2 Selected data for ITRF2000

2.1 Solutions submitted by the IERS analysis centers

The selected solutions for the ITRF2000 combination are summarized in Table 1, underlying the constraint type applied by the individual analysis centers.

Table 1 Individual TRF solutions used in the ITRF2000 combination.

Technique **Analysis Center(AC)**	**AC** **SSC**	**Data** **Span**	**Station** **Number**	**Constraints**
VLBI				
Geodetic Institute of Bonn University	(GIUB) 00 R 01	84-99	51	Loose
Goddard Space Flight Center	(GSFC) 00 R 01	79-99	130	Loose
Shanghai Astronomical Observatory	(SHA) 00 R 01	79-99	127	Loose
LLR				
Forschungseinrichtung Satellitengeodaesie	(FSG) 00 M 01	77-00	3	Loose
SLR				
Australian Surveying and Land Information Group	(AUS) 00 L 01	92-00	55	Loose
Centro Geodesia Spaziale, Matera	(CGS) 00 L 01	84-99	94	Loose
Communications Research Laboratory	(CRL) 00 L 02	90-00	60	Loose
Center for Space Research	(CSR) 00 L 04	76-00	139	Loose
Delft Ins. Earth Oriented Space Research	(DEOS) 00 L 05	83-99	91	Loose
Deutsches Geodätisches Forschungsinstitut	(DGFI) 00 L 01	90-00	43	Removable
Joint Center for Earth System Technology, GSFC	(JCET) 00 L 05	93-00	48	Loose
GPS				
Center for Orbit Determination in Europe	(CODE) 00 P 03	93-00	160	Minimum
GeoForschungsZentrum Potsdam	(GFZ) 00 P 01	93-00	98	Minimum
International GPS Service by Natural Resources Canada	(IGS) 00 P 46	96-00	179	Minimum
Jet Propulsion Laboratory	(JPL) 00 P 01	91-99	112	Minimum
Univ of Newcastle upon Tyne	(NCL) 00 P 01	95-99	90	Minimum
NOAA, National Geodetic Survey	(NOAA) 00 P 01	94-00	165	Removable
DORIS				
Groupe de Recherche de Geodesie Spatiale	(GRGS) 00 D 01	93-00	66	Loose
Institut Gographique National	(IGN) 00 D 09	92-00	80	Minimum
Multi-technique (SLR + DORIS + PRARE)				
GRIM5 project (GRGS+GFZ)	(GRIM) 00 C 01	85-99	183	Loose
CSR: SLR + DORIS on TOPEX	(CSR) 00 C 01	-	147	Loose
GPS Densification				
CORS Network by NOAA	(CORS) 00 P 01	94-99	80	Removable
South America Network by Deutsches Geodätisches Forschungsinstitut	(DGFI) 00 P 01	96-00	31	Loose
IAG Subcommission for Europe (EUREF), by Bundesamt fuer Kartographie und Geodäsie	(EUR) 00 P 03	96-00	81	Minimum
Geophysical Institute, University of Alaska	(GIA) 00 P 01	96-99	20	Minimum
Institut Géographique National	(IGN) 00 P 01	98-00	28	Minimum
Jet Propulsion Laboratory	(JPL) 00 P 02	91-99	28	Minimum
Antartica network, by Institut Gographique National	(IGN) 00 P 02	95-00	17	Minimum
REGAL Network, France	(REGAL) 00 P 03	96-00	29	Minimum
Antartica SCAR network, by Institut fuer Planetare Geodaesie, TU Dresden	(SCAR) 00 P 02	95-99	66	Removable

2.1.1 Summary of the VLBI solutions

SSC(GIUB) 00 R 01

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Observing technique: VLBI, group delay observables
Data span: January 1984 - December 1999 (2282 sessions),
worldwide set of VLBI observations
Number of sites: 51
Number of radio sources: 681

Type of results: EOP, RSC, SSC

- station coordinates and velocities
- right ascension and declination of radio sources
- earth orientation parameters (X,Y,UT1-UTC,dpsi,deps) corrected for short periodic variations according to Gipson (1996)
- reference epochs for UT1-UTC and polar motion: midnight epochs
- reference epochs for nutation offsets: beginning of each session

Connection between systems:

- The orientation of CRF is defined by no-net-rotation constraints for 206 ICRF defining sources.
- Definition of initial translation and rotation of the TRF: Condition that the sum of adjustments of 12 sites with respect to ITRF97 is zero.
- The evolution of the TRF velocity field is defined by introducing the condition that the sum of adjustments of the velocities of five sites with respect to ITRF97 is zero.

SSC(GSFC) 00 R 01

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Mark III VLBI delay observations between August 1979 and October 2000 acquired by the NASA Crustal Dynamics Project, POLARIS/IRIS organized by NOAA, the Communications Research Laboratory (Japan), the Geographical Survey Institute (Japan), the University of Bonn Geodetic Institute, the National Astronomical Observatory (Japan), the Naval Research Laboratory Reference Frame Program, the USNO NAVEX/NAVNET, the NASA Space Geodesy Program-GSFC, and the National Earth Orientation Service (USA) have been analyzed for TRF. The origin and orientation of the TRF are connected to ITRF97 at 1997.0 by applying no-net-horizontal-translation and no-net-rotation constraints to the position adjustments of twelve stations with uniform station weighting for both constraints. The evolution of the TRF is connected to ITRF97 by applying no-net-horizontal-translation and no-net-rotation constraints to the velocity adjustments of five stations with uniform station weighting for both constraints. The right ascension origin and orientation of the CRF are connected to ICRF by applying a no-net-rotation constraint to the position adjustments of the 212 ICRF defining sources with weighting proportional to the precision of the source positions. Three-dimensional velocities are adjusted for all sites with constraints for those sites with insufficient data. The velocities of some groups of stations are constrained to be equal. Some stations are allowed a single discontinuous jump. Pressure loading is applied to remove the temporal variations of the vertical positions without changing the mean vertical positions. Troposphere gradient parameters are generally estimated every six hours with a priori mean gradients derived from VLBI and weather data. Piece-wise linear, continuous troposphere zenith parameters are generally estimated every 20 minutes. Observations below 7 degrees elevation are excluded.

SSC(SHA) 00 R 01

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The VLBI analysis center at the Shanghai Observatory of Chinese Academy of Sciences analyze in this year the MKIII VLBI group delay observations between August 1979 and December 1999. The solutions produce the full set of RSC, SSC, SSV and EOP. Using almost all geodetic and astrometric experiments from the NASA Crustal Dynamics Project, POLARIS/IRIS organized by NOAA, the Communications Research Laboratory (Japan), the Geographical Survey Institute (Japan), the University of Bonn Geodetic Institute, the National Astronomical Observatory (Japan), the Naval Research Laboratory Reference Frame Program, the USNO NAVNET/NAVEX, the NASA Space Geodesy Program-GSFC, the National Earth Orientatio n Service (USA), CORE project, and APSG VLBI observations, the data include 2971 sessions and 2240434 group delay observations. There are 127 sites and 636 sources in the analysis. The TRF solution was loosely constrained.

2.1.2 Summary of the SLR solutions

SSC(AUS) 00 L 01

Lageos1 and Lageos2 global SLR solution from November 1992 to December 1999. Data processing undertaken in MICROCOSM, normal equation stacking in SOLVE. Solution epoch is 97:001:00000. ITRF97 used as apriori model, coordinates constrained to $\pm 1m$, velocities constrained to $\pm 1m/yr$.

SSC(CGS) 00 L 01

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G. Bianco Italian Space Agency (ASI), Space Geodesy Center, Matera, Italy

The SLR solution CGS00L01 provides SSC/SSV at the reference epoch 970101 and 3-day EOP derived from Lageos I (Jan 84 - Oct 99) and Lageos II (Nov 92 - Oct 99) data. The normal points are analysed in 30-day arcs using EGM96 geopotential (up to degree 70) and its own tides model, taking into account the secular drift and the influence of the dynamical pole on C21 and S21 coefficients, all the major planets perturbations as well as the relativistic effects. Residual unmodelled effects in the along-track direction are minimized by the estimation of empirical accelerations. The normal equations are built up for all the parameters to be estimated, but at this stage, they are solved just for the arc parameters, namely those related to the orbit (state vector and along-track acceleration) and to the laser tracking systems (station range bias). This arc inversion is performed with a bayesian least square procedure by the NASA/GSFC GEODYNII software. All the normal equations with the updated arc parameters are then combined solving for the global parameters in a least squares sense using the NASA/GSFC SOLVE software. Site coordinates and velocities, C20 zonal coefficient and EOP (X, Y, UT1R-UTC) are estimated keeping UT1R-UTC fixed at the IERS values at the beginning of each arc and with loose constraints on SSC/SSV.

SSC(CRL) 00 L 02

Toshimichi Otsubo (NERC & CRL), Tadahiro Gotoh (CRL)

SSC(CRL)00L02 is a 10-year solution of station positions and velocities from Communications Research Laboratory, Tokyo, Japan. CRL analysis software CONCERTO 3.22 processed the global SLR data from 60 stations: Lageos-1 tracking data from 9 Jan 1990 (MJD 47900) to 6 Jan 2000 (51549), and Lageos-2 data from 24 Nov 1992 (48950) to 6 Jan 2000 (51549). Positions (epoch: 1 Jan 1997) were solved for per system, but velocities of systems in the same 'site', which is defined by first 5 digits of DOMES number, were constrained to be the same. Loose constraints to ITRF97 were also applied to the sites of 7090, 7105, 7110, 7210, 7403, 7839 and 7840, both for positions (10m) and velocities (1m/y). Earth orientation parameters were also solved for. The IERS Conventions 1996 were followed except the use of the EGM96 earth gravity field and the JPL DE/LE 405 planetary ephemeris. Range bias was estimated for all the stations every 50 days.

SSC(CSR) 00 L 04

The solution CSR00L04 used Lageos-1 data from May 1976 to February 2000 and Lageos-2 data from November 1992 to February 2000. A single station position at epoch 1997Jan01 00:00 and a single velocity were adjusted for each location from which SLR data to the Lageos satellites was obtained. Range biases were adjusted for every site every 12 days. Orbital elements were adjusted for each satellite every 30 days for the earliest data and each day for the most recent.

SSC(DEOS) 00 L 05

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The solution SSC(DEOS)00L05 consists of a coherent set of station positions and velocities. This solution has been determined from SLR observations of LAGEOS-1 (September 1983 - December 1999) and of LAGEOS-2 (October 1992-December 1999). In total, SSC(DEOS)00L05 includes 91 stations. The reference epoch is January 1, 1993. The kinematic component of SSC(DEOS)00L05 is not rigidly determined: a priori values for station velocities are taken from the NUVEL-1A NNR model, whereas a priori standard deviations of the velocities for all stations are set at 1 m/yr.

SSC(DGFI) 00 L 01

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The global solution SSC(DGFI)00L01 has been derived from LAGEOS-1 (January 1990 - December 1999) and LAGEOS-2 (October 1992 - December 1999) data. This solution consists of a coherent set of station positions and velocities of 43 stations. The reference epoch is January 1, 1997. SLR stations with a time series of less than one year are not included. Furthermore the final SLR solution does not include stations that show significant differences between our LAGEOS-1 and LAGEOS-2 results. In a first step weekly solutions were computed for LAGEOS-1 and LAGEOS-2. The results were used for data screening and outlier detection. Normal equations (including station positions, velocities and EOP's) were generated. In a second step these weekly normal equations were combined to derive the final set of station coordinates and velocities.

The datum is defined by fixing one UT1 correction for each weekly arc and by introducing constraints (a-priori ITRF97 station coordinates with a standard deviation of 1 mm and velocities with a standard deviation of 1 mm/yr) for the stations 7105 (Washington) and 7840 (Herstmonceux).

SSC(JCET) 00 L 05

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Space Geodesy Branch, Code 926
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The solution is based on the analysis of laser ranging data to Lageos 1 and Lageos 2 from January 3, 1993 to January 3, 2000, in the form of ILRS Normal Points (NP). We have used all the data available from all the stations that tracked the two spacecraft during the analysis period.

2.1.3 Summary of the GPS solutions

SSC(CODE) 00 P 03

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The solution made available to the IERS by the CODE Analysis Center of the IGS for the 2000 submission was produced using as observations the GPS data of the global IGS network. The solution is based on observation over the time interval from GPS week 0782 (Jan. 1, 1995) to GPS week 1050 (Feb. 26, 2000).
A constraint of 1 m was put onto the coordinates in order to regularize the a priori significant constraints matrix (MATRIX_ESTIMATE). These constraints were week enough and did not change the solution.

SSC(GFZ) 00 P 01

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A global set of station coordinates (SSC(GFZ)00P01) and earth orientation parameters (EOP(GFZ)00P01) have been estimated from the analysis of the global GPS data spanning 7 years from January 1, 1993, to December 31, 1999 using the GFZ analysis software package EPOS.P.V2.

The number of sites included in the estimated global set is 104. Site velocities are adjusted for all sites which were analyzed for more than one year (∼90 sites). The velocity in height is loosely constrained. The orientation of the system was defined by applying no-net-rotation constraints both for the site coordinates and the site velocities, as a reference the ITRF99 (ITRF97_IGS_RS51.SNX) reference frame including velocities was used.

SSC(IGS) 98 P 46

Remi Ferland

This cumulative solution contains almost 5 years (1996-2001) of GPS data. Between GPS weeks 0837 and 1088, the weekly combined solutions from jpl, mit and ncl Global Associates Analysis Centers (GNAAC) were used in the cumulative solution. Since GPS week 0978, the Analysis Centers (AC) (code, emr, esa, gfz, jpl, ngs and sio) are used in the combination, while the GNAAC are used to quality control the weekly combination. The solutions are combined using the least-squares technique. All the available covariance information is used. All the solutions were unconstrained and compared. AC/GNAAC station coordinates estimates were rejected if they exceed thresholds of 5 sigmas or 50 mm. The weekly combination also includes daily ERP (pole position and rate, LOD) since GPS week 1013 and weekly apparent geocenter estimates since GPS week 0978. The cumulative combination is updated every week with the current weekly combination. This cumulative solution includes station coordinates and velocity for 167 sites. The cumulative solution is aligned to ITRF97 by applying 14 parameters transformation estimated using a set of 51 so called reference frame stations. Inner constraints in origin, orientation and scale (and rates) are applied to the solution.

SSC(JPL) 00 P 01

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Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

The most recent velocity and position solution from JPL is based on nearly nine years of data from 91JAN22 through 99OCT30. Position and velocity estimates were included for global sites with two year or more of data and official IGS log file information. Daily estimation was carried out with JPL's GIPSY software using strategies which generally adhered to IERS/IGS standards as described by Zumberge et al. (1997), Blewitt et al. (1992), and Heflin et al. (1992). Each daily coordinate and eop solution was aligned with ITRF97 by estimation and application of three rotations, three translations, and one scale. Antenna height corrections were applied based on information in the official IGS site logs. Unknown offsets due to equipment changes or co-seismic motion were estimated as necessary and outliers were removed. Positions, velocities, and time series of latitude, longitude, height, polar motion, length of day, geocenter, and scale estimates are all available via the web at <[1]>.

SSC(NCL) 00 P 01

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The solution presented is a kinematic combination of weekly P-sinex solutions from the Newcastle IGS Global Associate Analysis Centre. The data span four years gpsweeks 815-1022 (August 95 - August 99) and the minimum observation period for individual sites is 2 years.

Each weekly solution is a combination of the 7 IGS Analysis Centre (AC) solutions, stations having a minimum of 3 AC estimates form the core of the weekly solution (NCL G-sinex) any remaining AC stations being attached by back substitution, IGS RNAAC stations are also attached in this manner but are not included in the current kinematic solution.

The kinematic solution is iterated removing outliers at 3.0 standard deviations times the mean residual for each station. The resulting solution has loose constraints on orientation and orientation rate, the solution is aligned to the IGS ITRF97 constraining subset by estimating and applying a 14 parameter Helmert transformation. The estimate variance covariance is projected using minimum internal constraints to reflect the level of frame attachment.

[1] http://sideshow.jpl.nasa.gov/mbh/series.html

SSC(NOAA) 00 P 01

Mark Schenewerk and William Dillinger
NOAA N/NGS6 SSMC3; STA 9805 1315
East-West HWY Silver Spring, MD 20910

This SINEX file was generated using NOAA's pages and gpscom software from the GPS ionosphere-free combination of phase observations. All available data from every third day between 94/001 - 99/365 were included. From this, station coordinates and velocities, GPS orbits, EOP X and Y pole and daily UT1 rates, and double-difference phase ambiguities were estimated. The adjustment included a number of sites which do not have Domes numbers and therefore are not wanted for the ITRF combination. These sites have been treated as nuisance parameters, like the orbits, EOP, etc., and were eliminated in the reduction of the matrix before the final set of sites included in this Sinex file.

2.1.4 Summary of the DORIS solutions

SSC(GRGS) 00 D 01

J.F. Cretaux, A. Cazenave (LEGOS-GRGS)
L. Soudarin, J-J Valette (CLS)

A solution of coordinates and velocities has been computed using the DORIS data of 6 years of SPOT2, SPOT3, SPOT4 and TOPEX/POSEIDON: January 1993 to December 1998. This solution concerns all the stations of the DORIS network which have observed enough in order to estimate their motions (66 stations).

Data analysis:

The DORIS data are analysed through a dynamical orbit computation in which the satellite orbit, station positions and velocities, and EOP are determined in a single inversion, together with selected parameters required to improve the force model and the measurement corrections. Orbits are computed on a daily basis for the both SPOT satellites, and on a 3-days basis for the TOPEX/POSEIDON satellite, from which normal equations for station coordinates, velocity vectors and EOP are derived. Individual normal equations of orbit computations for each satellite have been accumulated to form a 6-year combined matrix involving data of the four satellites. The inversion of this matrix yields the solution for the geodetic parameters.

The gravity field model used in the orbit computation is EGM96.

Estimated parameters:

- The EOP parameters are kept free with EOPC04 values as a-priori values.
- The stations parameters (positions and velocities) were all estimated, to make the frame entirely free.
- For DORIS stations located on the same site only the velocity of the site was estimated, and the coordinates of each stations were estimated separately.
- The solution SSC(GRGS) 00 D 01 gives positions and motions of 66 stations.

References

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- Soudarin L., J-F Cretaux, and A. Cazenave, Vertical crustal motions from the DORIS space geodesy system, Geophysical Research Letter, 26, 1207-1210, 1999.
- IERS Technical Note 27.

SSC(IGN) 00 D 09

Pascal Willis and Zuheir Altamimi (IGN)

Monthly station position solutions for DORIS Network were computed at IGN using Gipsy/Oasis II software including DORIS data of all available satellites (SPOT2+SPOT3+SPOT4+TOPEX). Data span: October 1993 - March 1999. These monthly solutions were combined together using CATREF software, estimating station positions at a reference epoch (mid data span) and station velocities.

2.1.5 Summary of the Multi-technique solutions

SSC(GRIM) 00 C 01

COMBINED SLR, DORIS and PRARE SITE COORDINATES AND VELOCITIES SOLUTION COMPUTED BY GRGS/GFZ in the framework of GRIM5-S2

R. Biancale, J-M. Lemoine, J-C. Marty, G. Balmino, B. Moynot, P. Exertier, Y. Boudon, O. Laurain, F. Barlier, P. Schwintzer, Ch. Reigber, A. Bode, F.-H. Massmann, H. Meixner, J.C. Raimondo, S. Zhu

A solution of coordinates and velocities has been computed using:

- SLR data of 14.5 years of tracking on Lageos (Mai 1985 to September 1999)
- SLR data of 7 years of tracking on Lageos2 (November 1992 to September 1999)
- DORIS data of four 4-month periods for SPOT2, SPOT3, SPOT4 (between November 1993 and June 1999)
- SLR and DORIS data of four 4-month periods for TOPEX/Poseidon (between November 1993 and June 1999)
- PRARE data from 50 ERS2 6-day arcs (between July 1995 and October 1997)

This solution concerns 183 SLR and DORIS and 26 PRARE stations in position and in velocity.

Data analysis:

The tracking data are analysed through a dynamical orbit computation in which the satellite orbit, station positions and velocities are determined in a single inversion, together with selected parameters required to improve the force models and the measurement corrections. Orbits are computed by 10-day arcs for the Lageos satellites, by 2- to 4-day arcs for the SPOT satellites, by 3- to 5-day arcs for the TOPEX/Poseidon satellite and by 6-day arcs for ERS2. Normal equations are then formed for orbit parameters, force parameters, station coordinates and velocity vectors. Individual normal equations are accumulated to form a combined matrix. The inversion of this matrix yields the solution for the geodetic parameters. The connection between the SLR, DORIS and PRARE networks in that combined station solution is obtained through the simultaneous use of these techniques on satellites such as TOPEX/Poseidon and ERS2, and not through the use of ground survey ties between stations.

The gravity field model used in the orbit computation is GRIM5-S1.

Estimated parameters

- The position of 209 SLR, DORIS and PRARE stations was estimated, using as only constraint: final position = initial position $\pm 10m$.
- The velocity of 153 sites was estimated. The solution was stabilized by constraining it to an a-priori model (NNR-NUVEL1A and ICE4G-VM2) with a sigma of 1 m/y.

SSC(CSR) 00 C 01

The CSR00C01 solution is made using ninety-six sets of twenty-eight 1-day orbital arcs fit using all of the SLR and DORIS tracking of the Topex/Poseidon satellite.

2.1.6 Summary of the GPS Regional solutions

SSC(CORS) 00 P 01

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This SINEX file was generated using NOAA's pages and gpscom software from the GPS ionosphere-free combination of phase observations. All available CORS data from every third day between 94/001 - 99/365 were included. From this, station coordinates and velocities, GPS orbits, EOP X and Y pole and daily UT1 rates, and double-difference phase ambiguities were estimated. The adjustment included a number of sites which do not have Domes numbers and therefore are not wanted for the ITRF combination. These sites have been treated as nuisance parameters, like the orbits, EOP, etc., and were eliminated in the reduction of the matrix before the final set of sites included in this Sinex file.

SSC(DGFI) 00 P 01

Klaus Kaniuth, Wolfgang Seemüller
Deutsches Geodätisches Forschungsinstitut (DGFI)
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SC(DGFI)00P01 is a regional solution including the permanent GPS network of South America as available to DGFI and a number of additional sites in the Antarctica, the Atlantic Ocean, the Pacific Ocean and the Caribbean Sea. It covers the time period from July 1996 to February 2000, and provides position and linear velocity estimates of 31 sites being in operation since at least one year. The solution is based on weekly SINEX files generated by DGFI as the IGS RNAAC for South America. IGS combined orbits and Earth orientation parameters were held fixed. The solution is referred to ITRF97 by introducing positions at the reference epoch (1998, day 119) and velocities of CRO1, FORT and SANT as fictitious observations. The weight applied to these "observations" is set such as to still allow the positions and velocities of these fiducial stations to deviate from their ITRF97 values by some mm and mm/10 respectively.

SSC(EUR) 00 P 03

M. Becker, P.Franke (Federal Agency for Cartography and Geodesy),
D. Ineichen, L. Mervart (Astronomical Institute, University of Berne),
C. Bruyninx (Royal Observatory Belgium)

The EUREF ITRF2000 contribution solution SSC(EUREF)00.P03 was generated November 2000 and comprises data from 96:182:00000 to 00:001:86369, GPS weeks 0860 to 1042.

It is stored in SINEX VERSION 1.00 and was created by the program ADDNEQ2, V4.3 of the Bernese Software. The technique is GPS (P). Original solutions were computed with 180s sampling interval and estimated parameters were coordinates, phase ambiguities and 12 tropospheric zenith path delay values per day. By use of IGS products loosely constrained solutions in the ITRF97 reference frame are computed.

It is computed from the weekly EUREF combination solution obtained from the 12 EUREF analysis centers (ASI, BEK, BKG, COE, GOP, IGN, LPT, NKG, OLG, ROB, UPA, WUT) and generated at the Bundesamt für Kartographie und Geodäsie BKG, Frankfurt.

Contact is the EUREF analysis coordinator[2] on behalf of the IAG Commission X, Subcommission for Europe (EUREF).

The combination of 183 weekly solutions comprise 86 estimated coordinate sets of 81 stations. Stations ANKR 20805M002 (1999 08 15 00 00 00), HERS 13212M007(1999 04 25 00 00 00), PFAN 11005S002(1999 10 31 00 00 00), TRO1 10302M006(1998 12 27 00 00 00) and ZIMM 14001M004(1998 11 08 00 00 00) were assigned two sets of coordinates after discontinuities in the time series at the epochs given above.

Velocities for 81 sites were estimated. Coordinates and velocities of sites with time series of less than 6 months were not estimated.

Coordinates and velocities in the SINEX file are tied to the ITRF97 by a minimum constraint in translation applied to the IGS core sites: VILL, REYK, ONSA, WTZR, POTS, KOSG, MATE and ZWEN.

The a-priori covariance matrix is not included to the SINEX file. Constraints should be removed by estimation of three translation parameters for coordinates and for velocities in the combination. In this way the relative constraints used for some stations with jumps in the co ordinates are maintained. Detailed sites descriptions and logsheets can be accessed at <[3]>.

SSC(GIA) 00 P 01

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We contribute an IGS densification solution to the ITRF2000. This solution includes positions and velocities of well-determined permanent GPS sites in Alaska and NW Canada.

SSC(IGN) 00 P 01

Philippe Nicolon and Zuheir Altamimi (IGN)

Weekly station position solutions of the French RGP network were generated using Bernese Software as part of the IGN contribution to EUREF. Spanning approximately 2 years, these weekly solutions were combined together using CATREF software, estimating station positions at a reference epoch (mid data span) and station velocities.

[2] heinz.habrich@bkg.bund.de
[3] http://homepage.oma.be/euref/eurefhome.html

SSC(IGN) 00 P 02

Marie-Noëlle Bouin and Zuheir Altamimi (IGN)

Weekly station position solutions of the Antarctica network were generated using GAMIT Software. Spanning approximately 5 years (1995-2000), these weekly solutions were combined together using CATREF software, estimating station positions at a reference epoch (mid data span) and station velocities.

SSC(REGAL) 00 P 03

Eric Calais and Jean-Mathieu Nocquet

We process on a daily routine basis about 30 permanent GPS sites around the Alps in Italy, France, Germany, Austria, and Switzerland. We process pseudo-range and phase GPS data in single solutions using the GAMIT software. We solve for regional station coordinates, satellite state vector, 13 tropospheric zenith delay parameters per site and day, and phase ambiguities using doubly-differenced GPS phase-measurements, with IGS final orbits and IERS earth orientation parameters. The least-squares adjustment vector and its corresponding variance-covariance matrix for station positions and orbital elements estimated for each independent daily solution are then passed to a Kalman filter (GLOBK, Herring et al., 1990) in order to estimate position and velocities, using loose constrains on IGS sites coordinates.

2.2 Local surveys

As an improvement of the use of the local ties, all the eccentricities of colocated sites were converted into a complete set of positions for each site, provided in SINEX format. Each SINEX file reflects correlations between the cartesian components of the points within each site. This has been achieved by solving for the following system of observation equations (2):

$$\begin{pmatrix} \Delta x_s^{i,j} \\ \Delta y_s^{i,j} \\ \Delta z_s^{i,j} \end{pmatrix} = \begin{pmatrix} x^j - x^i \\ y^j - y^i \\ z^j - z^i \end{pmatrix} \tag{2}$$

Where ($\Delta x_s^{i,j}$, $\Delta y_s^{i,j}$, $\Delta z_s^{i,j}$) are the geocentric components of the tie vector linking two points i and j, of a given data set s. The standard deviations (SD) ($\sigma\Delta x_s^{i,j}$, $\sigma\Delta y_s^{i,j}$, $\sigma\Delta z_s^{i,j}$) for each local tie vector are used to compute a diagonal variance matrix. If these SD are not available, they are computed by:

$$\sigma_{computed} = \sqrt{\sigma_1^2 + \sigma_2^2} \tag{3}$$

where, $\sigma_1 = 3$ mm and $\sigma_2 = 10^{-6} \times \sqrt{(\Delta x_s^{i,j})^2 + (\Delta y_s^{i,j})^2 + (\Delta z_s^{i,j})^2}$
The equation system (2) needs of course initial coordinates for one point per tie vector set s, which are taken from ITRF solutions with 1 meter as standard deviation.

Table 5 of the appendix lists the local ties vectors used in the ITRF2000 combination.