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[IGSMAIL-5447]: Proposed IGS05 Realization

- *To*: <igsmail @ igscb.jpl.nasa.gov>
- *Subject*: [IGSMAIL-5447]: Proposed IGS05 Realization
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Author:  R. Ferland

Dear colleagues,

        You will find below a review of the IGS05 proposed reference frame
realization, along with some comparisons and analysis of its effects on
the apparent geocenter, ERP's and the scale.

        See IGSMAIL 5438 by Gerd Gendt for the proposed timeline:
http://igscb.jpl.nasa.gov/mail/igsmail/2006/msg00161.html

        I have updated the proposed realization "IGS05.snx".
For those of you who may need it, I have also posted a corresponding
"IGT05.snx" which uses the relative antenna phase center offsets.
Those can be found at:
ftp     macs.geod.nrcan.gc.ca
cd      /pub/requests/sinex/IGS05

and should be made available soon at the igscb.

The proposed update includes:
        - 1) Reference Frame Stations review
        - 2) ITRF2000 to ITRF2005 update.
        - 3) Relative to absolute antenna phase calibration change

        Preliminary versions of the IGS realization of was provided last
spring (last one IGS05_060606.snx).
This latest release differs only slightly from the earlier one.
One version was presented at the last IGS workshop in Darmstadt in
May 2006 , where details of the changes were provided.
(see: http://nng.esoc.esa.de/ws2006/Ferland.pdf)
In summary, the proposed changes w.r.t IGb00 were:
        -89 stations were retained,
        -10 were removed and
        -50 were added
Total   139 stations was in the proposed realization.

Following the recent official release of ITRF2005,
(http://itrf.ensg.ign.fr/ITRF_solutions/2005/ITRF2005.php)
the proposed realization has been updated.

The station selection generally follows the criterions from:
     Kouba, J., J. Ray and M.M. Watkins, IGS Reference Frame Realization,
1998 IGS Analysis Center Workshop Proceedings, European Space Operations
Centre, Darmstadt, Germany.
and from the guidelines:
        Moore, A., IGS Site Guidelines, Jet Propulsion Laboratory, 2004.


1) Review of the proposed realization:
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        The originally proposed network of 139 stations was reviewed.
The following stations may no longer be suitable for the IGS05 reference
frame realization. It is proposed to remove them:

BAKO:   Discontinuity introduced at 06:149:00000,
        Equipment Change.
BRMU:   Discontinuity introduced at 06:213:00000,
        Equipment Change/Cut-off angle change.
CORD:   Decommissioned.
KOUR:   Discontinuity introduced at 06:183:00000,
        Cause Unknown.
LHAS:   Discontinuity introduced at 06:209:45000,
        Antenna & receiver Change.
OUS2:   Discontinuity introduced at 06:239:79200,
        Radome removed.
RBAY:   Discontinuity introduced at 06:211:00000,
        Cause Unknown.

        This would reduce the originally proposed 139 stations network to
132 stations. The following stations performance is currently questionable:

ASC1:   Off since 06:056 due to equipment problems,
GOUG:   Data availability ???,
NICO:   No data since 06:166,
OHI2:   Recent Solutions are questionable.

It is proposed to leave them in, hoping that their status does improve.

        The following section first compares the currently proposed realization
with the previous one, dating back to last June. It is followed by the effect
of the alignment of the proposed IGS05 to ITF2005.

2)      IGS05:
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2-1)    IGS05 - IGS05_060606.snx:
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        Since significant testing, has already taken place with the
"IGS05_060606.snx" and earlier proposed realizations, comparisons are first
made with the latest. The coordinates for all the proposed realizations were
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extracted from ITRF2005 (and its preliminary release). The position differences at the reference epoch (2000.0) between this proposed release and the previous one are sub-mm for about half of the stations. Only 2 (CONZ and KOKB) have horizontal positions exceeding 2mm, and 2 (CONZ and NOT1) have 3D position exceeding 3mm; velocity differences are all sub-mm/y. The larger differences at those two stations are likely caused by the ties with other techniques.

The proposed realization relative to absolute receiver antenna phase center corrections have also been updated using all the available test solutions up to GPS week 1389. Results with data available up to April were presented at the workshop.
(See: http://nng.esoc.esa.de/ws2006/ABSA4.pdf) The inclusion of an additional 6 months of data affects the phase center corrections (N,E,H) components by less than 2mm (RMS).

Although the vertical component of the correction is the most significant, the 3D corrections were applied.
Those final corrections are:

Code	Pt	Soln	d	d. Lat (mm)	d. Lon (mm)	d. Hei (mm)
ALGO	A	7	D	-1.1	-0.4	16.5
ALIC	A	1	D	-0.1	0.1	13.2
ALRT	A	1	D	-1.6	-1.0	-12.8
AMC2	A	4	D	-1.5	-2.1	11.0
ARTU	A	3	D	1.4	-0.6	15.4
ASC1	A	1	D	-1.3	-3.0	4.7
ASPA	A	1	D	-2.0	1.4	4.1
BAHR	A	1	D	-1.5	-0.6	15.5
BILI	A	4	D	0.3	1.9	-2.5
BJFS	A	1	D	-0.5	1.8	25.9
BOR1	A	2	D	-0.4	0.4	4.6
BRAZ	A	1	D	-2.8	-2.0	12.1
BRUS	A	2	D	0.0	0.3	3.6
CAGL	A	3	D	0.3	2.2	3.8
CAS1	A	3	D	-3.3	1.3	6.5
CEDU	A	1	D	0.1	0.5	18.9
CHAT	A	1	D	-3.0	0.4	18.9
CHPI	A	1	D	-2.5	-2.5	10.4
CHUR	A	4	D	0.4	-1.7	13.7
COCO	A	3	D	-1.3	2.2	8.4
CONZ	A	2	D	-2.6	-1.5	11.3
CRO1	A	1	D	-2.6	-0.5	18.9
DAEJ	A	1	D	-0.1	2.6	16.4
DARW	A	1	D	-0.4	0.7	12.6
DAV1	A	1	D	-2.9	0.5	9.2
DGAR	A	2	D	-0.9	-1.2	5.4
DRAO	A	3	D	-1.4	-1.1	12.6
DUBO	A	4	D	0.5	-2.1	19.9
FAIR	A	6	D	-1.3	0.7	10.2
FLIN	A	2	D	0.5	-1.8	12.1
GLPS	A	1	D	-2.1	-0.6	7.9
GLSV	A	1	D	0.2	3.0	5.1
GODE	A	2	D	-1.3	-0.0	15.3
GOLD	A	7	D	-3.1	-1.6	7.8
GOUG	A	1	D	-5.0	-0.5	93.2
GRAS	A	3	D	-0.5	1.1	3.4
GUAM	A	4	D	-3.2	0.0	16.0
GUAO	A	1	D	-1.0	1.0	8.7
HARB	A	1	D	-1.4	3.6	14.3
HLFX	A	1	D	-1.1	-1.0	16.6
HNLC	A	1	D	-2.4	-1.2	10.2
HOB2	A	2	D	-2.5	-0.2	14.6
HOFN	A	2	D	0.8	0.5	3.3
HOLM	A	1	D	-0.5	-0.5	0.5
HRAO	A	1	D	-3.1	1.8	16.0
HYDE	A	2	D	-2.1	-1.6	9.9
IISC	B	2	D	-1.5	-1.0	8.2
IRKT	A	1	D	0.5	1.0	18.0
ISPA	A	1	D	-1.3	-2.7	9.7
JAB1	A	2	D	-0.6	0.2	13.9
JOZE	A	2	D	1.2	0.0	-4.9
KARR	A	1	D	-0.5	1.6	10.0
KELY	B	1	D	-0.2	-0.5	0.6
KERG	A	2	D	-2.7	1.7	18.2
KIT3	A	1	D	-1.1	-0.9	28.9
KOKB	A	5	D	-3.4	1.1	9.9
KUNM	A	2	D	-1.9	1.9	21.8
LAE1	A	1	D	-1.6	-1.4	19.9
LPGS	A	1	D	-2.2	-0.8	24.0
MAC1	A	4	D	-3.2	-0.1	18.4
MADR	A	9	D	-0.5	0.1	5.5
MALI	A	2	D	-1.8	0.5	14.1
MANA	A	2	D	-4.5	-2.4	17.7
MAS1	A	1	D	-1.6	-2.1	7.9
MATE	A	4	D	0.6	1.3	9.7
MAW1	A	1	D	-3.3	1.3	10.7
MBAR	A	1	D	-2.4	0.6	15.9
MCM4	A	3	D	-1.2	1.3	4.3
MDO1	A	3	D	-3.6	-2.5	20.1
MDVJ	A	1	D	4.1	-0.2	14.9
METS	A	1	D	0.4	0.8	1.2
MKEA	A	1	D	-3.5	0.9	12.7
NICO	A	2	D	-3.2	1.1	17.3
NKLG	A	1	D	-0.8	3.1	14.1
NLIB	A	2	D	-0.6	-1.4	15.0
NOT1	A	1	D	0.1	3.7	10.2
NOUM	A	1	D	1.0	-1.0	7.5
NOVJ	A	1	D	5.3	-3.0	34.9
NRC1	A	1	D	-1.3	-0.5	16.2
NRIL	A	1	D	0.7	0.8	3.5
NYA1	A	2	D	-0.3	0.3	-9.7
NYAL	A	3	D	-0.9	-0.3	-8.9
OHI2	A	1	D	-2.2	-1.3	8.7
OHI3	A	1	D	-6.5	-1.0	1.2
ONSA	A	3	D	0.2	0.4	1.6
PDEL	A	1	D	-1.2	-3.2	5.3
PERT	A	4	D	-0.9	2.0	19.6
PETP	A	3	D	0.1	-0.1	12.8
PIE1	A	1	D	-1.7	-2.0	11.7
PIMO	A	3	D	-2.4	1.4	19.9
POL2	A	1	D	0.6	-0.7	18.0
POLV	A	1	D	0.3	1.1	0.4
POTS	A	1	D	-0.2	0.8	0.9
QAQ1	A	3	D	-0.5	-1.2	5.9
QUIN	A	3	D	-3.5	-1.6	10.4
RABT	A	1	D	-0.7	1.0	11.8
RAMO	A	3	D	-3.4	0.3	12.9

REUN	A	1	D	-1.6	-0.6	20.8
REYK	A	3	D	0.1	-0.7	2.1
RIOG	A	1	D	-2.0	-0.4	14.7
SANT	A	3	D	-2.6	-1.4	9.4
SCH2	A	1	D	-0.8	-0.9	15.4
SCUB	A	1	D	-2.2	1.4	14.4
SEY1	A	2	D	-1.2	0.2	11.7
SFER	A	5	D	0.8	1.9	3.4
STJO	A	4	D	-2.1	-1.3	16.7
SUTH	A	1	D	-3.1	2.1	12.2
SYOG	A	1	D	-4.0	0.3	21.9
THTI	A	1	D	-1.2	0.8	22.3
THU3	A	1	D	-1.8	-1.0	-3.6
TIDB	A	2	D	-1.6	0.1	16.6
TIXI	A	1	D	-0.4	0.7	1.4
TOW2	A	1	D	-0.4	-0.8	11.3
TRAB	A	1	D	-0.8	0.9	16.6
TRO1	A	4	D	0.5	0.4	-3.3
TROM	A	1	D	0.6	0.8	2.0
TSKB	A	2	D	-1.8	0.7	13.5
ULAB	A	1	D	0.7	1.6	17.1
UNSA	A	1	D	-2.1	-1.0	11.9
USNO	A	1	D	-1.7	-0.5	18.5
VESL	A	1	D	-3.6	-0.1	-5.1
VILL	A	5	D	-0.8	-0.2	11.1
WES2	A	9	D	-1.9	-0.8	20.4
WHIT	A	1	D	-0.2	-0.0	12.2
WILL	A	1	D	-0.5	-0.9	11.9
WSRT	A	1	D	-0.1	0.5	3.8
WTZR	A	3	D	-0.3	0.5	3.1
WUHN	A	4	D	0.0	2.9	22.1
YAR1	A	2	D	-0.2	1.9	11.4
YELL	A	5	D	-0.6	-1.1	12.8
YSSK	A	2	D	-0.2	1.6	7.7
ZIMM	A	2	D	0.7	2.8	2.0
Obs. Mean				-1.2	0.1	11.5
Mean Std.				1.6	1.4	10.6
R.M.S.				2.0	1.4	15.6

2-2) IGS05 --> ITRF2005:

To remain consistent with ITRF2005, the proposed realization was also realigned to ITRF2005 using a 7-parameters transformation (3 rotations, 3 translations, 1 scale); the rates were assumed unaffected by the phase center change.
The estimated transformation parameters are:

R X (mas)	:	-0.01118
R Y (mas)	:	-0.00693
R Z (mas)	:	-0.00046
T X (m)	:	0.00165
T Y (m)	:	-0.00016
T Z (m)	:	0.00236
SCL (ppb)	:	-1.85533

This shows the effect of the relative to absolute phase center calibration change. Note that ALRT, GOUG and NOVJ were excluded from the estimation of the transformation parameters due to the size of their phase center corrections. As expected, the scale is the dominant parameter.

The residuals ITRF2005 minus IGS05 (after transformation):

SOLUTION ESTIMATE Difference (mm) & (mm/y)

Code	Pt	Soln	d	d. Lat (mm)	d. Lon (mm)	d. Hei (mm)
ALGO	A	7	D	-0.6	-1.1	-6.7
ALIC	A	1	D	-1.1	1.0	0.7
ALRT	A	1	D	1.8	-0.4	22.1
AMC2	A	4	D	-0.8	0.7	-0.5
ARTU	A	3	D	-2.0	1.8	-6.0
ASC1	A	1	D	-1.6	2.8	5.8
ASPA	A	1	D	0.3	-1.9	9.9
BAHR	A	1	D	-0.1	1.8	-5.5
BILI	A	4	D	-2.4	-1.4	12.7
BJFS	A	1	D	-1.5	-0.4	-14.9
BOR1	A	2	D	0.0	-0.1	4.4
BRAZ	A	1	D	-0.2	0.9	-0.8
BRUS	A	2	D	-0.5	-0.3	5.3
CAGL	A	3	D	-1.3	-2.0	5.3
CAS1	A	3	D	3.4	0.3	7.8
CEDU	A	1	D	-1.0	0.5	-4.8
CHAT	A	1	D	2.7	-0.9	-4.3
CHPI	A	1	D	-0.5	1.5	1.2
CHUR	A	4	D	-2.0	0.3	-3.9
COCO	A	3	D	-0.6	-0.5	4.3
CONZ	A	2	D	-0.0	-0.1	1.4
CRO1	A	1	D	0.2	-0.9	-8.6
DAEJ	A	1	D	-2.1	-1.4	-5.1
DARW	A	1	D	-1.2	0.4	0.9
DAV1	A	1	D	2.2	1.4	4.7
DGAR	A	2	D	-1.2	2.9	6.4
DRAO	A	3	D	-0.9	-0.1	-2.1
DUBO	A	4	D	-2.4	0.6	-9.9
FAIR	A	6	D	-0.9	-1.3	0.0
FLIN	A	2	D	-2.3	0.4	-2.1
GLPS	A	1	D	-0.6	-1.0	3.8
GLSV	A	1	D	-0.7	-2.3	4.0
GODE	A	2	D	-0.6	-1.5	-5.4
GOLD	A	7	D	0.6	0.3	3.1
GOUG	A	1	D	1.9	0.6	-81.1
GRAS	A	3	D	-0.3	-1.0	5.6
GUAM	A	4	D	0.9	0.9	-3.3
GUAO	A	1	D	-0.5	0.5	1.6
HARB	A	1	D	-1.3	-2.5	-2.7
HLFX	A	1	D	-0.4	-0.4	-7.1
HNLC	A	1	D	-0.3	0.6	2.1
HOB2	A	2	D	2.2	0.8	-0.1
HOFN	A	2	D	-0.7	-1.0	5.7
HOLM	A	1	D	-1.1	-0.7	9.3
HRAO	A	1	D	0.4	-0.7	-4.4
HYDE	A	2	D	0.2	3.2	1.1
IISC	B	2	D	-0.5	2.6	2.9
IRKT	A	1	D	-2.0	0.5	-7.7
ISPA	A	1	D	-0.8	1.0	3.6

JAB1	A	2	D	-1.0	0.9	-0.3
JOZE	A	2	D	-1.6	0.4	13.9
KARR	A	1	D	-1.0	-0.2	3.5
KELY	B	1	D	-0.1	-0.7	8.6
KERG	A	2	D	1.1	0.2	-4.9
KIT3	A	1	D	-0.2	2.3	-19.0
KOKB	A	5	D	0.7	-1.7	2.4
KUNM	A	2	D	-0.1	-0.4	-10.5
LAE1	A	1	D	-0.2	2.2	-6.3
LPGS	A	1	D	-0.7	-0.5	-11.7
MAC1	A	4	D	3.5	0.3	-3.7
MADR	A	9	D	-0.5	-0.3	3.5
MALI	A	2	D	-0.6	0.7	-3.3
MANA	A	2	D	1.9	0.8	-6.6
MAS1	A	1	D	-0.1	1.7	1.4
MATE	A	4	D	-1.5	-0.9	-0.6
MAW1	A	1	D	2.1	0.6	3.1
MBAR	A	1	D	0.0	0.4	-5.4
MCM4	A	3	D	2.6	-1.4	10.2
MDO1	A	3	D	1.1	1.0	-9.3
MDVJ	A	1	D	-4.4	1.0	-5.7
METS	A	1	D	-0.4	-0.3	7.8
MKEA	A	1	D	0.8	-1.6	-0.3
NICO	A	2	D	2.0	-0.3	-7.9
NKLG	A	1	D	-1.7	-2.7	-3.9
NLIB	A	2	D	-1.5	-0.1	-4.8
NOT1	A	1	D	-1.2	-3.3	-1.0
NOUM	A	1	D	-2.2	1.1	6.7
NOVJ	A	1	D	-6.3	4.5	-25.1
NRC1	A	1	D	-0.4	-1.0	-6.5
NRIL	A	1	D	-1.3	0.6	6.1
NYA1	A	2	D	1.2	-0.2	18.9
NYAL	A	3	D	1.8	0.4	18.1
OHI2	A	1	D	-0.1	-0.0	4.8
OHI3	A	1	D	4.2	-0.3	12.3
ONSA	A	3	D	-0.3	-0.2	7.4
PDEL	A	1	D	-0.1	2.5	3.8
PERT	A	4	D	-0.2	-0.6	-5.8
PETP	A	3	D	-2.5	0.8	-1.9
PIE1	A	1	D	-0.8	0.6	-0.9
PIMO	A	3	D	0.2	-0.1	-7.7
POL2	A	1	D	-1.9	2.1	-8.0
POLV	A	1	D	-0.9	-0.3	8.8
POTS	A	1	D	-0.2	-0.6	8.1
QAQ1	A	3	D	0.0	0.1	3.2
QUIN	A	3	D	1.0	0.3	0.4
RABT	A	1	D	-0.6	-1.2	-2.7
RAMO	A	3	D	2.0	0.6	-3.4
REUN	A	1	D	-0.7	2.2	-8.9
REYK	A	3	D	-0.1	0.0	6.9
RIOG	A	1	D	-0.4	-1.1	-1.4
SANT	A	3	D	-0.1	-0.1	3.1
SCH2	A	1	D	-0.3	-0.5	-6.0
SCUB	A	1	D	-0.2	-2.9	-3.9
SEY1	A	2	D	-1.1	1.3	-0.5
SFER	A	5	D	-2.0	-2.1	5.7
STJO	A	4	D	0.9	0.1	-7.4
SUTH	A	1	D	0.3	-1.1	-0.4
SYOG	A	1	D	2.1	1.3	-8.3
THTI	A	1	D	-0.6	-1.9	-8.5
THU3	A	1	D	1.6	-0.4	12.9
TIDB	A	2	D	0.9	0.5	-2.2
TIXI	A	1	D	-1.1	0.5	8.5
TOW2	A	1	D	-1.0	1.5	2.7
TRAB	A	1	D	-0.2	0.0	-7.2
TRO1	A	4	D	-0.0	-0.1	12.4
TROM	A	1	D	-0.1	-0.5	7.1
TSKB	A	2	D	-0.6	0.3	-2.0
ULAB	A	1	D	-2.4	-0.1	-6.6
UNSA	A	1	D	-0.8	-0.4	0.2
USNO	A	1	D	-0.2	-1.0	-8.6
VESL	A	1	D	1.1	0.5	18.6
VILL	A	5	D	-0.2	0.0	-2.1
WES2	A	9	D	0.2	-0.6	-10.7
WHIT	A	1	D	-2.0	-0.9	-1.9
WILL	A	1	D	-1.7	-0.3	-1.5
WSRT	A	1	D	-0.2	-0.4	5.1
WTZR	A	3	D	-0.2	-0.3	5.9
WUHN	A	4	D	-2.1	-1.5	-10.8
YAR1	A	2	D	-1.0	-0.4	2.3
YELL	A	5	D	-1.2	-0.2	-2.8
YSSK	A	2	D	-2.1	-0.6	3.3
ZIMM	A	2	D	-1.3	-2.7	7.0
Obs. Mean				-0.3	-0.0	-0.5
Mean Std.				1.5	1.3	10.3
R.M.S.				1.5	1.3	10.2

The following section compares the proposed realization with a recent cumulative solution.

3) IGS05 - IGS cumulative solution:

The proposed IGS05 realization was also compared to the cumulative solution (IGS06P34.snx) at GPS week 1390 (06/08/30 - 06:242:00000). Absolute phase center corrections are used in both solutions. The differences (IGS05 - IGS06P34.snx) are:

Code	Pt	Soln	d	d. Lat	d. Lon	d. Hei	d.VLat	d.VLon	d.VHei
ALGO	A	7	d	-0.1	-0.0	0.6	0.2	0.2	-0.0
ALIC	A	1	d	-0.6	0.0	1.8	0.6	0.2	-1.1
ALRT	A	1	d	-1.6	0.7	2.6	-1.0	0.4	0.9
AMC2	A	4	d	-0.7	0.4	-2.2	0.2	0.4	-1.0
ARTU	A	3	d	-0.2	-0.7	-1.0	0.4	-0.7	-0.7
ASC1	A	1	d	0.4	-0.1	-0.3	0.5	-0.4	-0.9
ASPA	A	1	d	-1.1	-0.3	-1.7	0.7	0.4	-2.0
BAHR	A	1	d	-0.5	-0.7	-2.1	0.5	-0.6	-1.2
BILI	A	4	d	0.9	0.2	-1.6	1.1	0.3	-1.3
BJFS	A	1	d	-1.0	-0.7	-1.6	0.7	-0.3	-1.1
BOR1	A	2	d	-0.0	-0.4	-1.8	0.2	-0.6	-0.7
BRAZ	A	1	d	0.6	1.0	1.7	0.7	-0.1	-0.4
BRUS	A	2	d	-0.6	-0.1	-1.9	-0.1	-0.5	-0.7
CAGL	A	3	d	-0.4	-0.3	-2.3	0.1	-0.5	-1.1
CAS1	A	3	d	-0.9	-0.3	-0.6	-0.1	0.3	-2.0
CEDU	A	1	d	-0.3	-0.2	3.2	0.6	0.2	-0.8
CHAT	A	1	d	-0.4	-0.3	1.8	0.7	0.3	-1.2

CHPI	A	1	d	0.0	1.0	4.6	0.6	0.1	1.1
CHUR	A	4	d	-0.5	0.2	-0.2	-0.1	0.1	-1.2
COCO	A	3	d	-3.2	1.1	1.3	-2.4	1.1	0.1
CONZ	A	2	d	0.9	0.3	0.2	1.5	-0.4	-1.1
CRO1	A	1	d	-0.5	-0.5	0.8	0.4	-0.1	-0.1
DAEJ	A	1	d	-0.0	-0.2	-2.0	1.0	-0.1	-1.2
DARW	A	1	d	-1.2	0.0	-0.0	0.6	0.2	-1.5
DAV1	A	1	d	-0.8	-0.4	0.2	-0.3	0.0	-1.8
DGAR	A	2	d	-1.9	-1.4	1.1	-1.0	-1.4	0.7
DRAO	A	3	d	0.3	0.8	1.9	0.5	0.6	0.2
DUBO	A	4	d	-0.5	0.4	6.3	0.0	0.5	3.5
FAIR	A	6	d	-1.9	0.4	2.7	-0.5	0.5	1.3
FLIN	A	2	d	0.1	0.5	1.4	0.3	0.5	0.1
GLPS	A	1	d	1.3	1.6	-6.2	1.3	0.6	-3.5
GLSV	A	1	d	-0.9	-0.6	-2.0	0.1	-0.7	-0.7
GODE	A	2	d	-0.5	-0.1	0.3	0.2	0.1	-0.1
GOLD	A	7	d	-1.7	0.9	3.2	-0.2	0.7	1.4
GRAS	A	3	d	-0.6	0.4	-4.7	-0.4	-0.0	-3.5
GUAM	A	4	d	-3.1	-1.6	0.2	0.0	-0.5	-0.9
GUAO	A	1	d	1.5	0.9	-2.9	1.4	0.1	-1.8
HARB	A	1	d	-0.2	1.6	-1.8	0.3	0.3	-2.1
HLFX	A	1	d	-0.2	0.8	-0.1	0.2	0.5	-0.3
HNLC	A	1	d	-0.2	0.1	0.1	1.0	0.5	-0.4
HOB2	A	2	d	0.9	0.2	0.1	1.5	0.6	-1.8
HOFN	A	2	d	0.3	-1.7	-4.6	0.0	-0.9	-1.8
HOLM	A	1	d	0.6	0.4	0.8	0.4	0.6	0.2
HRAO	A	1	d	1.1	-1.5	2.8	0.6	-0.8	-0.7
IRKT	A	1	d	-0.4	-0.8	-0.2	0.8	-0.5	-0.6
ISPA	A	1	d	-1.3	1.3	-8.3	0.2	0.5	-6.2
JAB1	A	2	d	0.3	-0.2	8.0	0.9	0.2	1.8
JOZE	A	2	d	-1.2	2.8	10.6	-0.6	2.0	8.6
KARR	A	1	d	-0.3	-0.5	2.7	0.6	0.0	-0.9
KELY	B	1	d	0.1	0.1	-0.4	-0.1	0.1	0.9
KERG	A	2	d	-0.5	-0.8	2.2	0.0	-0.2	-1.3
KIT3	A	1	d	-0.0	-0.7	-0.3	0.6	-0.6	-0.6
KOKB	A	5	d	-1.3	-0.8	-4.6	0.0	-0.1	-3.1
KUNM	A	2	d	4.3	2.8	15.0	22.7	5.4	16.6
LAE1	A	1	d	-0.6	-0.3	2.7	0.8	0.1	-0.7
LPGS	A	1	d	0.6	-0.4	-0.0	0.7	-0.4	-1.0
MADR	A	9	d	0.2	0.1	0.0	0.2	-0.3	-0.4
MALI	A	2	d	-0.3	-0.4	2.3	0.4	-0.5	-0.7
MANA	A	2	d	9.2	4.3	0.7	10.4	4.1	1.4
MAS1	A	1	d	0.5	0.3	1.6	0.3	-0.3	-0.1
MATE	A	4	d	0.3	0.1	0.1	0.3	-0.4	-0.4
MAW1	A	1	d	-0.7	-0.9	-0.4	-0.3	-0.2	-2.0
MBAR	A	1	d	0.1	-0.6	1.1	0.5	-0.5	-0.8
MCM4	A	3	d	-0.9	0.8	0.6	0.1	0.6	-1.6
MDO1	A	3	d	0.2	0.8	-1.3	1.0	0.6	-1.1
MDVJ	A	1	d	1.4	0.3	0.5	1.3	-0.2	0.3
METS	A	1	d	-0.2	-0.5	-2.0	0.1	-0.6	-0.6
MKEA	A	1	d	-0.6	-0.7	-1.3	0.9	0.2	-0.8
NICO	A	2	d	0.2	-1.1	0.4	0.4	-0.7	-0.5
NKLG	A	1	d	1.1	-0.8	-1.2	0.7	-0.6	-1.4
NLIB	A	2	d	-0.5	-0.2	1.2	0.3	-0.1	0.5
NOT1	A	1	d	-0.4	-0.3	-1.4	0.2	-0.5	-1.1
NOUM	A	1	d	-0.1	-0.4	1.7	0.9	0.2	-1.0
NOVJ	A	1	d	0.9	0.4	-2.7	1.2	-0.2	-1.7
NRC1	A	1	d	-0.3	-0.1	1.0	0.2	0.2	0.1
NRIL	A	1	d	0.3	-0.7	0.3	0.7	-0.6	-0.2
NYA1	A	2	d	-0.2	-1.3	3.3	-0.2	-1.0	1.4
NYAL	A	3	d	-0.6	0.1	3.4	-0.3	-0.3	1.4
OHI2	A	1	d	1.7	-0.9	-6.2	1.0	-0.7	-3.8
OHI3	A	1	d	1.5	0.3	-10.6	1.1	-0.3	-6.8
ONSA	A	3	d	-0.4	-0.4	-2.9	0.0	-0.6	-0.9
PDEL	A	1	d	-0.4	-0.0	-0.4	0.0	-0.3	-0.7
PERT	A	4	d	1.3	-0.7	-0.8	1.3	-0.1	-2.1
PIE1	A	1	d	-1.3	0.9	0.2	0.4	0.4	-0.2
PIMO	A	3	d	-1.3	-0.3	-6.3	0.1	0.3	-4.5
POL2	A	1	d	0.1	-0.6	-1.4	0.7	-0.6	-0.9
POLV	A	1	d	0.0	-0.4	-4.2	0.3	-0.6	-1.8
POTS	A	1	d	-0.2	-0.4	-1.3	0.1	-0.6	-0.4
QAQ1	A	3	d	-0.2	0.3	-2.3	-0.1	0.2	-1.4
QUIN	A	3	d	0.4	0.1	4.1	0.7	0.4	0.9
RABT	A	1	d	0.1	0.0	-0.2	0.3	-0.4	-0.5
RAMO	A	3	d	1.8	-3.5	-3.2	1.6	-2.5	-2.2
REUN	A	1	d	0.7	-0.1	3.6	0.7	0.0	0.7
REYK	A	3	d	0.1	1.1	1.6	-0.1	0.1	0.3
RIOG	A	1	d	-0.3	0.0	-1.9	0.5	-0.4	-1.9
SANT	A	3	d	0.5	0.3	-1.2	0.8	-0.2	-1.4
SCH2	A	1	d	0.0	-0.3	-0.1	0.0	0.1	-0.1
SCUB	A	1	d	-1.6	-1.4	-0.4	-0.0	-0.4	-0.5
SEY1	A	2	d	2.3	0.9	7.1	1.0	-0.1	0.3
SFER	A	5	d	0.9	0.6	-3.8	0.8	0.0	-2.0
STJO	A	4	d	-0.4	0.2	1.4	-0.0	0.0	0.1
SUTH	A	1	d	0.3	-1.8	0.0	0.4	-0.8	-2.3
SYOG	A	1	d	-0.0	-1.0	1.7	-0.2	-0.4	-1.3
THTI	A	1	d	-0.6	-0.3	-2.2	0.9	0.3	-1.7
THU3	A	1	d	-1.2	0.1	-3.6	-0.7	0.2	-1.7
TIDB	A	2	d	0.1	0.3	2.2	0.7	0.3	-1.2
TIXI	A	1	d	0.3	0.1	-1.5	0.8	-0.1	-0.6
TOW2	A	1	d	-0.1	0.4	2.4	0.9	0.3	-0.9
TRAB	A	1	d	0.3	-0.3	-1.8	0.5	-0.6	-1.0
TRO1	A	4	d	0.5	-0.0	-5.2	0.5	-0.4	-3.2
TROM	A	1	d	0.0	1.4	-0.2	-0.0	-0.2	-0.0
TSKB	A	2	d	-0.1	-1.0	-1.7	1.0	-0.2	-1.0
ULAB	A	1	d	0.1	-0.2	-0.3	0.9	-0.3	-0.7
UNSA	A	1	d	0.6	0.4	-0.7	0.9	-0.2	-1.1
USNO	A	1	d	0.2	-0.4	1.1	0.4	0.1	0.1
VESL	A	1	d	0.5	-0.8	-1.3	0.1	-0.6	-2.0
VILL	A	5	d	-1.6	-2.0	-0.3	-1.0	-1.8	-0.4
WES2	A	9	d	-0.8	-0.5	-1.2	-0.1	-0.1	-1.0
WHIT	A	1	d	0.4	0.7	-0.5	0.5	0.6	-0.2
WILL	A	1	d	0.0	0.9	1.5	0.4	0.6	0.1
WSRT	A	1	d	-0.4	-0.1	-0.5	0.0	-0.5	-0.4
WTZR	A	3	d	-0.3	-0.1	0.2	0.1	-0.5	-0.3
WUHN	A	4	d	0.6	0.5	-4.0	1.3	0.3	-2.3
YAR1	A	2	d	-0.5	-0.9	0.7	0.5	-0.0	-1.5
YELL	A	5	d	0.8	0.7	0.2	0.5	0.6	-0.1
YSSK	A	2	d	3.2	0.6	1.5	2.8	0.4	0.2
ZIMM	A	2	d	-0.6	0.0	-1.4	0.0	-0.4	-0.6
Obs. Mean				-0.0	-0.0	-0.1	0.6	-0.0	-0.6
Mean Std.				1.3	0.9	3.2	2.2	0.8	2.2
R.M.S.				1.3	0.9	3.1	2.3	0.8	2.3

Stations PETP, HYDE, MAC1 were removed from the statistics due to larger residuals. Those large residuals were traced back to short time series

< 2 years for the segment. Since no condition is currently imposed on the velocity in the cumulative solution, short segments can have unreliable velocity estimates.
Velocity conditions are imposed in ITRF solution.
As was done in the earlier "preliminary" realizations of ITRF, the coordinates/velocity were extracted directly from ITRF rather that the IGS cumulative solution. This should address some legitimate concern that ITRF should whenever possible be used directly. The above statistics suggest that we have probably reached this time to switch back to a more direct connection with ITRF.

4) IGb00 - IGS05:

The transformation parameters between the currently official realization (IGb00) and the proposed realization (IGS00) are important to connect the IGS products.
The estimated transformation parameters are available in section 4-1) and the corresponding residuals are available in the section 4-2.
The official transformation parameters between ITRF2000 - ITRF2005 are provided by
(http://itrf.ensg.ign.fr/ITRF_solutions/2005/tp_05-00.php)

4-1) IGb00 - IGS05 Transformation:

The (14) transformation parameters were estimated using a subset of 60 stations from the proposed IGS05 to the current IGS realization (IGb00). The results are below, along with the official ITRF estimates (epoch 2000.0). To ensure consistency between IGb00 and IGS05, the latter did not include the relative to absolute phase center correction for the estimation of the transformation parameters.

(Epoch 2000.0)	IGS	ITRF	IGS-ITRF
R X (mas) :	-0.0224	0.0000	-0.0224
R Y (mas) :	0.0341	0.0000	0.0341
R Z (mas) :	-0.0099	0.0000	-0.0099
T X (m) :	0.0000	0.0001	-0.0001
T Y (m) :	-0.0017	-0.0008	-0.0009
T Z (m) :	-0.0053	-0.0058	0.0005
SCL (ppb) :	0.8473	0.4000	0.4473
d R X (mas/y) :	0.0033	0.0000	0.0033
d R Y (mas/y) :	-0.0001	0.0000	-0.0001
d R Z (mas/y) :	-0.0161	0.0000	-0.0161
d T X (m/y) :	-0.0004	-0.0002	-0.0002
d T Y (m/y) :	0.0007	0.0001	0.0006
d T Z (m/y) :	-0.0018	-0.0018	0.0000
d SCL (ppb/y) :	0.1748	0.0800	0.0848

The more significant difference at the reference epoch is with the scale (and rate) (0.5ppb ~ 3.3mm) followed by the X&Y rotations (0.03mas ~ 0.9mm at the equator).

4-2) Residuals:

The residuals after the transformation (IGS05-IGb00) at epoch 2000.0 are:

Code	Pt	Soln	d	d. Lat (mm)	d. Lon (mm)	d. Hei (mm)	d.VLat (mm/y)	d.VLon (mm/y)	d.VHei (mm/y)
ALGO	A	----	D	-0.8	0.3	2.4	0.1	-0.3	-2.1
ALIC	A	----	D	0.0	-0.4	2.7	0.4	0.3	-1.4
ARTU	A	----	D	-0.6	0.6	1.1	0.4	-0.1	0.4
ASC1	A	----	D	-0.0	-1.1	-0.7	-0.1	0.3	0.8
BAHR	A	----	D	-0.1	-0.7	0.1	0.2	0.6	-0.0
BOR1	A	----	D	-0.1	1.7	-1.2	0.2	-0.5	1.1
BRUS	A	----	D	-1.7	1.5	1.4	0.9	-0.8	-0.2
CAS1	A	----	D	0.7	0.7	-2.8	-0.1	-0.3	0.7
CEDU	A	----	D	0.3	-0.5	2.5	0.2	0.3	-1.2
CHAT	A	----	D	-0.3	-0.3	-1.0	0.6	0.4	1.4
CHUR	A	----	D	2.4	2.7	3.8	0.2	-0.4	-1.5
CRO1	A	----	D	-0.8	-0.2	-3.8	-0.1	0.5	2.7
DARW	A	----	D	-2.0	0.4	1.0	1.0	-0.0	-0.5
DAV1	A	----	D	0.3	0.7	1.0	-0.0	-0.5	-0.7
DRAO	A	----	D	-1.2	0.5	1.8	0.2	-0.4	-1.3
FLIN	A	----	D	-1.8	0.6	2.4	0.3	-0.4	-1.4
GLSV	A	----	D	-0.3	0.3	-0.5	0.5	0.1	0.7
GODE	A	----	D	-0.5	0.8	-0.8	-0.2	-0.8	-1.0
GOLD	A	----	D	1.3	-5.6	-2.5	0.4	1.4	-0.7
GUAM	A	2	D	0.5	-1.1	1.3	0.2	0.8	-0.1
HOB2	A	----	D	-2.4	2.7	-3.8	0.1	0.3	-0.9
HRAO	A	----	D	1.2	0.0	-1.6	-0.9	0.1	1.1
IRKT	A	----	D	0.5	0.1	-0.4	0.0	0.4	-0.1
KARR	A	----	D	-0.2	-0.1	2.3	0.5	0.1	-1.0
KELY	B	----	D	-1.3	2.5	1.5	0.3	-1.1	0.5
KERG	A	----	D	0.2	0.4	2.0	-0.0	-0.3	-1.3
KIT3	A	----	D	0.4	-0.3	0.9	0.3	0.3	0.4
LPGS	A	----	D	0.3	0.4	0.5	-0.4	-0.3	1.6
MALI	A	----	D	2.1	-3.3	-2.1	-1.0	1.5	0.8
MAS1	A	----	D	-0.2	-1.0	0.0	-0.4	0.3	-0.5
MATE	A	----	D	-1.4	2.6	-0.2	0.5	-0.9	0.2
MAW1	A	----	D	-0.1	0.3	-0.7	0.2	-0.2	0.6
MCM4	A	----	D	-1.0	-2.3	0.3	0.6	0.9	-1.3
MKEA	A	----	D	0.1	2.5	3.7	0.4	-0.8	-2.1
NICO	A	----	D	-0.2	-1.1	3.7	0.1	0.5	-1.3
NKLG	A	----	D	0.4	-0.2	-0.1	-0.5	0.1	0.6
NLIB	A	----	D	-2.8	-1.5	-0.6	0.6	-0.3	-1.8
NOUM	A	----	D	0.5	-1.1	0.6	-0.2	1.0	-0.2
NRC1	A	----	D	-0.8	0.1	2.0	0.3	-0.2	-1.5
ONSA	A	----	D	0.4	-0.1	-4.5	-0.2	0.1	2.5
PERT	A	----	D	-4.8	-0.6	-2.6	0.1	0.3	-0.7
PIE1	A	----	D	-0.5	0.9	0.0	0.7	-0.9	-0.8
POL2	A	----	D	0.2	0.3	0.6	0.3	0.2	0.9
POTS	A	----	D	-0.0	0.1	0.0	0.1	0.2	0.9
RIOG	A	----	D	-0.0	-0.1	-1.6	-0.2	0.0	2.1
SANT	A	----	D	0.1	-0.2	-1.3	-0.2	-0.1	1.5
SCH2	A	----	D	-0.8	-0.1	2.0	-0.5	-0.5	-2.1
STJO	A	----	D	-0.7	-0.5	0.6	0.4	-0.1	-0.6
SYOG	A	----	D	-0.1	0.7	1.1	0.1	-0.4	-0.6
THTI	A	----	D	-1.5	0.9	-0.7	1.2	-0.7	1.1
TIDB	A	----	D	0.3	-0.2	0.1	-0.2	0.0	-0.7
TIXI	A	----	D	0.0	0.5	-3.2	-0.1	-0.2	2.3
TOW2	A	----	D	-0.0	0.4	0.0	0.4	-0.2	0.3
TRAB	A	----	D	-0.7	0.8	0.3	0.5	-0.2	-0.3
TSKB	A	----	D	0.1	-0.1	-0.2	-0.4	-0.4	1.4
UNSA	A	----	D	0.9	0.4	-4.5	-0.8	-0.6	2.2
VESL	A	----	D	-0.8	-0.3	-0.7	0.4	0.1	0.8

```
 WSRT  A ---- D    -0.2     0.1     0.4      0.2    -0.1    -0.2
 WTZR  A ---- D    -0.4    -0.0    -2.1      0.2     0.2     0.8
 YELL  A ---- D    -0.7     0.5     0.3      0.1    -0.2    -0.4

 Obs. Mean         -0.3     0.1    -0.0      0.1    -0.0     0.0
 Mean Std.          1.1     1.3     1.9      0.4     0.5     1.2
 R.M.S.             1.1     1.3     1.9      0.4     0.5     1.2
```

4-4) Scale:

Comparison of the scale factor for GPS weeks 1385-9 show the following change

	cod	co2	emr	em2	gfz	gf2	mit	mi2	sio	si2
1385	2.71	-0.77	4.47	-0.60	2.22	-0.68	3.58	-0.31	3.37	0.27
1386	2.71	-0.73	4.47	-0.53	2.26	-0.70	3.48	-0.50	3.22	0.20
1387	2.91	-0.73	4.50	-0.45	2.29	-0.69	3.41	-0.42	3.39	0.37
1388	2.86		4.63	-0.23	2.32	-0.64	3.45	-0.50	3.12	0.33
1389	2.90	-0.72	4.52	-0.40	1.97	-0.80	3.44	-0.51	3.26	0.18
Avg.	2.82	-0.74	4.52	-0.44	2.21	-0.70	3.47	-0.45	3.27	0.20

The average scale factor goes from 3.26 (IGb00 & relative antenna phase center) to -0.41 (IGS05 & absolute antenna phase center).
This indicates a significant improvement of the IGS scale, which was one of the important objective of the receiver antenna phase center calibration change.

4-5) Apparent geocenter:

The comparison below shows the apparent weekly geocenter variations between the official solutions using IGb00 and IGS05.
In the IGb00 combination, cod, emr, esa, jpl and sio solution were included in the combined apparent geocenter. In the IGS05 solution the co2, em2, mi2 and si2 solutions are included.

	X-00	X-05	Y-00	Y-05	Z-00	Z-05
1385	0.4	2.9	4.4	2.0	-7.6	5.8
1386	-0.1	2.4	4.8	2.2	-10.0	-3.6
1387	-1.8	-1.3	4.9	7.7	-7.9	24.8
1388	-4.1	-3.6	4.8	5.0	-9.1	1.1
1389	0.4	1.3	4.2	5.1	-8.7	-11.9
Avg.	-1.0	0.3	4.6	4.4	-8.7	3.2

The apparent geocenter X&Y coordinates indicates little changes. However in the Z component there is a shift of about 12mm in the right direction. The transformation parameters (Sect. 4-1) suggest a shift of ~5mm. If we disregard GPS week 1387 (24.8mm) the Z shift is about 6.5mm.

4-6) ERP's:

The effect of the Reference Frame and phase center changes can be inferred from the rotational components of the transformation parameters (Sect. 4-1). A reference frame rotation (RX, RY) has a direct effect on the pole position (dXp, dYp) ; thus:
RX - dXp = 0 & RY - dXp = 0

The rotation component of the transformation at GPS week ~1387 can be estimated with (and Sect. 4-1):
RX = RX0 + dRX * dt & RY = RY0 + dRY * dt

RX = -0.006 mas & RY = 0.033 mas

Comparison of the daily pole position between the solutions using the available test solutions using IGS05 and the official results using the official products (using IGb00) between GPS weeks 1385-1389 results in the average pole position differences (Official - new):
dXp = 0.028 mas & dYp = -0.005 mas

Then:

RX - dYp = -0.006 + 0.005 mas = -0.001 mas
RY - dXp = 0.033 - 0.028 mas = 0.005 mas

The observed pole position differences and the predictions using the estimates transformations are consistent to better than 0.01mas for t weeks considered.

5) Other changes:

5.1) Discontinuities:

All the "confirmed" and "probable" discontinuities are included as part of the weekly combination. All the soln # in the weekly and cumulative solutions are now consistent with the latest discontinuity table. The most significant change appears in the cumulative solution where all relevant discontinuities are now included.

5.2) Satellite phase center:

The satellite phase center estimates provided by the ACs are included in the combined in the weekly solutions. The weekly combination residual file includes a table of the residuals of the adjustment for these new parameters. A new section has been added in the summary report for these parameters.

5.3) Stations Antenna phase center + Cumulative Solution

To consistently continue accumulating the igs weekly combined solutions to the cumulative solution; the latter one has been corrected for the phase center switch using the information derived from the parallel runs. In the cases where corrections could not be derived directly from the parallel runs, averages for antenna types were used. In the case where no corrections were available, the stations were deleted to avoid mixing relative and absolute antenna phase centers in one solution.
Stations deletion is generally limited to older sites.

6) Parallel solutions:

```
        Combinations used in the analysis above have also been posted at:
ftp     macs.geod.nrcan.gc.ca
cd      /pub/requests/sinex/
cd xxxx_IGS05   xxxx=GPS week
Those and more will be updated/added as they become available.

Best regards,
Remi,
```

- Prev by Date: **[IGSMAIL-5446]: New Secretary for IGS Central Bureau**
- Next by Date: **[IGSMAIL-5448]: site OBET decommission**
- Previous by thread: **[IGSMAIL-5446]: New Secretary for IGS Central Bureau**
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