranspiration. Utomo *et al.* (1999) reported the mean monthly flow of Way Besai River as shown in Table 10. Using data in table, Sinukaban *et al.* (1999) reported that the total water yield of the catchment is 20.2 m³/s or 650 million m³/year, about 63.7% of the average annual rainfall. The maximum monthly stream flow is in March and the minimum occurs in September.

TOPOGRAPHY

Regional

The topography of Lampung region is shown in Figure 4. Most of the Lampung region is dominated by peneplain areas with the slope gradient of 0-15%. The hilly and mountainous areas are situated in the west part of Lampung province which belongs to the Bukit Barisan mountain range. According to Wiryawan *et al.* (1999) the topographic unit of Lampung region can be divided into five categories:

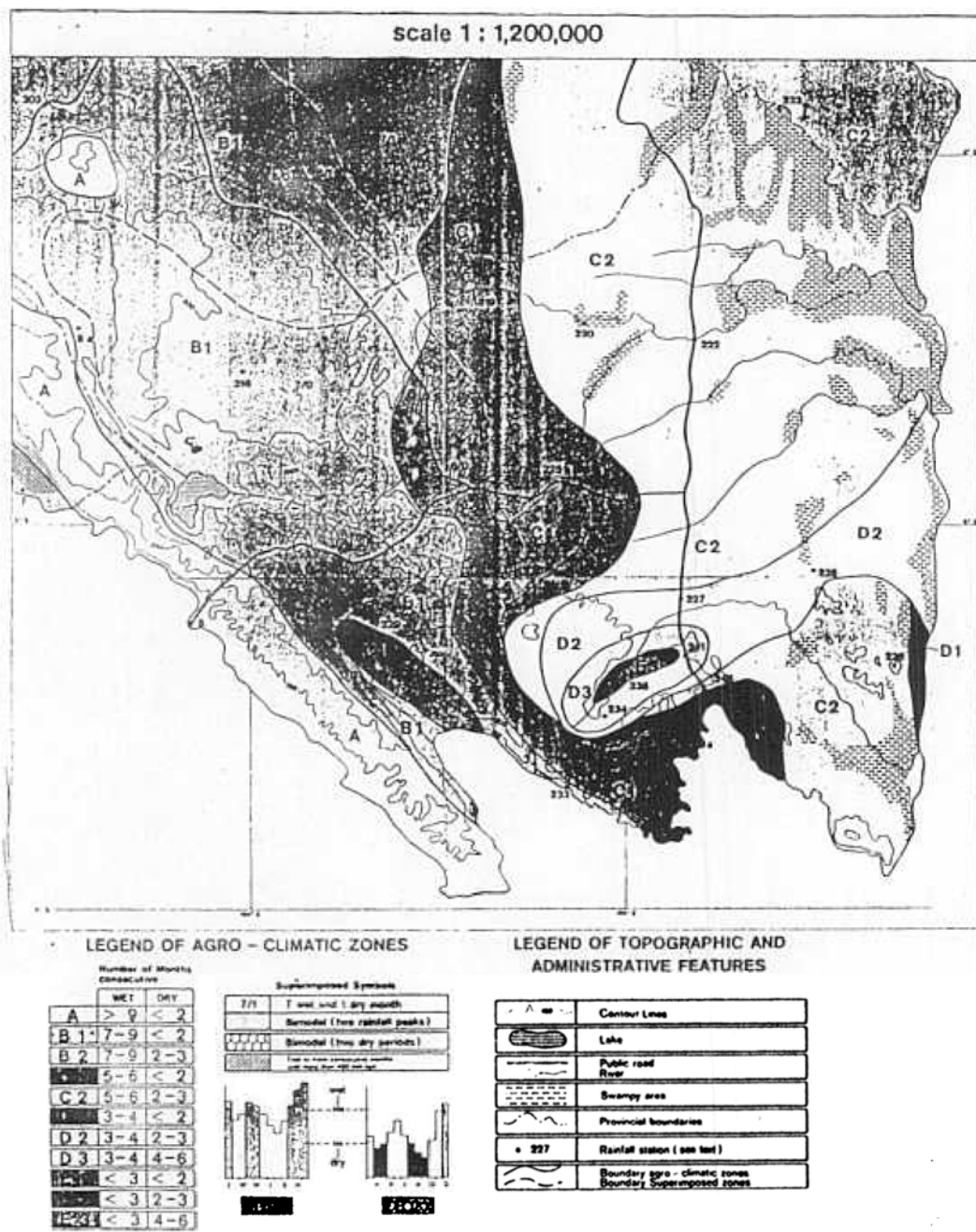


Figure 2. Agroclimate map of Lampung and South Sumatra (Oldeman *et al.*, 1979).

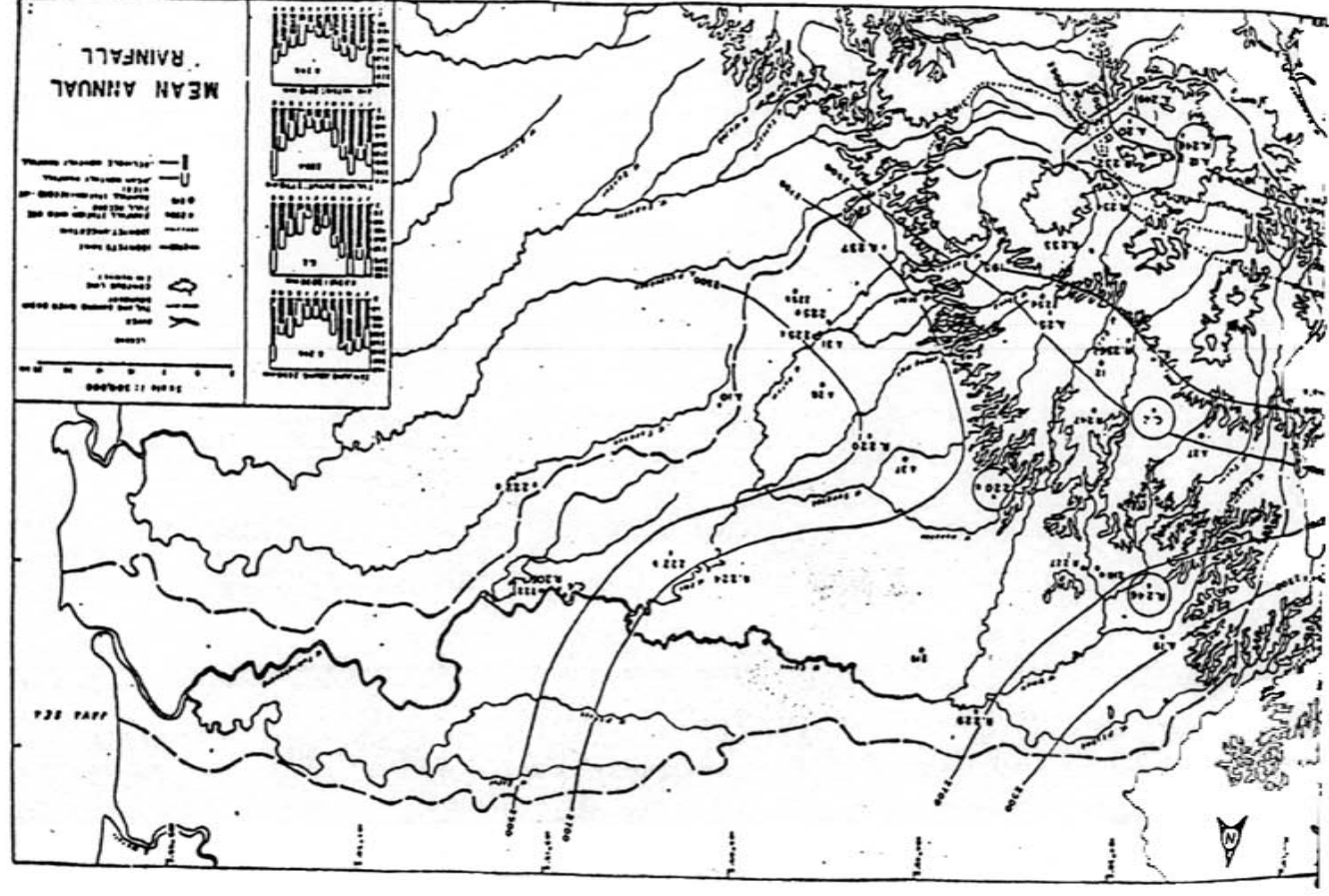


Figure 3. Isohyetal map of the Tulang Bawang watershed (Binnie and Partners, 1994a).

Table 1. Mean monthly rainfall data from Pajar Bulan station (830 m asl)

Year	Month												SUM
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1974	228.7	218.1	61.6	319.1	308.5	30.7	162.3	171.8	309.2		119.9	193.6	2123.5
1975	397.5	294.3	128.1	261.7	208.3	168.3	133.3	113.4	117.2	172.3	313.8	159.7	2467.9
1976	226.6	150.8	299.5	259.6	127.7	8.6	76.7	114.6	66.2	208	336.8	307.4	2182.5
1977	356.5	174	171	273.5	281	209	67	53	137.5	91.5	258.5	560.5	2633
1978	254	290	537.5	134	315	213.5	155	95	332	256.5	336.5	620.5	3539.5
1979	480.8	324.5	213.1	291.4	422.8	116.2	195.8	149.3	156.9	111.5	144	182.5	2788.8
1980	334	241.5	246.5	295	91.5	76	112	65.6	241.1	341.5	329.6	277	2651.3
1981	30.5	186	113	309.5	242	211	218	280	187	94	170.5	166	2207.5
1982	270	136	101.5	176	149	37.5		30	1.5	12	7	541.2	1461.7
1983	386.3	75	307	164	447	139	80	61.6	44.8	279	205.9	564.8	2754.4
1984	290.4	182	438	86.1	319.3	108.6	192.6	181.8	286.4	344.8	299.9		3029.9
1985	319.9	93.8	413.8	222	111.2	307.4	264.3	61.7	138.5	382.8	168.7	283	2767.1
1986	304.7	182.1	271.4	180.8	235.4	233.8	84.62	14.2	204.8	252	215	391.5	2570.3
1987	283.9	307.5	334.1	368.1	139	126.6	115.8	64	45.2	118.4	128.4	218.8	2249.8
1988	423	225	281	157	220	116	84	73.4	60	223	316.4	169	2347.8
1989	401.6	122.2	180.5	156.5	148.4	80.8	128	209.4	42.2	138.8	309.1	356	2273.5
1990	131	264	161	263	168	80	200	108	99	47	167	167	1855
1991	436.8	128.8	304	269.3	154.4	73.8	14.2	0	171.4	22	424.4	33	2032.1
1992	158	321.3	387.6	291.4	159.2	63.4	84.4	176.5	272.2	203.6	445.2	371	2933.8
1993	384	186	244	382	207	99	98	135	15.4	157	507	369	2783.4
1994	562	318	337	236	80	69	0		55.2	9.7	56.1	363	2086
1995	444	480	507	250.9	147.6	364.4		5.1					2199
1996	389.5	397	377.1	359.5	150.5	22.3	93	140	208	270.5	243		2650.4
1997	199	71	124.6	172.5	373	27.5		15			19	363.5	1365.1
1998	411.5	334.8	333	274	260	157	37.5	104.5	131	283	46.5	129	701.8
NOBS	25	25	25	25	25	25	22	24	23	22	24	22	25
AVG	324.1	228.1	274.9	258.1	218.6	125.5	122.5	100.9	144.4	182.6	236.1	308.5	2426.2
MAX	562	480	537.5	386.1	447	364.4	264.3	280	332	382.8	507	620.5	3539.5
MIN	30.5	71	61.6	134	80	8.6	0	0	1.5	9.7	7	33	365.1
SD	117.6	101.5	124.7	72.49	98.60	88.31	63.33	69.11	95.58	109.3	127.8	155.5	471.22
CV	36.30	44.52	45.39	28.08	45.09	70.32	51.67	68.45	66.16	59.84	54.15	0.41	19.422

Table 2. Monthly rainfall data from Air Hitam station (805 asm)

Year	Month												SUM
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1974									81.3	203.5	182	154.6	621.4
1975	533.6	208.6	125	309.6	192.4	109	124.6	179	142.6	234.6	263.8	131.4	2554.2
1976	894	218.4	245.6	210	123.6	24.4	110.6	126	27.4	28.6	317.4	260.8	2586.8
1977	389.2	196.4	243.8	190.4	206	207.4	124	61.4	189.2	81	246.2	426	2561
1978	283.8	219.4	611.8	158.8	211.8	177.6	182.2	103.8	328.1	252.8	374.2	438	3342.3
1979	323.4	265.6	306	368.2	270.4	63	80.8	98.4	218	190.8	169.8	255.8	2610.2
1980	336.8	296.8	208.4	252.8	117.8	215	169.2	92.6	195.6	331.1	388	408.4	3012.5
1981	221.8	294.6	311.2	280	362.2	255.2	206.2	55	248	131.8	269.6	236.4	2872
1982	425	216.4	213.4	290.6	152	47.4	26.8	24	41.6	45.8	67.4	48.7	1599.1
1983	256.8	131.2	432.4	269.2	40	103.4	96.4	33	318.8	152	312.8	251.8	2397.8
1984	242	5	349.4	301	234.6	50.2	84.4	165.6	340.5	196.7	277.4	258.6	2505.4
1985	254.2	142.2	322	236.4	91.8	247.8	353.4	100	214.4	381.6	235.3	300	2879.1
1986	227.6	198.4	373.2	129.2	134.4	251.6	126.6	142	393	251.4	275.6	328.8	2831.8
1987	233.4	458.8	256.7	267.8	116	181.3	86.4	124.2	101.4	98.4	205.4	242.2	2372
1988	534.2	218.4	420	119.2	161.4	56.2	50.6	149.6	50.2	337	339.8	169.8	2606.4
1989	386.2	334.6	235.6	214.8	210.6	137	36.2	273.6	97.8	384.6	333.2	450	3094.2
1990	142	349	483.4	117.5	159.8	126.8	155.8	149.6	89.4	27	161.6	186.6	2148.5
1991	378.4	296.2	300.8	447.6	224.8	58.2	1.2		34.6	57.6	370.2	371.6	2541.2
1992	181	299	399.4	332.8	255	24.4	90.4	143.6	218	256.4	411.8		2611.8
1993	333	267	237	353	305	149	184.4	117.2	59.8	80.4	382.4	442.6	2910.8
1994	386	213.4	253.4	188.6	161.6	54.6	0	9	28.8	83	106	231.2	1715.6
1995	336	387	256	269.6	299.8	148.8	155.6	16	123.7	177	203	81	2453.5
1996	274.2	200.8	160.2	207	164.6	28.8	152	101	76	213.2	42.8	51.3	1671.9
1997	68	83.8	140	147.4	481.6	260	260	35.8	26	162	311	408.4	2384
1998	3980	1571	3348	2910	2436	2692	1052	1472	1470	2822	1504		25257
NOBS	24	24	24	24	24	24	24	23	25	25	25	23	25
VG	484.1	294.6	426.3	3571A	296.3	236.2	162.9	164.0	204.5	287.2	310.0	266.6	3365.6
AX	3980	1571	3348	2910M	2436	2692	1052	1472	1470	2822	1504	450	25257
IN	68	5	125	1175M	40	24.4	0	9	26	27	42.8	48.7	621.4
D	745.9	282.4	619.1	538.5S	455.6	518.0	201.5	285.3	279.8	527.7	262.6	124.0	4502.8
CV	154.0	95.84	145.2	1507C	153.7	219.3	123.6	173.9	136.8	183.7	84.71	46.49	133.79

Table 3. Monthly rainfall data from Sumber Jaya station (735 asm)

Year	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	SUM
1972	512	320	235	195	439	56	34	91	8	27	237	452	2632
1973	254	316	416	366	304	278	17	138	421	248	287	409	3454
1974	131	239	91	511	368	85	237	196	230	338	295	249	2970
1975	339	197	208	226	148	54	144	78	218	333	308	96	2349
1976	159	105	443	209	15	10	15.6	121	98	58	204	143	1580.6
1977	222	326	429	103	255	269	83	35	89			375	2186
1978	184	164	416	213	372	279	298	171.1	335.8	162	307.9	411.8	3314.6
1979	442.2	294.1	242.7	317.4	328	119.9	207.8	134.9	176.7	106.3	294.5	286.8	2951.3
1980	250.2	248.5	253.2	181.2	186.4	103.2	131.4	122.1	114.4	193.5	361.9	493.1	2639.1
1981	684.7	219.6	506.9	403.8	320	173.8	320.5	64	357.1	141.8	205.8	158.4	3556.4
1982	313.2	319.3	132.3	246.2	133.4	66.7	68.2	32.1	43.1	58.6	29.4	512	1954.5
1983	619.7	259.3	284.6	317.5	437.8	36.5	58.2	24.2	14.4	79	416.9	282.4	2830.5
1984	275.5	208.8	315.5	270.4	320.1	133.3	214.3	301.7	160.5	275.3	160.8	237.1	2873.3
1985	426.5	160.6	270.4	321.2	86.3	185.9	197.1	95.9	159.7	249.3	216.9	648.6	3018.4
1986	174.4	220.7	437.5	164.6	135.5	59	108.1	80.3	201.4	308.7	102.8	282.9	2275.9
1987	129.1	160.5	311.8	72.7	177.3	130.1	47.3	44.9	28.5	27.9	340.7	347.7	1818.5
1988	375.5	177.3	196.7	79.5	112.4	105.9	66.5	222	57.5	581	100.3	164.5	2239.1
1989	304.9	274.4	144.6	179.7	905	528	102.7	54.1	111.6	206.3	212.6	315.3	3339.2
1990	284.4	595.6	226.4	83.1	118.7	182.4	117	142.5	81.6	72.3	138		2042
1991	435.4	233.6	327.9	406.9	191.3	136.7		20.5	47.1	1.5	411	350.1	2562.0
1992	299	345	449.9	202.1	206.6	97.6	193.4	203	61	641.5	303	365	3367.1
1993	266.7	151.3	243.1	239.2	132.8	118	117.5	102.7	32	54.5	289	270	2016.8
1994	413	185.5	28.3	279	99	38	155.5	2.5	25	54	50	208.1	1537.9
1995	373.7	398	243	422.2						262	760	279.6	2738.5
1996	548	701	544	518.9	235.5	65	344	166.7	131.2	288	278.8	71	3892.1
1997	128.8	90	298.5	306.5	270		10.9	21		13.6	56	249	1444.3
1998	493.4	406.5	353.5	299.2	263.3	93.5	163.5	123	158.5	195.5	159	217.5	2926.4
NOBS	27	24	24	24	23	22	22	23	22	23	23	23	24
AVG	334.7	268.4	304.4	252.5	236.9	135.7	143.8	102.7	122.8	189.7	248.1	294.1	2560.5
MAX	684.7	701	544	518.9	905	528	344	301.7	357.1	641.5	760	648.6	3892.1
MIN	128.8	90	28.3	72.7	15	10	10.9	2.5	14.4	1.5	29.4	71	1444.3
SD	147.8	141.2	122.7	112.5	174.2	109.0	90.61	73.41	91.65	163.9	155.2	133.7	658.24
CV	44.16	52.64	40.31	44.56	73.55	80.36	62.99	71.45	74.62	86.39	62.55	45.46	25.707