Status Report on KASI Combination Center

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|| Abstract || This paper reports the current status of the Korea Astronomy and Space Science Institute (KASI) as an IVS Combination Center. We combine the products of individual IVS Analysis Centers (ACs) at normal equation level using Bernese GPS Software Version 5.0. Since the software was initially developed for GPS data processing and analysis, we modified the software to deal with IVS analysis products properly. In order to validate the modified Bernese S/W, we reanalyzed solutions of BKG, GSFC and OPA that use identical analysis software, Calc/Solve, and combined them. As a preparatory combination analysis, we also combined IVS analysis products of six ACs, BKG, DGFI, GSFC, IAA, OPA and USNO.

1. Combination Scheme

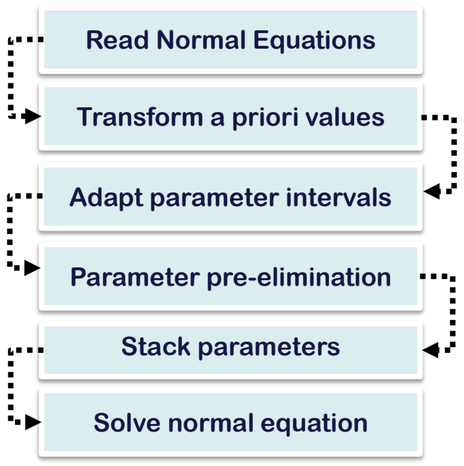
IVS Intra Combination at the Normal Equation Level Using Modified Bernese 5.0

Input solutions from Acs	
BKG	bkg2010a
GSFC	gsf2010a
OPA	opa2010c
USNO	usn2007b
DGFI	dgf2009a
IAA	iaa2010a

Current Combination Products

Daily SINEX(mainly Rapid Session)

- Station coordinates & velocities
- Polar motion (X-pole,& Y-pole) & their rates
- UT1 & LOD
- Nutation



Whole processes are automated by Bernese Processing Engine (BPE).

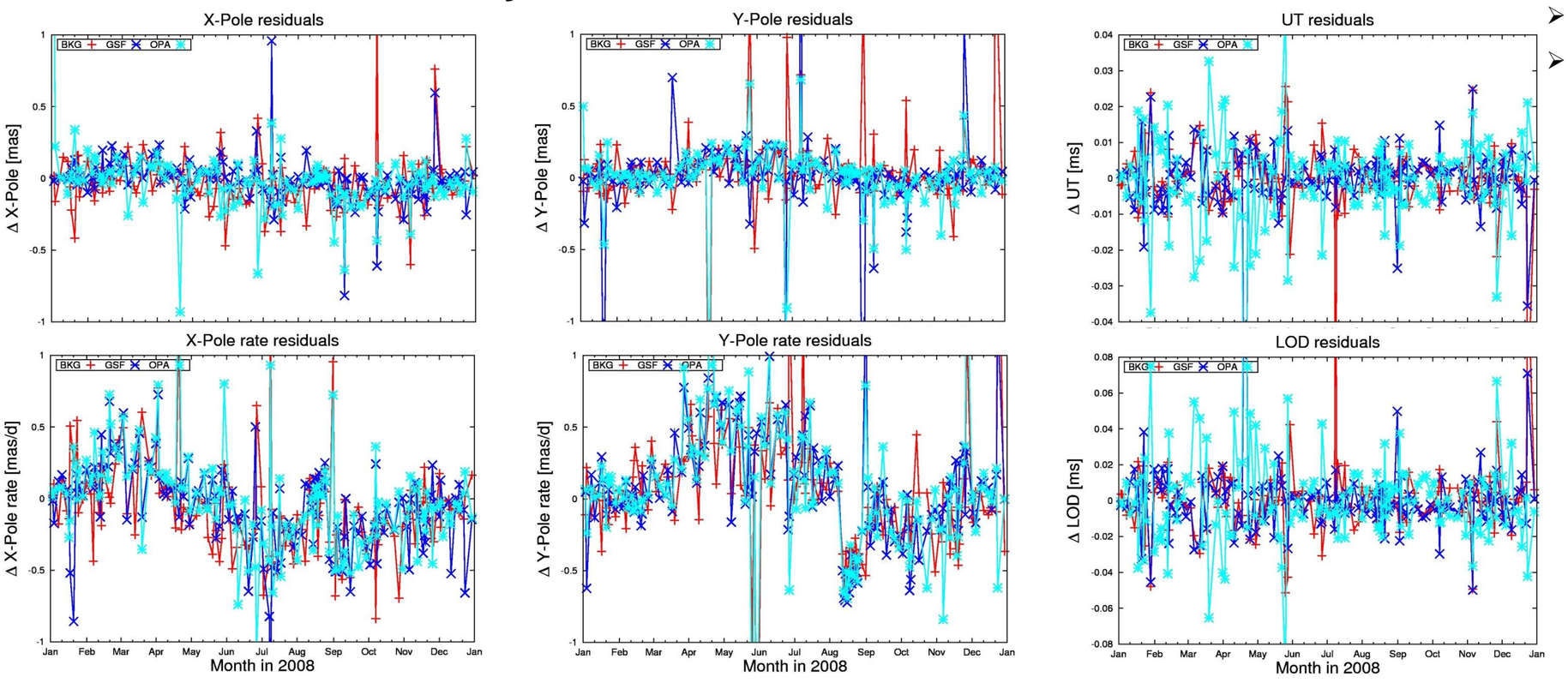
Reference / A priories	
Datum definition	Minimum Constraint to ITRF2008 (NNR/NNT)
A priori EOP series	IVS EOP series

In this stage, we do not apply any weights for individual solutions.

2. Test Combination with 3 ACs

$COM_{KAS} = BKG_{KAS} + GSFC_{KAS} + OPA_{KAS}$

Internal Comparisons [Residuals (Individual AC – KASI Combination)]



➢ In order to validate the modified Bernese S/W, we begin with combining the solutions of BKG, GSFC and OPA using identical analysis software, Calc/Solve.

➢ 144 sessions(XA/XE) in 2008 are combined.

➢ Outliers are not excluded.

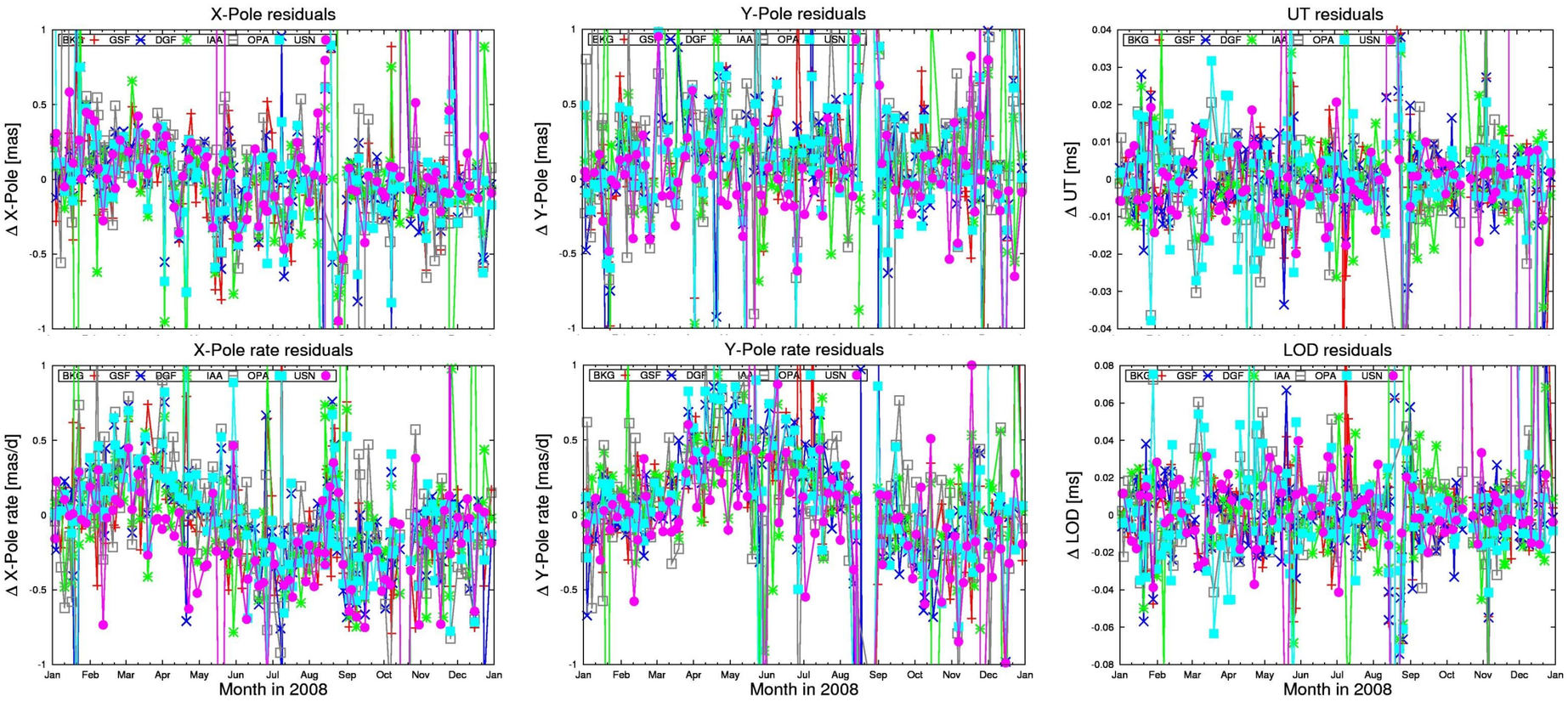
	XPO RMS / Offset (mas)	YPO RMS / Offset (mas)	UT RMS / Offset (ms)
BKG_{KAS} – COM_{KAS}	0.193 -0.025	0.329 0.055	0.018 -0.002
GSF_{KAS} – COM_{KAS}	0.163 -0.008	0.432 0.011	0.013 -0.001
OPA_{KAS} – COM_{KAS}	0.263 -0.019	0.236 0.007	0.016 0.000

	XPOR RMS / Offset (mas/d)	YPOR RMS / Offset (mas)	LOD RMS / Offset (ms)
BKG_{KAS} – COM_{KAS}	0.335 -0.049	0.702 0.069	0.035 0.003
GSF_{KAS} – COM_{KAS}	0.308 -0.066	0.481 0.086	0.025 0.001
OPA_{KAS} – COM_{KAS}	0.345 -0.015	0.592 0.068	0.032 0.001

3. Full Combination with 6ACs

$COM_{KAS} = BKG_{KAS} + DGFI_{KAS} + GSFC_{KAS} + IAA_{KAS} + OPA_{KAS} + USN_{KAS}$

Internal Comparisons [Residuals (Individual AC – KASI Combination)]



	XPO RMS / Offset (mas)	YPO RMS / Offset (mas)	UT RMS / Offset (ms)
BKG_{KAS} – COM_{KAS}	0.325 -0.034	0.350 0.130	0.010 0.002
GSF_{KAS} – COM_{KAS}	0.282 -0.012	0.340 0.124	0.010 0.001
OPA_{KAS} – COM_{KAS}	0.291 -0.046	0.331 0.119	0.011 0.001
DGF_{KAS} – COM_{KAS}	0.276 -0.029	0.312 0.077	0.011 0.000
IAA_{KAS} – COM_{KAS}	0.283 0.014	0.380 0.160	0.011 -0.001
USN_{KAS} – COM_{KAS}	0.264 0.031	0.294 0.024	0.008 -0.001

	XPOR RMS / Offset (mas/d)	YPOR RMS / Offset (mas/d)	LOD RMS / Offset (ms)
BKG_{KAS} – COM_{KAS}	0.323 -0.054	0.290 0.072	0.021 -0.003
GSF_{KAS} – COM_{KAS}	0.308 -0.034	0.373 0.118	0.021 -0.003
OPA_{KAS} – COM_{KAS}	0.320 -0.010	0.361 0.129	0.023 -0.002
DGF_{KAS} – COM_{KAS}	0.334 -0.045	0.320 0.112	0.021 0.000
IAA_{KAS} – COM_{KAS}	0.372 -0.039	0.360 0.135	0.022 0.003
USN_{KAS} – COM_{KAS}	0.334 -0.162	0.335 0.000	0.016 0.003

5. Concluding Remarks

(1) All of six IVS AC solutions are combined using modified Bernese S/W.

(2) Combination process is automated using BPE.

(3) Systematic variations of X-/Y- pole rates between combination solution and all of IVS solutions.

|| Future works ||

- ✓ Weighting all of individual solutions
- ✓ Combining whole period IVS products(1984 ~ present)
- ✓ Comparison with BKG/DGFI CC, IERS 08C04 and IGS solutions
- ✓ Providing IVS EOP Format Solution (Rapid & Quarterly)