3) RESULTS

3.1) Values

We have adjusted combined coordinates in the ITRF93 solution for two epochs; 1988.0 and 1993.0. In total, 290 stations located in 157 sites (see Figure 2) have been independently adjusted. These coordinates are given in Table T5 of the appendix under the label SSC(IERS) 94 C 01 for epoch 1993.0 .

Table T6 of the appendix lists the ITRF93 combined velocity field. These velocities should be used to refer the ITRF93 coordinates from 1993.0 epoch to another desired epoch. This Table gives for each site its DOMES number, name, the individual solutions in which its velocities are available, the cartesian velocities and their standard deviations, the plate and a code : CN for Combined Velocities with NAR velocities, C for Combined velocities with NAR velocities deweighted, and N for NAR velocities.

The adjusted transformation parameters were published in Tables T-2 and T-3 of the 1993 IERS Annual Report. They are also available in the appendix: Table T7 (epoch 1988.0) and T8 (epoch 1993.0).

Table T9 of the appendix gives the rate of change of the transformation parameters. These values have to be considered as annual variations to the transformation parameters given in Tables T7 and T8. So for a given transformation parameter T at an epoch t in years, we have:

$$T(t) = T(t_0) + \dot{T} \cdot (t - t_0) \qquad (2)$$

Where t_0 is the reference epoch of the used transformation parameters; 1988.0 (Table T7), or 1993.0 (Table T8). Values of $\dot{T}$ are given in Table T9. When $\dot{T}$ is not given one can assume $\dot{T} = 0$.

Table T12 of the appendix lists the ITRF93N velocity field.

3.2) Analysis of results

The quality of the results is studied by examining residuals by groups. All residuals on a site-by-site basis are given in the appendix. Table T10 lists the site coordinate residuals in meter, for 1993.0 combination, while Table T11 lists site velocity residuals in mm/years, both in equatorial and local frame, as well as equatorial residuals divided by the a priori standard errors.
At the end of each site, the following RMS are given:

SX: unweighted 3-D RMS
NSX: 3-D normalized RMS
SP: unweighted 2-D RMS
SU: unweighted vertical RMS

with,

$$SX = \sqrt{\frac{\sum_{i=1}^{N} (RX_i^2 + RY_i^2 + RZ_i^2)}{3N}} \tag{3}$$

$$NSX = f \cdot \sqrt{\frac{\sum_{i=1}^{N} (NX_i^2 + NY_i^2 + NZ_i^2)}{3N}} \tag{4}$$

$$SP = \sqrt{\frac{\sum_{i=1}^{N} (RE_i^2 + RN_i^2)}{2N}} \tag{5}$$

$$SU = \sqrt{\frac{\sum_{i=1}^{N} (RU_i^2)}{N}} \tag{6}$$

with N as the number of points in the site and f a scaling factor,

$$f = \frac{1}{\sigma_0} \sqrt{\frac{\text{Number of observations}}{\text{Number of degree of freedom}}} \tag{7}$$

A summary of the quality of the various sites is given in Table 7, where can be found N, NSX, SP and SU in cm, the maximum standard deviation of ITRF93 coordinates at epoch 1993.0 for this site, also in cm.

A similar analysis has been done by solution. Table 8 lists the RMS of those solutions used in at least one of the three combinations: station coordinate combinations at 88.0 and 93.0 and velocity fields combination. Statistics presented in this Table involve the following parameters:

N: number of points common to other solutions
WSP: weighted 2-D RMS
WSU: weighted vertical RMS

Table 7: Summary of the quality of the ITRF93 sites at 1993.0

SITE	N	NSX	SP cm	SU cm	Max(*) cm
GRASSE	6	0.5	0.9	2.3	0.7
TOULOUSE	2	0.1	0.1	0.1	1.2
BREST	2	0.1	0.0	0.2	1.0
HOFN	2	0.4	0.1	0.9	1.5
TROMSO	10	0.7	1.6	1.6	0.5
NY-ALESUND	2	0.7	0.5	1.1	1.0
TRYSIL	2	0.6	0.1	0.6	0.6
ONSALA	8	0.9	0.5	0.6	0.3
METSAHOVI	8	1.1	18.3	17.2	0.6
GRAZ	5	0.5	0.3	0.6	0.7
BOROWIEC	2	0.8	13.1	13.1	15.2
RIGA	2	0.4	2.9	3.8	15.0
SIMEIS/KATZIVELY	4	0.7	5.4	23.5	13.6
DIONYSOS	2	0.2	0.4	0.4	1.7
ASKITES	2	0.3	0.7	0.6	1.7
ROUMELLI	2	0.3	0.1	2.6	2.6
KARITSA	2	0.2	0.8	1.0	3.6
KATAVIA	2	0.3	0.1	2.8	2.6
XRISOKALARIA	2	0.2	0.4	0.2	1.9
LAMPEDUSA	2	0.5	0.9	0.7	1.7
BOLOGNA	5	0.6	3.7	2.3	0.6
NOTO	5	0.6	0.7	2.4	0.5
TRIESTE	2	0.3	2.6	1.1	7.3
CAGLIARI	2	0.8	1.9	2.3	2.5
MATERA	10	0.8	0.9	1.0	8.6
CHILBOLTON	2	0.0	0.2	0.1	1.1
HERSTMONCEUX	5	0.5	0.4	0.5	0.5
CARNUSTY	2	0.8	0.4	1.9	1.4
MADRID	8	1.1	0.8	0.7	5.4
KOOTWIJK	9	0.5	1.0	2.2	7.3
ZIMMERWALD	4	0.5	0.4	0.8	0.9
POTSDAM	2	0.8	1.5	10.1	5.4
WETTZELL	18	0.8	1.5	1.6	0.4
HOHENBUNSTORF	2	0.7	0.1	1.0	0.7
EFFELSBERG	2	0.2	0.0	0.2	0.4
HOHENPEISSENBERG	2	0.2	0.1	0.1	1.3

KARLSBURG	2	0.5	0.2	0.9	1.7
KIRSCHBERG	2	0.1	0.1	0.1	0.9
DIYARBAKIR	2	0.5	1.9	4.3	4.6
YOZGAT	2	0.6	0.6	2.0	1.9
MELENGICLICK	2	0.1	0.2	0.2	2.1
YIGILCA	2	0.2	0.1	0.7	2.1
SHANGHAI	5	1.5	2.5	5.8	13.8
KASHIMA	4	0.7	0.1	0.5	0.4
MIZUSAWA	2	0.4	0.3	0.5	1.0
NOBEYAMA	2	1.5	2.3	0.4	1.0
SIMOSATO	2	2.4	0.4	4.6	1.2
USUDA	3	0.7	1.2	0.7	2.1
MINAMI TORI SIMA	2	0.9	0.1	1.0	0.8
TAIPEI	4	0.8	1.3	0.9	0.7
HELWAN	2	0.5	0.3	1.2	1.5
JOHANNES	9	1.9	1.4	1.7	5.3
MASPALOMAS	4	0.7	0.2	0.9	0.5
SAO MIGUEL	2	0.1	0.1	0.0	0.8
ST. JOHNS	4	0.8	0.4	1.0	0.5
ALGONQUIN	10	1.4	0.4	1.9	0.4
PENTICTON	7	1.2	0.3	5.0	0.5
WHITEHOR	2	1.3	3.6	3.2	2.7
YELLOWKNIFE	11	1.0	0.5	2.9	0.4
ALBERT_HEAD	5	0.5	0.4	0.4	0.5
PASADENA	9	1.0	4.9	1.3	0.6
PALOS VERDES	2	1.4	0.2	5.3	1.3
PEARBLOSSOM	2	1.8	0.7	10.8	1.4
GOLDSTON	29	1.3	3.6	4.9	0.9
SAN FRANCISCO	2	1.9	0.6	3.7	1.1
PINYON F	4	0.9	0.3	2.6	1.0
FAIRBANKS	8	0.8	0.4	0.9	0.3
POINT REYES	2	1.1	0.1	2.2	0.7
AUSTIN	2	0.2	0.3	0.5	2.0
YAKATAGA	4	0.3	0.9	2.1	1.6
KODIAK	2	1.8	0.2	5.8	0.4
VANDENBERG	4	0.8	0.5	0.3	1.0
NOME	2	1.4	0.6	4.0	1.5
SANDPOINT	2	0.4	0.4	1.2	1.1
KAUAI	10	1.2	0.8	1.1	0.4
SOURDOUG	2	1.8	2.2	0.8	1.4
FORT ORD	6	1.1	0.2	3.5	1.3
SANTA PAOLA	2	1.0	0.5	4.6	1.3
BLACK BUTTE	2	1.1	0.3	5.7	1.2
DEADMAN LAKE	2	0.9	1.7	0.7	1.4
ELY	2	0.5	0.1	1.4	1.0
QUINCY	12	1.8	3.8	4.4	0.6
SAN DIEGO	3	0.9	8.2	3.5	1.5
MAMMOTH LAKE	2	2.0	3.3	1.1	2.4
BEAR LAKE	2	0.6	1.3	1.2	11.2
OWENS VALEY	9	1.4	2.9	5.8	1.2
WESTFORD	12	0.9	1.3	1.6	0.9
GREENBANK	4	0.7	0.2	0.3	0.6
FORT DAVIS	21	1.9	1.6	2.9	0.6
MAUI	6	2.2	2.8	2.8	0.7
OCOTILLO	2	0.8	0.5	3.2	2.5
WASHINGTON	29	0.7	5.4	5.6	0.4
BLOOMINGTON	2	0.2	0.4	1.7	4.2

CARROLLTON	2	1.2	0.8	17.4	4.4
LEONARD	2	0.2	0.2	0.8	2.1
MILES CITY	2	0.3	0.2	1.8	3.2
PIETOWN	5	1.3	0.3	2.3	0.4
SEATTLE	2	0.1	0.2	0.4	2.4
LOS ALAMOS	2	0.4	0.0	0.2	0.4
NORTH LIBERTY	4	0.5	0.2	0.8	0.4
KITT PEAK	2	0.3	0.1	0.2	0.5
HANCOCK	2	0.5	0.2	0.4	0.5
BREWSTER	2	0.1	0.0	0.0	0.4
MAUNA KEA	2	0.4	0.2	0.1	0.4
HAT CREEK	2	0.3	0.1	0.3	0.5
MARYLAND POINT	2	1.2	0.7	2.7	1.0
FLAGSTAFF	4	1.6	1.7	18.8	1.3
VERNAL	2	0.7	0.2	2.2	10.0
YUMA	3	0.6	1.3	2.3	0.8
PLATTEVILLE	5	0.7	0.6	1.2	0.6
MONUMENT PEAK	9	1.4	3.2	1.9	0.6
RICHMOND	16	1.3	0.9	1.8	0.4
MAZATLAN	2	0.2	0.2	0.4	1.0
ENSENADA	2	0.4	0.5	0.9	1.9
SANTIAGO DE CUBA	2	0.4	13.5	1.5	20.0
FORTALEZA	7	0.9	1.0	2.1	0.5
EASTER ISLAND	2	0.9	1.6	0.4	1.2
SANTIAGO	11	1.4	5.1	2.8	0.5
CERRO TOLOLO	2	1.0	1.0	4.4	2.0
SEST	2	0.6	0.5	1.6	1.6
AREQUIPA	4	0.6	0.6	1.0	1.5
BERMUDA	4	0.2	0.3	0.1	1.5
SAINTE CROIX	2	0.5	0.3	0.4	0.6
CANBERRA	13	1.9	1.3	4.5	1.3
YARRAGADEE	8	1.1	0.8	1.2	0.5
HOBART	5	0.7	0.8	0.8	1.0
KWAJALEIN ATOLL	4	0.6	3.3	4.2	1.0
MC MURDO	5	1.3	2.0	1.7	11.7
O'HIGGIN	3	0.7	0.6	0.4	0.6
PAMATAI	4	0.6	0.8	1.8	0.7
HUAHINE	4	0.8	0.6	2.3	1.9
KOUROU	4	0.9	0.8	1.4	0.8

(*) Max: Maximum standard deviation of the ITRF93 coordinates at 93.0

Table 8: Statistics of the ITRF93 station coordinates and velocity fields combinations

		Positions at 88.0			Positions at 93.0			Velocities		
Tech.	Sol.	N	WSP mm	WSU mm	N	WSP mm	WSU mm	N	$\dot{W}$SP 0.1mm/y	$\dot{W}$SU 0.1mm/y
	RF	7	16	10	7	6	8			
	RG	110	4	7	109	4	7	70	7	7
	RJ	6	13	38				3	3	15
VLBI	RM							26	12	31
	RN	106	4	8	106	4	9	63	8	24
	RO							48	6	17
	PJ	28	20	41	41	5	11	44	57	106
	PB				38	7	22			
GPS	PE				16	8	15			
	PA				23	11	20			
	PZ				30	8	12			
	LC	105	14	24	83	19	24	47	17	--
SLR	LZ	100	26	36				56	30	51
	LG	38	8	16				38	22	--
Comb. L + P	CU	58	9	24	58	12	25	50	25	33

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