Influence of source constellations on UT1 derived from IVS INT1 sessions

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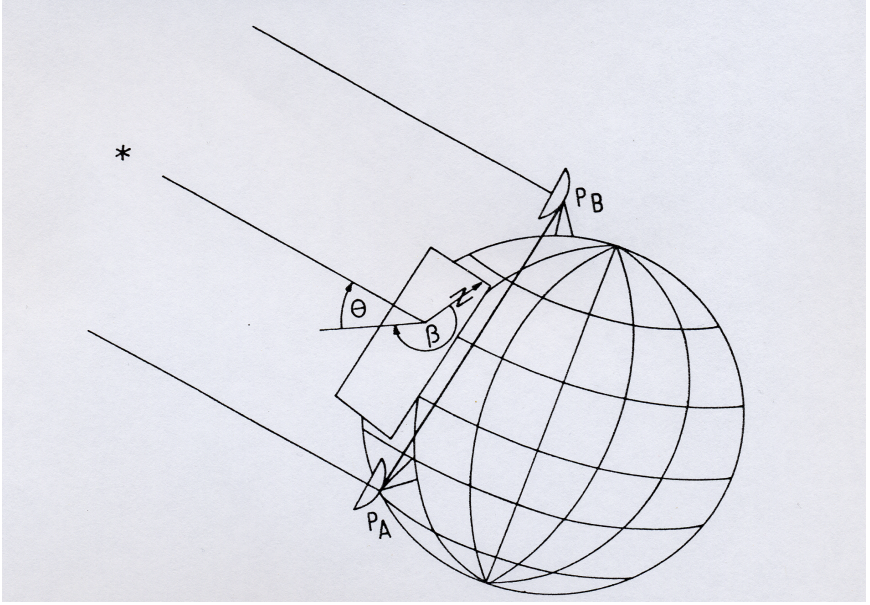
Background

A fictional baseline reference point is defined as the projection of the baseline midpoint onto the ellipsoid



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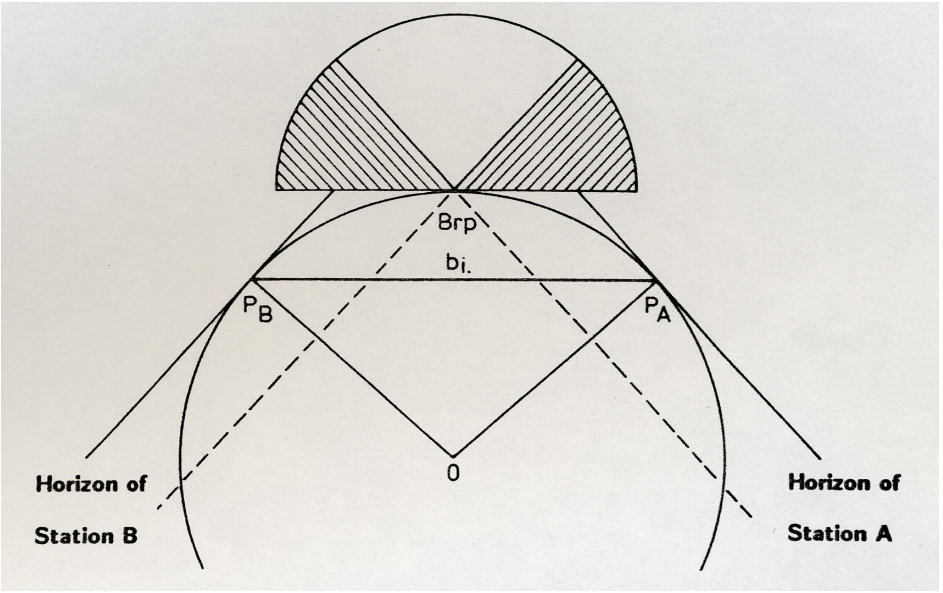
Background

In a different projection the baseline system can be seen as a hemisphere put on top of the ellipsoid at the baseline midpoint.



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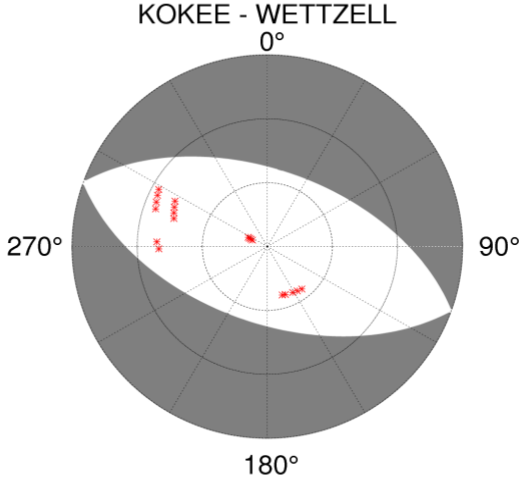
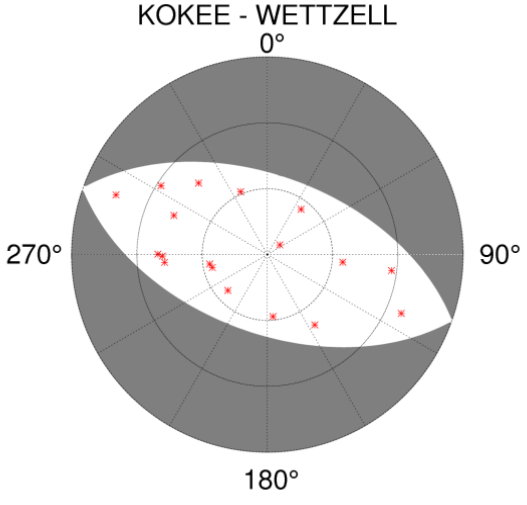
SkyPlot program

- Horizon limits of the two stations and the observations are best displayed in a stereographical projection (plotted with SkyPlot)

- SkyPlot uses SKD files as inputs and creates azimuth – elevation files where the baseline midpoint is the reference point

- Horizon masks are marked with grey, sources with red





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Analysis strategy

- Process INT1 sessions (baseline Kokee-Wettzell) from 2009-2011 with SkyPlot program (SKD files as input)
- Analyze dUT1 estimates and formal errors with Vienna VLBI Software (VieVS)
- Write a Matlab program to give quality codes depending on source positions (SkyPlot output files as input files)
- Calculate how many of the scheduled scans were observed and correlated

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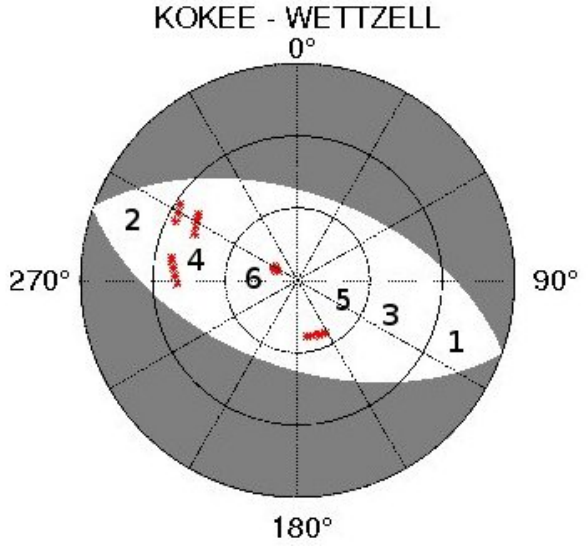
Analysis strategy

- Sky was divided to 6 sections
- The azimuth – elevation files have the values in the format (because of plotting):
- Azimuth = -azimuth + π /2, Elevation = π/2 – elevation
- Limits for different sections:



Sections	1,3 & 5	2,4 & 6	1 & 2	3 & 4	5 & 6
Azimuth limits	π/2 > az >-π/2	-π/6 >az > -3π/2	-	-	-
Elevation limits	-	-	π/2 > el > π/3	π/3 > el > π/6	π/6 > el > 0

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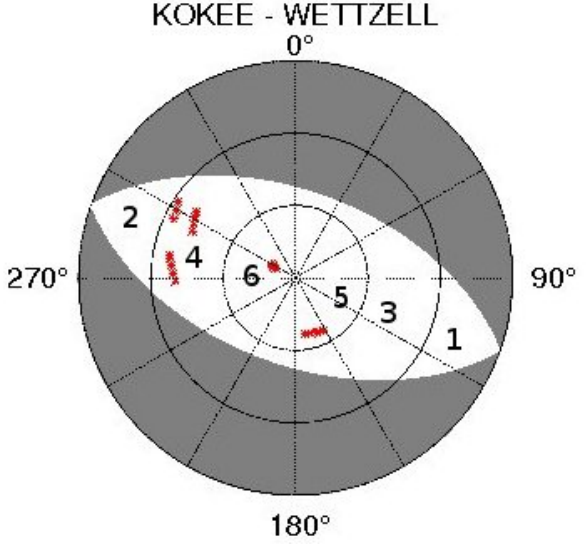
Analysis strategy

- Quality codes A, B, C and D were given, if there was 3 or more sources in both sections of a section pair
- Code F is given, if the session does not have enough sources in any of the section pairs

Code	Section pair
A	1 & 2
B	1 & 4 or 2 & 3
C	3 & 4
D	5 & 6



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Analysis strategy

	VieVS modeling options
A priori EOP	IERS C04
Ephemerides	JPL 421
Precession/nutation	IAU 2000A
TRF	VTRF2008
CRF	ICRF2
Mapping function	VM1
Elevation cutoff	0 degrees

	VieVS setup options
dUT1 interval, constraint	60 min, 0.0001 ms/day
ZWD interval, constraint	60 min, 0.0001 ps^2/s
Clock interval, constraint	1440 min, 0.5 ps^2/s

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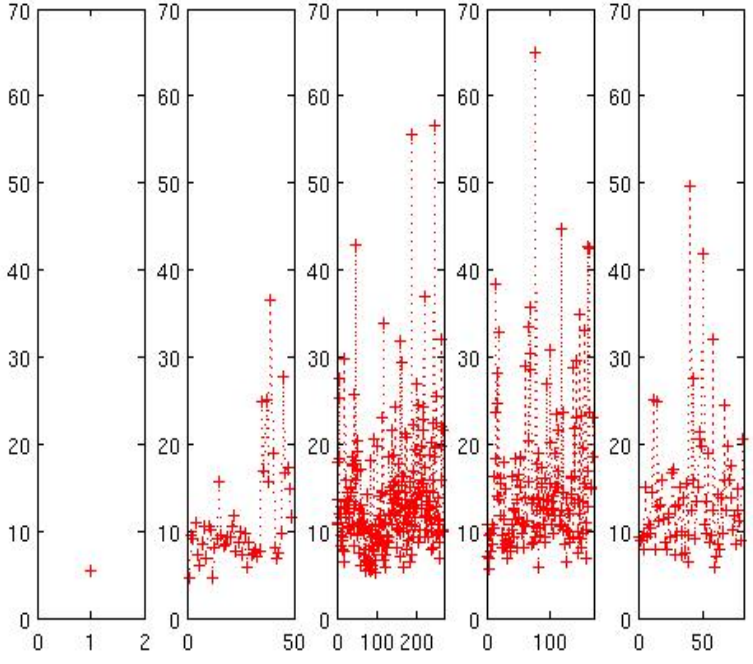
Results

- 600 INT1 sessions were processed from 2009-2011 with SkyPlot
- 568 were analyzed with VieVS (32 could not be analyzed due to missing NGS files, unmeasured or uncorrelated sessions)
- 5 sessions were removed due to large formal errors (>100 µs). These were from categories C and D.



Formal errors (µs) of A-F categories (session counts on x-axis)

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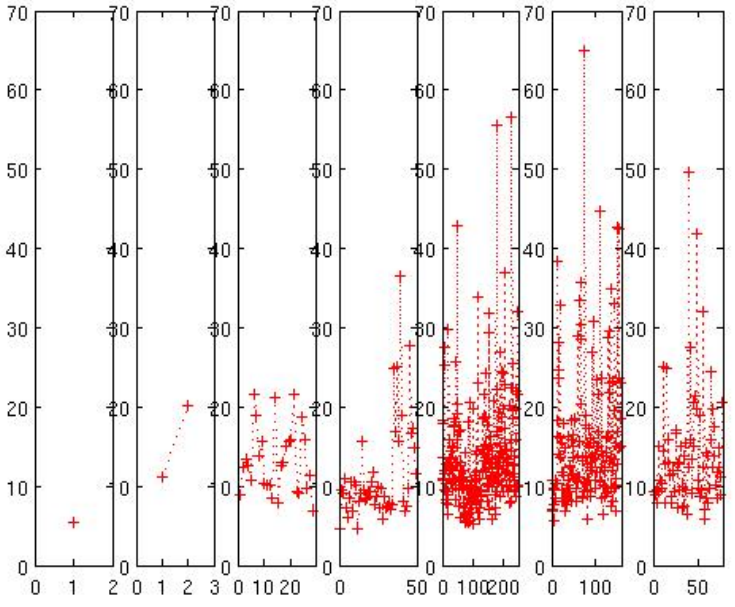
Results

- More categories were added, because there was only 1 session with code A
- AAA: former A with 3 or more sources in sections 1&2
- AA: 2 sources in both sections 1&2
- A: 1 source in both sections 1&2
- No outliers for AAA, AA and A



AAA AA A B C D F

Formal errors (μs) of AAA-F categories (session counts on x-axis)

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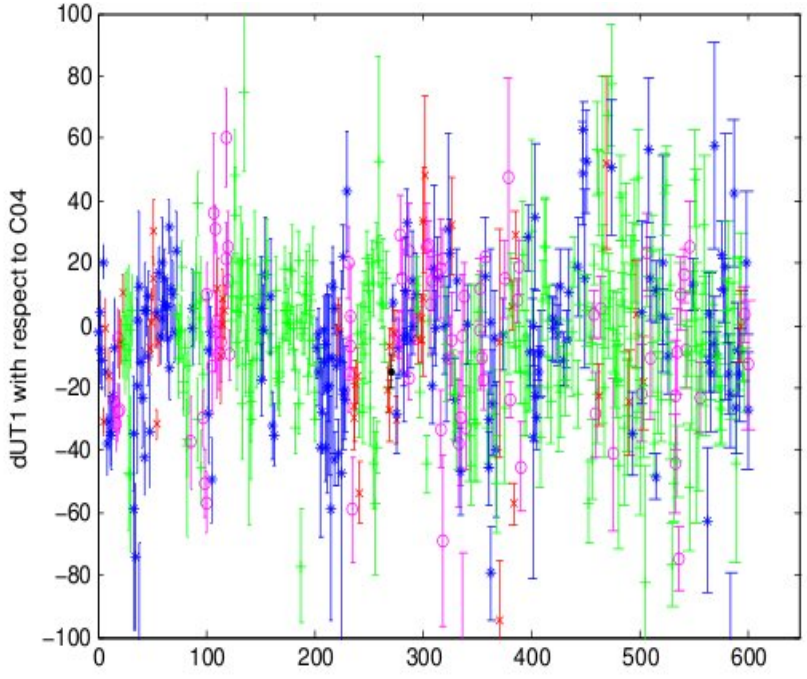
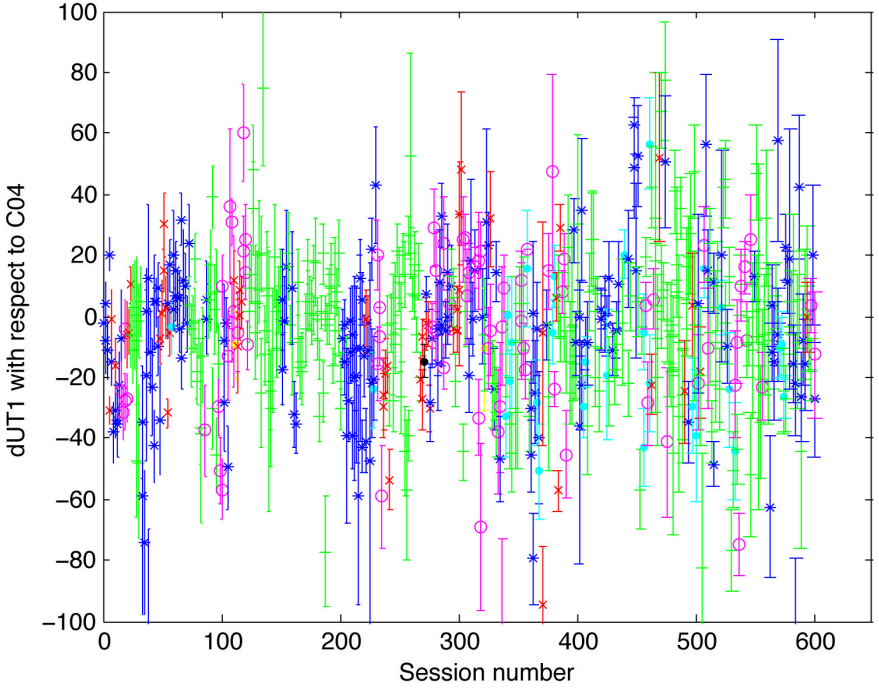
Results





- dUT1 estimate relative to the IERS C04 a priori on the left for A-F (A marked with black, B: red, C: green, D: blue, F: magenta), on the right for AAA-F (AAA: black, AA: yellow, A: cyan)

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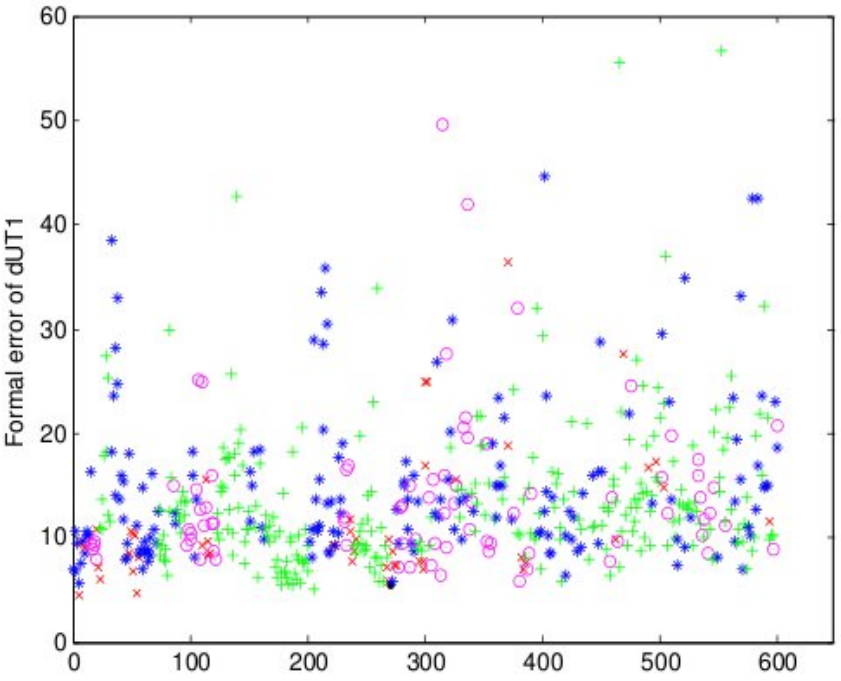
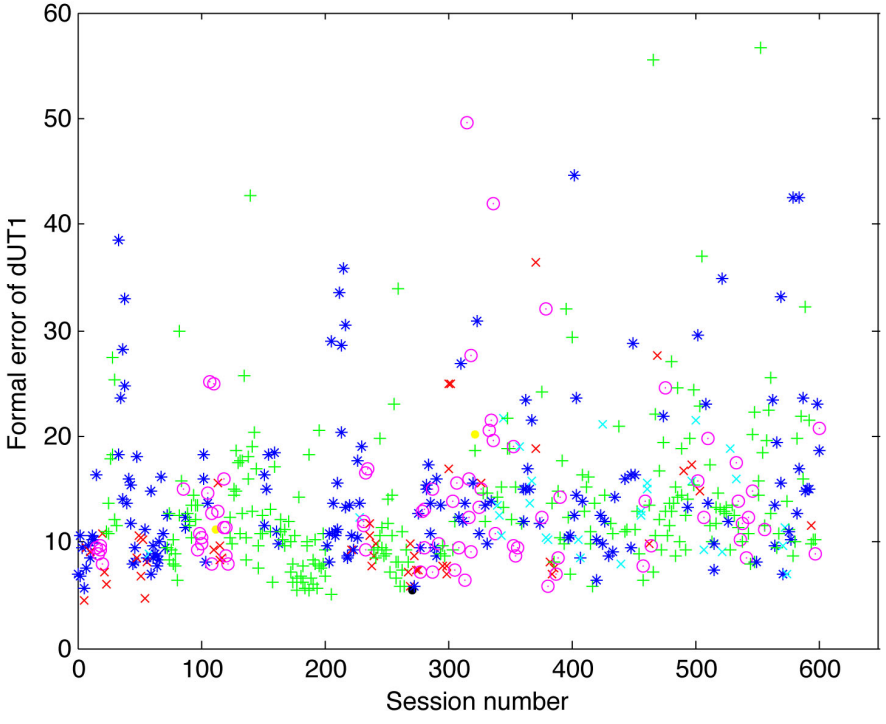
Results





- Formal errors on the left for A-F (A marked with black, B: red, C: green, D: blue, F: magenta), on the right for AAA-F (AAA: black, AA: yellow, A: cyan)

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Results

- RMS values of dUT1 estimates relative to the IERS C04 a priori and their formal errors
- $dUT1_A$ = 14.76 +/- 5.37 µs

Code	RMS (µs)
A	-
B	25.22 +/- 12.39
C	23.83 +/- 14.75
D	27.45 +/- 17.06
F	47.07 +/- 15.13

Code	RMS (µs)
AAA	-
AA	9.94 +/- 16.24
A	25.06 +/- 13.20
B	25.22 +/- 12.39
C	23.62 +/- 14.83
D	27.96 +/- 17.28
F	47.53 +/- 15.18

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Results

- Session counts in different categories were calculated
- 7.2% of the sessions in the new categories came from C
- 4.8% from D
- and 3.8% from F

Code	A	-	-	B	C	D	F
Sessions	1	-	-	49	265	168	80
Code	AAA	AA	A	B	C	D	F
Sessions	1	2	28	49	246	160	77

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Results

- A Matlab script was written to calculate the number of scheduled scans from SKD files and the number of observed scans from NGS files
- Unmeasured / Uncorrelated sessions are excluded from this results (32 sessions)
- 98.80% of scheduled scans were observed and correlated in 2009-2010

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Results

- Mean scan counts (MSCs) were calculated
- MSCs for categories A-D are about 22 scans per session
- Category F is an exception with a scan count of about 20 scans per session

Code	A	B	C	D	F
MSC	22	22.25	21.49	22.74	19.61

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Conclusions

- No outliers were found for formal errors in categories AAA, AA and A
- More sessions could be analyzed (only 1 session with code A found so far), but earlier sessions might use the same source distribution
- Only 31 of the 563 sessions had more than one source in the sections 1 or 2
- B code could be divided to BBB, BB and B to see if more sessions from category F would move into these
- A test campaign? More sources to sections 1&2 could be scheduled to ensure the results

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Thank you!

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