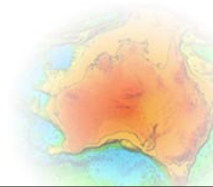




Australian Government
Geoscience Australia

***Problems of the reference radio
source selection***

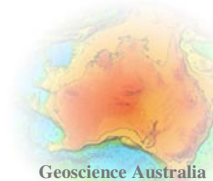
**General Assembly of IAU, 14-25, August,
2006, Prague, Czech Republic**



Problems...

- 1. What list of radio sources to be selected for the next ICRF?**
- 2. What is stability measure of any selected list of radio sources?**

22 August 2006



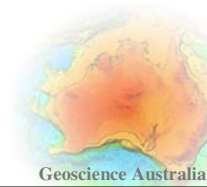
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Selection of radio sources

A set of reference quasars to be fixed

- 1. ICRF (Ma et al., 1998)**
- 2. Feissel-Vernier (2003), Feissel-Vernier et al. (2006)**
- 3. Structure index (Fey & Charlot, 1997; 2000)**

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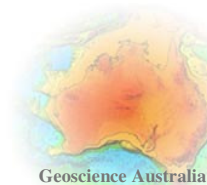


ICRF catalogue (1998)

608 sources spitted into 3 groups

- 1. 212 defining sources with position accuracy ~0.4 mas**
- 2. 294 candidate sources**
- 3. 102 other sources**

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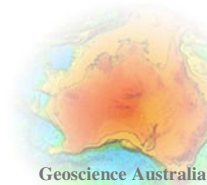


Feissel-Vernier (2003)

362 pre-selected sources spited into 4 groups

- 1. 199 'stable' sources (groups 1 and 2)**
- 2. 7 'unstable' sources (group 3)**
- 3. 156 'highly unstable or drifting' sources (group 4)**

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Structure index Fey and Charlot (1997, 2000)

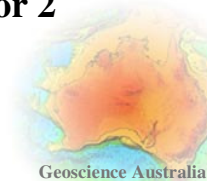
Radio sources spited into four groups by structure index based on median structure correction (in terms of the X-band time delay)

1. Structure index = 1 , if $0 \text{ ps} \leq \tau < 3 \text{ ps}$
2. Structure index = 2 , if $3 \text{ ps} \leq \tau < 10 \text{ ps}$
3. Structure index = 3 , if $10 \text{ ps} \leq \tau < 30 \text{ ps}$
4. Structure index = 4 , if $30 \text{ ps} \leq \tau < \infty$

388 ICRF radio sources

- 1. 229 compact or very compact; Index 1 or 2**
- 2. 159 extended; Index 3 or 4**

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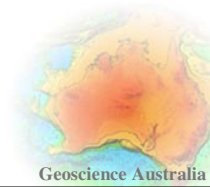


All three lists are not well correlated

What list of radio sources to be selected for the next ICRF?

What is stability measure?

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Selection based on the yearly spaced time series

Feissel-Vernier (2003)

Feissel-Vernier et al. (2006)

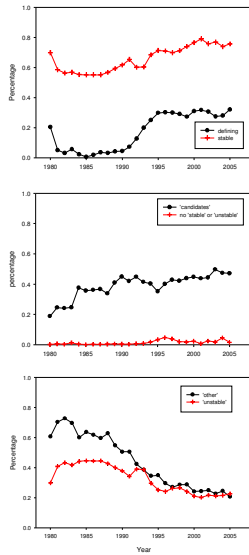
Time series of the yearly spaced orientation angles and nutation offsets are better statistically if the 199 'stable' sources are used w.r.t. to the 212 'defining'.

Does it mean that the 199 'stable' sources are really more stable than the 212 ICRF 'defining' sources?

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'Defining' and 'stable' sources



The number of the ICRF 'defining' sources observed by the IRIS-A network

1984	1
1985	0
1986	0
1987	0
1988	0
1989	0

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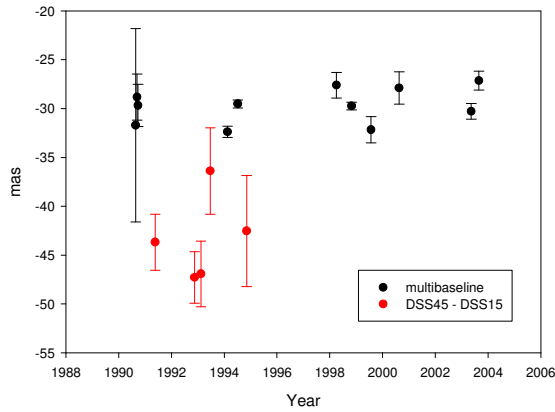
Does it mean that the 199 'stable' sources are really more stable than the 212 ICRF 'defining' sources?

Not necessary. The 199 'stable' sources are better just because they were more frequently observed than the 212 ICRF 'defining' sources.

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ICRF source instability (quasar 0237-233, declination)



'other'

'stable'

4

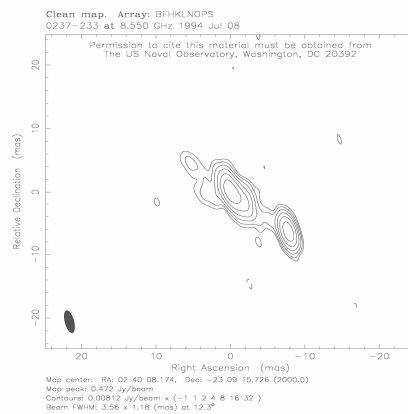
Offset ~12 mas

(~35 cm)

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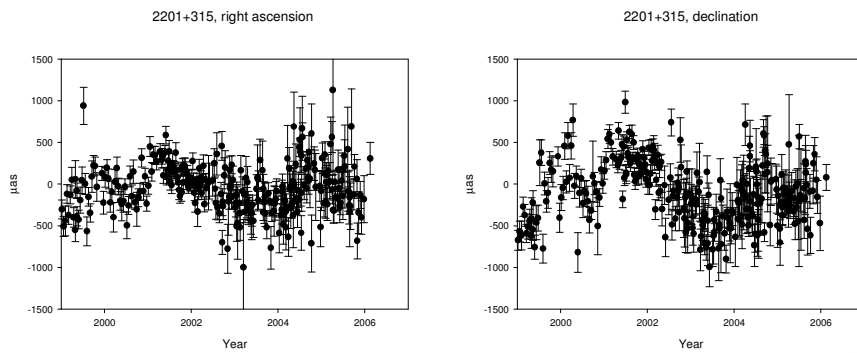
ICRF source instability (0237-233, structure)



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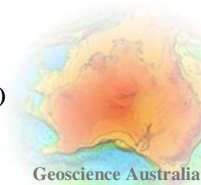
ICRF source instability (quasar 2201+315)



Selected as 'other' in the ICRF

Selected as 'stable' by Feissel-Vernier (2003) and Feissel-Vernier et al. (2006)

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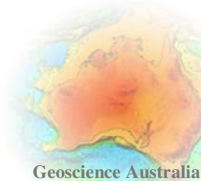
Problems of the extended radio sources

Large structure delays result in the large wrms in position time series;

extended radiosource, even stable now, can become unstable any time;

positions of extended radiosources observed by different networks can be inconsistent.

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What is stability measure of any selected list of radio sources??

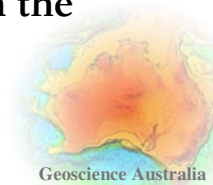
- Weighted RMS from global solution

or,

- Independent parameter based on the structure delay

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Weighted structure delay (WSD)

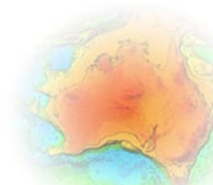
N – the number of reference radio sources (212 or 199);

n_i – the number of observations of the i -th reference radio source;

τ_i – median structure delay of the i -th reference radio source (Fey and Charlot 1997, 2000).

$$WSD = \frac{\sum_{i=1}^N n_i \tau_i}{\sum_{i=1}^N n_i}$$

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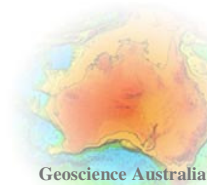


Solutions

All observed radiosources were split into 3 groups

- 'reference' (estimated as global parameters with NNR);
- 'unstable' (estimated as daily parameters);
- all other (estimated as global parameters without NNR)

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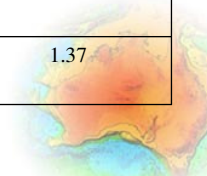


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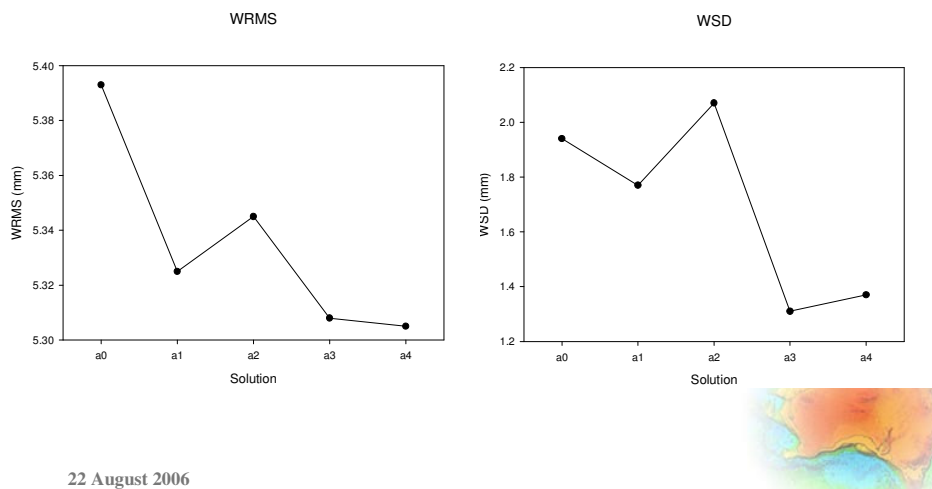
Solution statistics

	<i>a0</i>	<i>a1</i>	<i>a2</i>	<i>a3</i>	<i>a4</i>
Number of global radio sources with NNR	212 ICRF 'defining'	212 ICRF 'defining'	199 'stable'	145 'stable' compact	155 ICRF 'defining' compact
Number 'arc' radio sources	0	102 'other' ICRF	163 'unstable'	217 (163 unstable', 54 'stable')	210 (91 'other', 57 'defining', 64 'candidates')
Weighted RMS (mm)	5.393	5.325	5.345	5.308	5.305
WSD (mm)	1.94	1.77	2.07	1.31	1.37

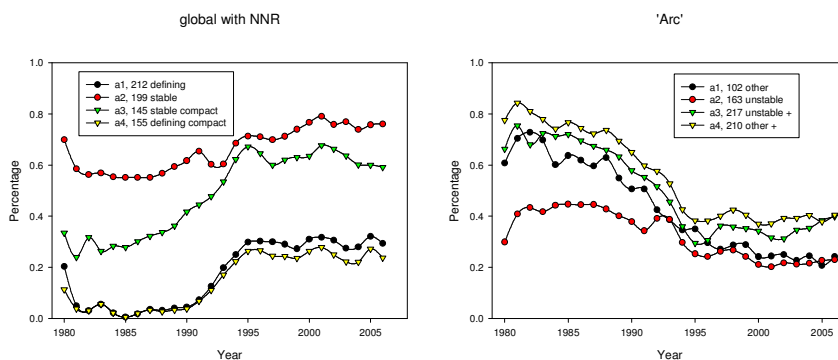
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WRMS and WSD



'Defining' and 'stable' sources



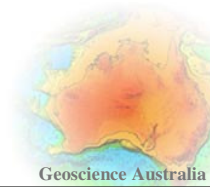
Conclusions

List of the 145 'stable and compact' sources would be a reasonable compromise;

More work should be done;

Another selection scheme is proposed...

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Selection for ICRF

- long observational history

- structure index # 1 or # 2 only!

- statistical analysis of the original daily time series.

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