VLBI RESEARCH ACTIVITIES IN HOBART: AN OFFER FOR COLLABORATION

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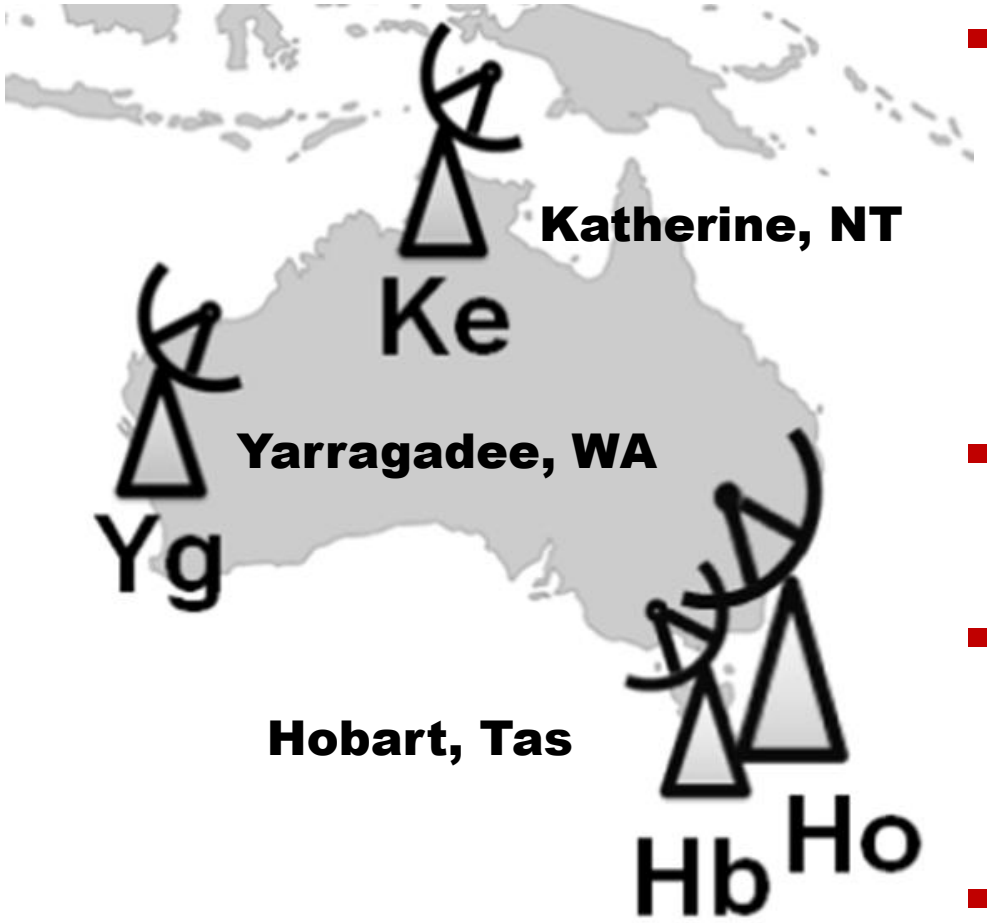
Erwin Schrödinger Fellowship J 3699-N29

AUSCOPE VLBI

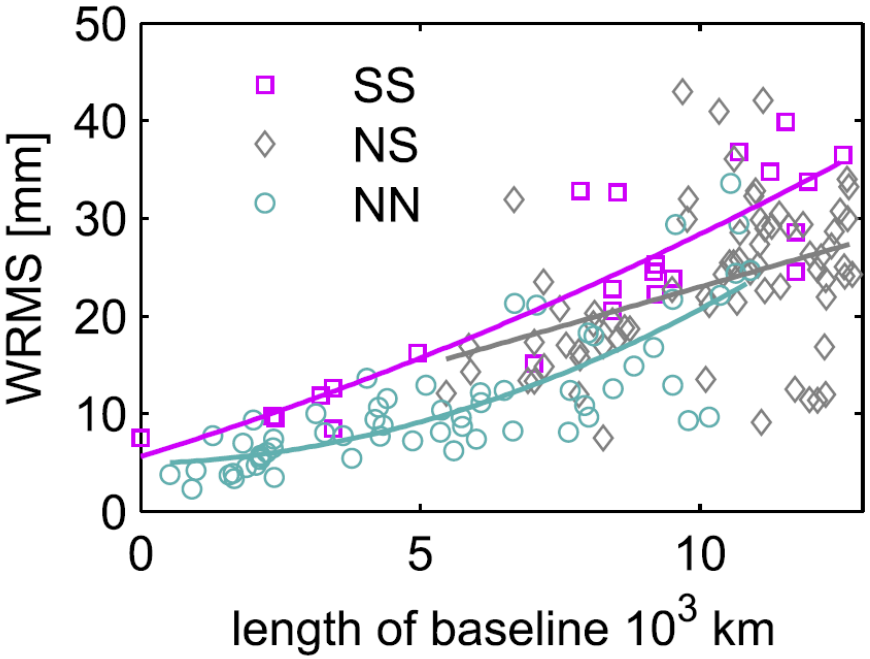


- AuScope VLBI network with the busiest geodetic antennas worldwide (235 experiments in 2015)
- 26m legacy antenna Ho
- AUSTRAL observing program
- Fully independent, from scheduling to analysis

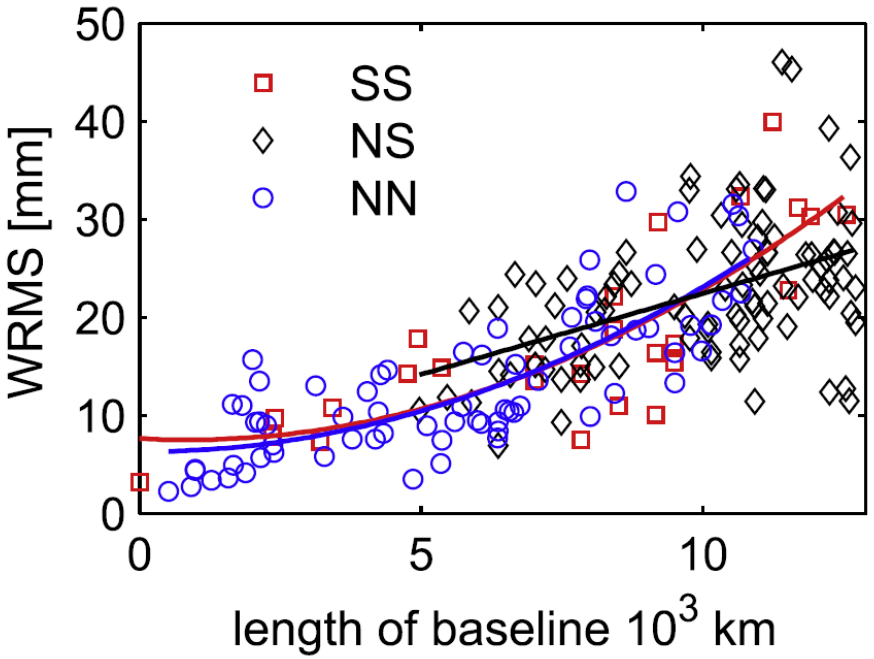
BETTER RESULTS IN THE SOUTH

Baseline lengths from IVS R1 & R4 sessions ***[Plank et al., Adv Space Res 2015]***

2012/1-2013/6



2013/7-2014/12



The addition of more southern stations has significantly improved the results!

AUSTRALS

- Experiments with the AuScope array (Hb, Ke, Yg)
  - Plus Ww, Ht, (Ho, Hh)
  - 2011-2015: Aust02-74, AUST13, AUST14, AUST15/1, AUST15/2, AUG001-019, AUA001-008 → 160 sessions
- Scheduling @ Vienna University of Technology
- 1 Gbps recording
- Correlation @ Curtin University
  - From 2016: SHAO
- Pre-analysis @ UTAS (fringe-fitting, Level1 DB)

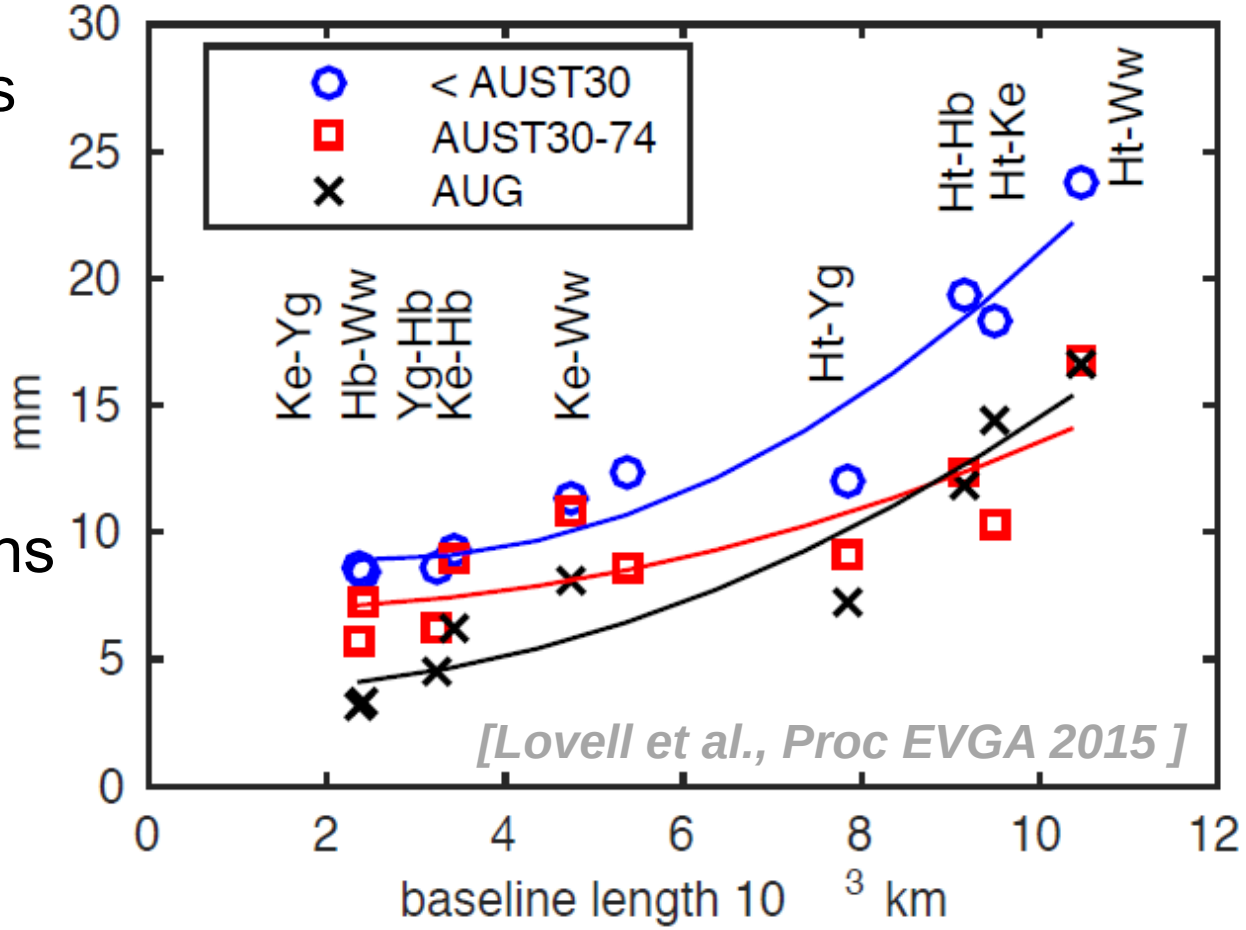
AUSTRALS: SCIENCE

- Pre-VGOS observing
  - High recording rate, small and fast antennas
  - Remote operations, towards 24/7
  - VGOS operation; FS modifications
  - Data logistics
- Scheduling
- Geodesy: improved baselines
- Astrometry: new sources, more sources
- Relativity
- Siblings (Hb+Ho, Ht+Hh)

SCHEDULING

Results show a factor of ~2 improvement in baseline wrms.

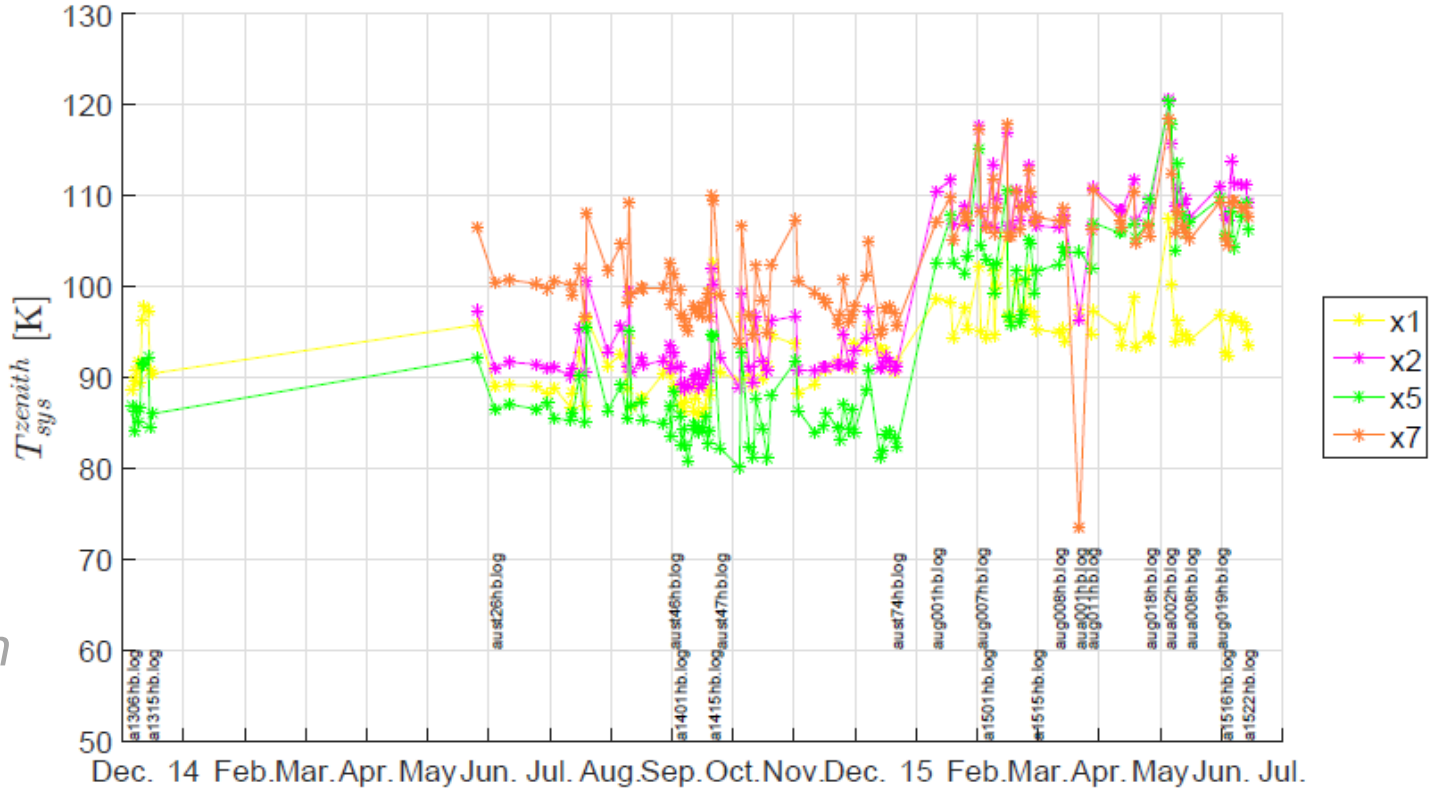
- 1 Gbps (16x16 MHz IFs and 2-bit digitisation)
- 2 sub-networks
- Only strong sources (>0.8 Jy) – VieVS simulations
- Latest antenna SEFD levels
- 20” min. scan lengths
- Shorten ‘calibration time’



INSTRUMENTAL EFFECTS?

- We have plenty of data which can now be studied
- E.g. instrumental effects on Tsys (J.F. Gruber)

X-band Tsys measurements of Hobart12 during the Austral experiments: jump coincides with recabelling event.

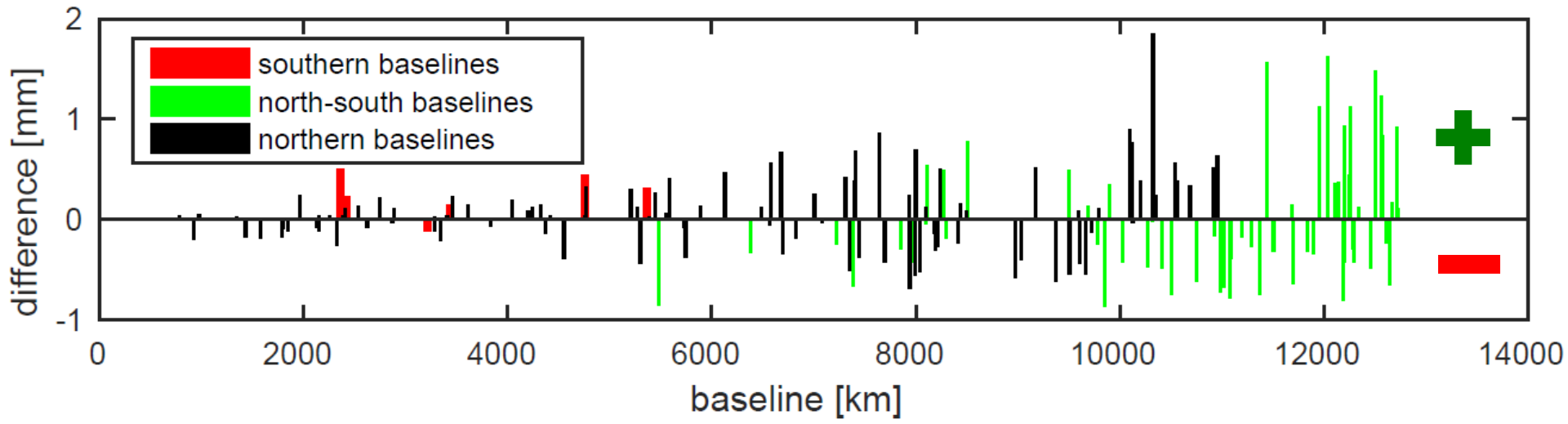


DYNAMIC (VGOS) OBSERVING

- Goal: more flexibility in the scheduling and adjustment to actual antenna capabilities

Simulation scenario:
Change in baseline repeatabilities when all observations of Hartrao are lost between

a) the original schedule is observed
b) the schedule was redone



SIBLING TELESCOPE

Sibling Radio Telescopes for Geodesy:

Optimising the use of co-located VLBI telescopes in the southern hemisphere

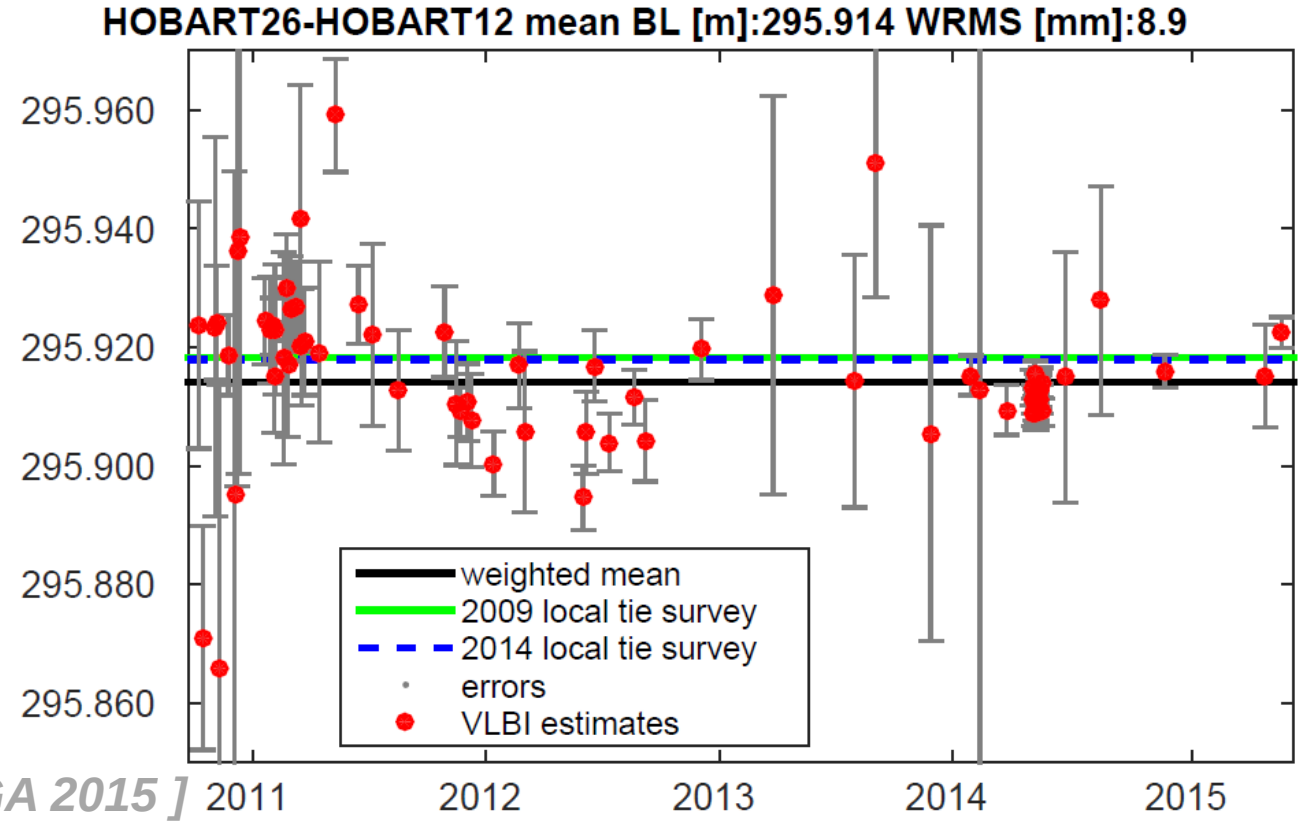
Linking legacy and VGOS antennas

How to operate a twin/sibling telescope? – scheduling!

Improved analysis through common parameters

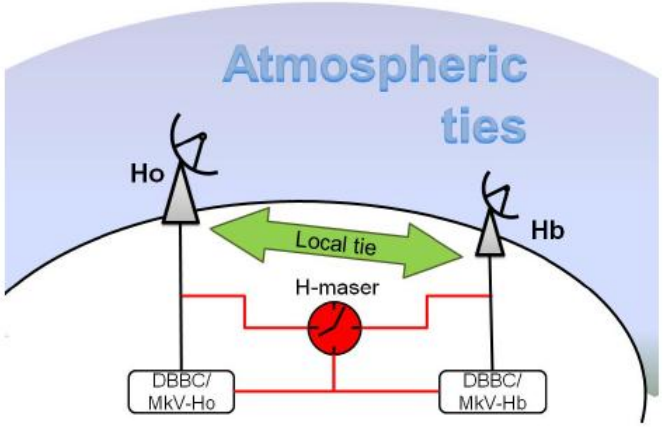
HOBART TIE

The Hobart-Hobart baseline determined of 72 common VLBI sessions. The black line shows the mean calculated baseline length of 295.914 m, which is 4 mm off from the baseline determined in two local tie surveys.



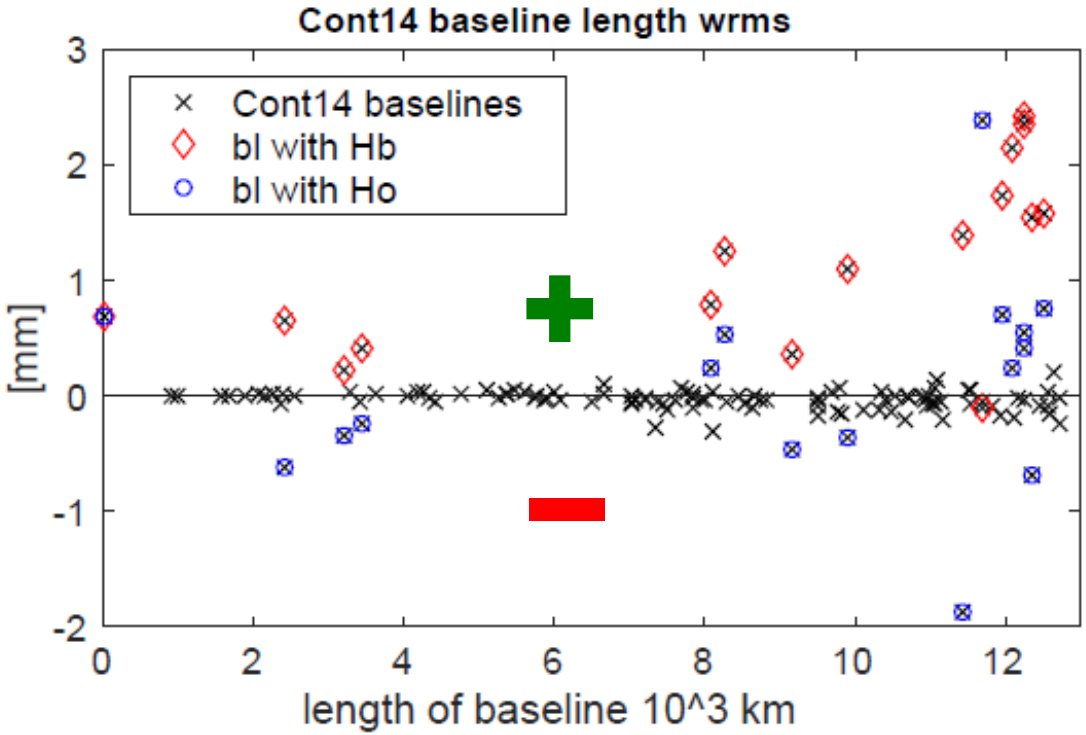
[Plank et al., Proc EVGA 2015]

ANALYSIS



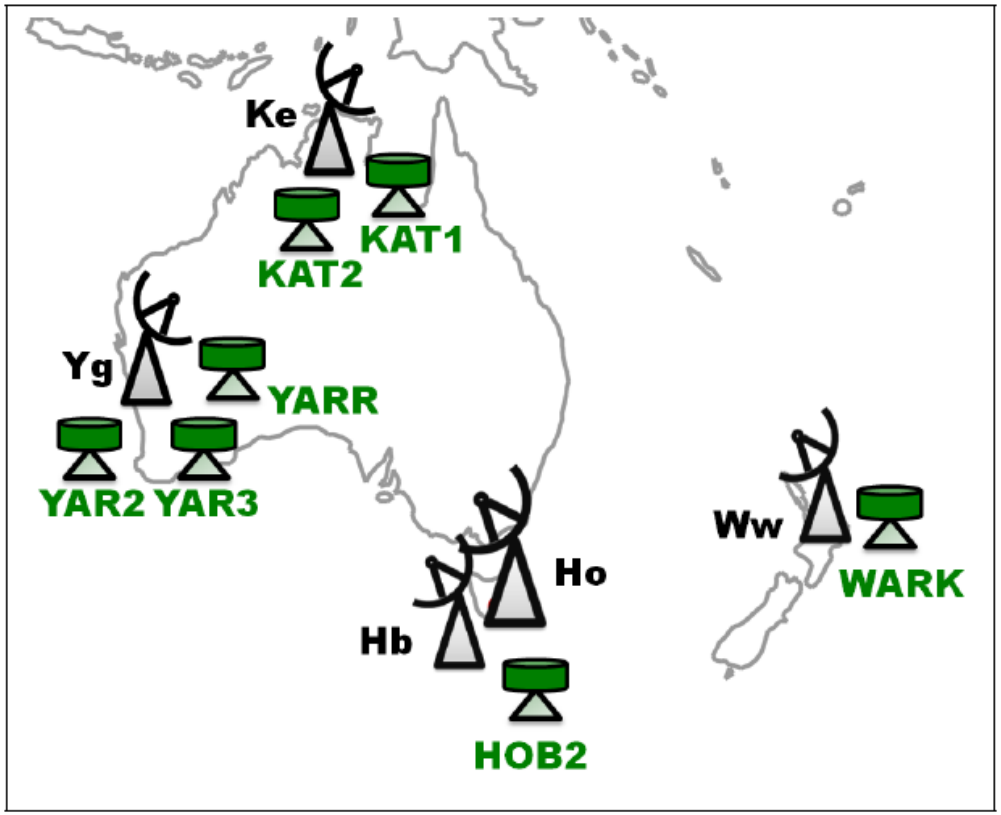
- New analysis options implemented in VieVS
- Combining zwd & gradients, clocks, station coordinates.

Improvements in baseline lengths of Cont14 when common parameters are constrained in the analysis



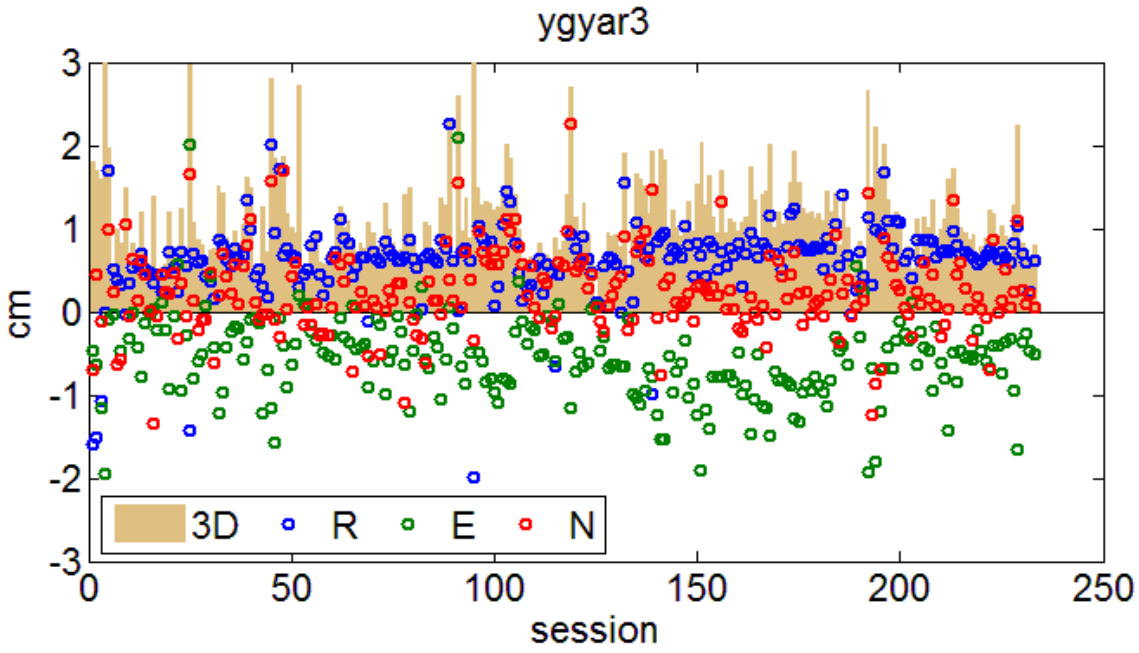
INTER-TECHNIQUE TIES

- High cadence time series (2011-2015) allows for a unique comparison between VLBI and GNSS baselines
- Inter-technique ties are a major issue for the ITRF



TIE DISCREPANCIES

Discrepancies (radial, east, up) in the local tie between Yg (VLBI) and YAR3 (GPS).

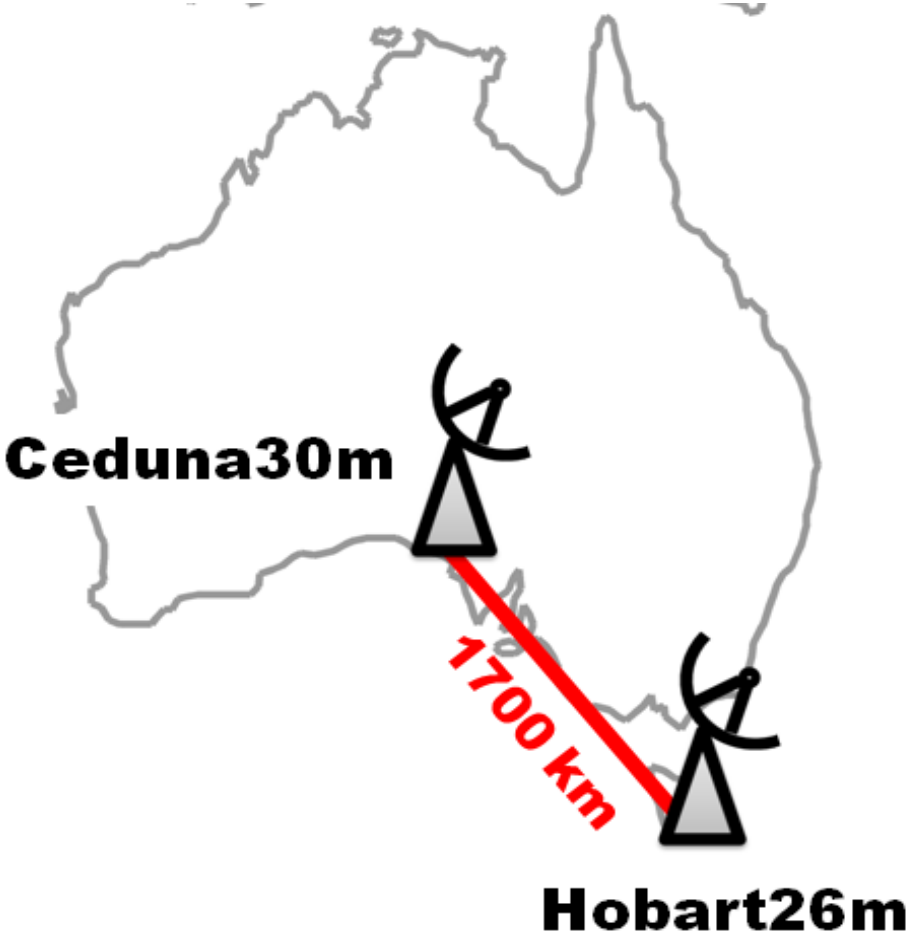


- High consistency between sessions & networks (4-10 mm rms).
- We find systematic discrepancies of a few mm between local tie measurements and geodetic results.

QUASAR STRUCTURE

- See talks by Stas & Oleg

VLBI SATELLITE TRACKING

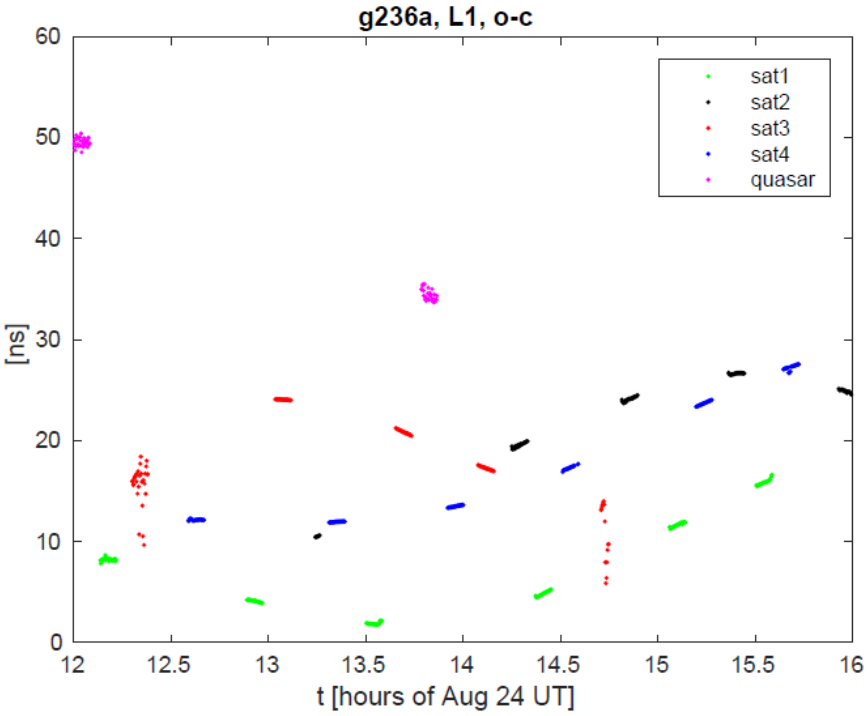


- 'Proof of concept'
- Single baseline
- L-band receivers
- GPS & GLONASS satellites
- 3 successful sessions (2-4 hours)
- From scheduling to analysis

SATELLITE TRACKING – HIGHLIGHTS:

- Combined scheduling (station-dependent vex-files) to satellites and quasars *(A. Hellerschmied, Vienna)*
- Correlation with DiFX, a priori model from VieVS *(Plank et al., JoG 2014)*
- Fringe fitting in AIPS
- Fringes in all 4 channels

  (GPS resp. GLONASS L1, L2)
- 5-30 ps rms over 5 minutes (per scan)
- Residuals +/- 10 ns at the moment (improvable)



AREAS OF VLBI RESEARCH

- Future operations: towards VGOS
- AUSTRAL observing program:
  - Fully independent observing program.
  - Improvements through smart scheduling.
- Dynamic Observing
- Sibling telescopes
  - VGOS-legacy link
  - Sibling/Twin scheduling
  - Improved analysis
- Intra- & Inter-technique frame ties (VLBI & GNSS)
- Quasar structure
- VLBI satellite tracking in L-band

! LAST SLIDE !

THANK YOU FOR YOUR ATTENTION!

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