MIT ANALYSIS STRATEGY SUMMARY (template version 2.0, 12 Feb. 2008)	
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Software used	GAMIT v. 10.32, GLOBK v. 5.12
GNSS system(s)	GPS
Final products generated for GPS Week 'WWWW' day of Week 'n' (n=0,1,...,6) Rapid products generated daily	mitwwwwn.sp3 GPS ephemeris files in 7 daily files at 15 min intervals in SP3 format, including accuracy codes computed from 6-hour overlap with surronding days. mitwwww7.erp ERP (pole, UT1-UTC) weekly solution mitwwww7.sum Summary of weekly solution. mitwwww7.snx Weekly coordinates in SINEX format mitwwwwn.clk Station and satellite clock solutions. 30 second interval for satellites and reference site. 15 minutes for other sites.
Preparation date	2008-02-29 (original updated version)
Modification dates	
Effective date for data analysis	2006-11-05 (GPS week 1400) and afterwards, including IGS reanalysis campaign
Instructions: Please provide as complete information as possible. The template below is illustrative only; replies should reflect actual analysis implementation. Please accumulate changes with effective dates of usage, rather than remove earlier information.	
MEASUREMENT MODELS	
Preprocessing	Networks are selected based on available rinex data files and a core list of 117 clock and igs reference sites. Small rinex files (less than 3hrs of data) are rejected. 250 sites processed daily.
Basic observables	Doubly differenced, ionosphere-free combination of L1 and L2 carrier phases. Pseudoranges are used only to obtain receiver clock offsets and in ambiguity resolution Melbourne-Wuebbena widelane method. Non-redundant double differences are used [Schaffrin and Bock, 1988]
	Elevation angle cutoff: 10 degrees Sampling rate: 30 seconds for cleaning; 2 minutes in least-squares analysis. Code biases: C1 & P2' corrected to P1 & P2 using receiver type dependent monthly tables from http://www.aiub.unibe.ch/ionosphere/p1c1.dcb
Modeled observables	Double-differenced carrier phase with ionosphere-free linear combination applied. Clocks are estimated in

	a post-processing step using one-way observables with the ensemble mean of the clock residuals at a set of reference ground stations set to zero at each epoch.
*Satellite antenna -center of mass offsets	SV-specific z-offsets & block-specific x- & y-offsets (from manufacturers) from file igs05_wwww.atx based on GFZ/TUM analyses using fixed ITRF2000 coordinates [refer to IGS Mail #5189, 17 Aug 2005]
*Satellite antenna phase center corrections	Block-specific nadir angle-dependent "absolute" PCVs applied from file igs05_wwww.atx; no azimuth-dependent corrections applied [refer to IGS Mail #5189, 17 Aug 2005]
*Satellite clock corrections	2nd order relativistic correction for non-zero orbit ellipticity (-2*R*V/c) applied [NOTE: other dynamical relativistic effects under Orbit Models]
GPS attitude model	GPS satellite yaw attitude model: applied (Bar-Sever, 1995) based on nominal yaw rates
*RHC phase rotation corrections	Phase wind-up applied according to Wu et al. (1993)
*Ground antenna phase center offsets & corrections	"Absolute" elevation- & azimuth-dependent (when available) PCVs & L1/L2 offsets from ARP applied from file igs05_wwww.atx [refer to IGS Mail #5189, 17 Aug 2005]
*Antenna radome calibrations	Calibration applied if given in file igs05_wwww.atx; otherwise radome effect neglected (radome => NONE)
*Marker -> antenna ARP eccentricity	dN,dE,dU eccentricities from site logs applied to compute station marker coordinates
Troposphere a priori model	Met data input: latitude, longitude, height, DOY climate model from Boehm et al. (2007) (GPT version 2006June16); rel. humidity set to 50% for all sites
(parameter estimation is below)	Zenith delay: Saastamoinen (1972) "dry" + "wet" using synthesized input met data
	Mapping function: GMF (Boehm et al., 2006) for dry & wet zenith delays individually
	Horiz. grad. model: no a priori gradient model is used
Ionosphere	1st order effect: accounted for by dual-frequency observations in linear combination
	2nd order effect: no corrections applied
	Other effects: no corrections applied
Tidal Displacements	Solid Earth tide: IERS 2003
(IERS Conventions 2003, Ch. 4, eqn 11)	Permanent tide: zero-frequency contribution left in tide model, NOT in site coordinates
	Solid Earth pole tide: IERS 2003; mean pole removed by linear trend (Ch. 7, eqn 23a & 23b)
	Oceanic pole tide: no model is applied [IERS Conventions updated, Ch. 7, eqn 27]
	Ocean tide loading: IERS Conventions 2003 (updated Ch. 7, 2006) using site-dependent amps & phase for 11 main tides from Bos & Scherneck website for FES2004 model; CMC corrections applied to SP3 orbits.
	Ocean tide geocenter: site-dependent coeffs corrected for center of mass motion of whole Earth; CMC corrections also applied to SP3 orbits.
	Atmosphere tides: corrections for S1 & S2 tidal pressure loading not applied (no model available yet) [IERS model under development]
Non-tidal loadings	Atmospheric pressure: not applied
	Ocean bottom pressure: not applied

	Surface hydrology: not applied
	Other effects: none applied
Earth orientation Variations	Ocean tidal: diurnal/semidiurnal variations in x,y, & UT1 applied according to IERS 2003.
	Atmosphere tidal: S1, S2, S3 tides not applied [no IERS model specified yet]
	High-frequency nutation: prograde diurnal polar motion corrections (IERS 2003, Table 5.1) applied using IERS routine.
[NOTE: effects are included in observation model as well as in the transformation of orbits from inertial to terrestrial frame]	
REFERENCE FRAMES	
Time argument	GPS time as given by observation epochs, which is offset by only a fixed constant (approx.) from TT/TDT
Inertial frame	Geocentric; mean equator and equinox of 2000 Jan 1.5 (J2000.0)
Terrestrial frame	ITRF2005 reference frame realized through the set of up to 132 station coordinates and velocities given in the IGS internal realization IGS05.snx (aligned to ITRF2005). Reference sites may be removed from the realization if the standard deviation of their position estimates deviates too much from the median sigma of the remaining reference sites or if their position estimate deviates by more than 4-sigma from the apriori value. Conditions are applied iteratively. The datum for Finals is specified only for orientation using NNR constraints wrt IGS05 coordinates.
Tracking network	Tracking network is based on 117 clock sites as specified by the type of clock plus an additional 208 sites that fill out the core list of sites. Six global distributed networks of ~50 sites each, with two overlap sites between each pair of networks, form a global network of 243 stations that are dynamically selected based on available data.
Interconnection	Precession: IAU 1976 Precession Theory
	Nutation: IAU 2000A Nutation Theory
(EOP parameter estimation is below)	A priori EOPs: polar motion & UT1 interpolated from IERS Bulletin A, updated weekly, with the restoration of subdaily EOP variations using IERS models (see MODELS above)
ORBIT MODELS	
Geopotential (static)	EGM96 degree and order 9; C21 & S21 modeled according to polar motion variations (IERS 2003, Ch. 6)
	GM=398600.4415 km**3/sec**2 (for TT/TDT time argument)
	AE = 6378136.3 m
Tidal variations in geopotential	Solid Earth tides: C20,C21,S21,C22, and S22 as in IERS (1992); n=2 order-dependent Love numbers & frequency dependent corrections for 6 (2,1) tides from Richard Eanes (private comm., 1995)
	Ocean tides: none
	Solid Earth pole tide: None applied in orbit models
	Oceanic pole tide: no model applied
Third-body forces	Sun & Moon as point masses
	Ephemeris: Generated from the MIT PEP program

	GM_Sun 132712440000.0000 km**3/sec**2 GM_Moon 4902.7989 km**3/sec**2
Solar radiation pressure model (parameter estimation is below)	A priori: nominal block-dependent constant direct acceleration; corrections to direct, y-axis, and B-axis constant and once-per-rev terms estimated (Beutler et al., 1994; Springer et al. 1998)
	Earth shadow model: umbra & penumbra included
	Earth albedo: not applied
	Moon shadow: umbra & penumbra included
	Satellite attitude: model of Bar-Sever (1995) applied; using nominal yaw rates
	Other forces: none applied
Relativitic effects	Dynamical correction: not applied (see IERS 2003, Ch. 10, eqn 1)
	Gravitational time delay: IERS 2003, Ch. 11, eqn 17 applied
Numerical integration	Adams-Moulton fixed-step, 11-pt predictor-corrector with Nordsieck variable-step starting procedure (see Ash, 1972 and references therein)
	Integration step-size: 75 s; tabular interval: 900 s
	Starter procedure: Runge-Kutta Formulation; initial conditions taken from prior orbit solution at 12:00
	Arc length: 24 hours (00:00:00 - 23:59:30 GPS time)
ESTIMATED PARAMETERS (& APRIORI VALUES & CONSTRAINTS)	
Adjustment method	Weighted least squares to generate loosely constrained covariance matrices and solutions that are passed to a Kalman filter for network combinations and weekly combinations for orbit determination
Data span	24 hours used for each daily analysis (00:00:00 - 23:59:30 GPS time)
Station coordinates	All station coordinates are adjusted, relative to the a priori values from IGS05.snx; a no-net-rotation condition is applied wrt the IGS05 frame using up to 132 reference frame stations; apriori sigmas for all stations are 10 m for each component.
Satellite clocks	Estimated using one-way phase data aligned with pseudorange. Time reference is defined by an ensemble average over selected hydrogen maser sites fit to broadcast ephemeris clocks. Clock estimation is completed after orbits and station coordinates for a week of data have been determined.
	sp3,clock files: Estimated values included 30-sec sampling for clock files.
Receiver clocks	Estimated during clock estimation. Stations clocks except the reference clock station are decimated to 300 seconds.
Orbits	Geocentric position and velocity, solar radiation pressure scales and once-per-revolution perturbation terms. Radiation pressure scaling factors and perturbation terms are estimated for each of the orthogonal directions: satellites - sun, body centered Y, and orthogonal third directions estimated as constant offsets for each one-day arc; plus once-per- rev sine/cosine terms are estimated with apriori values from the prior day, and weak apriori

	constraints.
	sp3 files: orbits transformed to crust-fixed (rotating) frame accounting for geocenter motions due to ocean tides and for subdaily tidal EOP variations
Satellite attitude	No attitude parameters are adjusted
Troposphere	Zenith delay: residual delays are adjusted for each station assuming mostly dominated by "wet" component; parameterized by piecewise linear, continuous model with 2-hr intervals
	Mapping function: GMF (Boehm et al., 2006) wet function used to estimate zenith delay residuals
	Zenith delay epochs: each even-integer hour
	Gradients: two N-S & two E-W gradient parameter per day for each station, with linear variation during the day; 30mm at 10-deg elevation 1-sigma constraint is applied at all stations. Mapping function from Chen and Herring (1997) used.
Ionospheric correction	not estimated
Ambiguity	Real-valued double-differenced phase cycle ambiguities adjusted except when they can be resolved confidently in which case they are fixed using the Melbourne-Webana widelane to resolve L1-L2 cycles and then estimation to resolve L1 and L2 cycles. About 95% of all ambiguities are fixed using modern network data
*Earth orientation parameters (EOP)	Daily x & y pole offsets, pole-rates, and LOD at noon epochs; x and y pole estimated as piece-wise, linear offsets from IERS Bulletin A a prioris over each 1-day segment. UT1 is estimated with tight constraints on the first day.
Other parameters	none

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