Investigation of Earth Orientation Parameters for VLBA Calibrator Survey sessions

D. Mayer, J. Böhm, H. Krásná

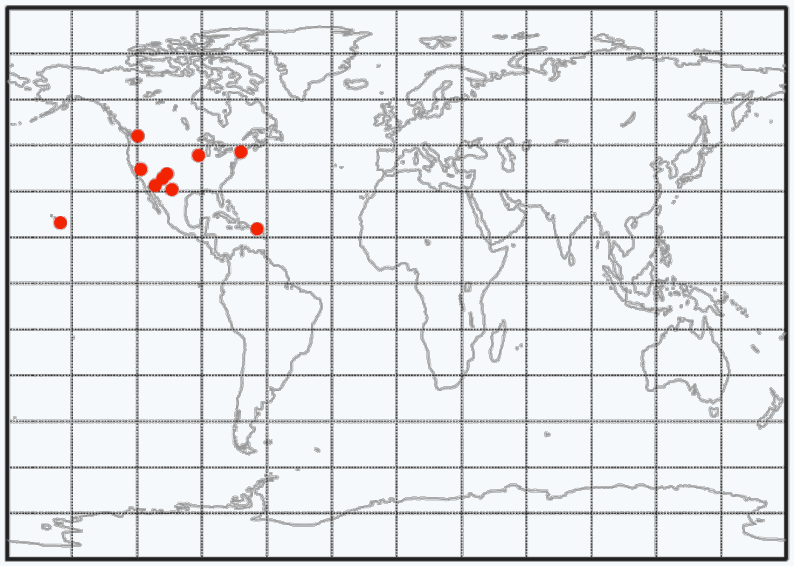
Technische Universität Wien

Content and objectives

- VCS sessions
- EOP from VCS sessions
- Error propagation

- Is it possible to improve source position with fixed a priori EOP?

VLBA Calibrator Survey (VCS)



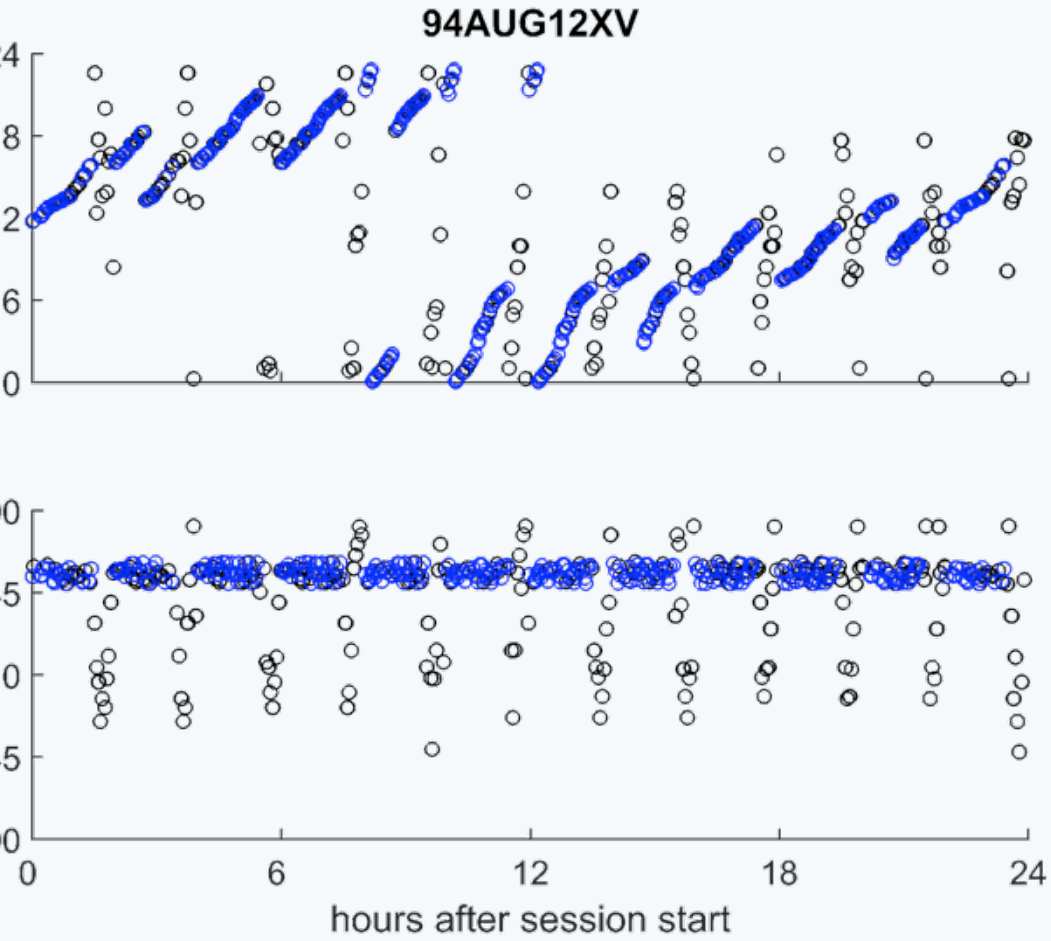
24 sessions from 1994 – 2007

→ Split into 6 campaigns (VCS1 – VCS6)

→ Densify ICRF

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

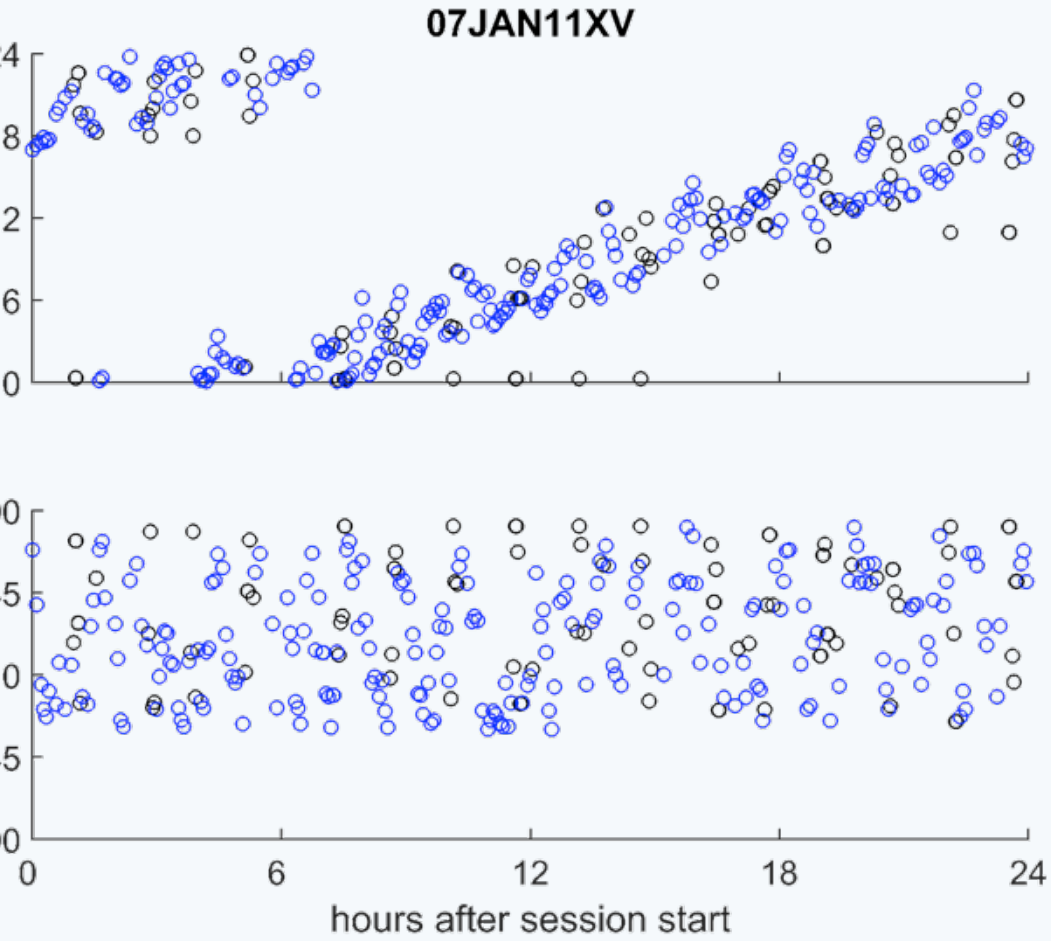
VCS schedules



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

VCS sources
Non-VCS sources

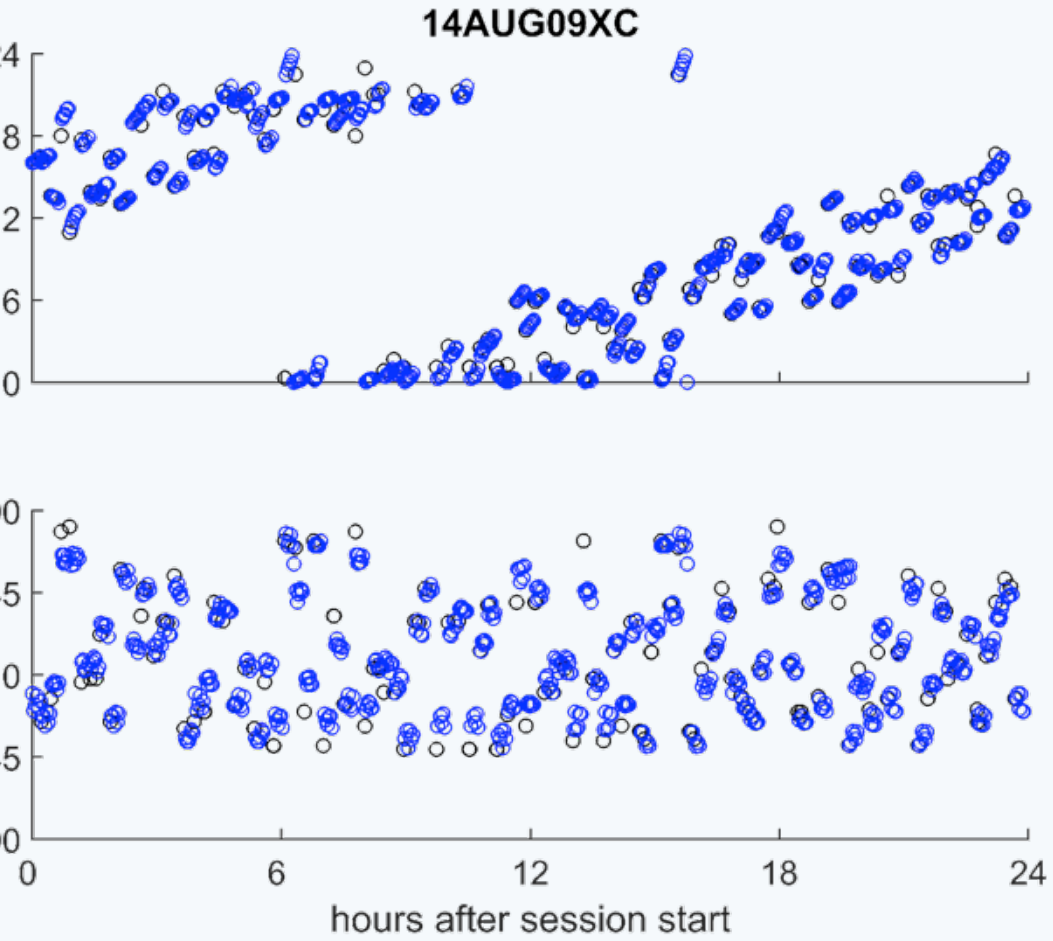
VCS schedules



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

VCS sources
Non-VCS sources

VCS schedules



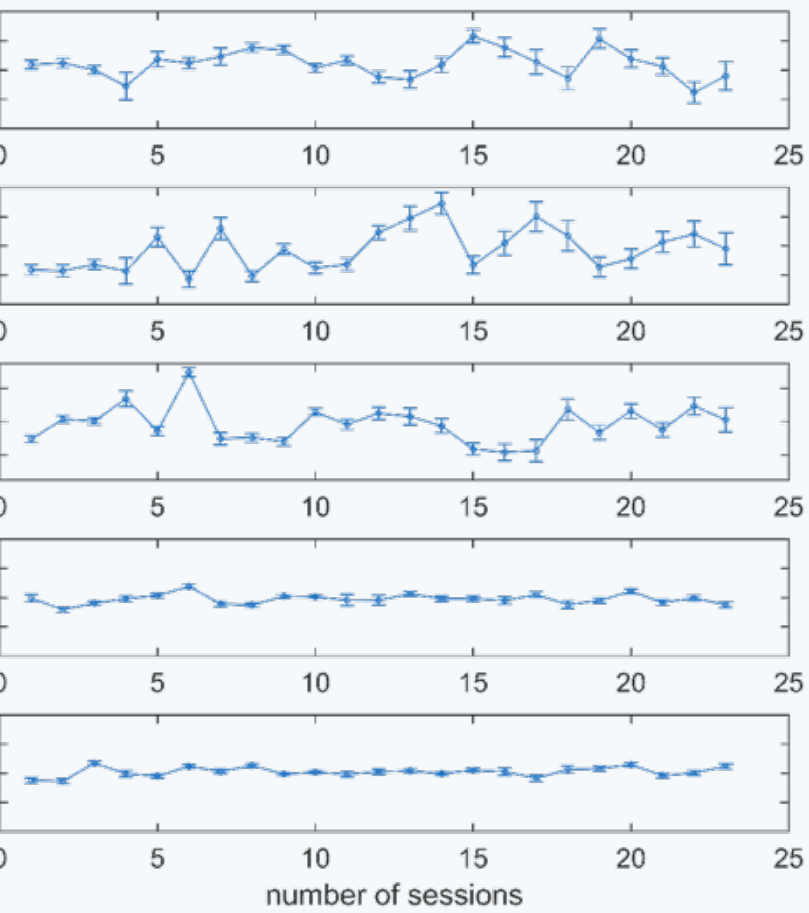
VCS-II → constant meridian + declination spread evenly between -45° and 90°

→ Sources are observed in clusters

VCS sources
Non-VCS sources

with courtesy of David Gordon

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

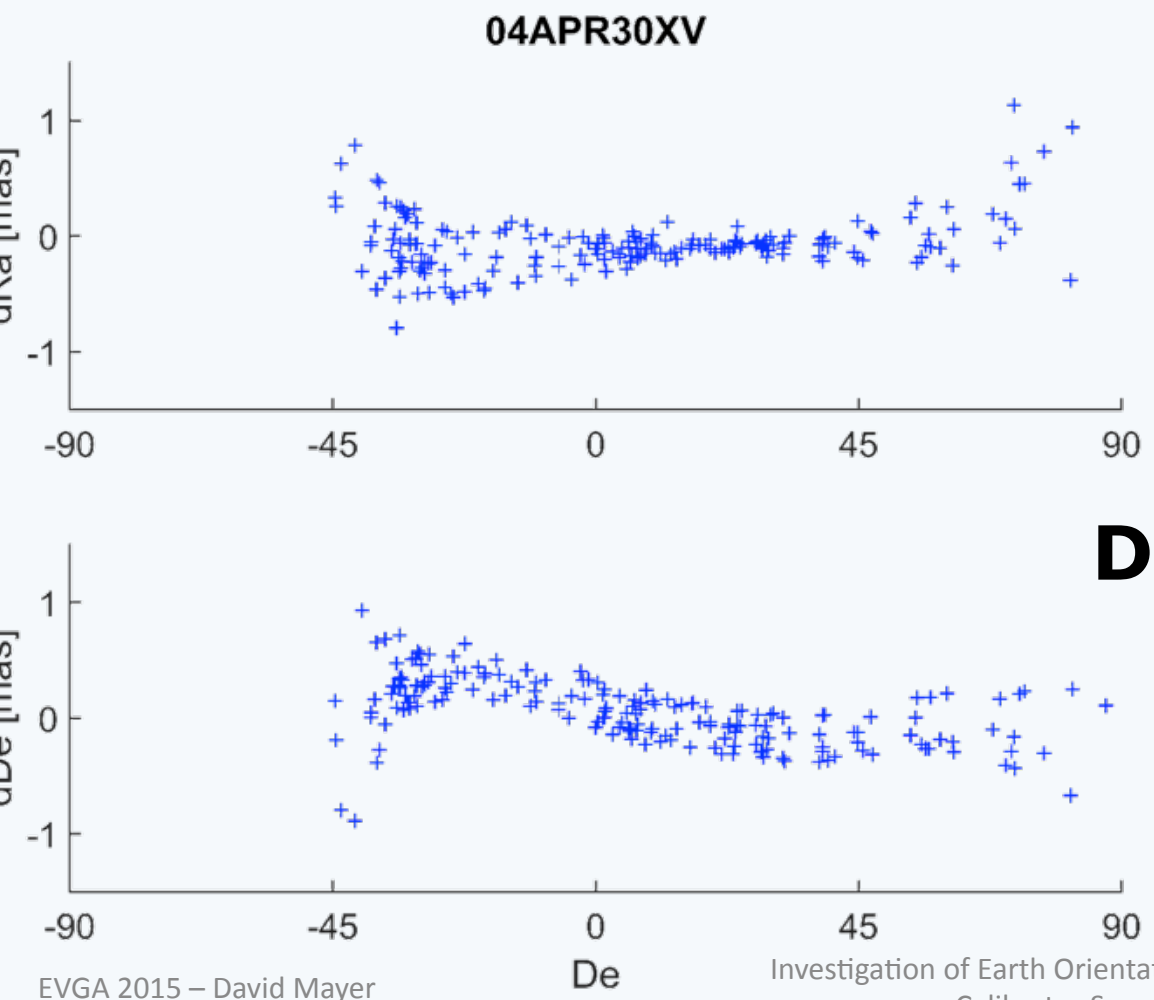
Solved for:

- 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

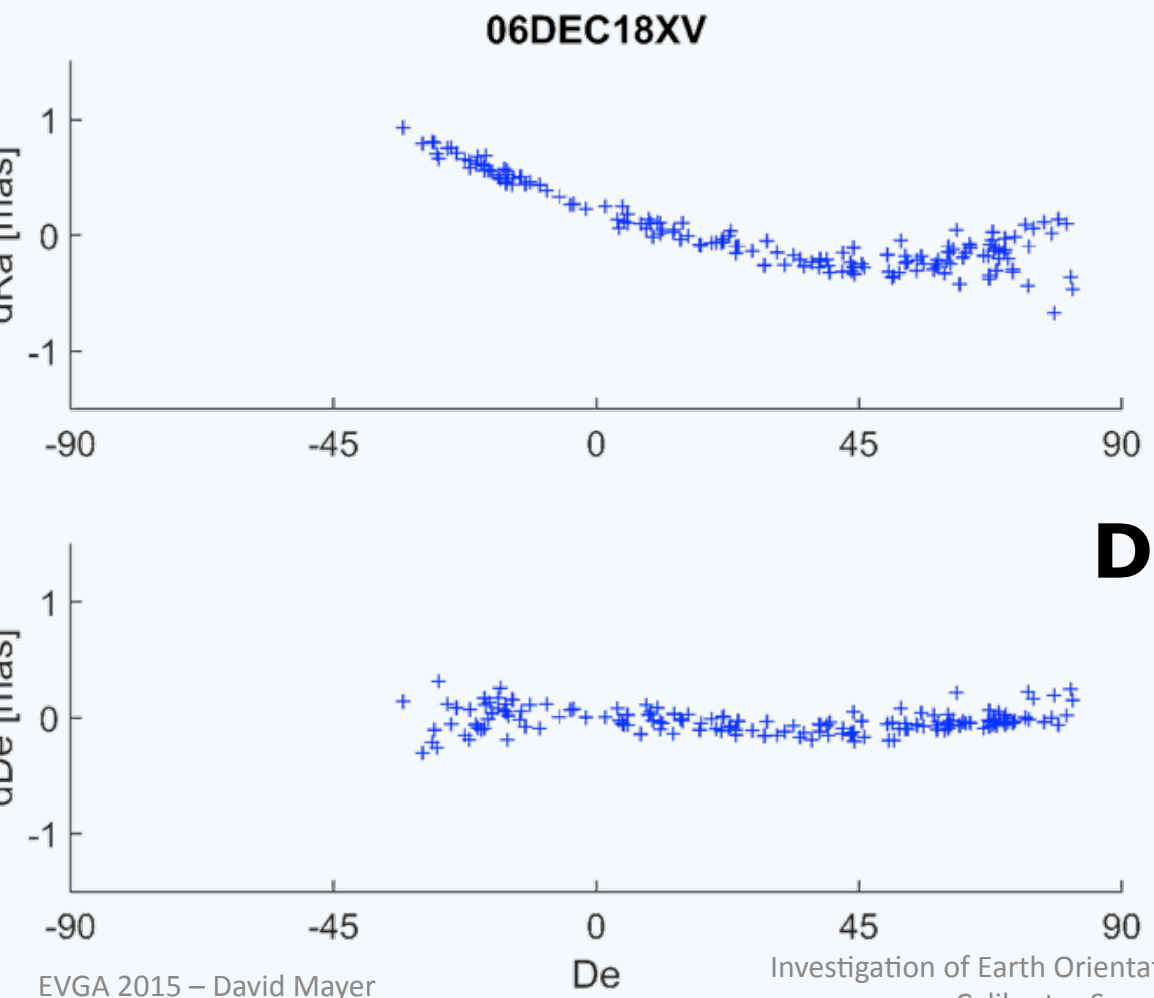
Estimate source coordinates from VCS sessions



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

Differences of up to 1 mas

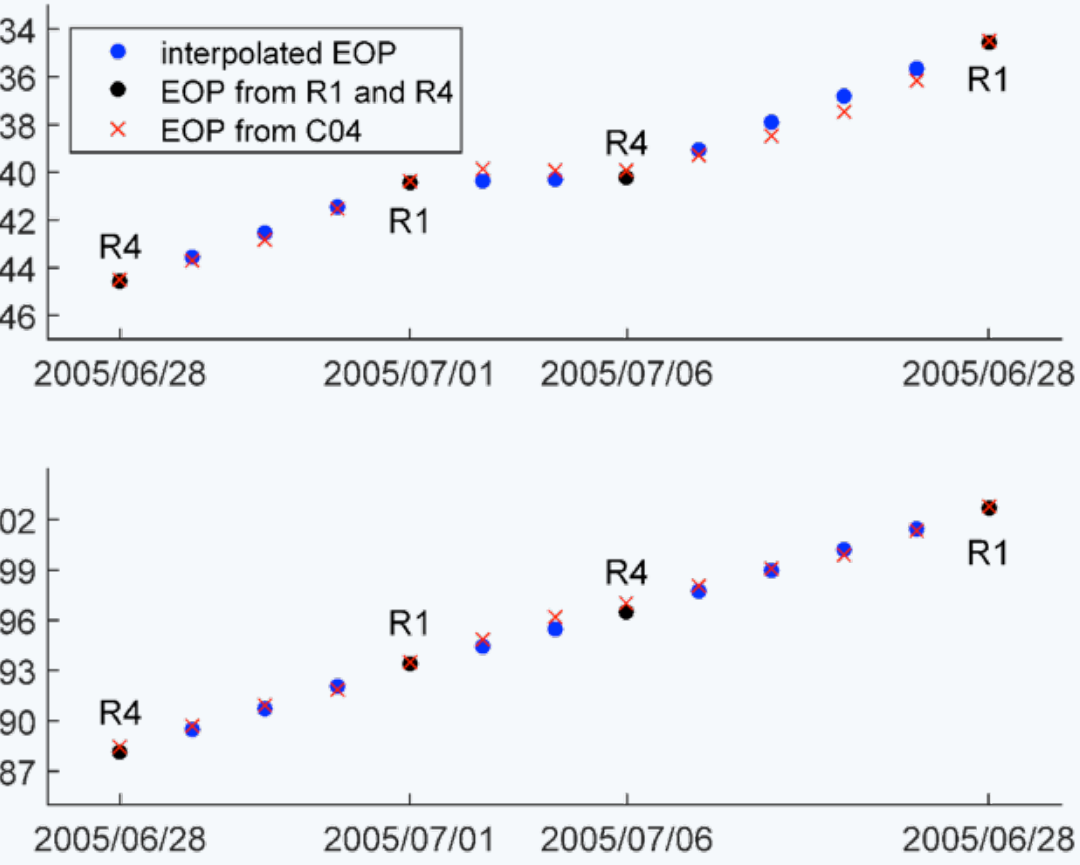
Estimate source coordinates from VCS sessions



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

Differences of up to 1 mas

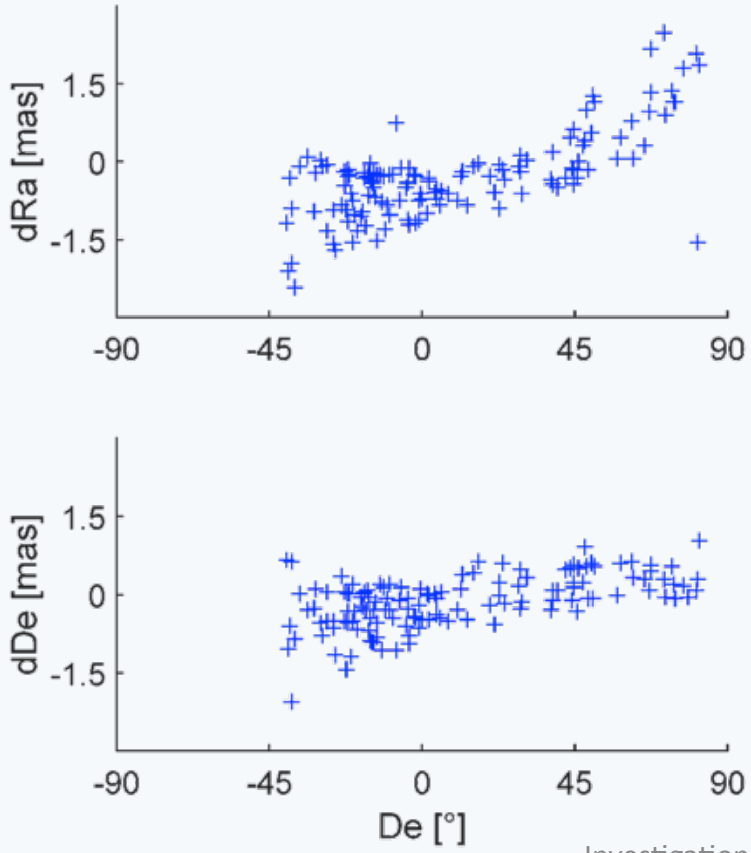
Interpolated a priori EOP



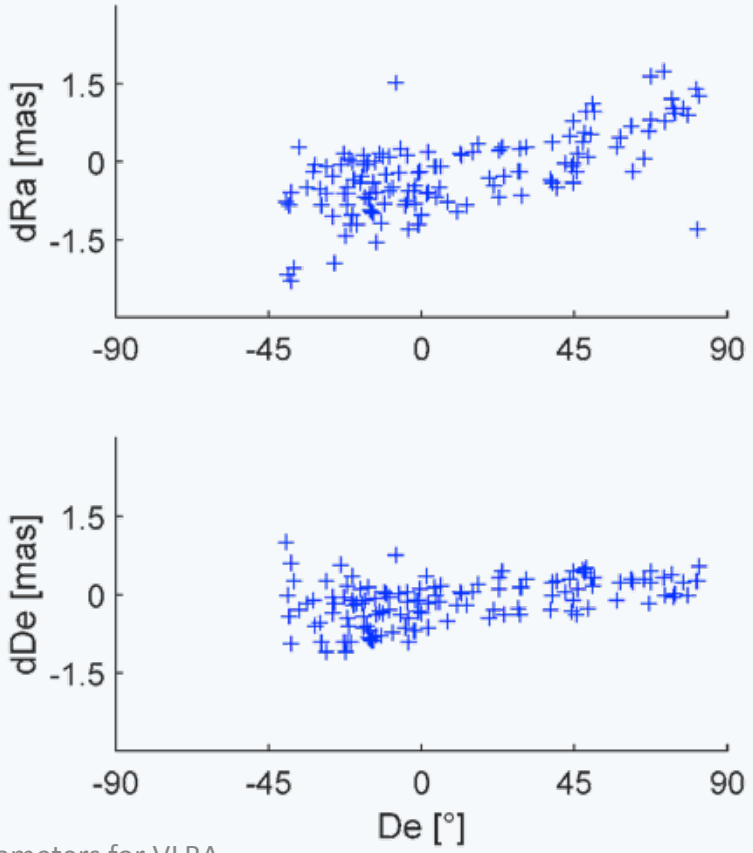
→ Interpolate EOP from R1 and R4 sessions and use them as a priori EOP for VCS sessions

Interpolated a priori EOP

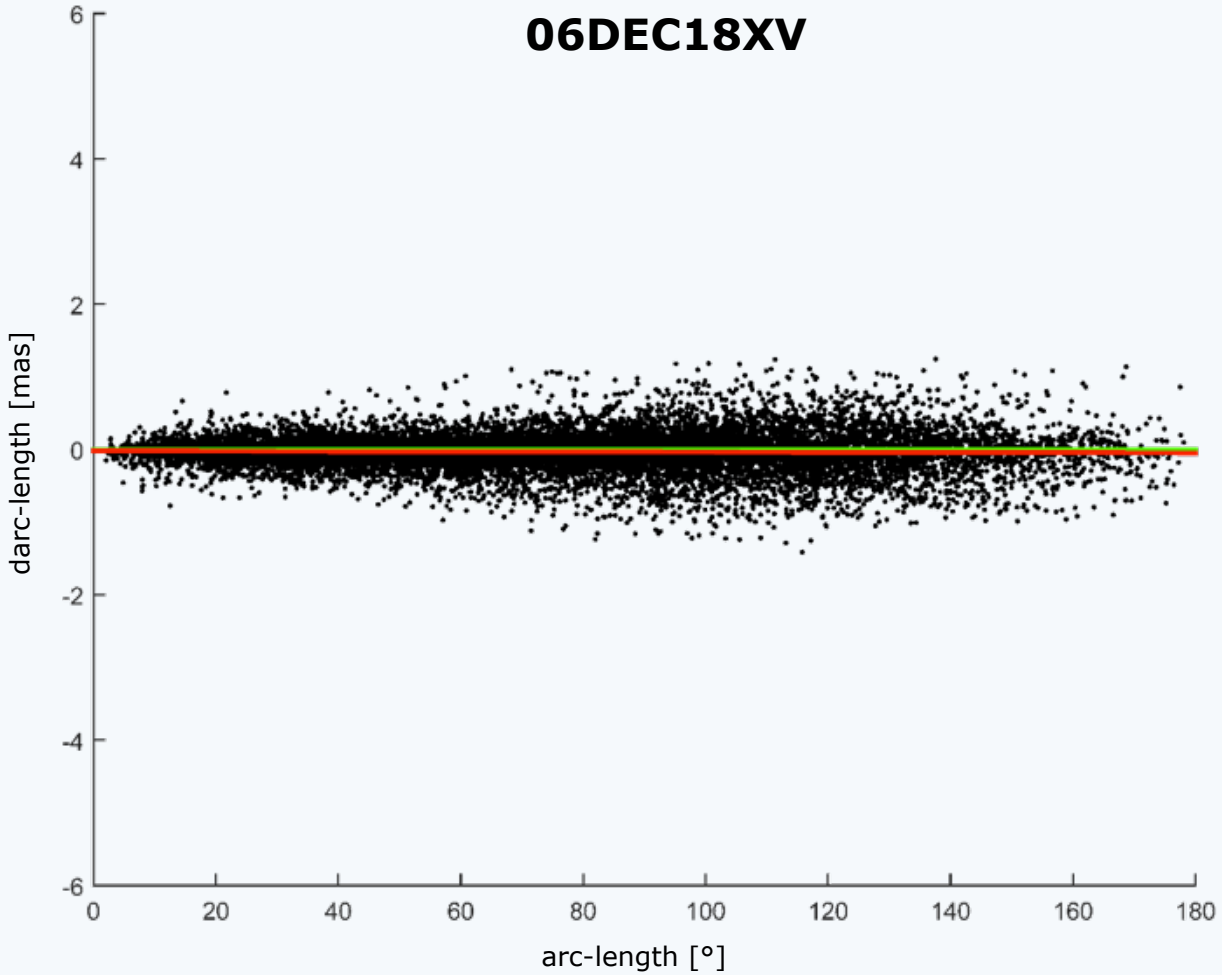
05JUN30XV
C04 EOP
estimated vs. fixed



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

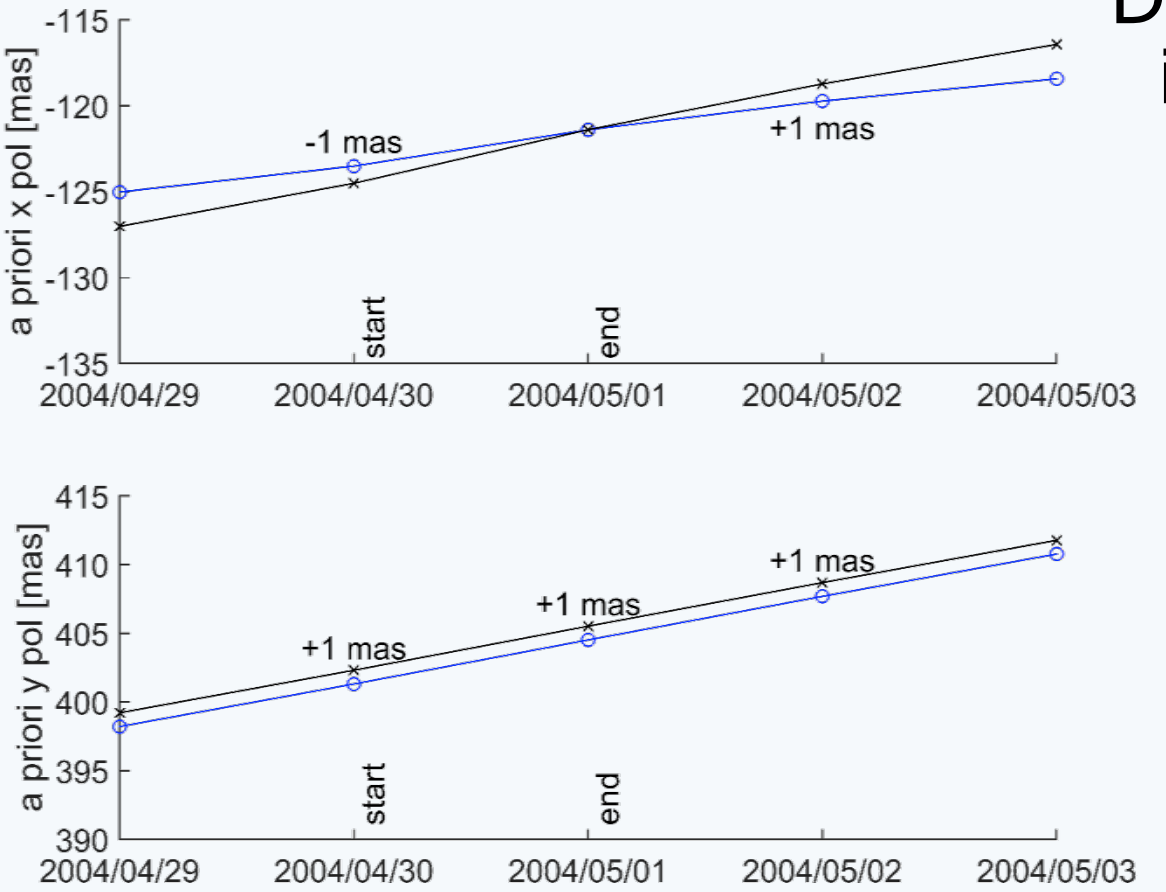


Influence on arc-length



No influence on arc-length visible

Simulations of error propagation

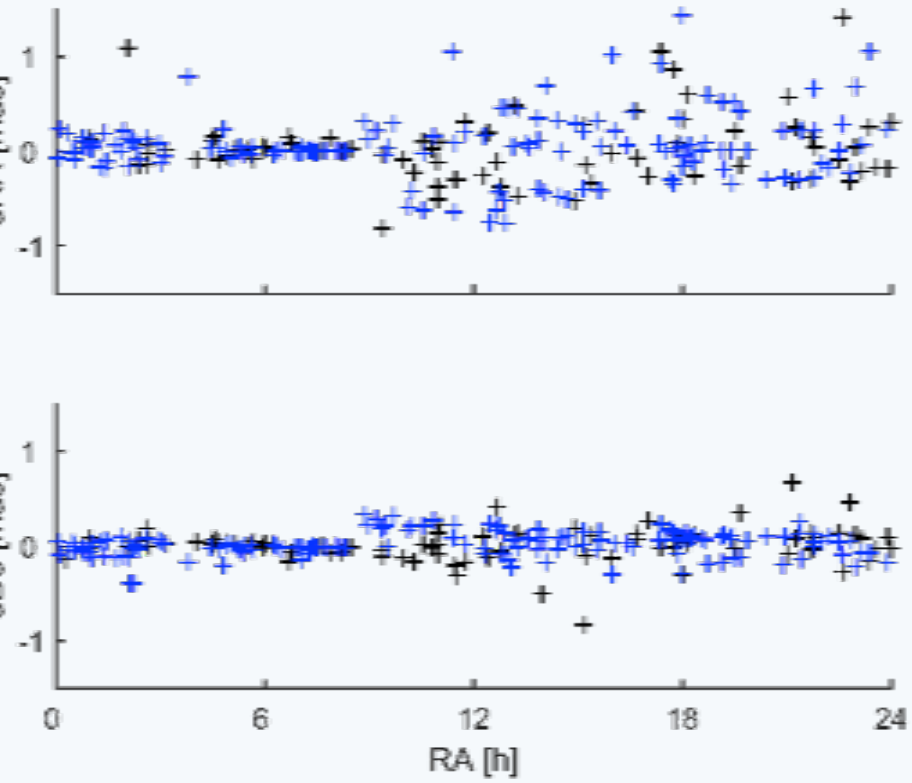


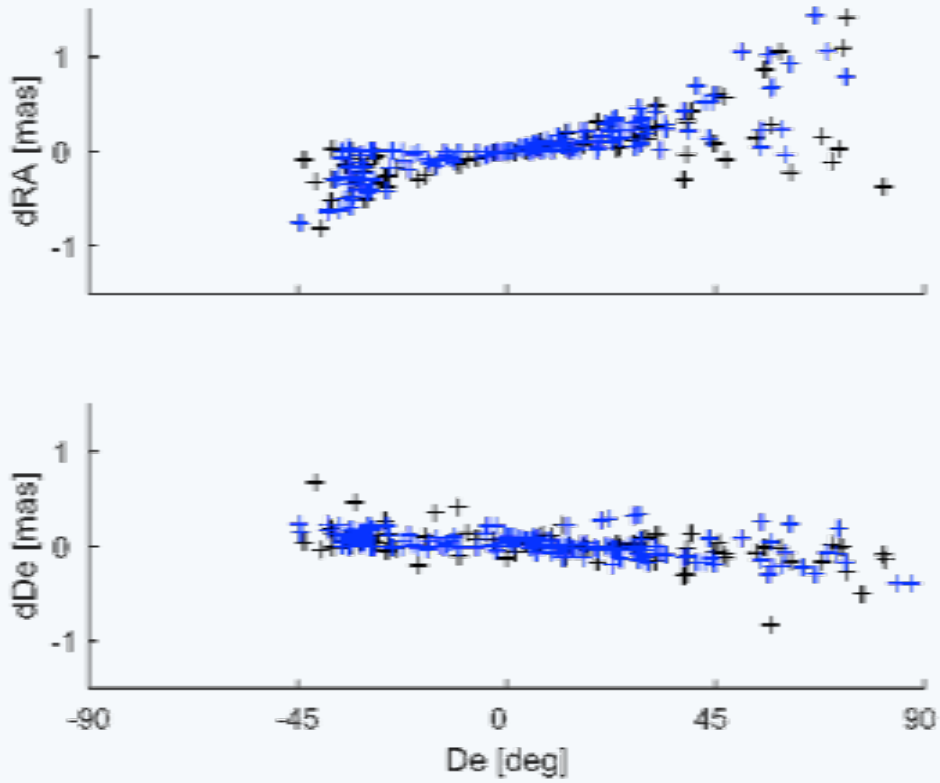
Different errors were investigated

- Error in x- and y-pole rate of 1 mas/day
- Error in dUT1 rate of 1/15 ms/day
- Error in x- and y-pole offset of 1 mas

04APR30XV was used

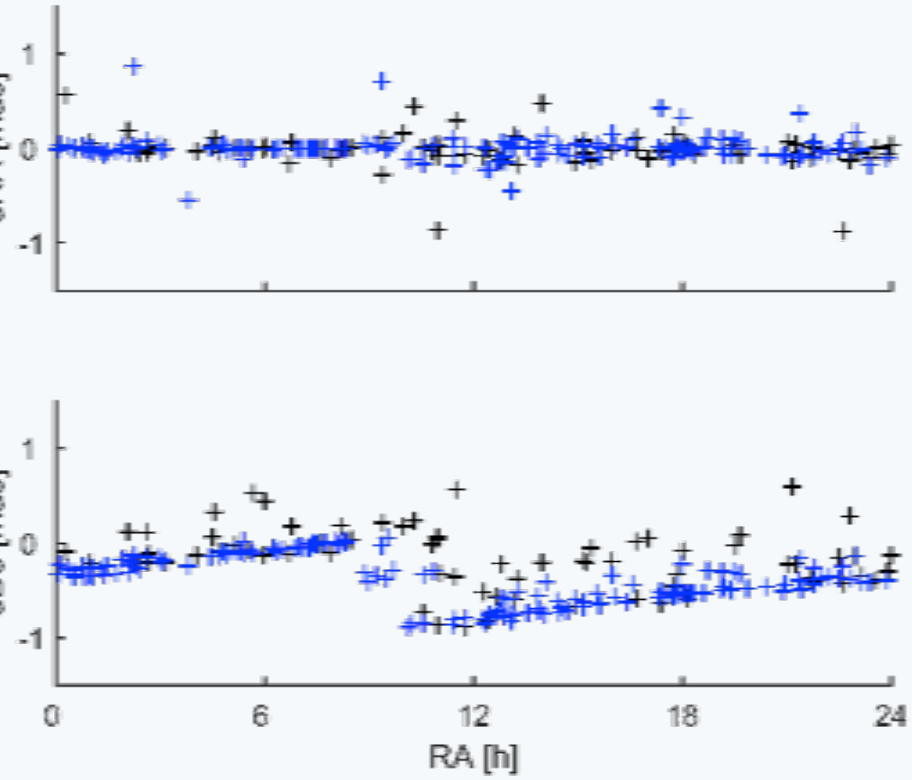
Simulation of error (1 mas/day) in x-pole rate

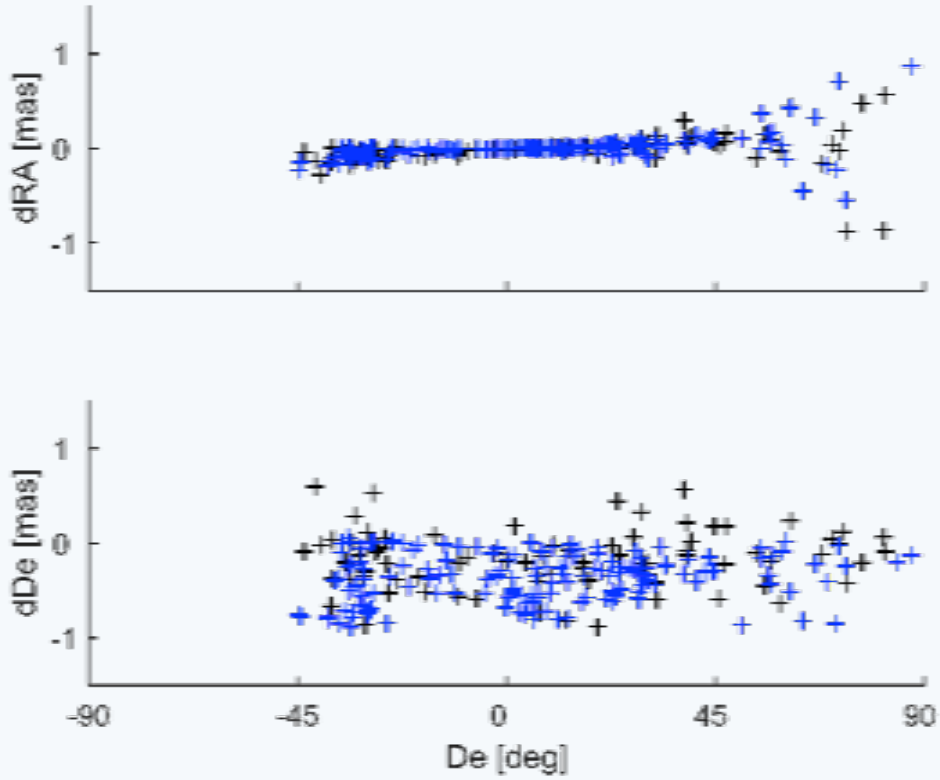




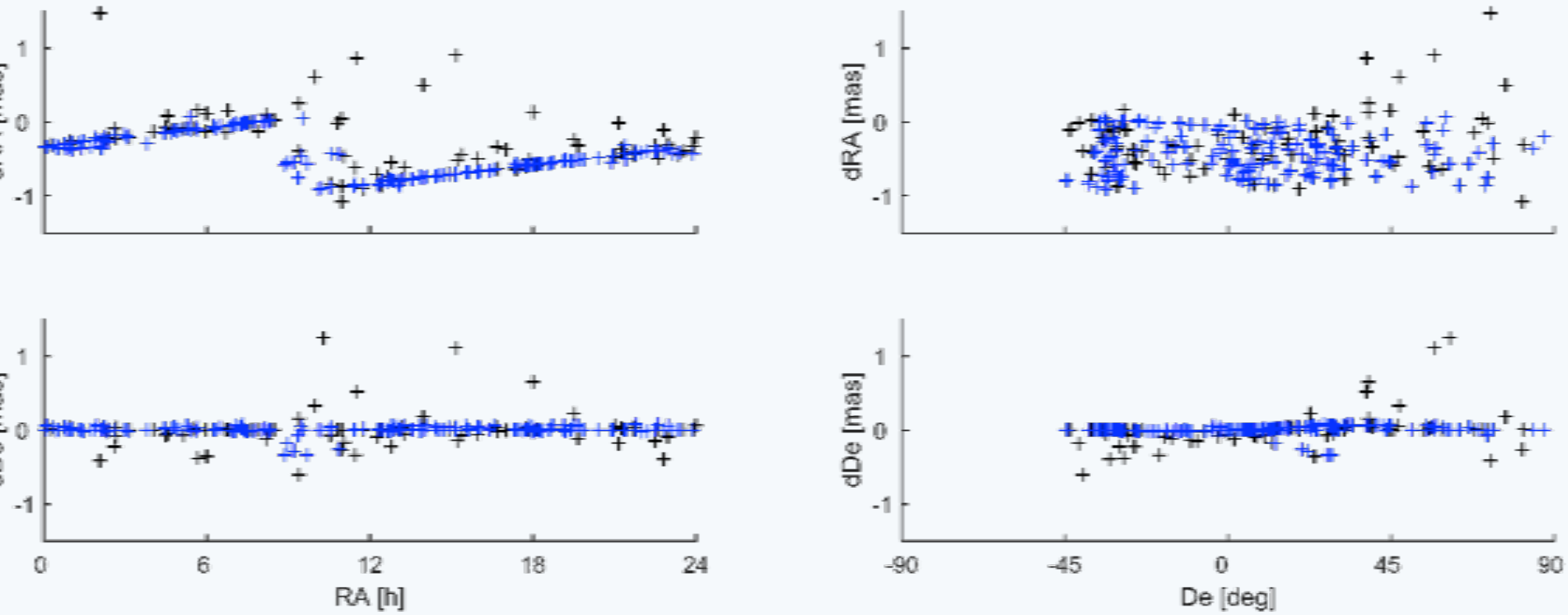
➡ Only source coordinates estimated

Simulation of error (1 mas/day) in y-pole rate

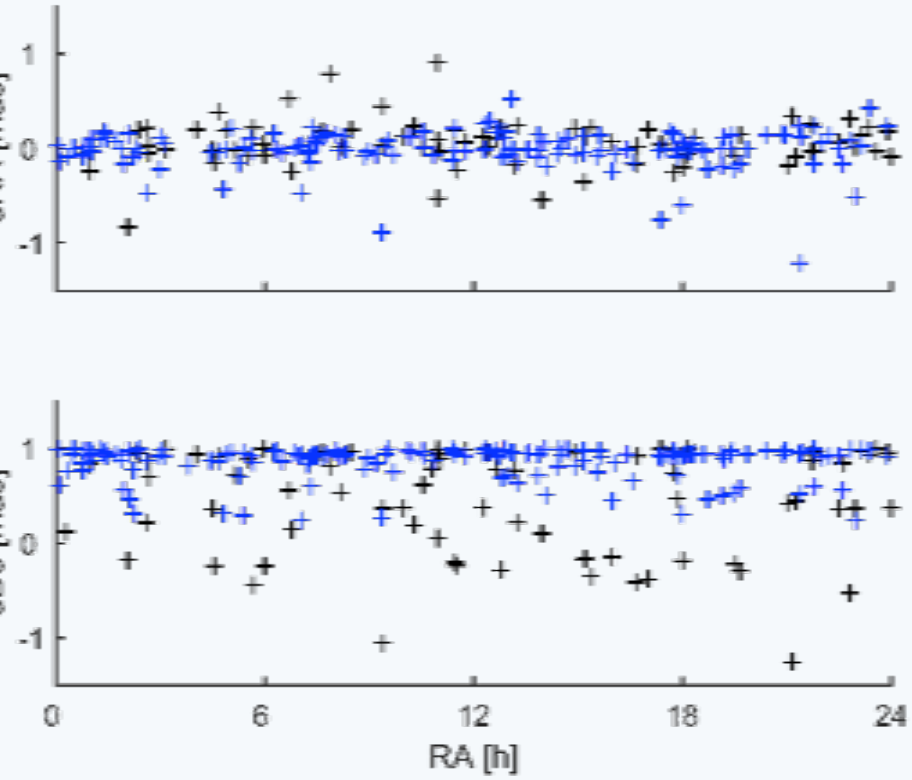


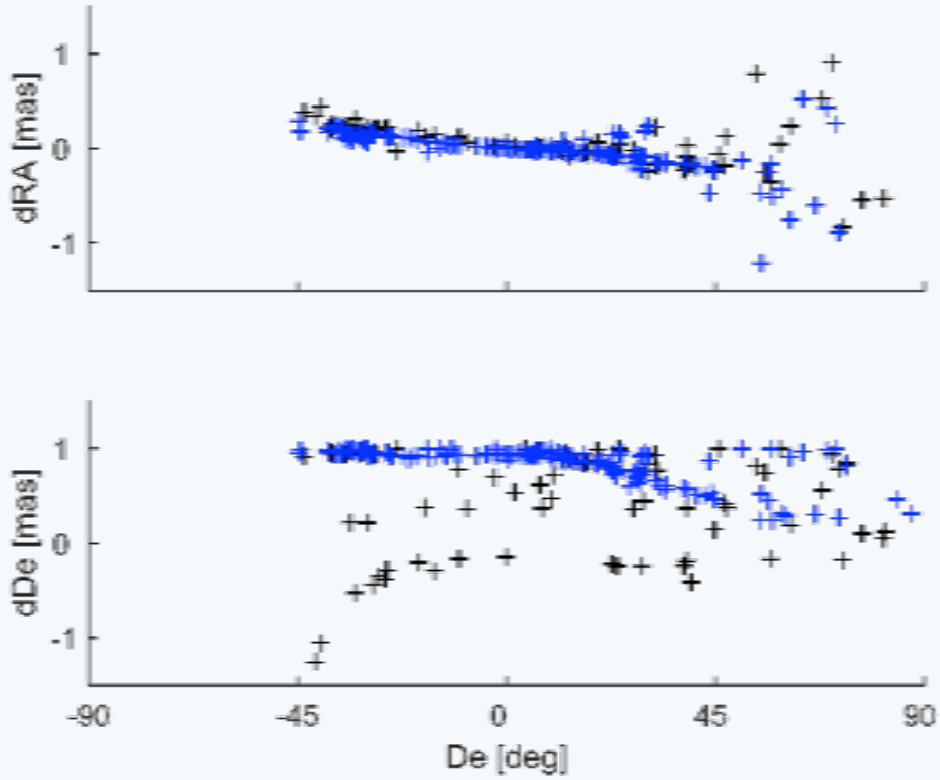


Simulation of error (1/15 ms/day) in dUT1 rate



Simulation of error (1 mas) in y-pole offset





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
- No effect on arc-length
- Errors in rate of y-pole propagate into declination estimates
- Errors in rate of x-pole propagate into right ascension estimates
- Errors in rate of dUT1 propagate into right ascension estimates