



# Investigation of EOP for VLBA Calibrator Survey sessions

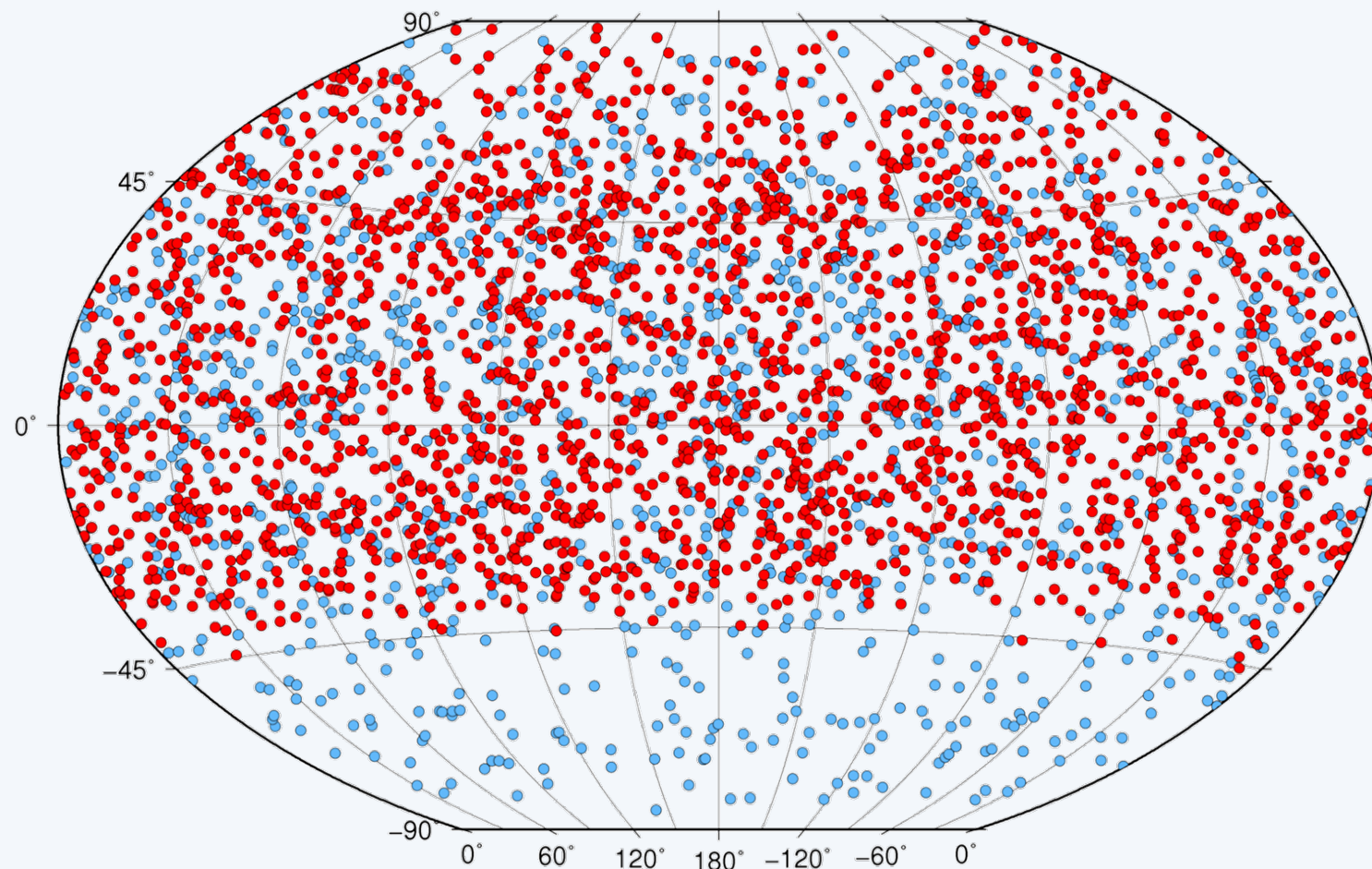
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# Content and objectives

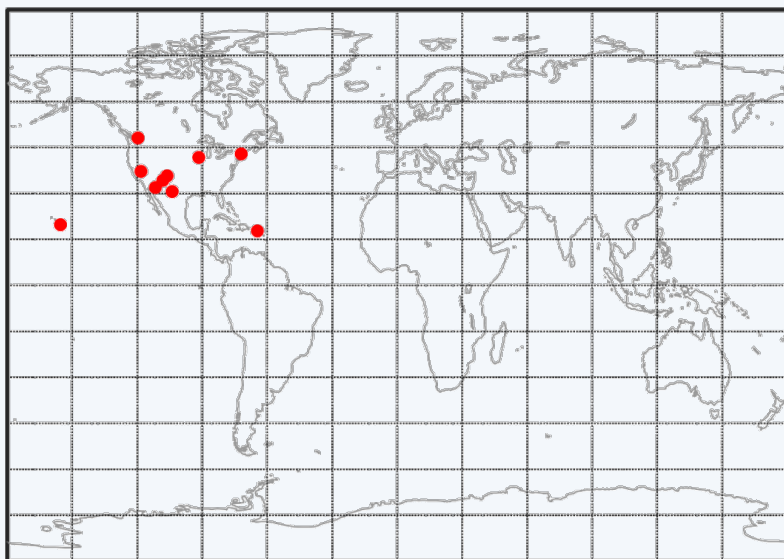
- VCS sessions
  - EOP from VCS sessions
  - Is it possible to improve source position with fixed a priori EOP?
- Astrometric AUSTRAL sessions
- ICRF3 contribution from Vienna

# ICRF2



- 1217 non-VCS sources
- 2197 VCS only sources

# VLBA Calibrator Survey (VCS)



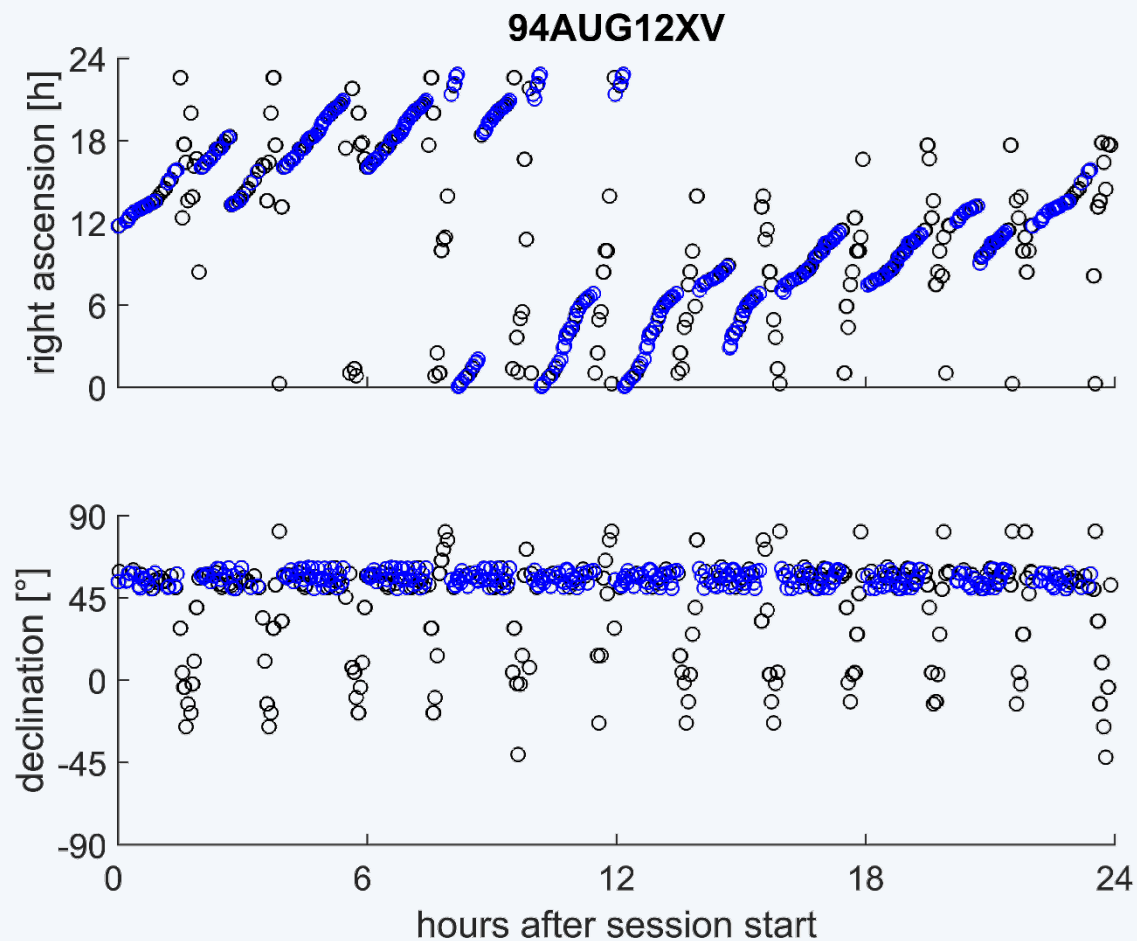
24 sessions from 1994 – 2007

→ Split into 6 campaigns (VCS1 – VCS6)

→ Densify ICRF

→ ICRF2 has 1217 non-VCS sources and 2197 VCS sources

# VCS schedules

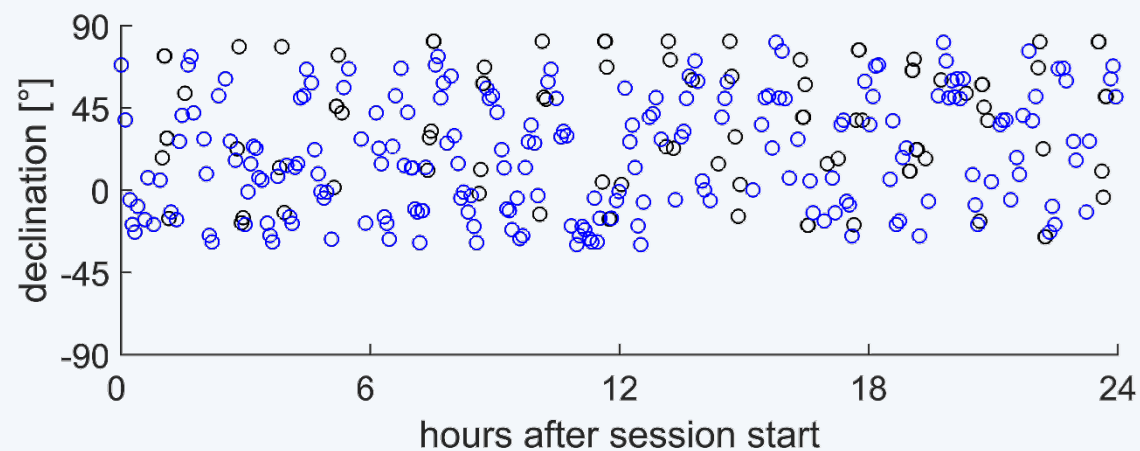
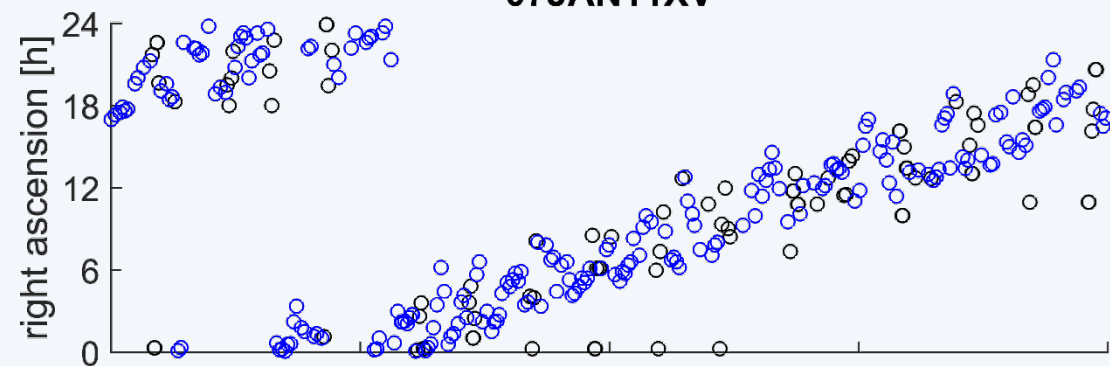


VCS1 → piece-wise  
observations on a meridian  
+ one declination stripes

VCS sources  
Non-VCS sources

# VCS schedules

07JAN11XV

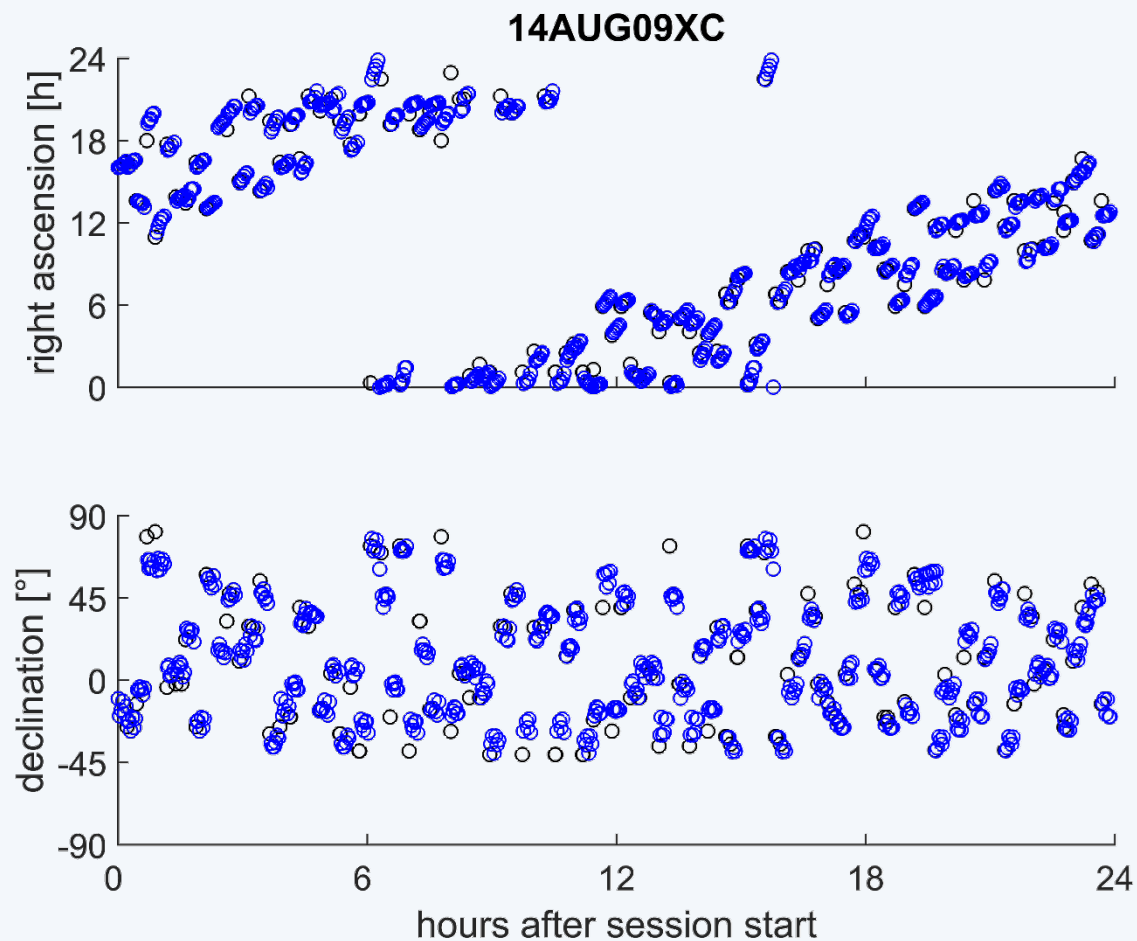


VCS2 – VCS6 → constant  
meridian + declination  
spread evenly between -  
45° and 90°

VCS sources

Non-VCS sources

# VCS schedules



VCS-II → constant  
meridian + declination  
spread evenly between -  
45° and 90°

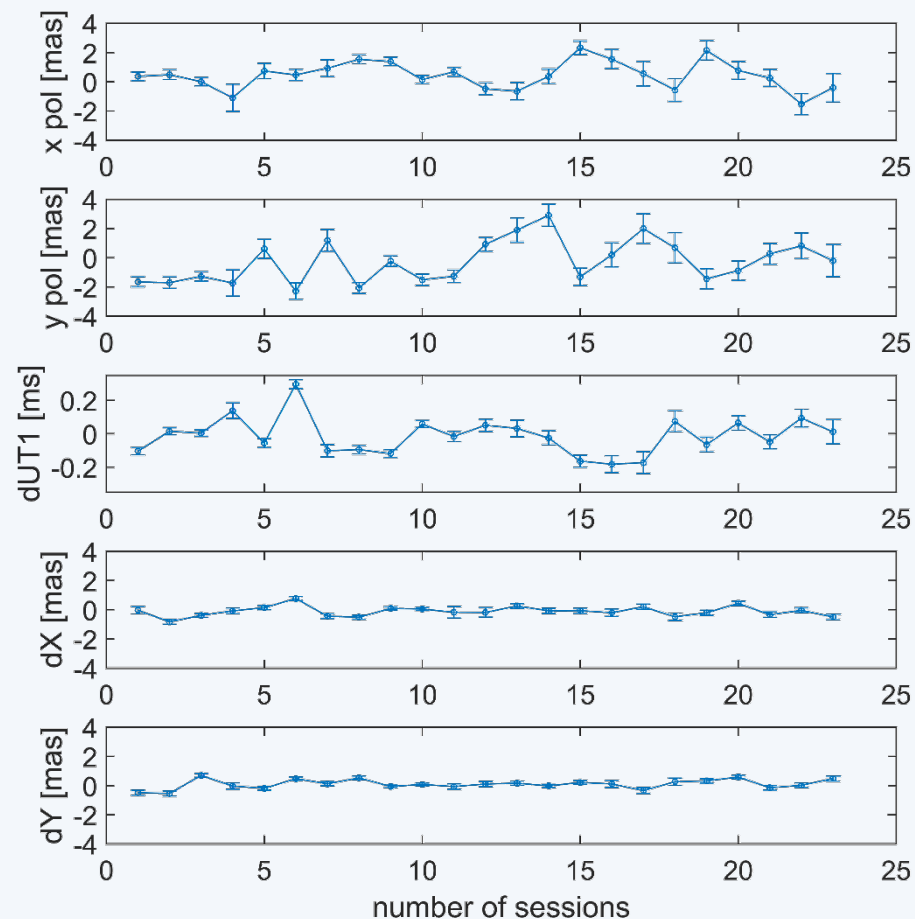
→ Sources are observed in  
clusters

VCS sources

Non-VCS sources



# Estimate EOP from VCS sessions



When EOP are estimated from VCS sessions we get large (up to 4 mas) offsets w.r.t. the C04 08 series

→ Network is regional and not suitable for EOP estimation

**RMS of the EOP estimates w.r.t. the C04 08 time series**

x-pole	0.95 mas
y-pole	1.31 mas
dUT1	0.11 ms
dX	0.34 mas
dY	0.31 mas



# Estimate source coordinates from VCS sessions

Solved for:

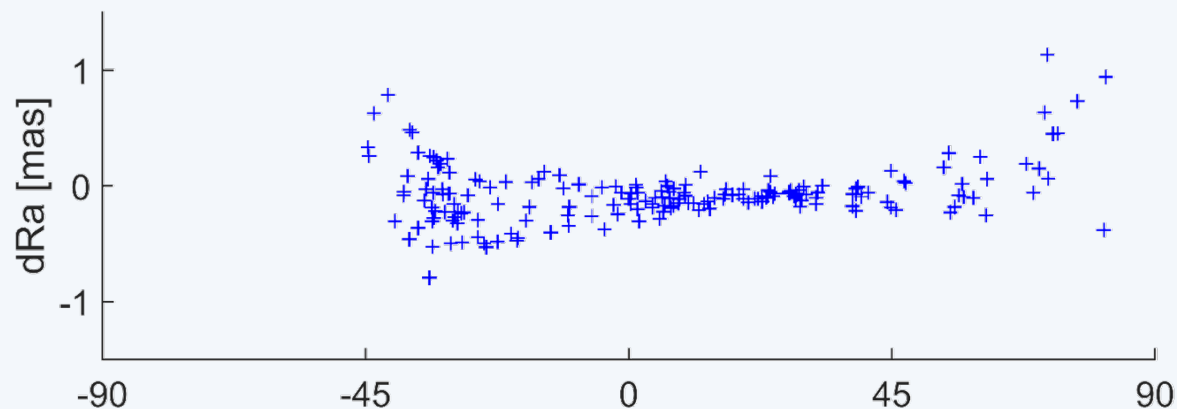
- Station coordinates (NNR + NNT w.r.t. VTRF2008)
- Source coordinates (NNR w.r.t. ICRF2 non-VCS sources)
- Troposphere (ZWD + gradients)
- Clock parameters
- EOP

Difference between two solutions was computed

- EOP and source coordinates are estimated simultaneously
- EOP were fixed to the C04 08 time series

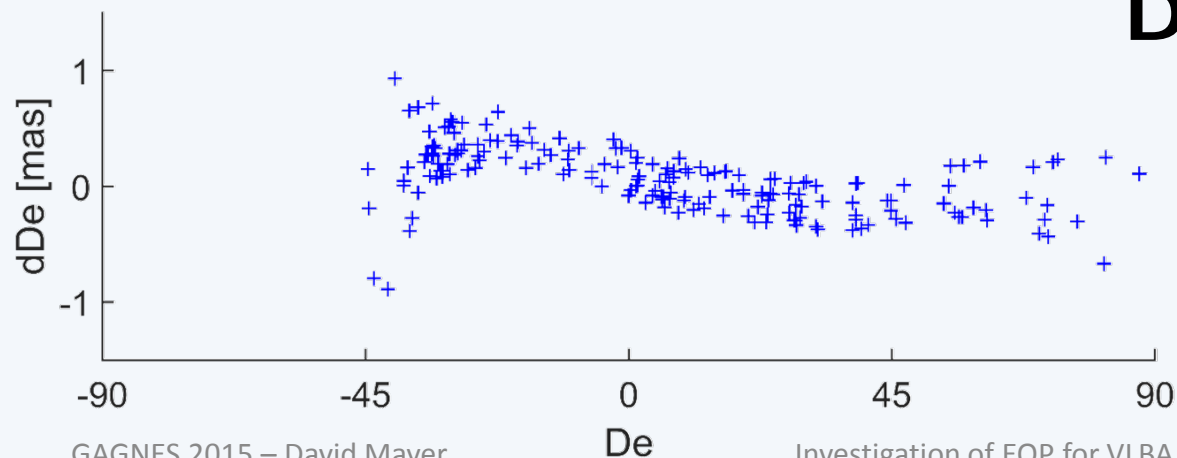
# Estimate source coordinates from VCS sessions

04APR30XV



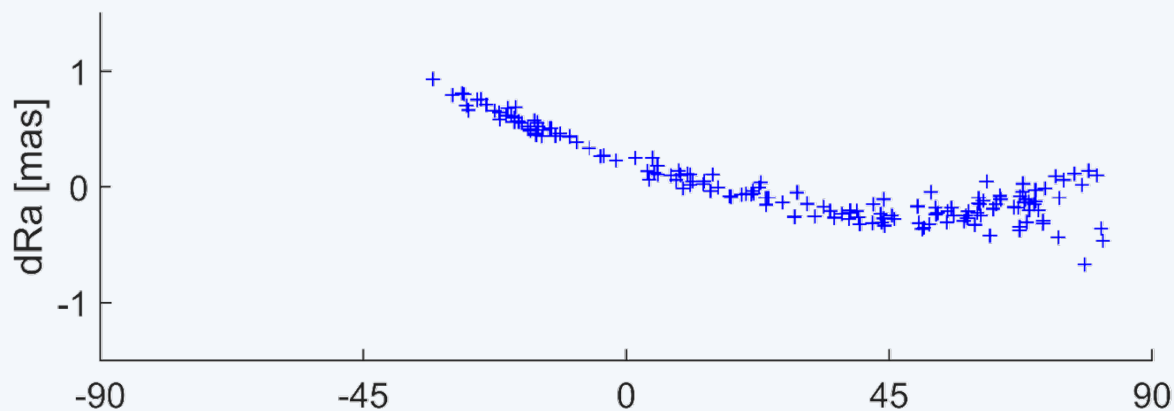
x-pole [mas]	y-pole [mas]	dUT1 [ms]
-0.64	1.90	0.032

**Differences of up to 1 mas**



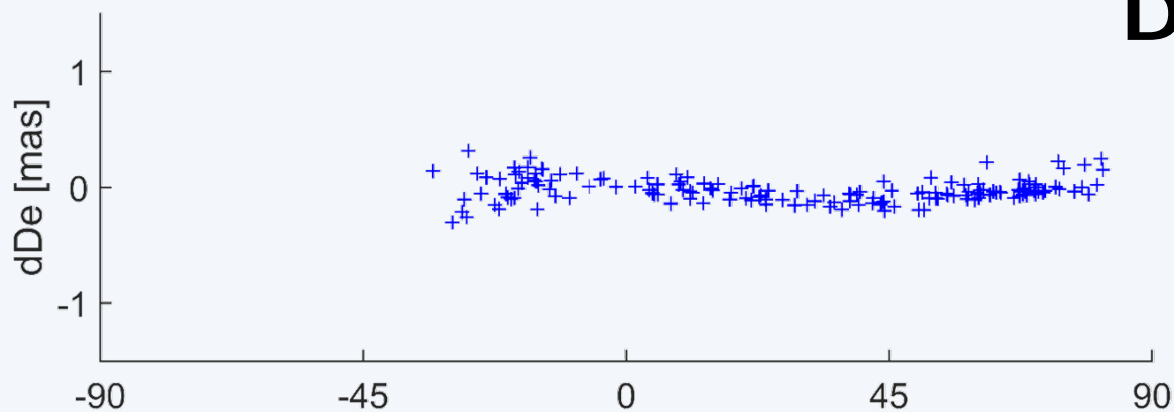
# Estimate source coordinates from VCS sessions

06DEC18XV

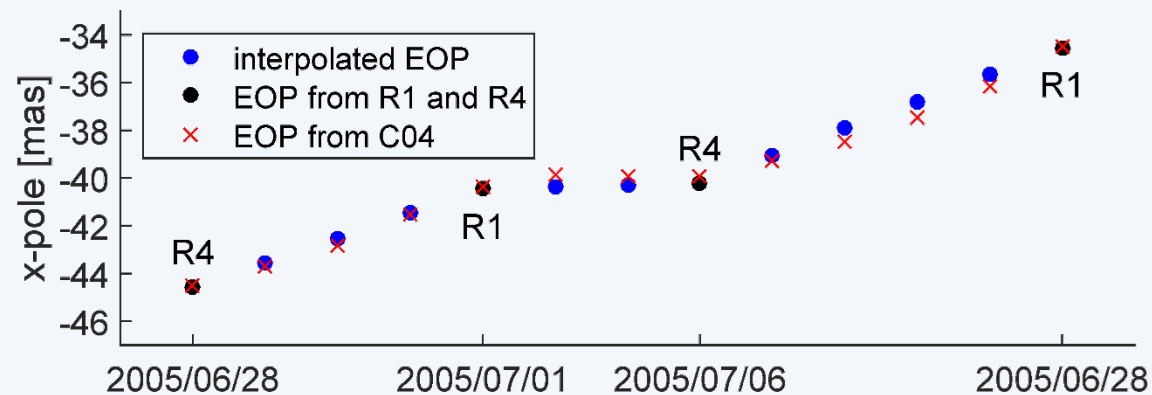


x-pole [mas]	y-pole [mas]	dUT1 [ms]
-1.53	0.81	0.094

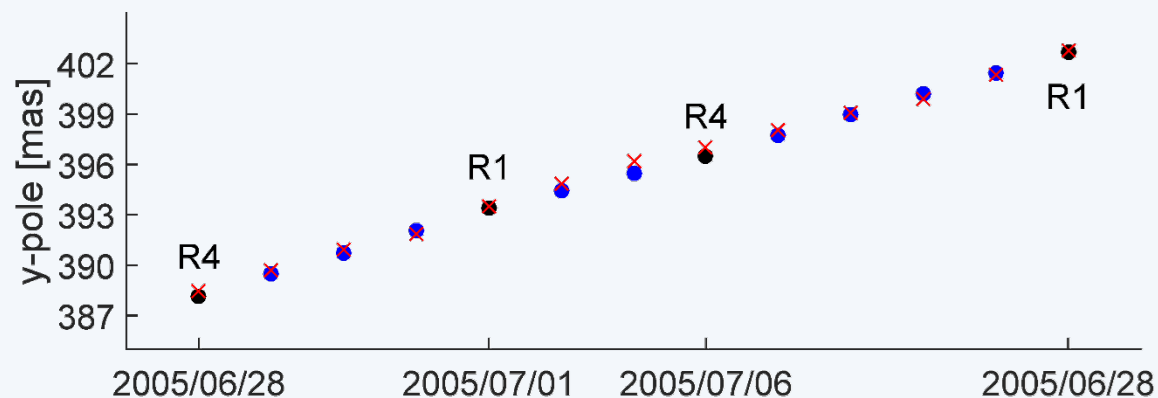
**Differences of up to 1 mas**



# Interpolated a priori EOP

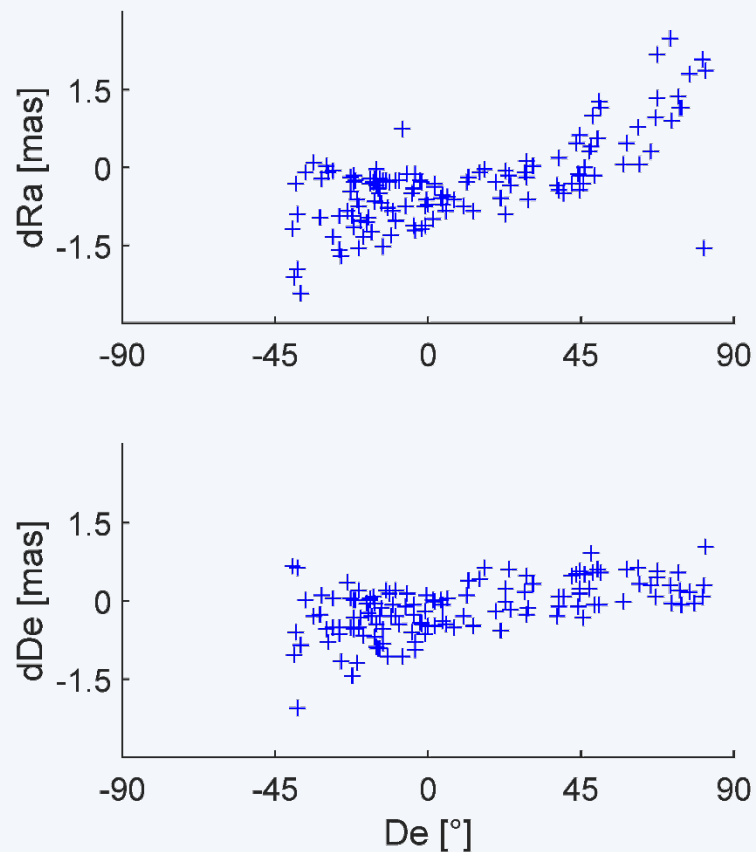


→ Interpolate EOP from R1 and R4 sessions and use them as a priori EOP for VCS sessions

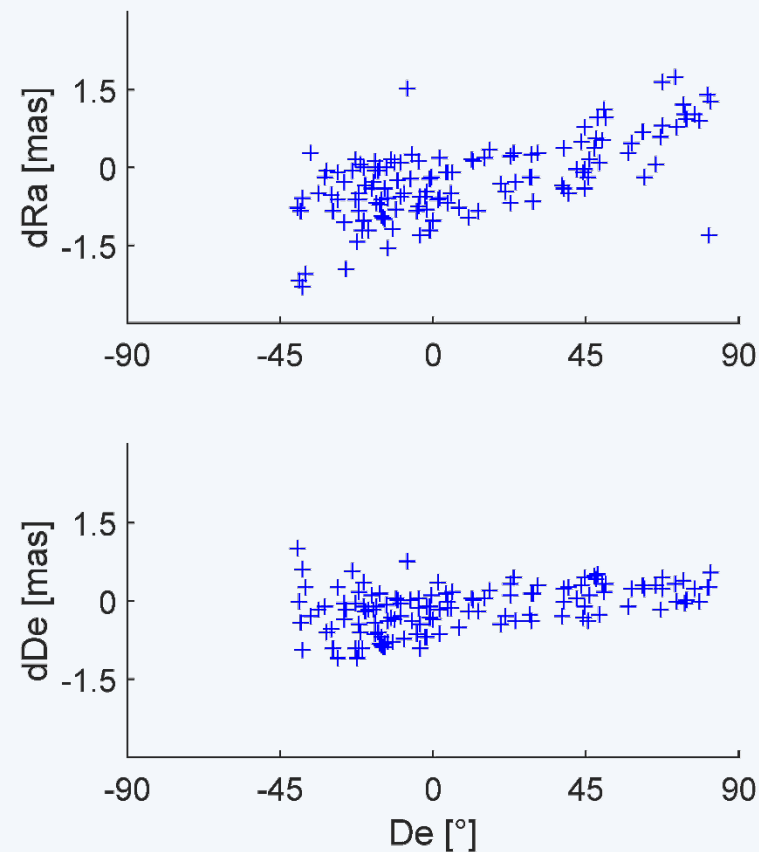


# Interpolated a priori EOP

**05JUN30XV**  
C04 EOP  
estimated vs. fixed



**05JUN30XV**  
Interpolated EOP (R1 and R4)  
estimated vs. fixed



# Conclusion

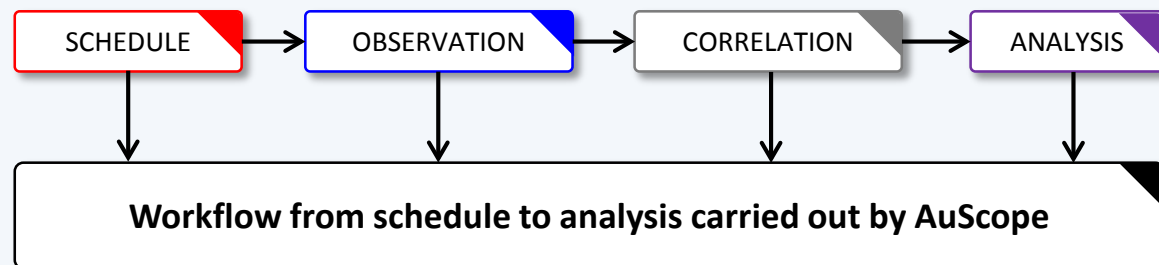
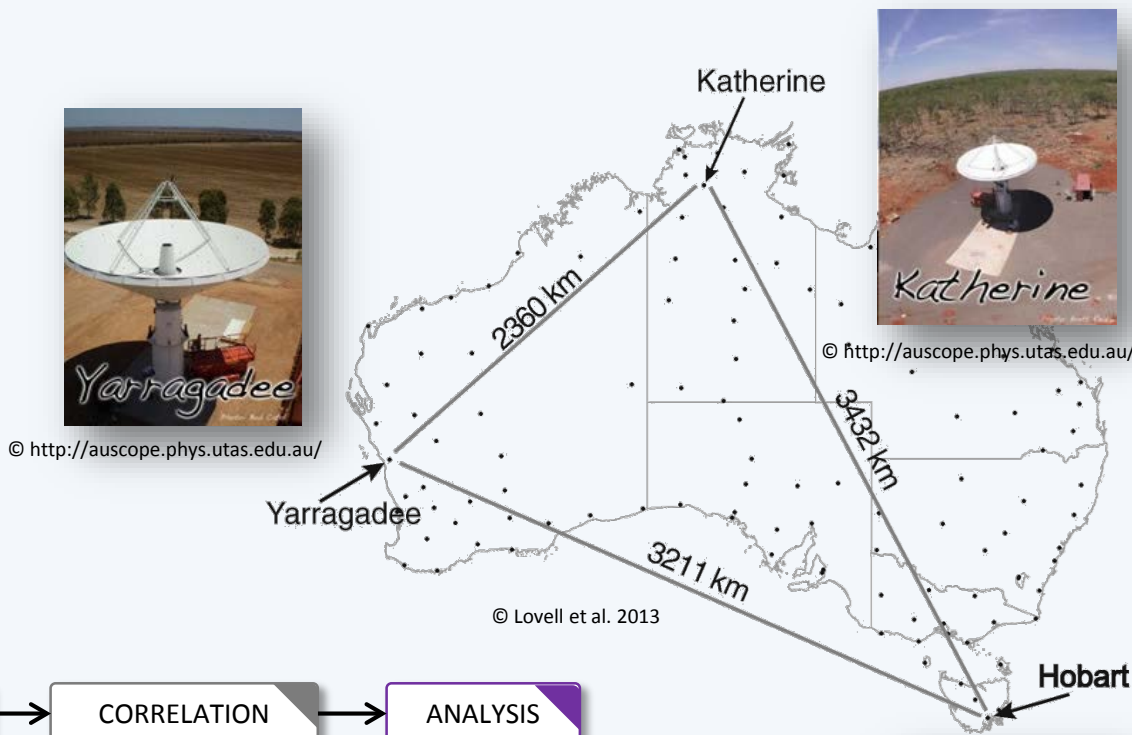
- The regionality of the VCS network results in imperfect EOP estimation
- The difference between source coordinates estimated from a solution where the EOP are fixed and a solution where EOP are estimated is up to 1 mas

# The AuScope VLBI array

3 telescopes (12 m)

- Hobart
- Katherine
- Yarragadee

1 correlator facility





## Normal Astrometric sessions

- Densify ICRF in the south
  - Observe ICRF sources with small number of observations
  - Find new candidates for ICRF
  - Observe sources which were only observed in single frequency

## AUA sessions (MAR-MAY 2015)

- Additional antennas
  - Parkes and occasionally DSS45 and DSS43
- Observe GAIA linking sources

# Astrometric results

Source	Type	Au18	Au20	Au22	Au24	Au33	Au40	Au43	Au58	Au64	Au72	S/X
0002-478	Def						x	x				0.2/0.2
0056-572	Non-def								x	x	x	0.3/0.2
0048-427	Def						x	x				0.3/0.4
0107-610	Def	x		x								0.25/0.3
0122-003	Non-def	x	x	x	x	x	x	x				0.4/0.3
0142-278	VCS								x	x	x	0.5/0.4
0230-790	Def	x	x	x	x	x	x	x	x	x	x	0.35/0.45
0312-770	Non-def						x	x				0.3/0.3
0742-562	Single F								x	x	x	0.4/0.4
0743-673	Single F	x	x	x	x	x	x	x				0.4/0.7
0758-737	Single F	x	x	x	x	x						0.2/0.1
1030-590	Single F	n/d	n/d	n/d	n/d	n/d	n/d	n/d				0.4/0.1
1312-553	Single F								x	x	x	0.4/0.4
1319-093	VCS								x	x	x	0.4/0.7
1336-237	VCS	x	x	x	x	x	x	x				0.5/0.4
1352-632	Non-def						n/d					0.3/0.14
1511-360	Single F						x	x				0.35/0.5
1531-352	Non-def	x	x	x	x	x	x	x				0.5/0.4
1707-376	Single F	n/d	n/d	n/d	n/d	n/d	n/d	n/d				0.4/0.19
1740-517	Non-def								x	x	x	0.4/0.4
1842-289	VCS	x	x	x	x	x	x	x				0.2/0.3
1922-224	Non-def						x	x				0.22/0.17
1933-400	Def	x	x	x	x	x	x	x	x	x	x	0.6/0.9
2030-689	Non-def	x	x	x	x	x						0.3/0.7
2354-117	VCS	x	x	x	x	x	x	x	x	x	x	0.7/0.25
2355-534	Def	x	x	x	x	x	x	x	x	x	x	0.7/1.5

by courtesy of Oleg Titov

## Vienna contribution to ICRF3

- >5000 sessions

### Challenges:

- Distribution of observations not even over declination
- Declination bias

