2) HISTORICAL DESCRIPTION OF TERRESTRIAL REFERENCE FRAMES DETERMINED BY BIH AND IERS

2.1) BTS84

2.1.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 83 R 01	RN84			10
	(JPL) 83 R 05	RJ84			7
LLR	(JPL) 84 M 02	MJ84			4
SLR	(CSR) 84 L 01	LC84			58
Doppler	(DMA) 77 D 01				>100

2.1.2) Local excentricities : used as fixed values to connect each point to a selected reference point which was arbitrarly shoosen for each site. Data come from a BIH data set managed by IGN in its data base (EB84).

2.1.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of (JPL) 84 M 01 and (CSR) 84 L01

scale : obtained by fixing to zero the scale factor of (CSR) 84 L 01

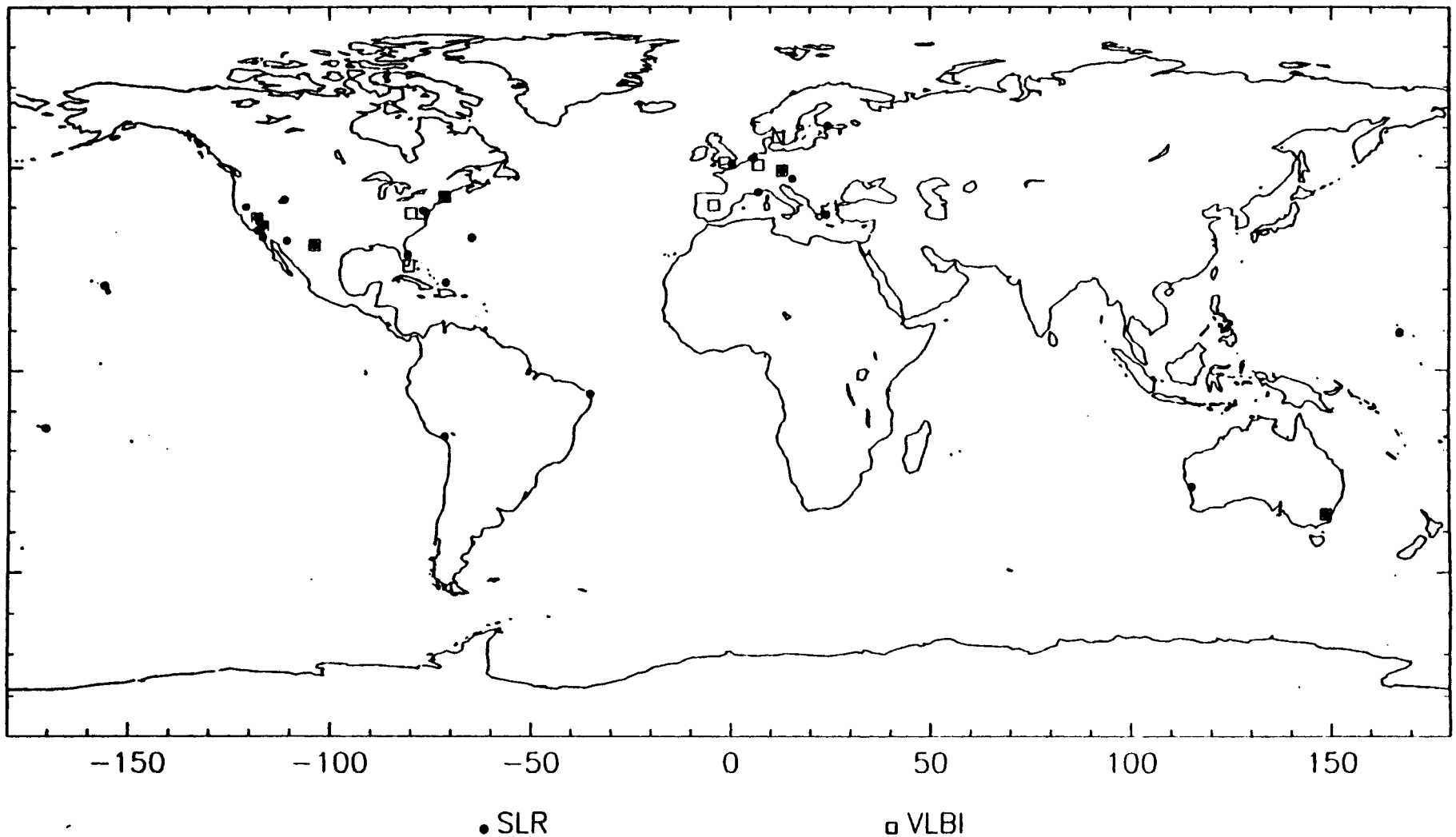
orientation : obtained by an alignment constraint on BIH ERP for 83

time evolution : unspecified

2.1.4) Results :

- coordinates of 34 site reference points (see Table 2, BIH Annual Report for 1984, p. B-4)
- transformation parameters between BTS84 and individual frames, (see Table 3, BIH Annual Report for 1984, p. B-6)
- ERP series from 84.00 to 84.95 (see Table 5, BIH Annual Report for 1984, p. B-8)

FIG. 7 - BTS84 SITES



2.2) BTS85

2.2.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 85 R 02	RN85			12
	(GSFC) 84 R 01	RG85			15
	(JPL) 83 R 05	RJ85			11
LLR	(JPL) 86 M 02	MJ85			5
SLR	(CSR) 84 L 01	LC85			58
	+(CSR) 85 L 07				35
Doppler	(DMA) 77 D 01				>100

2.2.2) Local excentricities : used as fixed values to connect each point to a selected reference point which was arbitrarly shoosen for each site. Data come from a BIH data set managed by IGN in its data base (EB85).

2.2.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of (JPL) 86 M 01 and (CSR) 84 L 01

scale : obtained by fixing to zero the scale factor of (CSR) 84 L 01

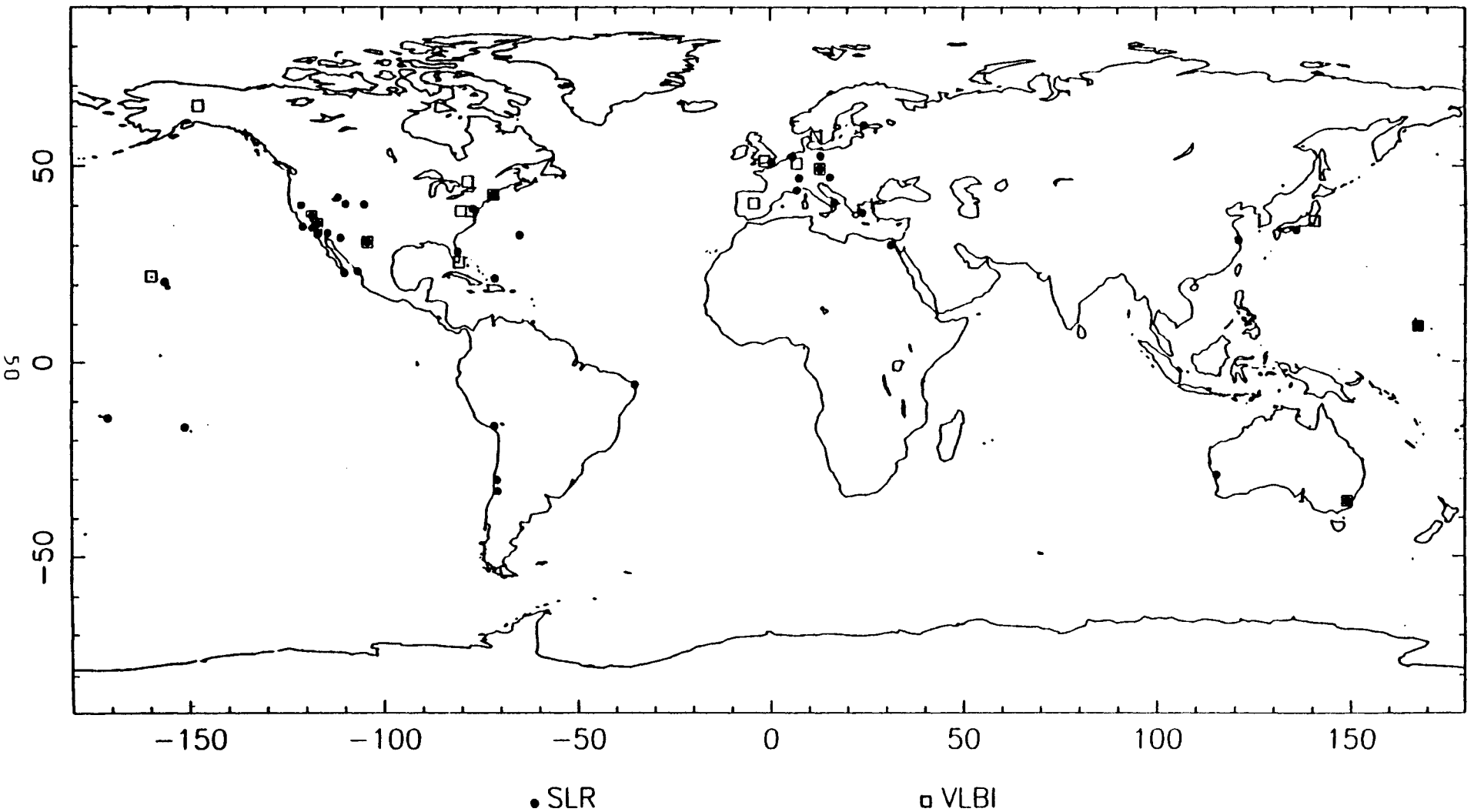
orientation : obtained by an alignment constraint on BIH ERP for 84

time evolution : unspecified

2.2.4) Results :

- coordinates of 35 colocation site reference points (occuring in at least 2 SSC), (see Table 2, BIH Annual Report for 1985, p. B-4)
- coordinates of 59 no-colocation site reference points (occuring in 1 SSC), (see Table 3, BIH Annual Report for 1985, p. D-101)
- transformation parameters between BTS85 and individual frames, (see Table 3, BIH Annual Report for 1985, p. B-5)
- ERP series from 85.00 to 85.95 (see Table 5, BIH Annual Report for 1985, p. B-7)

FIG. 8 - BTS85 SITES



2.3) BTS86

2.3.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 87 R 01	RN86			13
	(GSFC) 87 R 01	RG86			22
	(JPL) 83 R 05	RJ86			11
LLR	(JPL) 87 M 01	MJ86			4
SLR	(CSR) 86 L 01	LC86	AM1-2	1983	73
	(DGFI) 87 L 01	LD86	adjusted	1984	57
Doppler	(DMA) 77 D 01				>100

2.3.2) Local excentricities : used as fixed values to connect each point to a selected reference point which was arbitrarly shoosen for each site. Data come from a BIH data set managed by IGN in its data base (EB86).

2.3.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of (JPL) 87 M 01, (CSR) 86 L 01

scale : obtained by fixing to zero the scale factor of (CSR) 86 L 01

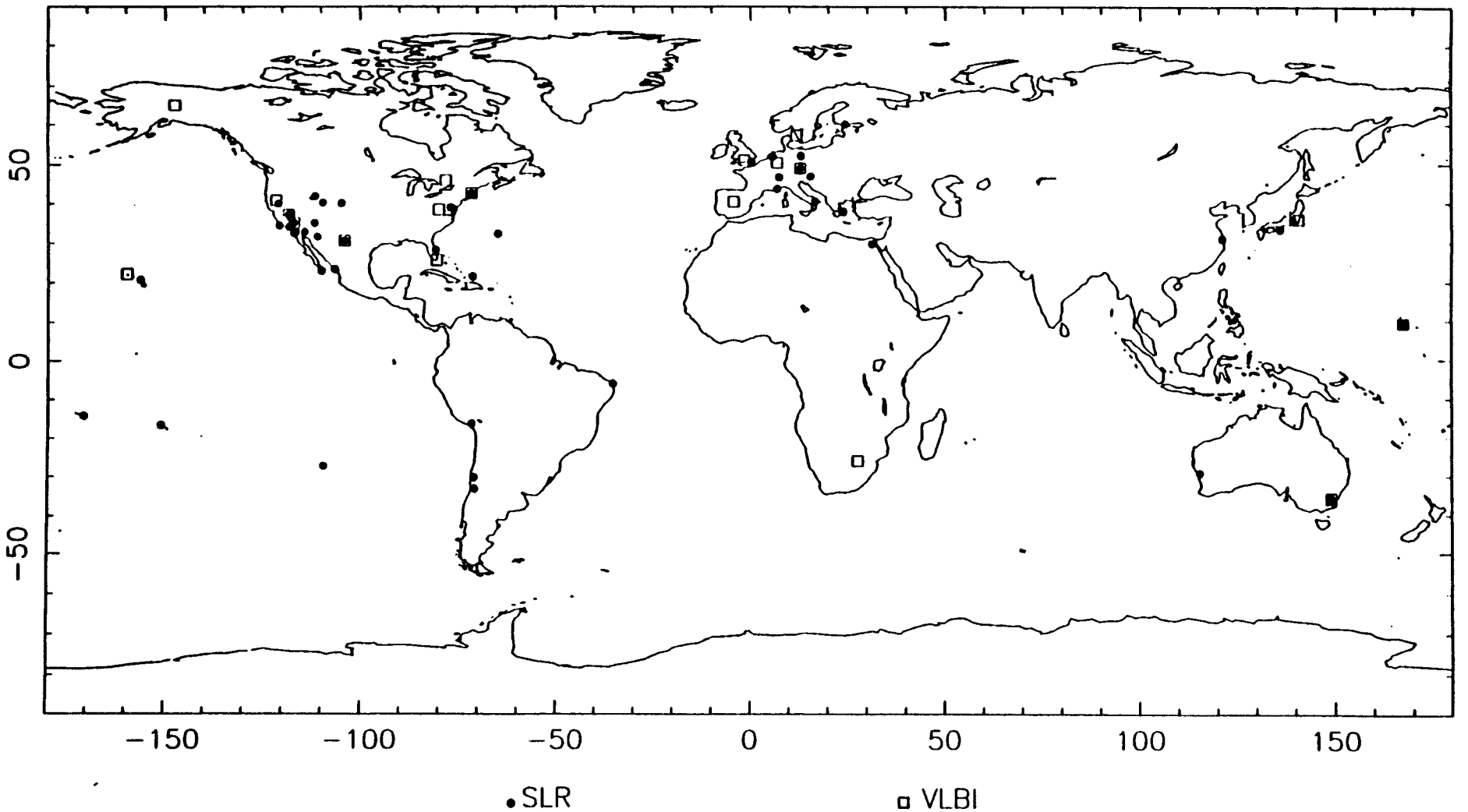
orientation : obtained by an alignment constraint on BIH ERP for 85

time evolution : AM0-2

2.3.4) Results :

- coordinates (at epoch 1984.0) of 51 colocation site reference points (occuring in at least 2 SSC), (see Table 2, BIH Annual Report for 1986, p. B-4)
- coordinates (at epoch 1984.0) of 72 no-colocation site reference points (occuring in 1 SSC), (see Table 3, BIH Annual Report for 1986, p. D-65)
- transformation parameters between BTS86 and individual frames, (see Table 3, BIH Annual Report for 1986, p. B-6)
- ERP series from 86.00 to 86.95 (see Table 5, BIH Annual Report for 1986, p. B-8)

FIG. 9 - BTS86 SITES



2.4) BTS87

2.4.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 88 R 01	RN87	AM0-2	1984	14
	(GSFC) 88 R 01	RG87	AM0-2	1980/10/17	28
	(JPL) 83 R 05	RJ87			8
	(SO) 88 R 01	RS87			5
LLR	(JPL) 88 M 01	MJ87			4
	(CERGA) 88 M 01	ME87			3
	(SO) 86 M 01	MS87			3
SLR	(CSR) 88 L 01	LC87	AM1-2	1983	92
	(GSFC) 87 L 14	LG87	AM0-2	1983	75
	(DGFI) 87 L 03	LD87	adjusted	1984	74
	(SO) 87 L 01	LS87			24
	(DUT) 87 L 04	LU87			28
Doppler	(DMA) 77 D 01				>100
Combination	BTS86		AM0-2	1984	51

2.4.2) Local excentricities : used as fixed values to connect each point to a selected reference point which was arbitrarly shoosen for each site. Data come from a BIH data set managed by IGN in its data base (EB87).

2.4.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of (JPL) 88 M 01, (CERGA)88 M 01, (SO) 86 M 01, (CSR) 88 L 01 and (GSFC) 87 L14

scale : obtained by fixing to zero the scale factor of (CSR) 88 L 01 and (GSFC) 87 L 14

orientation : obtained by an alignment constraint on BIH ERP for 86 and by fixing to zero the rotation parameters of BTS86

time evolution : AM0-2

2.4.4) Results :

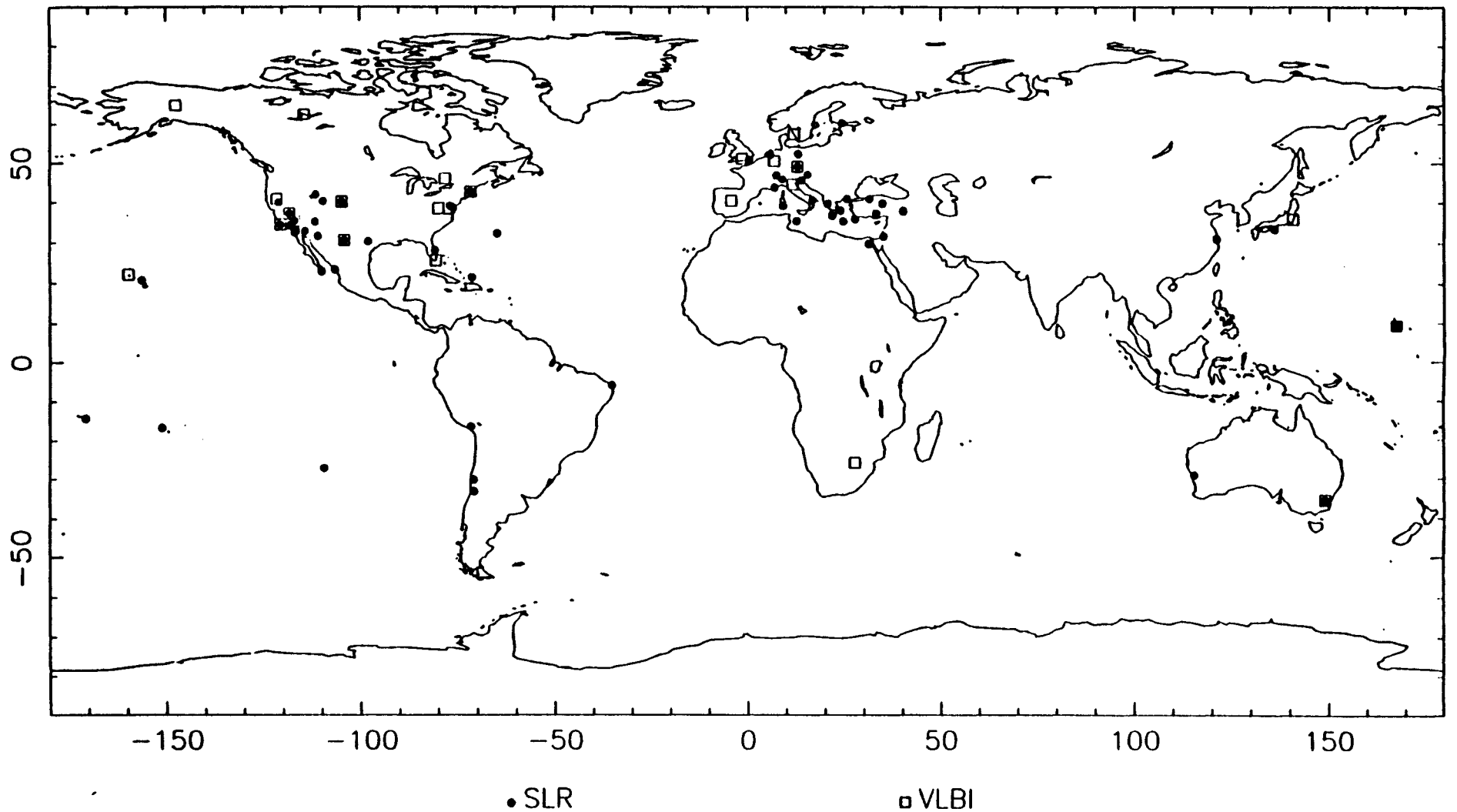
- coordinates (at epoch 1984.0) of 64 colocation sites. In each site, coordinates of both reference point and tracking points are given, (see Table 2, BIH Annual Report for 1987, p. B-4)

- coordinates (at epoch 1984.0) of 76 no-colocation site reference points (occuring in 1 SSC), (see Table 3, BIH Annual Report for 1986, p. D-125)

- transformation parameters between BTS87 and individual frames, (see Table 3, BIH Annual Report for 1987, p. B-8)

- ERP series from 87.00 to 87.95 (see Table 5, BIH Annual Report for 1987, p. B-11)

FIG .10- BTS87 SITES



2.5) ITRF-0

2.5.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 88 R 01	RN-0	AM0-2	1984	14
	(GSFC) 88 R 01	RG-0	AM0-2	1980/10/17	28
SLR	(CSR) 88 L 01	LC-0	AM1-2	1983	92
	(GSFC) 87 L 14	LG-0	AM0-2	1983	75
Combination	(BIH) 88 C 01 (extract of BTS87)	CB-0	AM0-2	1984	34

2.5.2) Local excentricities : used as fixed values to connect each point to a selected reference point which was arbitrarly shoosen for each site. Data come from a BIH data set managed by IGN in its data base (EI-0, published in IERS Technical Note 1, p 20-22).

2.5.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of (BIH) 88 C 01

scale : obtained by fixing to zero the scale factor of (BIH) 88 C 01

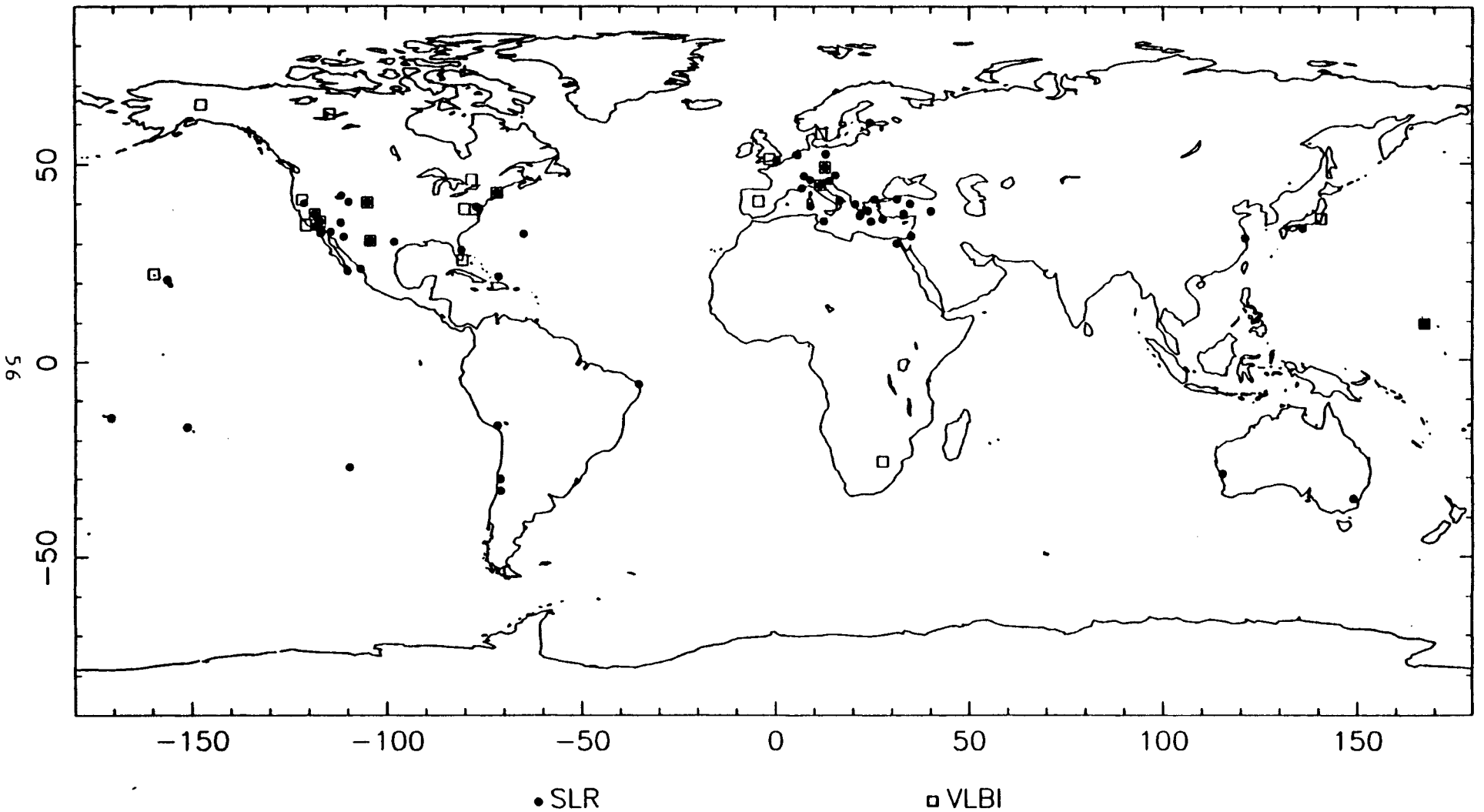
orientation : obtained by fixing to zero the rotation parameters of (BIH) 88 C 01

time evolution : AM0-2

2.5.4) Results :

- coordinates (at epoch 1988.0) of 34 primary sites. In each site, coordinates of both reference point and tracking points are given, (see Table 1, IERS Technical Note 1, p. 9),
- no published coordinates (at epoch 1988.0) of 29 colocation sites (occuring in at least 2 SSC),
- no published coordinates (at epoch 1988.0) of 13 no-colocation sites (occuring in 1 SSC),
- transformation parameters between ITRF-0 and individual frames (see appendix 4 of IERS Technical Note 1).

FIG.11 -ITRF-0 SITES



2.6) ITRF88

2.6.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 89 R 01	RN88	AM0-2	1984	27
	(GSFC) 89 R 01		AM0-2	1989	31
	(GSFC) 89 R 03	RG88	adjusted	1988	65
	(JPL) 89 R 02	RJ88	AM0-2	1985	10
	(NAOMZ)89 R 01	RM88	AM0-2	1984	6
	(SO) 89 R 01	RS88	-		6
LLR	(JPL) 89 M 01	MJ88	AM0-2	1988	5
	(CERGA)89 M 01	ME88	-		4
	(UTXMO)89 M 01	MX88	AM0-2	1984	4
	(SO) 86 M 01	MS88	-		24
SLR	(CSR) 89 L 02	LC88	AM1-2	1988	91
	(GSFC) 89 L 01	LG88	AM0-2	1983	85
	(ZIPE) 87 L 01	LZ88	AM0-2	1984	31
	(SO) 88 L 01	LS88	AM1-2	1988	24
	(DUT) 89 L 01	LU88	AM1-2	1987	24
Combination	ITRF-0	CI88	AM0-2	1988	71

2.6.2) Local excentricities : used as observations with proper variances (EI88, given in Appendix 3).

2.6.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of ITRF-0

scale : obtained by fixing to zero the scale factor of ITRF-0

orientation : obtained by fixing to zero the rotation parameters of ITRF-0

time evolution : input SSC has been computed for 1988.0. For solutions which were given at another epoch, 1988.0 values have been computed using their respective motion models.

2.6.4) Results :

- coordinates (at epoch 1988.0) of 158 tracking points (96 sites), (see Table T-4, IERS Annual Report for 1988, p. II-54)

- transformation parameters between ITRF88 and individual frames, (see Table T-5, IERS Annual Report for 1988, p. II-56)

2.7) ITRF88A

2.7.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 89 R 01	RN88A	AM0-2	1984	27
	(GSFC) 89 R 03	RG88A	adjusted	1988	65
	(JPL) 89 R 02	RJ88A	AM0-2	1985	10
LLR	(JPL) 89 M 01	MJ88A	AM0-2	1988	5
	(CERGA)89 M 01	ME88A	-		4
	(UTXMO)89 M 01	MX88A	AM0-2	1984	4
SLR	(CSR) 89 L 02	LC88A	AM1-2	1988	91
	(GSFC) 89 L 01	LG88A	AM0-2	1983	85
Combin-ation	ITRF-0	CI88A	AM0-2	1988	71

2.7.2) Local excentricities : used as observations with proper variances (EI88A, same as EI88)

2.7.3) Datum fixation:

origin : obtained by fixing to zero the translation parameters of ITRF-0

scale : obtained by fixing to zero the scale factor of ITRF-0

orientation : obtained by fixing to zero the rotation parameters of ITRF-0

time evolution : input SSC has been computed for 1988.0. For solutions which were given at another epoch, 1988.0 values have been computed using their respective motion models.

2.7.4) Results :

- coordinates (at epoch 1988.0) of 157 tracking points

- transformation parameters between ITRF88A and individual frames (Table 10)

2.8) ITRF88B

2.8.1) Sets of station coordinates included in the adjustment

Technique	SSC	Label	Plate motion model	Reference date	Number of points
VLBI	(NGS) 89 R 01	RN88B	AM0-2	1984	27
	(GSFC) 89 R 03	RG88B	adjusted	1988	65
LLR	(JPL) 89 M 01	MJ88B	AM0-2	1988	5
SLR	(CSR) 89 L 02	LC88B	AM1-2	1988	91
	(GSFC) 89 L 01	LG88B	AM0-2	1983	85

2.8.2) Local excentricities : used as observations with proper variances (EI88B, same as EI88).

2.8.3) Datum fixation:

origin : obtained by fixing the translation parameters of (CSR) 89 L 02 to the values obtained in ITRF88A

scale : obtained by fixing the scale factor of (CSR) 89 L 02 to the value obtained in ITRF88A

orientation : obtained by fixing the rotation parameters of (CSR) 89 L 02 to the values obtained in ITRF88A

time evolution : input SSC has been computed for 1988.0. For solutions which were given at another epoch, 1988.0 values have been computed using their respective motion models.

2.8.4) Results :

- coordinates (at epoch 1988.0) of 152 tracking points

- transformation parameters between ITRF88B and individual frames (Table 11)

FIG.12-ITRF88, ITRF88A,ITRF88B SITES

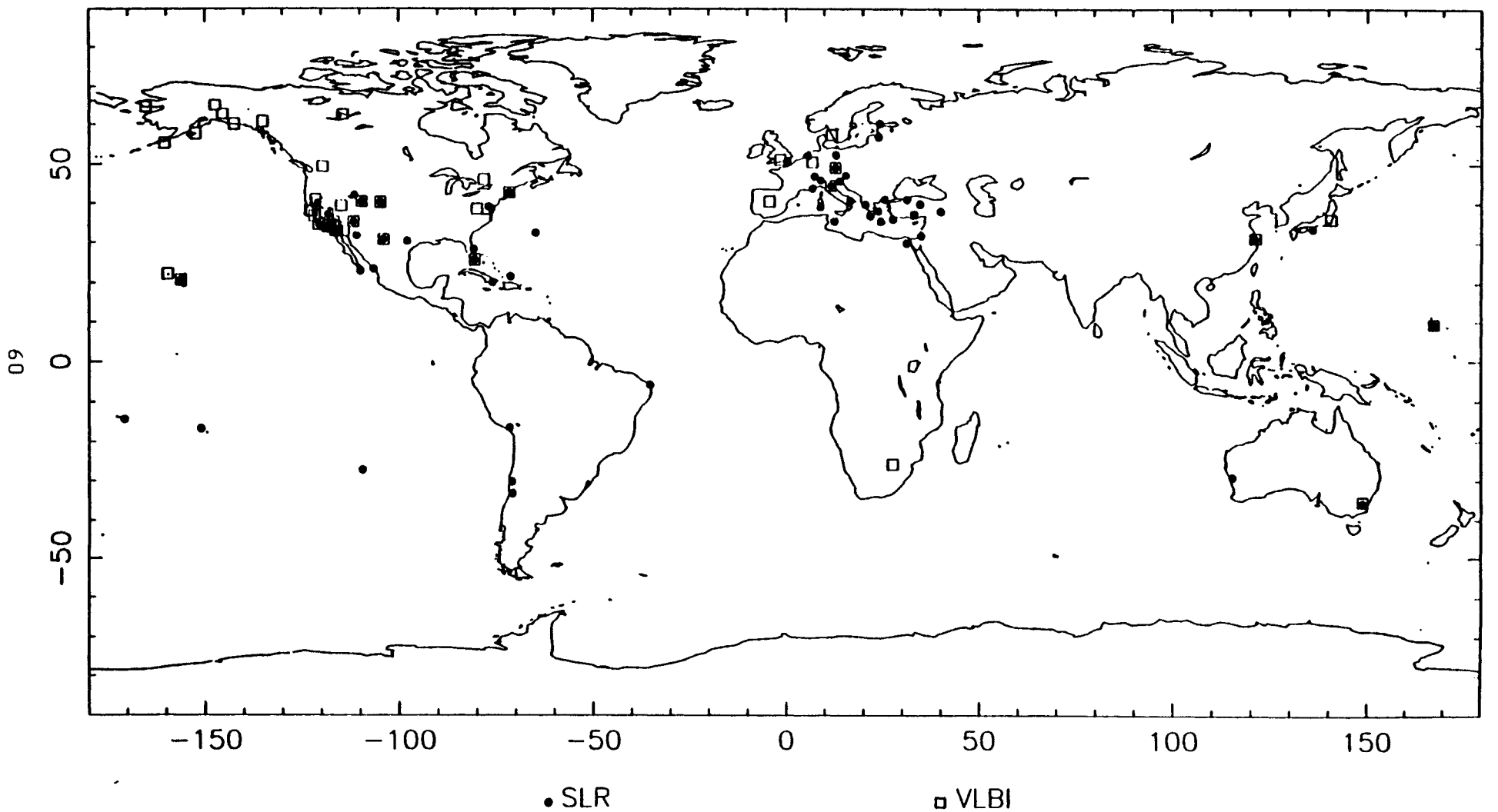


Table 10 Transformation parameters from ITRF88A to individual systems

NETWORK	T1 cm	T2 cm	T3 cm	D 10^{-8}	R1 .001"	R2 .001"	R3 .001"
SSC(NGS) 89 R 01	-5.6	15.3	3.9	1.5	-0.2	9.7	-1.0
	2.6	2.7	2.6	0.4	1.1	1.0	0.8
SSC(GSFC) 89 R 03	162.1	-86.1	59.5	-1.9	2.6	1.8	0.1
	2.5	2.6	2.5	0.3	1.0	1.0	0.8
SSC(JPL) 89 R 02	-6.7	0.2	-10.9	-5.2	1.7	0.0	6.8
	3.1	3.2	3.3	0.4	1.3	1.3	1.2
SSC(JPL) 89 M 01	-9.5	2.1	1.6	-1.7	4.2	0.8	-11.6
	6.2	7.1	6.6	0.8	3.3	2.3	1.8
SSC(CERGA)89 M 01	-9.6	-7.2	-8.3	-4.9	-5.9	1.0	-11.6
	6.3	7.7	6.6	0.8	3.7	2.4	1.9
SSC(UTXMO)89 M 01	-4.7	-4.7	-17.8	-3.6	-4.7	4.5	-2336.6
	11.5	13.4	12.1	1.5	6.4	4.4	3.3
SSC(CSR) 89 L 02	0.3	2.2	1.3	-0.3	-3.9	4.1	-15.7
	2.2	2.2	2.1	0.3	0.9	0.8	0.7
SSC(GSFC) 89 L 01	-0.6	1.3	3.7	-0.2	-1.5	5.0	-7.4
	2.2	2.2	2.1	0.3	0.9	0.9	0.7

Unscaled standard deviations (factor of unit variance = 1.3)

Table 11 Transformation parameters from ITRF88B to individual systems

NETWORK	T1 cm	T2 cm	T3 cm	D 10^{-8}	R1 .001"	R2 .001"	R3 .001"
SSC(NGS) 89 R 01	-4.8	16.5	0.6	2.2	-0.5	9.8	-0.9
	2.5	2.7	2.6	0.4	1.1	0.9	0.8
SSC(GSFC) 89 R 03	162.8	-84.7	55.0	-1.1	2.0	1.9	0.2
	2.4	2.6	2.5	0.3	1.0	0.9	0.8
SSC(JPL) 89 M 01	-13.1	10.5	2.4	-1.8	8.3	1.9	-11.5
	6.5	7.6	6.9	0.9	3.6	2.4	1.9
SSC(CSR) 89 L 02 (*)	0.3	2.2	1.3	-0.3	-3.9	4.1	-15.7
SSC(GSFC) 89 L 01	-0.6	1.3	3.8	-0.2	-1.5	5.0	-7.5
	1.2	1.2	1.2	0.2	0.5	0.5	0.4

(*) Transformation parameters fixed in the adjustment.
Unscaled standard deviations (factor of unit variance = 1.3)