3) RESULTS

3.1) Values

We have adjusted combined coordinates in the ITRF90 solution for epoch 1988.0. They are given in Table T6 under the label SSC(IERS) 91 C 01. They are also published in Table T3 of the IERS Annual Report for 1990.

As no global velocity field has been adjusted, the AMO-2 model is still valid to estimate positions at other epochs.

The adjusted transformation parameters were published in Table T-2 of the IERS Annual Report for 1990. It is also available in Table T7 of the appendix.

We have also computed for a practical point of view positions for epochs 1984, 1986, 1988, 1990, for both the combined and some individual solutions. For the last solutions, the procedure used is:

a) to compute position at the epoch using values of the individual solution, namely positions at the reference epoch and corresponding velocity.

b) to compute transformation parameters at the epoch from Table T7 and Table 3 values. For this case, corrections for rotation angles will be taken into account only for LU (SSC(DUT) 91 L 01), since the values of the other solutions are negligible.

c) to convert positions to IERS values using this formula.

This is done for :

RG	SSC(IERS) 91 R 01 (84, 86, 88, 90)
RN	SSC(IERS) 91 R 02 (84, 86, 88, 90)
LC	SSC(IERS) 91 L 01 (84, 86, 88, 90)
LG	SSC(IERS) 91 L 02 (84, 86, 88, 90)
LD	SSC(IERS) 91 L 03 (84, 86, 88, 90)
LU	SSC(IERS) 91 L 04 (84, 86, 88, 90)

The coordinate list of these solution is given in Table T9 of the appendix.

3.2) Analysis of results

The factor of unit variance is 1.3. Although it is close to 1, the proper weighting in the combined adjustment is a rather critical and delicate problem.

For a sample of 6 stations covering the Earth, Figures 14 to 19 show the evolution of their position in the local frame, from BTS84 to ITRF90.

FIG. 17 WETTZELL SLR 7834

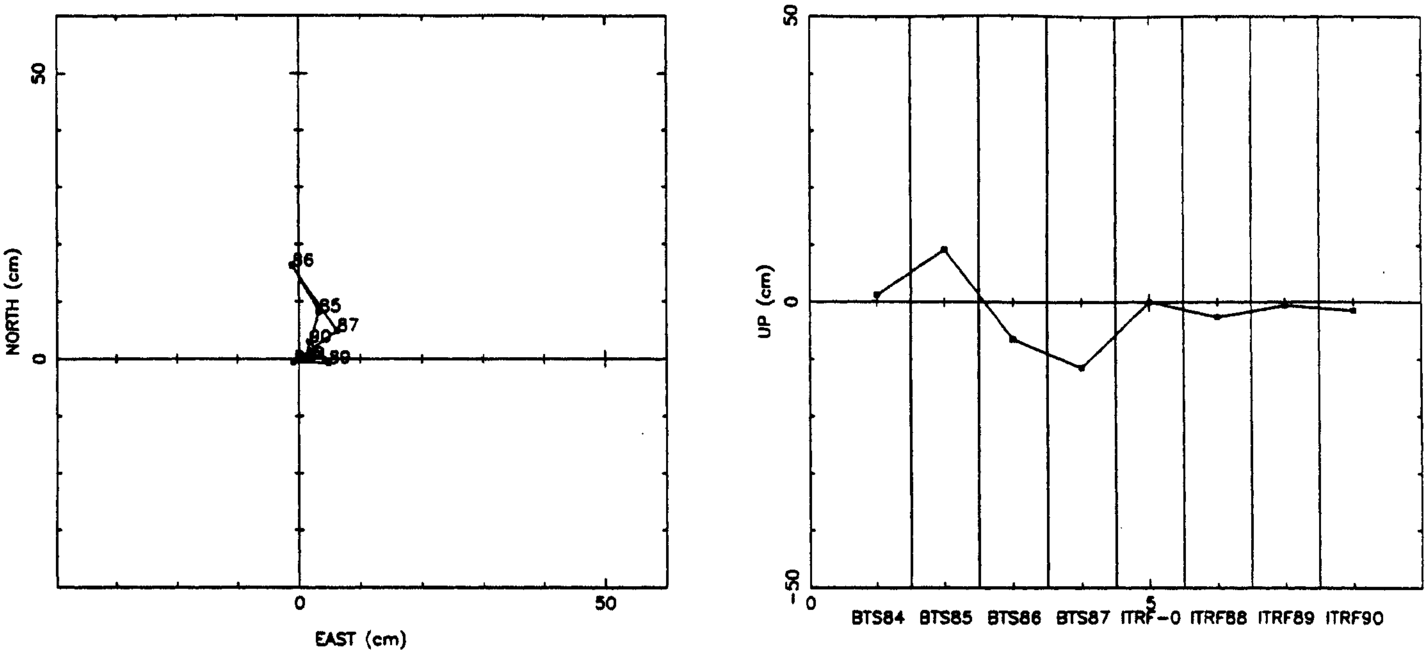


FIG. 18 AREQUIPA SLR 7907

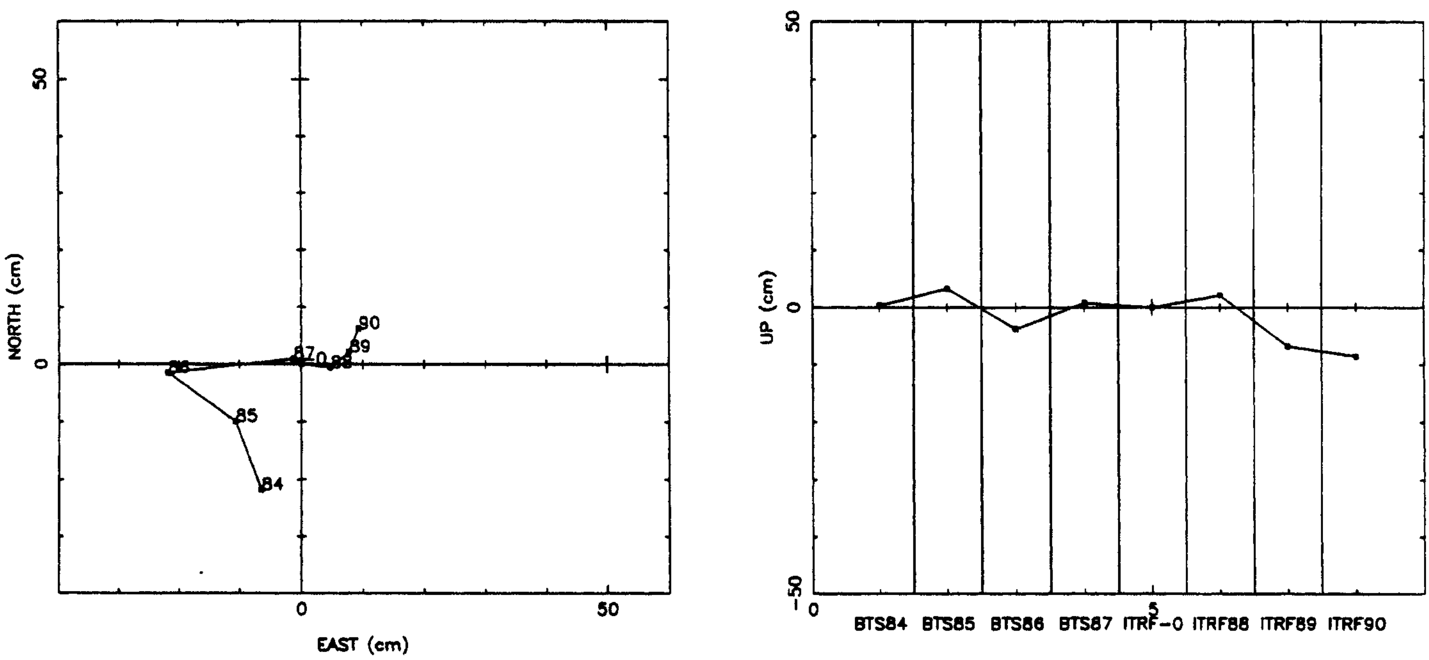


FIG. 19 FORT DAVIS SLR 7086

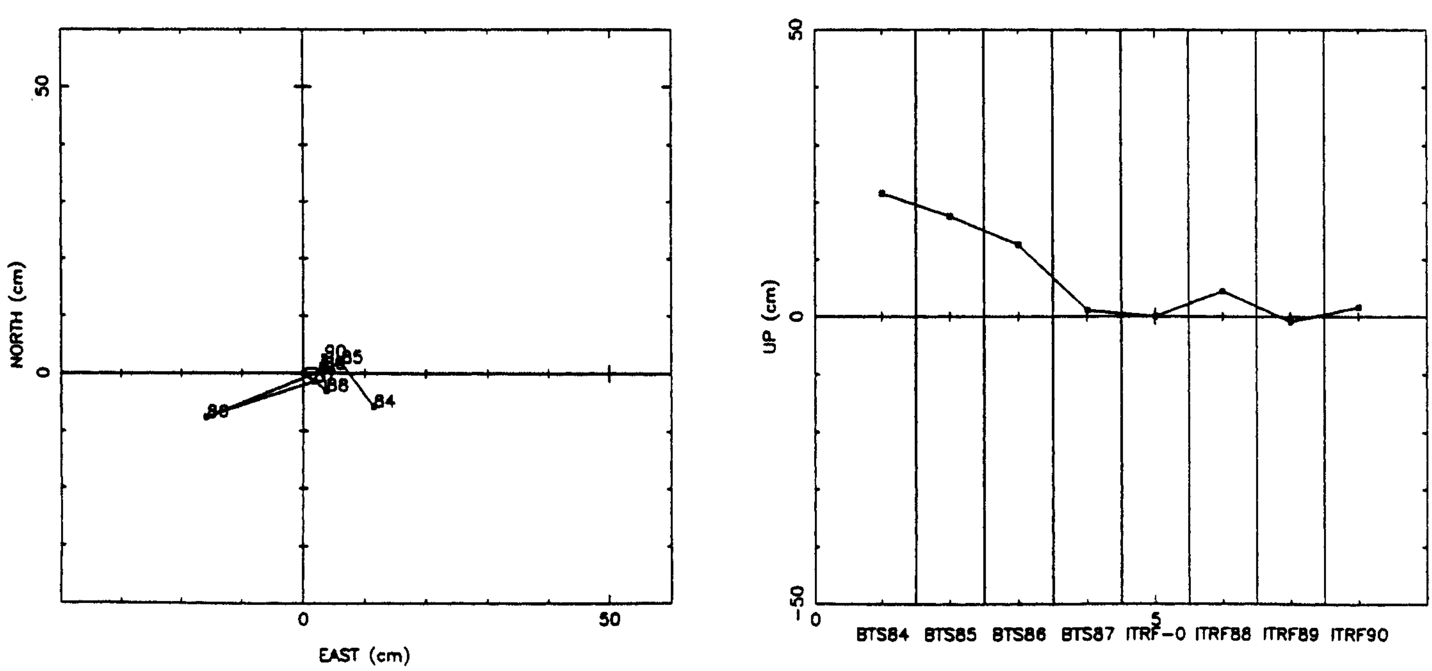


FIG. 14 CANBERRA SLR 7943

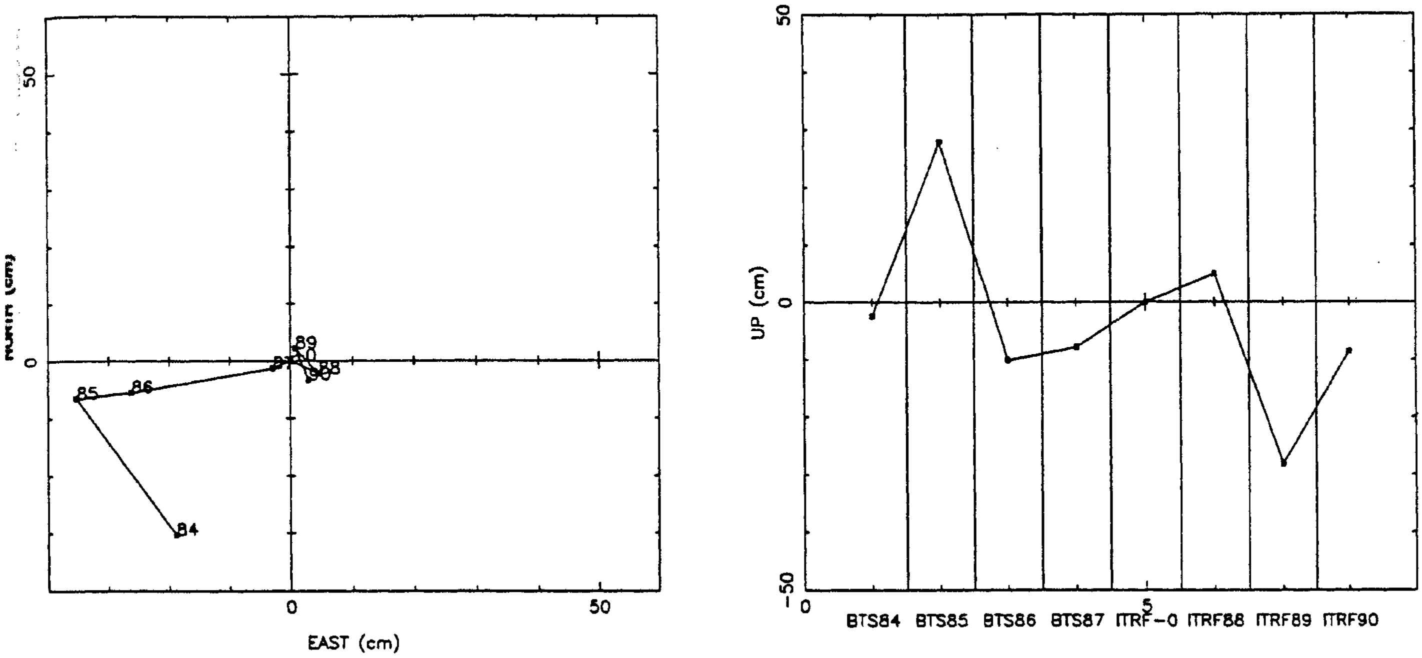


FIG. 15 SIMOSATO SLR 7838

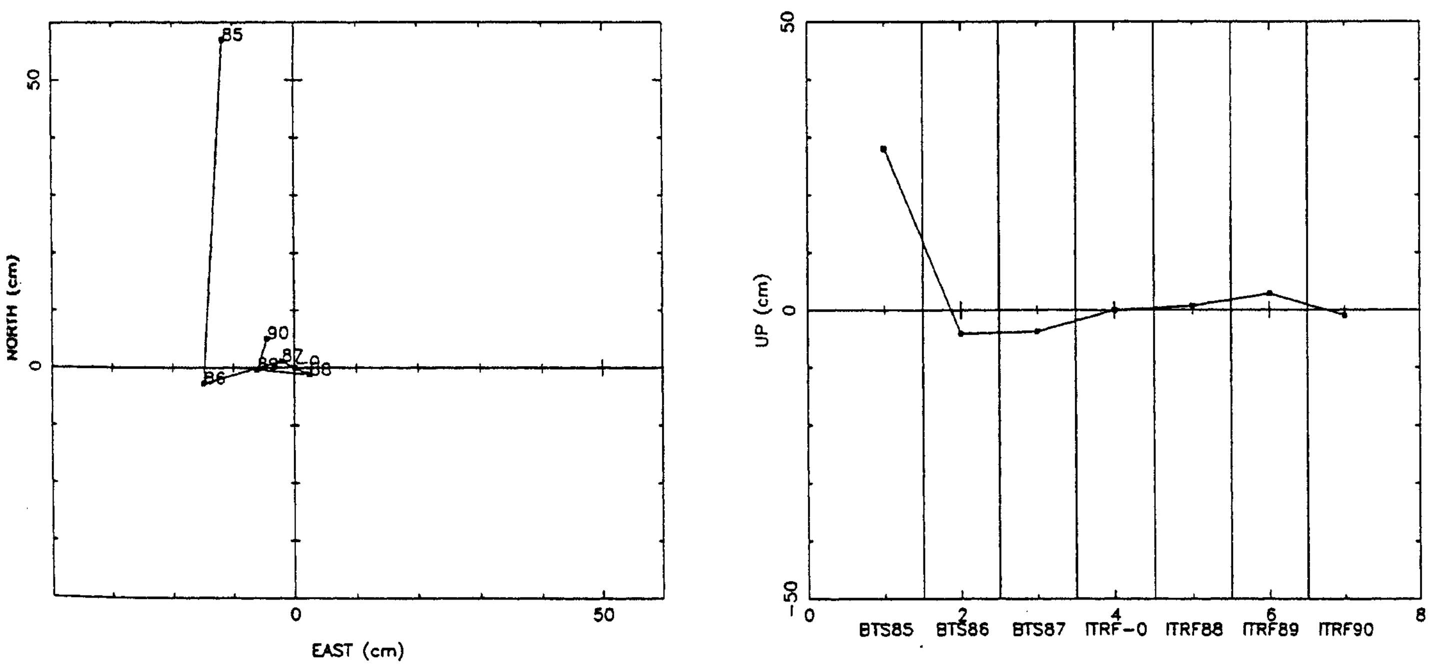
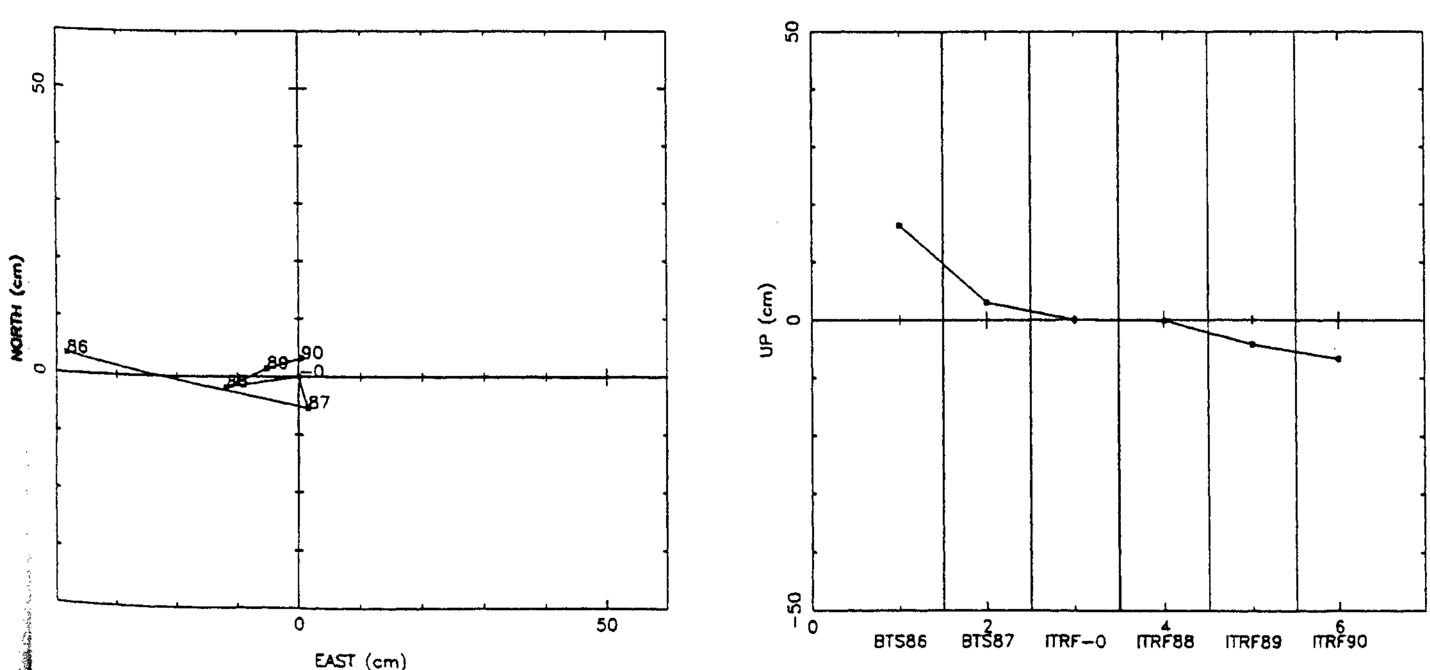


FIG. 16 HARTEBEESTHOEK VLBI 7232



The quality of the results is also given by examining residuals by groups.

All residuals by site are given in Table T8 of the appendix. This Table gives residuals in meters 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 means are given:

SX, 3-D RMS mean
NSX, 3-D RMS normalized mean
SP, 2-D RMS mean
SU, vertical RMS mean

with,

$$SX = \sqrt{\frac{\sum_i (RX_i^2 + RY_i^2 + RZ_i^2)}{3N}}$$

$$NSX = f \cdot \sqrt{\frac{\sum_i (NX_i^2 + NY_i^2 + NZ_i^2)}{3N}}$$

$$SP = \sqrt{\frac{\sum_i (RE_i^2 + RN_i^2)}{2N}}$$

$$SU = \sqrt{\frac{\sum_i RE_i^2}{N}}$$

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

$$f = \frac{1}{\sigma_o} \sqrt{\frac{\text{Number of degree of freedom}}{\text{Number of observations}}}$$

A summary of the quality of the various sites is given in Table 4, where can be found N, NSX, SP and SU in cm, the maximum standard deviation of ITRF90 coordinates for this site, also in cm.

A similar analysis has been done by solution. Table 5 gives the results.

In addition, one can analyze transformation parameters as given in Table T7, and also compare ITRF90 to previous solutions, such as ITRF89. This global transformation is obtained taking into account one point per site only. The values are (from ITRF89 to ITRF90) :

T1(cm) = -0.5 (±0.4)

T2(cm) = -2.4 (±0.4)

T3(cm) = 3.8 (±0.3)

D (10-8) = -0.3 (±0.1)

R1(0.001") = 0.0 (±0.2)

R2(0.001") = 0.0 (±0.2)

R3(0.001") = 0.0 (±0.1)

Table 4

Site	N	NSX	SP cm	SU cm	Max(*) cm
Grasse	13	0.8	1.3	1.4	1.1
Tromsoe	3	0.9	4.2	2.7	2.1
Onsala	2	0.1	0.0	0.2	1.2
Metsahovi	6	0.5	26.0	34.3	2.8
Graz	7	0.6	0.9	3.6	1.1
Borowiec	6	3.2	11.9	23.3	2.8
Riga	5	1.8	5.9	16.1	2.8
Simeis-katzively	8	0.6	5.5	4.6	5.2
Dionysos	6	1.1	3.0	1.6	1.3
Askites	6	0.9	3.3	0.9	1.3
Roumelli	6	3.2	8.5	4.1	1.3

Karitza	6	0.9	3.3	0.7	1.4
Katavia	6	1.2	3.8	1.9	1.3
Xrisokalaria	6	1.1	3.4	1.9	1.4
Lampedusa	6	0.7	9.9	6.1	1.4
Bologna	7	0.5	4.1	0.3	1.4
Noto	3	1.1	0.7	3.1	5.0
Trieste	5	0.3	3.1	0.7	1.9
Cagliari	6	0.4	1.2	0.8	1.4
Matera	12	0.4	1.7	1.0	4.4
Chilbolton	2	1.3	1.5	4.2	1.7
Herstmonceux	7	0.5	1.1	0.9	1.0
Madrid	5	0.8	1.0	3.0	4.8
Kootwijk	9	0.4	1.7	1.0	1.2
Zimmerwald	7	0.7	1.7	1.7	1.2
Monte Generoso	2	0.1	1.1	1.5	9.3
Potsdam	6	1.1	3.9	3.8	2.1
Wettzell	16	0.8	2.0	3.1	9.0
Effelsberg	2	0.2	0.9	0.7	4.4
Bar Giyyora	4	0.7	3.3	2.1	2.1
Diyarbakir	6	0.8	4.4	1.3	1.4
Yozgat	6	0.9	7.6	2.3	1.5
Melengiclick	6	0.9	3.7	1.8	1.5
Yigilca	6	0.5	3.4	0.3	1.4
Shanghai	8	0.5	2.8	2.1	2.1
Kashima	4	1.1	1.8	7.3	2.0
Simosato	7	0.7	2.5	1.6	1.3
Chichijima	4	0.1	6.1	2.6	8.6
Helwan	6	2.6	8.5	4.1	1.7
Johannesburg	2	0.3	0.4	0.3	2.2
Algonquin	3	0.6	0.4	0.5	0.9
Pasadena	6	1.7	9.0	5.9	1.8
Goldstone	30	1.3	2.3	10.2	2.8
Fairbanks	3	0.3	0.2	0.1	0.9
Austin	2	0.1	0.1	11.2	38.8
Patrick AFB	2	0.4	21.3	2.8	40.4
Vandenberg	2	0.3	0.1	0.4	1.9
Kauai	4	0.7	0.6	0.5	1.0
Quincy	18	1.5	7.3	1.7	0.9
Mount Hopkins	6	0.8	14.6	17.0	5.5
San Diego	8	1.0	5.0	2.4	1.4
Bear Lake	5	1.1	3.6	7.3	4.6
Owens Valley	12	1.1	3.0	2.1	18.0
Westford	11	1.0	1.1	4.2	0.8
Greenbank	4	1.1	0.2	1.6	1.1
Fort Davis	32	1.0	2.6	3.7	1.0
Maui	17	1.0	2.4	2.7	1.0
Washington	39	0.8	4.9	11.6	3.7
Pietown	2	2.1	0.4	2.7	1.0
Hat Creek	2	0.2	0.0	0.2	0.9
Maryland Point	3	0.5	3.8	22.8	1.0
Flagstaff	6	1.4	5.1	12.5	2.1
Vernal	3	0.7	4.3	6.3	4.2
Yuma	4	0.8	7.8	3.2	1.4
Platteville	8	0.9	2.4	1.1	1.0
Monument Peak	16	1.1	3.2	2.4	0.9

Richmond	8	0.5	1.7	0.6	0.9
Mazatlan	7	0.7	1.1	2.1	1.1
Cabo San Lucas	3	1.3	2.4	11.9	2.5
Ensenada	6	1.2	6.7	4.0	1.9
Santiago de Cuba	5	0.5	12.5	6.5	4.7
Natal	2	1.3	48.2	13.1	6.3
Easter Island	6	1.0	1.8	2.3	1.4
Santiago	3	0.4	2.5	1.9	3.7
Cerro Tololo	5	1.4	5.3	1.9	3.0
Sest	2	0.6	29.0	25.0	3.0
Arequipa	10	0.8	2.4	1.8	1.8
Bermuda	2	0.2	7.9	2.8	13.3
Canberra	20	1.2	6.6	6.0	2.3
Yarragadee	7	0.8	1.5	1.8	1.3
American Samoa	3	0.5	5.5	2.3	4.0
Kwajalein atoll	7	0.6	4.5	1.0	1.8
Huahine	11	1.2	5.0	2.1	1.6

Max : Maximum standard deviation of ITRF90 coordinates

Table 5

Solution	N	SP cm	SU cm	WSX cm	NSX	A (*) cm	B
RG	51	0.7	1.5	0.7	0.80	0.5	1.5
RN	31	7.6	11.3	0.7	0.78	0.5	1.5
RO	10	0.7	1.5	0.7	0.83	0.5	1.5
RJ	7	1.0	2.4	1.5	0.74	1.0	1.0
LC	96	7.5	12.5	2.8	1.09	1.5	1.0
LG	83	6.5	7.5	3.1	0.83	1.5	3.0
LD	85	11.9	6.8	2.9	0.90	1.5	3.0
LU	39	2.7	4.5	2.6	1.36	1.5	0.3
LZ	47	4.5	5.5	3.0	1.39	1.5	3.0
LK	48	6.3	6.1	5.0	1.38	2.5	2.0
LT	18	2.2	3.6	1.6	0.49	1.5	3.0
MX	5	3.6	2.5	3.0	1.36	1.5	0.2
MJ	5	2.3	4.9	3.2	0.94	3.0	0.0

(*) : A is the additive variance in cm and B is the factor of the formula (1) in page 3