Effect of the reference radio source selection on a VLBI CRF realization

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Selection of radio sources:

Four stability criteria based on different schemes have been used for selection of reference radio sources:

1. The list of the ICRF defining sources, published by Ma et.al. (1998)
2. The list of stable radio sources determined by M.Feissel-Vernier (2003)
3. The list of structure indices of radio sources set up by P.Charlot and A. Fey (1997)
4. The list of G. Engelhardt and V. Thorandt (2006)

Inconsistencies between results of the selection schemes

Table 1. Connection between list 1 and list 2.

Stability	Source Status in the ICRF		
	Defining	Candidate	Other
Stable	81	68	49
Unstable	60	62	38

Table 2. Connection between list 1 and list 2 and list 3.

Stab.	Source status			Structure index		
index	Def.	Can.	Oth.	1	2	3–4
1	33	26	15	46	11	7
2	48	42	34	76	26	6
3	2	1	4	6	2	0
4	58	61	34	70	26	13

Example of inconsistencies by some sources

Source	List of 121	ICRF lists	Charlot lists	Feissel lists
0003+380	-	+	-	+
0003-066	+	Candidate	-	+
0300+470	+	-	+	+
0319+121	+	-	-	+
0306+102	+	+	-	+
0319+121	+	-	-	+
0420-014	+	-	-	-
0014+813	-	+	+	-
1611+343	+	Candidate	-	+
2201+315	+	-	-	+
0237-233	-	+	-	+
2145+067	-	+	+	-

“ + ” Stable, “ - ” Unstable

Radio source time series

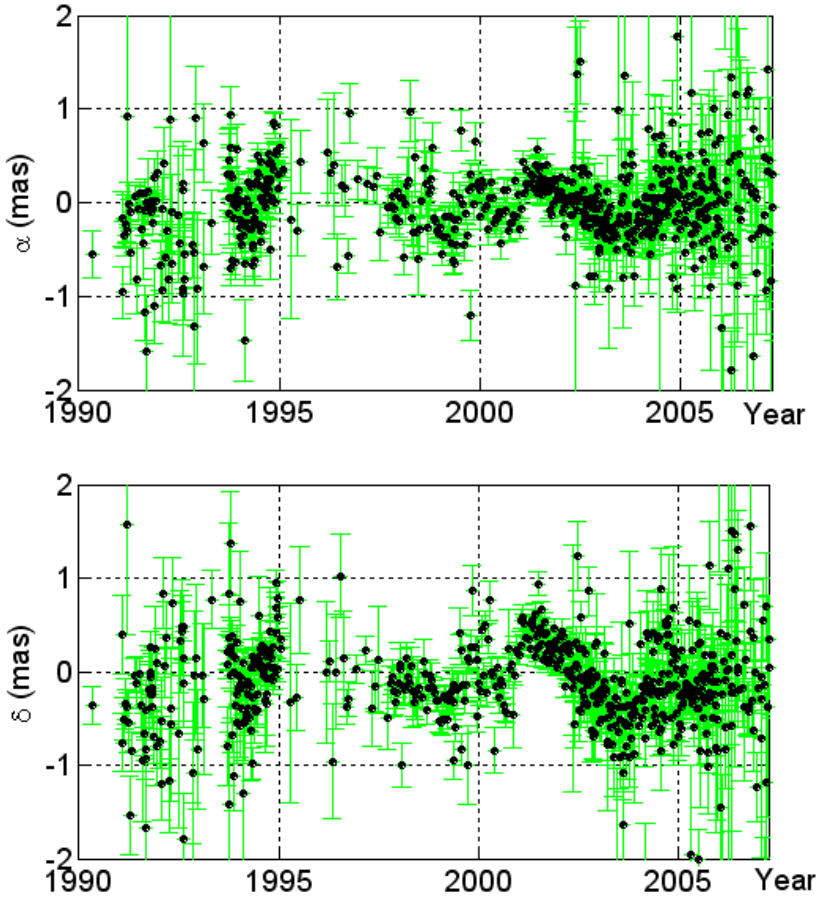
2201+315

1. ICRF “other” group

2. Stable source by M. Feissel

3. Stable (in first group of 121) by
   G.Engelhardt and V. Thorandt

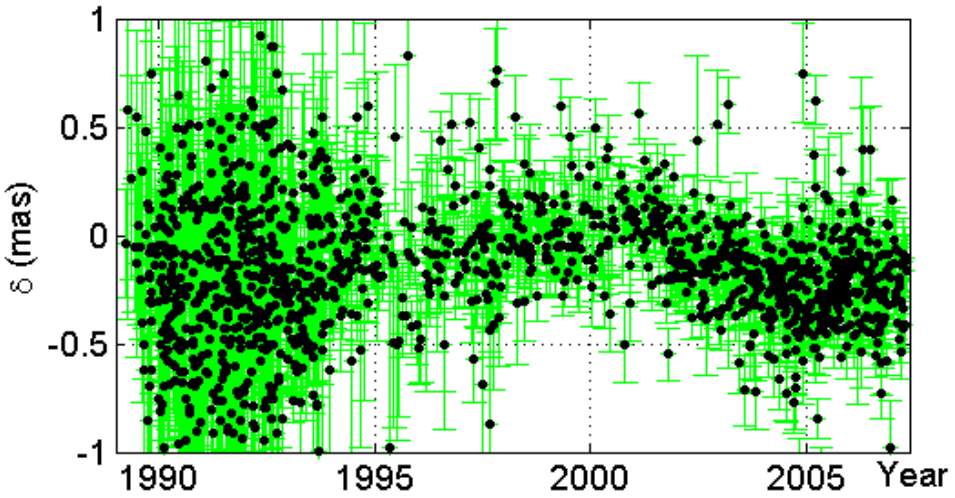
4. Index 3 (X-Band) by
   Patrick Charlot



Radio source time series

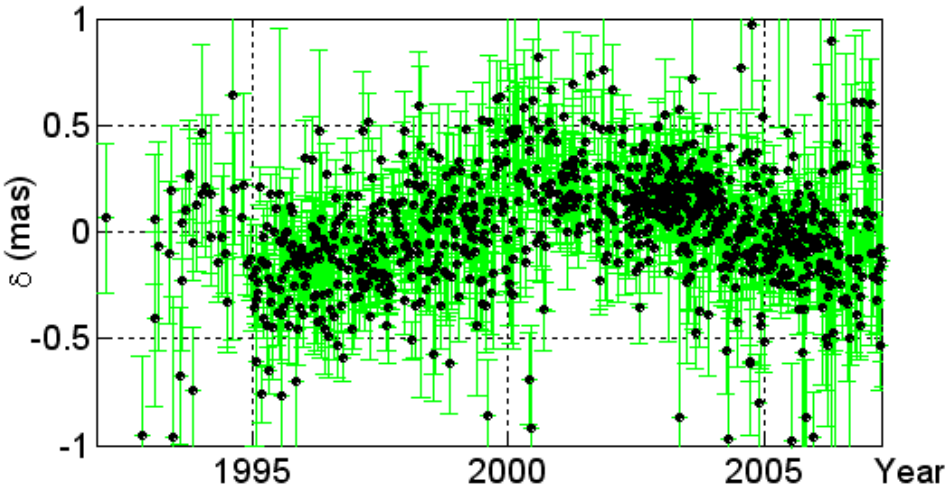
1611+343

1. ICRF "candidate" group
2. Stable source by M. Feissel
3. Stable (in first group of 121 by G.Engelhardt and V. Thorandt
4. Index 3 (X-Band) by P. Charlot



0014+813

1. ICRF "defining" group
2. Unstable source by M. Feissel
3. Unstable by G.Engelhardt and V. Thorandt
4. Index 1 (X-Band) by P. Charlot



CRF Solutions

1. **IGG07JS01a – using list 1 for NNR constraints.**
   Number of reference sources = 212 ICRF "defining" sources,
   Number of sources treated as arc parameters = 102 ICRF "
   other group"

2. **IGG07JS01b – using list 2 for NNR constraints.**
   Number of reference sources = 199 "stable" sources by M. Feissel,
   Number of sources treated as arc parameters = 163 "unstable"

Table. Solution statistics

	IGG07JS01a	**IGG07JS01b**
Num. of Obs.	2630247	2835457
Num. of Sources	1560	1494
Num. of Reference Sources	212 (ICRF defined group) list 1	199 (Feissel stable list 2)
Weighted RMS (mm)	4.77	4.79
WSD	1.37	1.50

CRF Solutions comparison

Fig. Nutation Δψcosε offset differences (above), Δε offset differences (below). Unit mas.

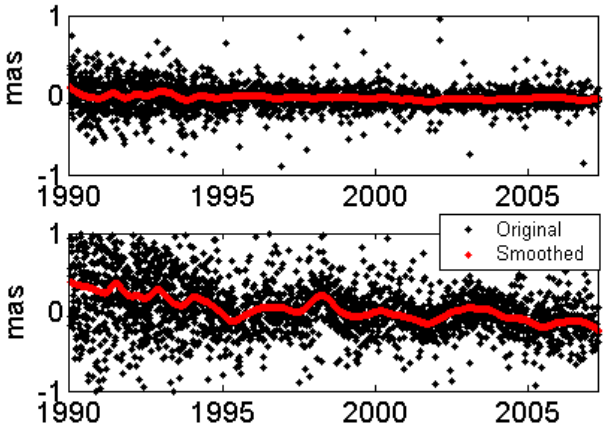
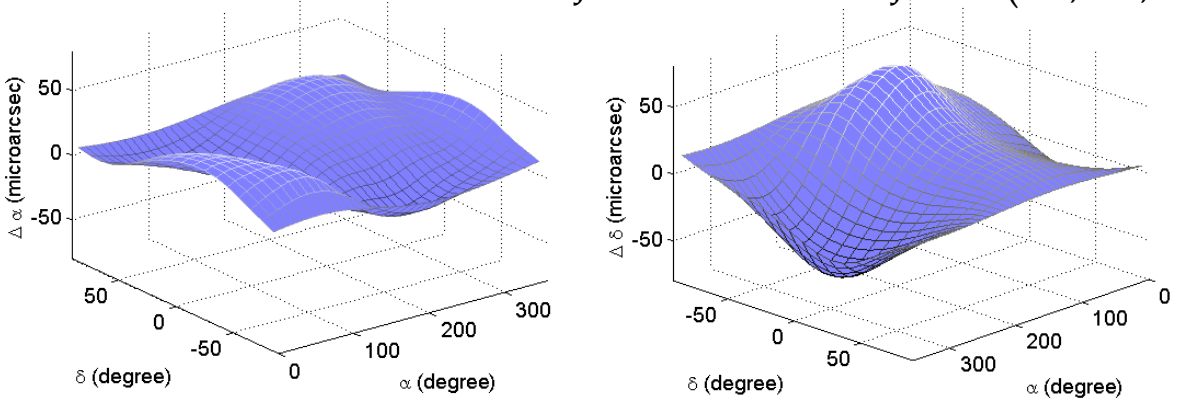


Table. Scatter of the celestial pole offset time series calculated with two catalogues.

Catalogues	FCN			ADEV		
	X	Y	Mean	X	Y	Mean
IGG07JS01a	99	105	102	103	106	105
IGG07JS01b	97	104	101	102	105	104

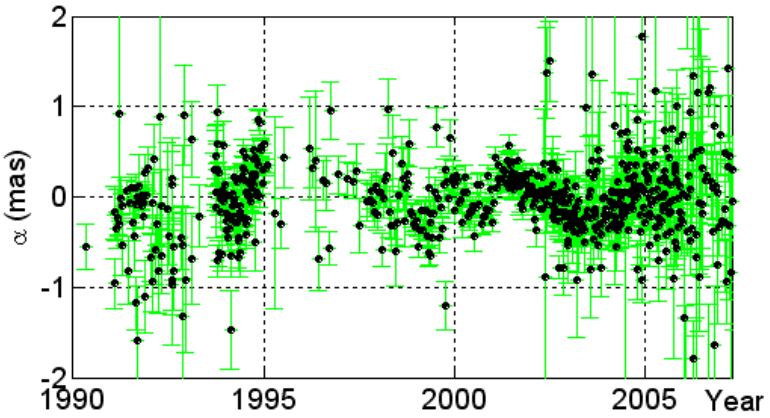
FCN column shows the scatter w.r.t. FCN model, the ADEV column shows Allan deviation. Unit μas

Fig. Smoothed differences between IGG07JS01a and IGG07JS01b (Δα, Δδ, Unit μas)

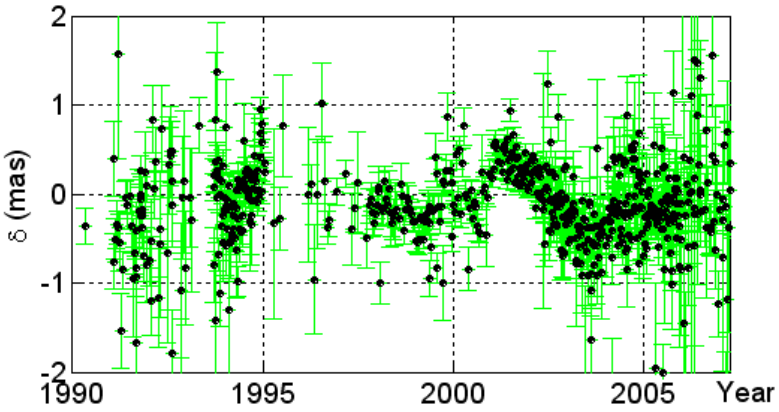


Impact of source instability on nutation time series

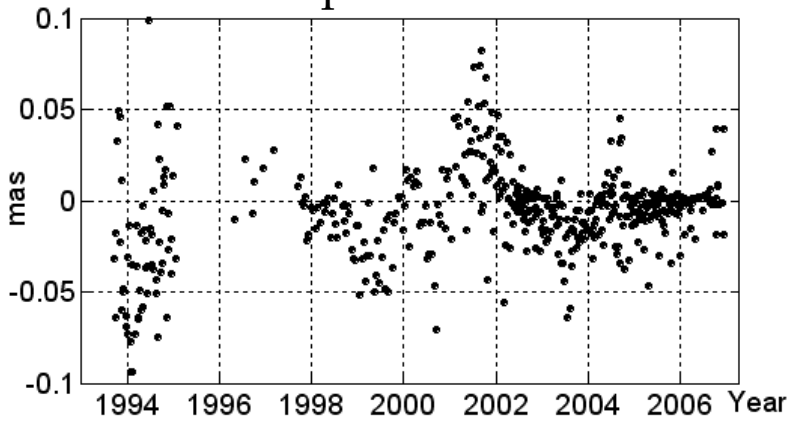
2201+315



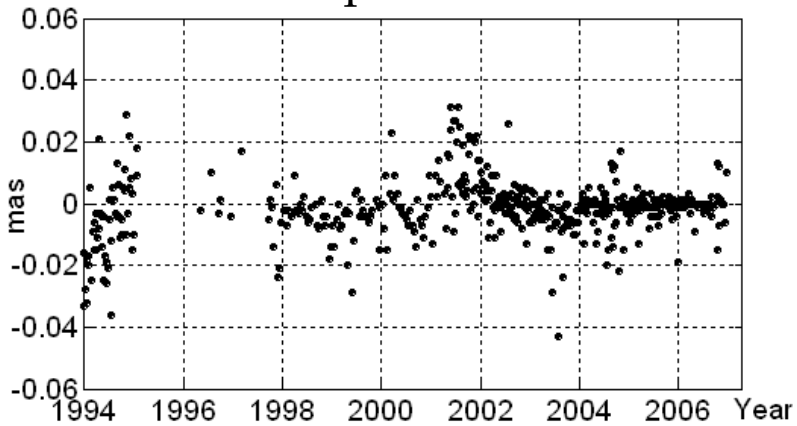
Time series (α, δ)



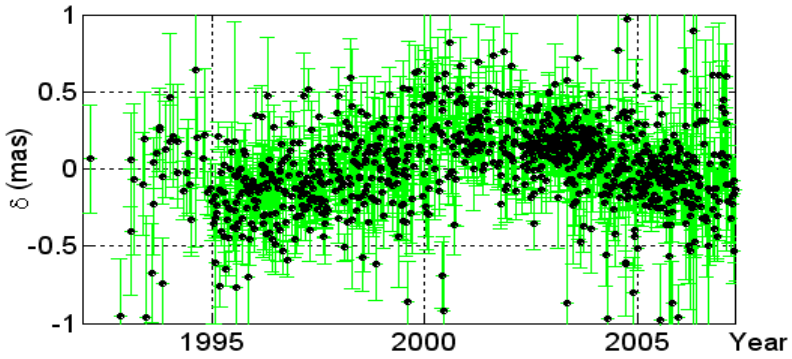
Nutation Dpsi offset difference



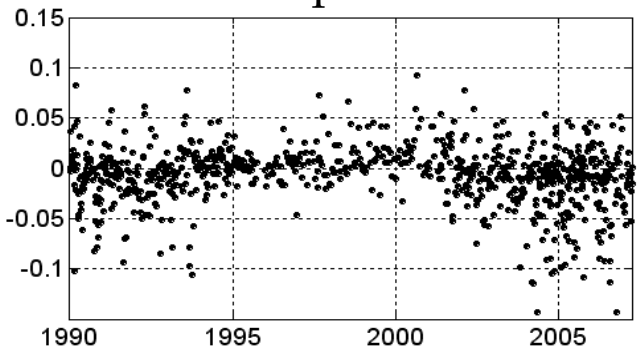
Nutation Deps offset difference



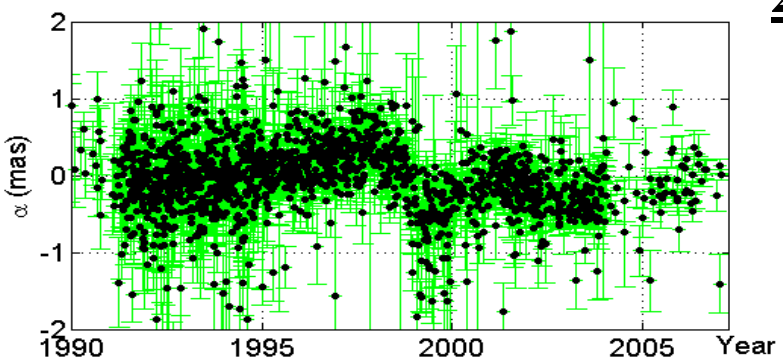
1611+343



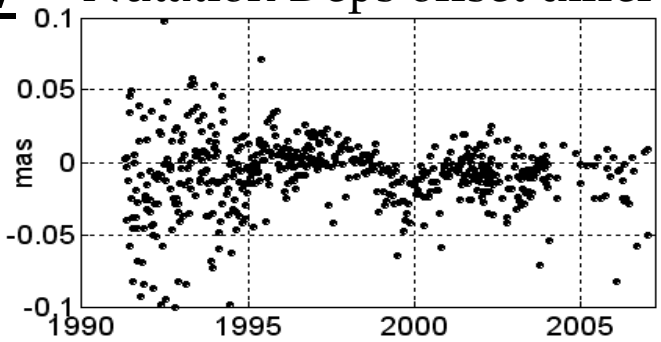
Nutation Dpsi offset difference



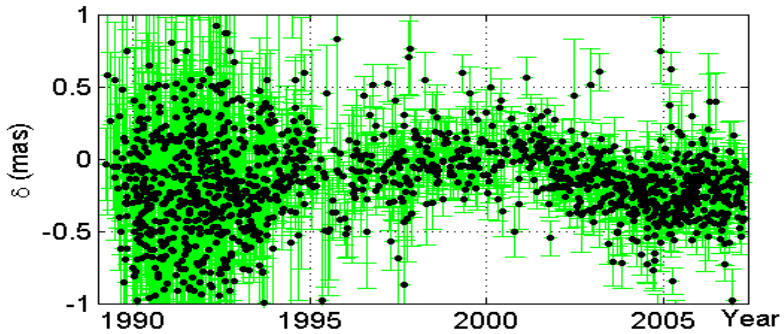
2145+067



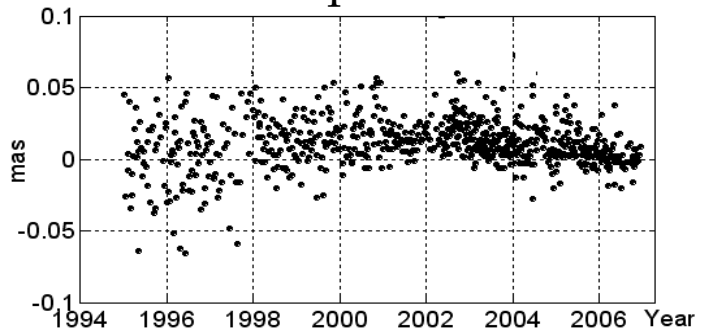
Nutation Deps offset difference



0014+813



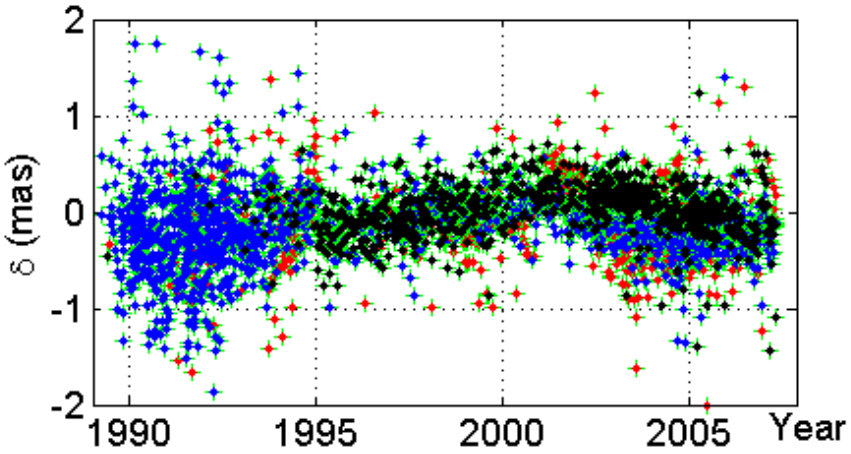
Nutation Dpsi offset difference



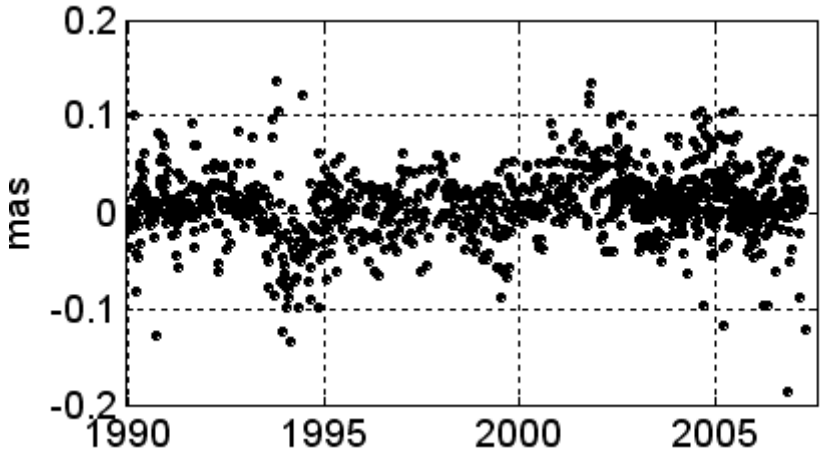
Impact of source instability on nutation time series

2201+315 + 1611+343 + 0014+813

Time series (δ, mas)



Nutation Dpsi offset difference



Summary

1. All four selection schemes have considerable inconsistencies.
2. Variations of radio sources coordinates significant affect on nutation time series.
3. It is necessary to develop a combination of the statistical and astrophysical criteria with the analysis of nutation time series for the procedure of stable radiosource selection.
4. As a preliminary version of a list of “stable ” sources the mix of “stable” lists by P. Charlot and by M. Feissel proposed by O. Titov can be used.

Thank you for your attention!