AUSCOPE VLBI AS A GGOS INSPIRED GEODETIC SYSTEM

Lucia Plank ▪ Jim Lovell

UNIVERSITY of TASMANIA

AuScope

Australian Government

Australian Research Council

VERY LONG BASELINE INTERFEROMETRY

$\vec{b}$ … baseline vector (Earth-fixed)

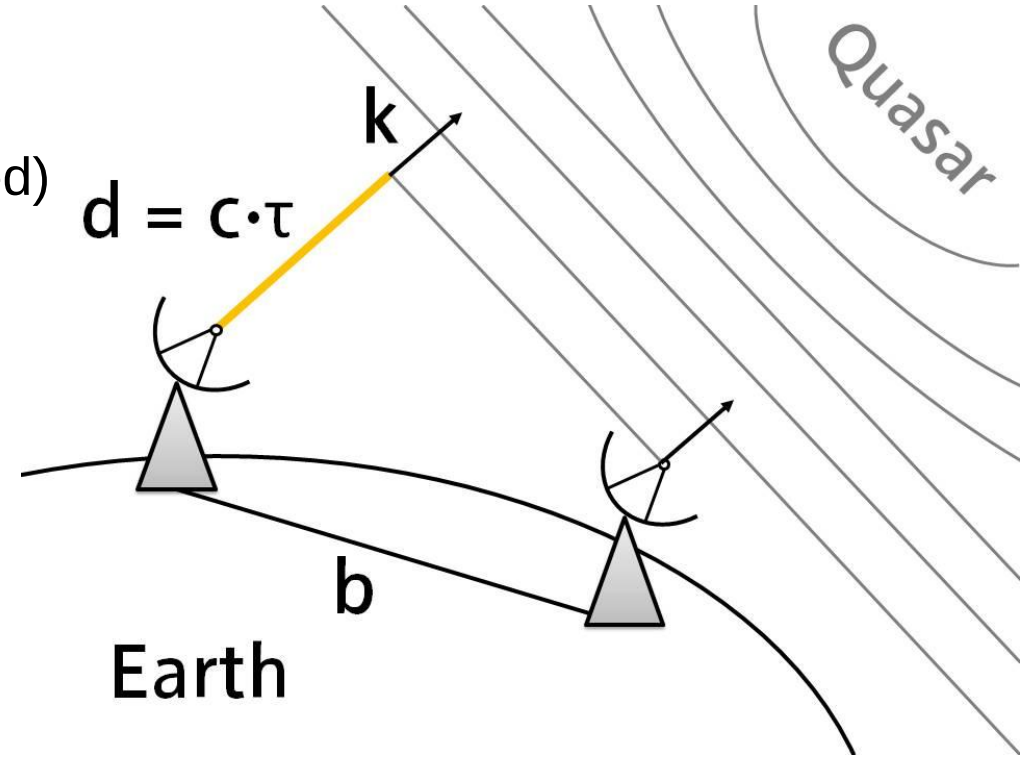
$\vec{k}$ … direction to radio source (space-fixed)

c … speed of light

W … polar motion

S … diurnal spin

NP … precession/nutation



$$\tau = -\frac{1}{c}\vec{b}\,WSNP\,\vec{k}$$

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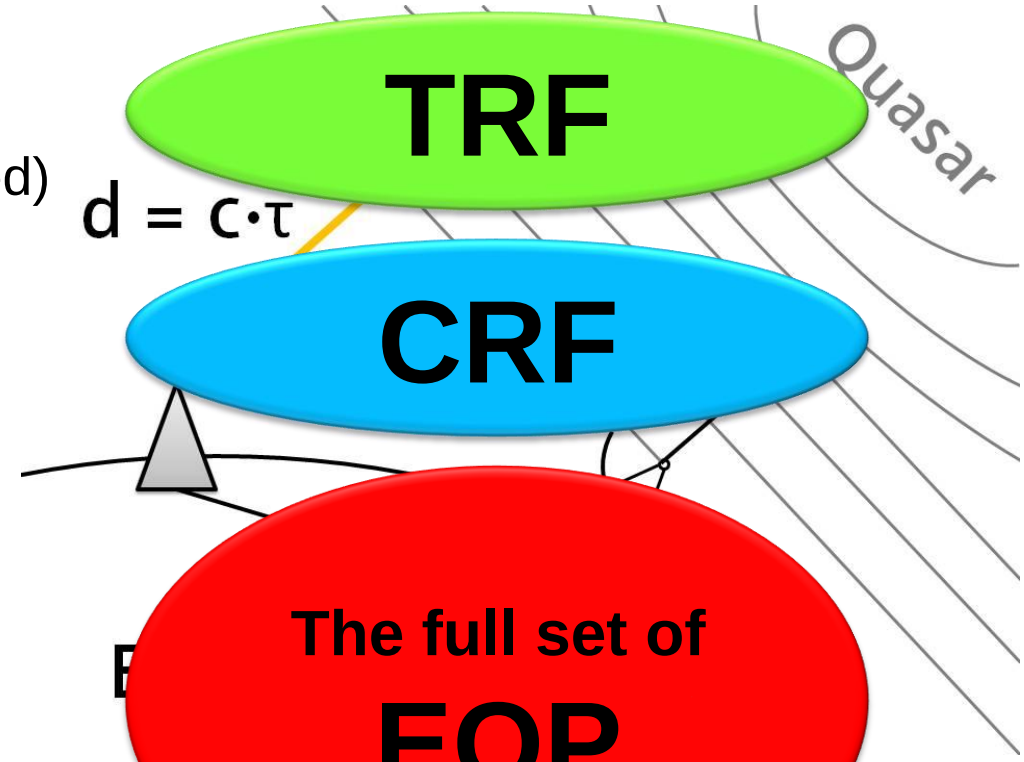
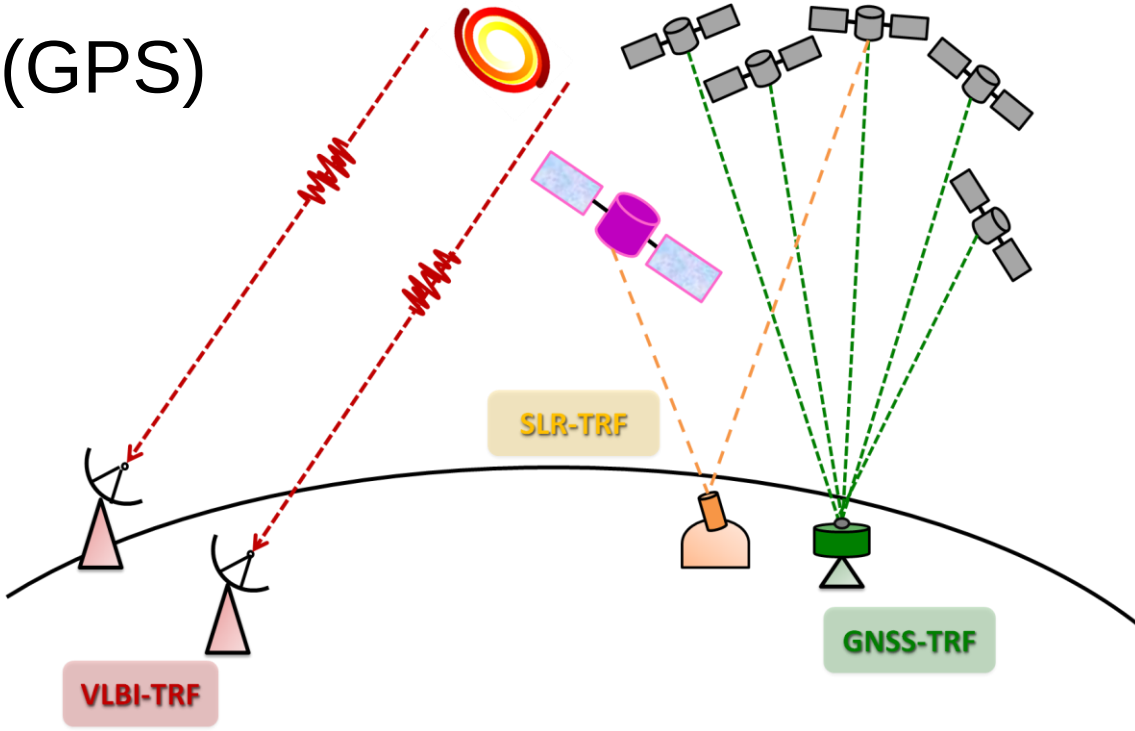


$$\tau = -\frac{\vec{b}}{c}WSNP\vec{k}$$

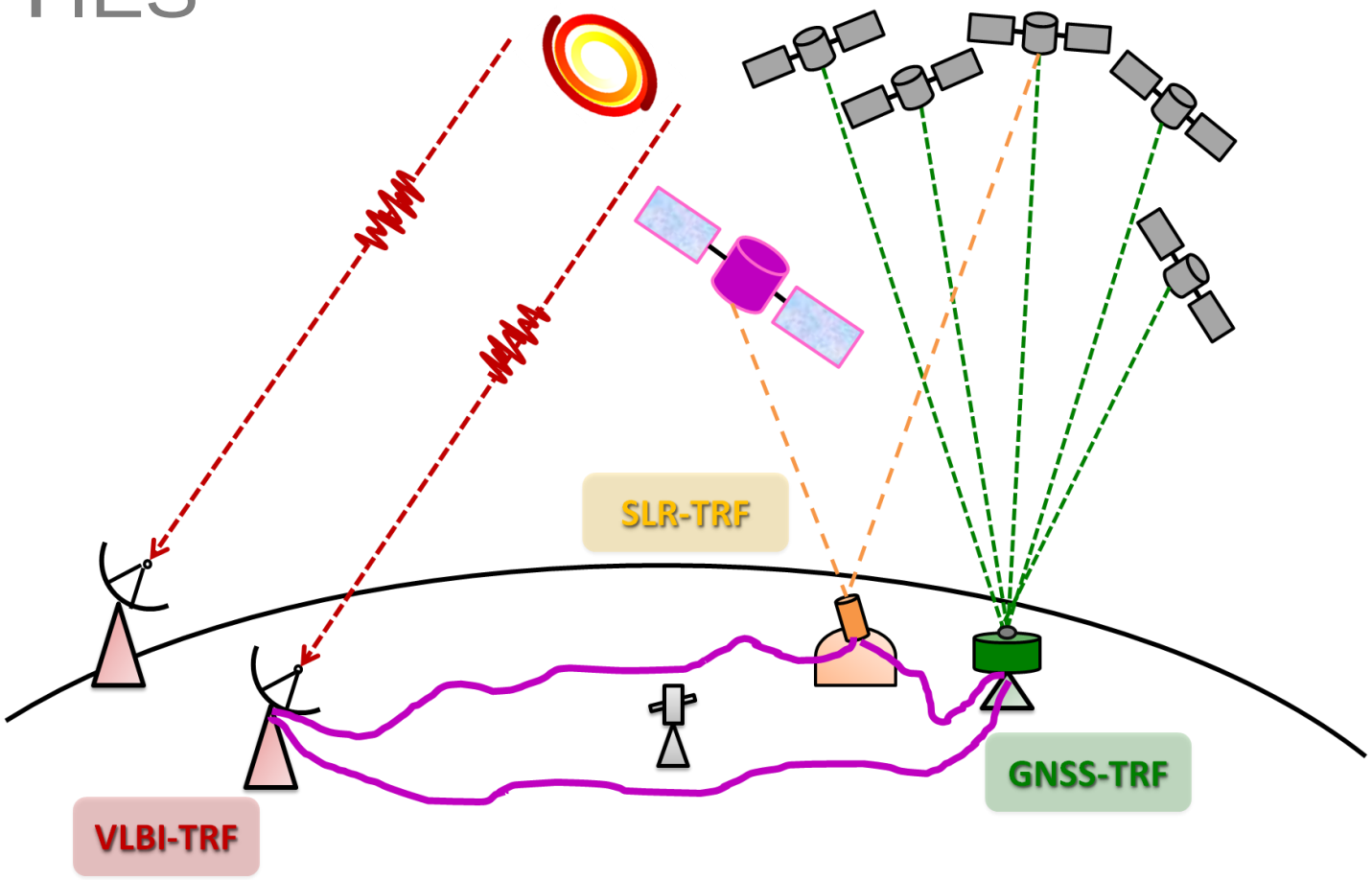
ITRF2008 [ALTAMIMI ET AL. 2011]

- GPS, SLR, VLBI, DORIS
  - Origin → SLR
  - Scale → VLBI + SLR
  - Orientation → (GPS)

ITRF = a multi-technique product



LOCAL TIES



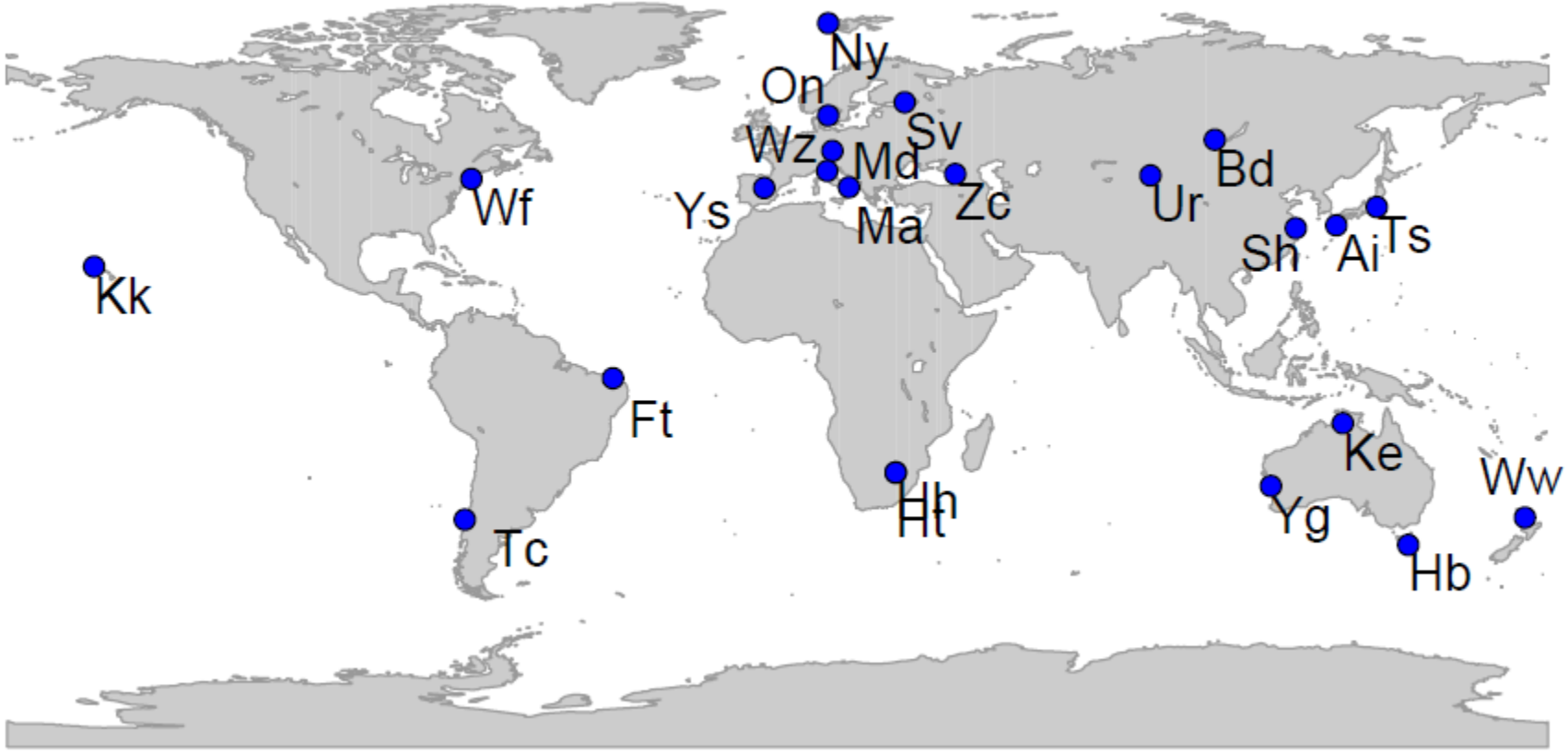
More co-location stations

AUSCOPE VLBI

- 178 days of observing in 2014
- each antenna records ~17 TB of data/week
- clear improvements in global VLBI results

IVS R1/R4 NETWORK OF 2013

104 sessions, 23 stations; north/south = 15/8



Map of stations participating in the 2013 R1 and R4 sessions.

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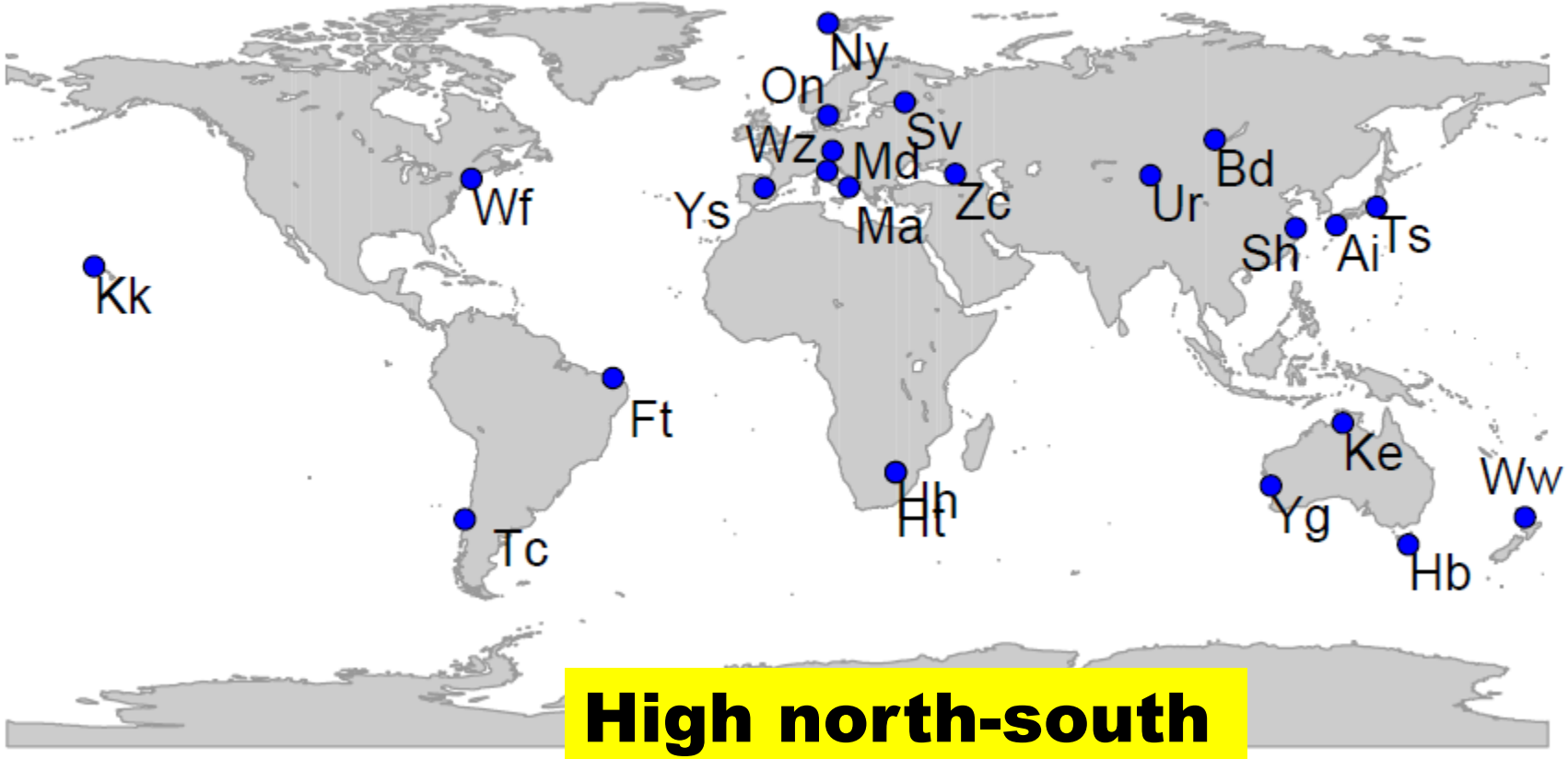

Map of stations partic R4 sessions.

High north-south imbalance!

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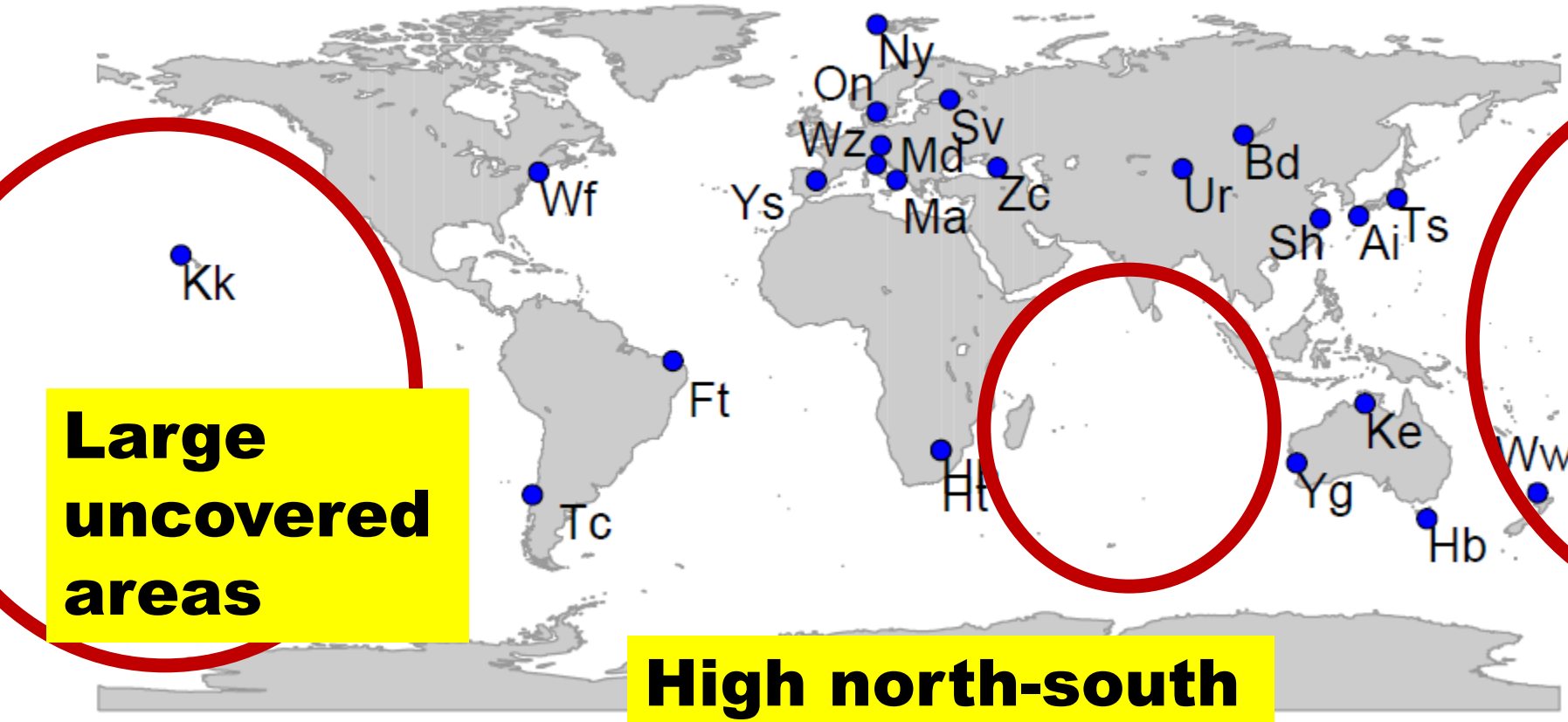
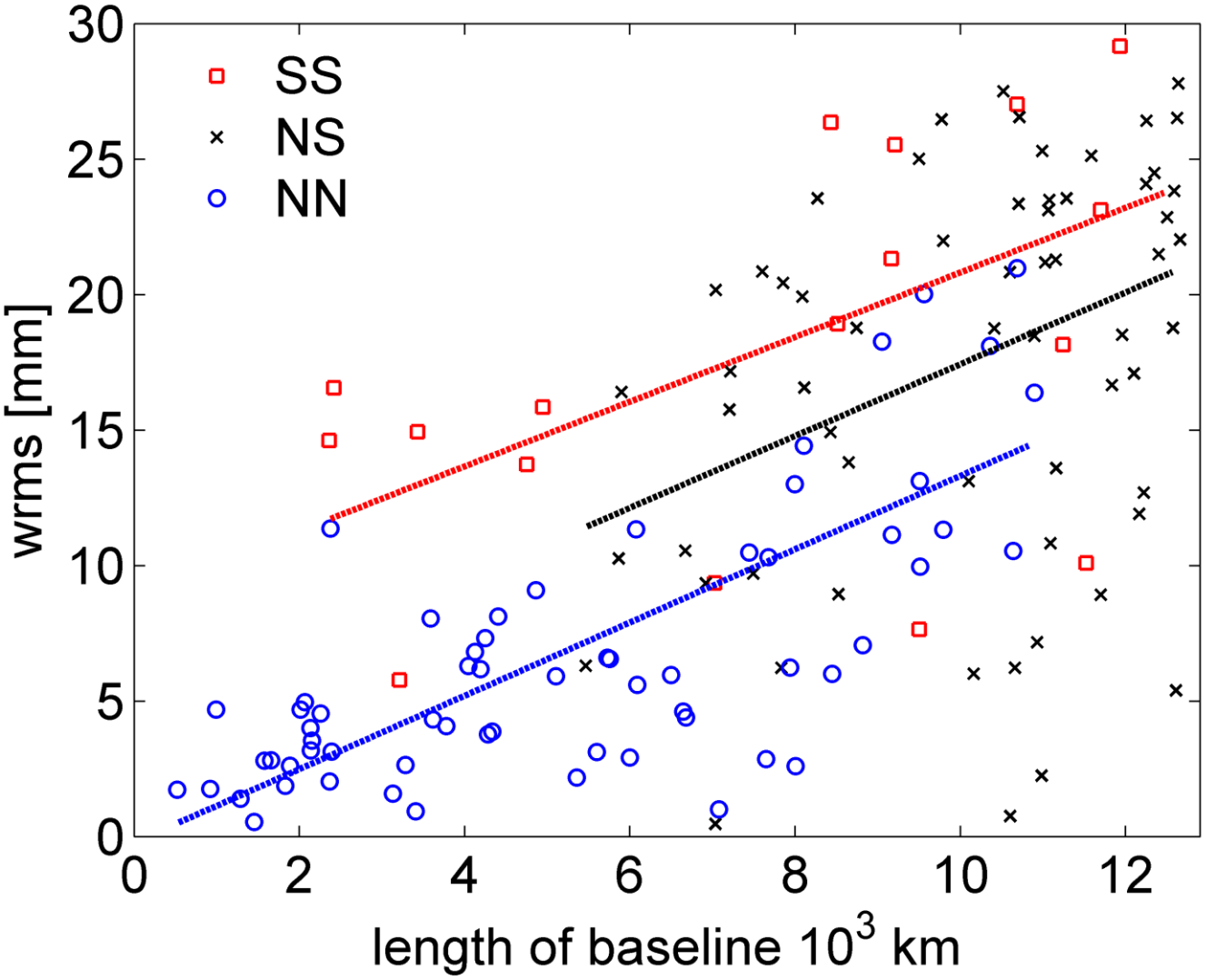


Map of stations partic R4 sessions.

Large uncovered areas

High north-south imbalance!

CHALLENGE FOR THE SOUTH



Jan –Jun 2013 N/S=5/3

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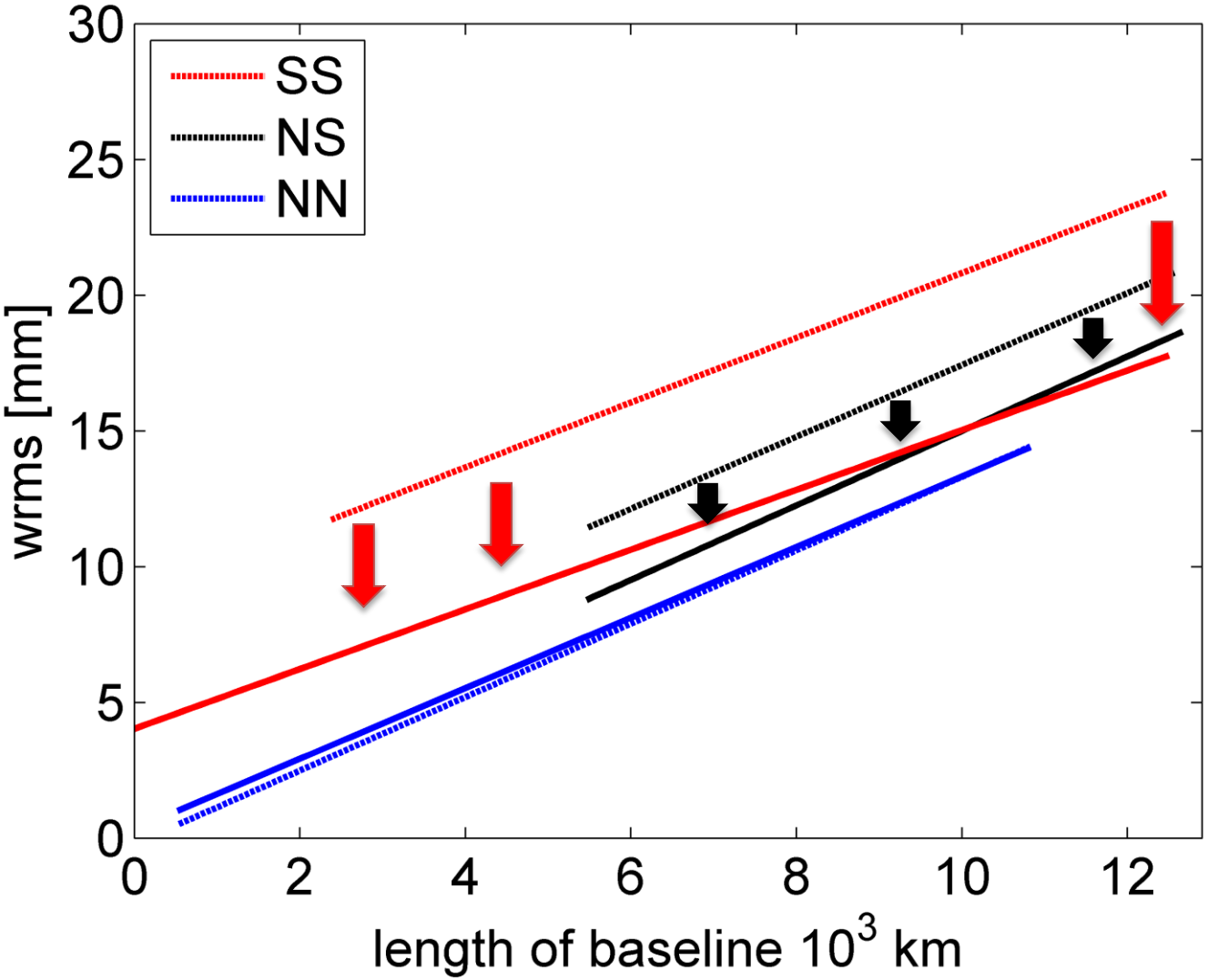

Jan –Jun 2013 N/S=5/3

Since Jul 2013, the 3 AuScope antennas join almost every R1/R4

Jul –Dec 2013 N/S=5/4

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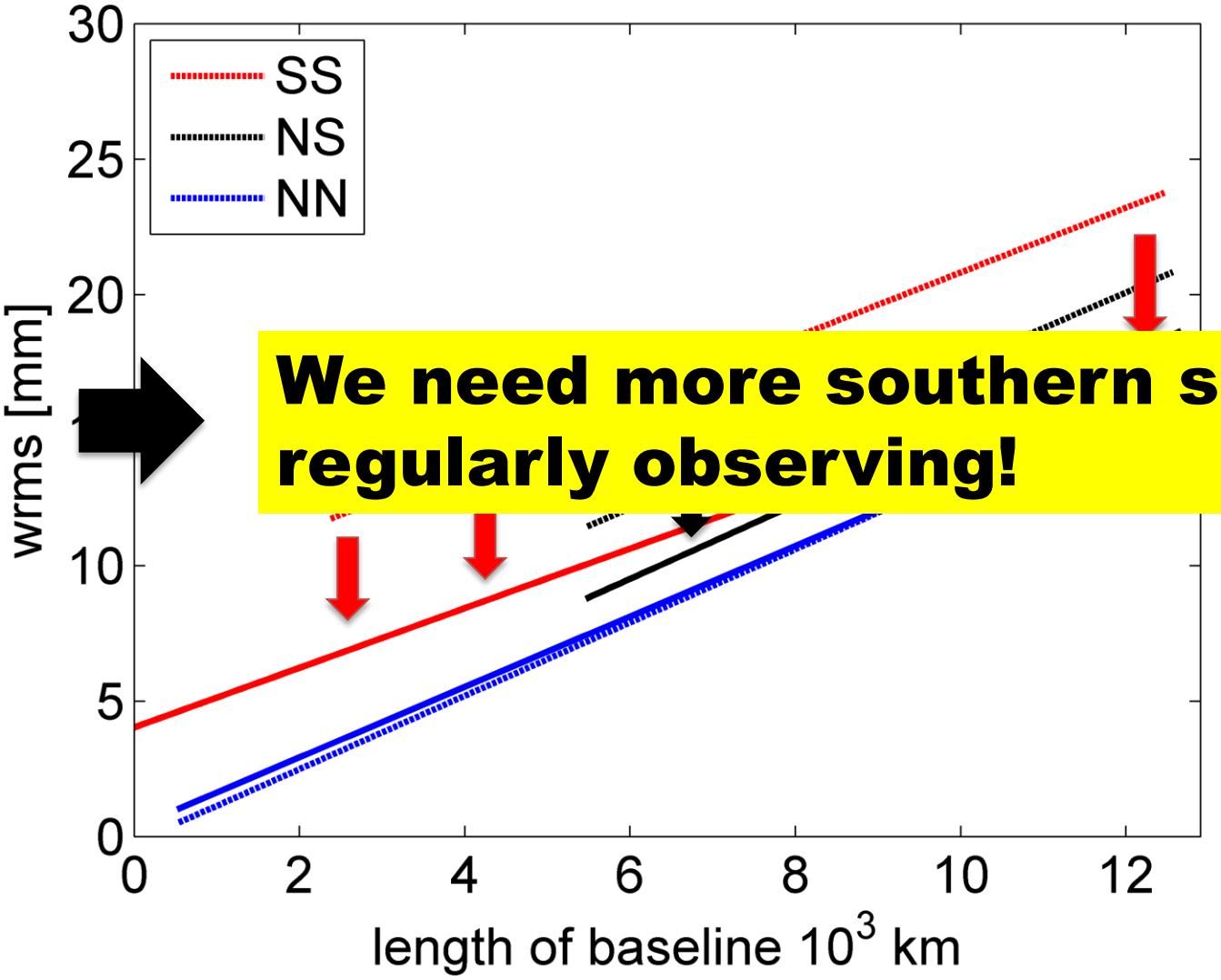

We need more southern stations regularly observing!

Jan –Jun 2013 N/S=5/3

, the
in
almost every R1/R4

Jul –Dec 2013 N/S=5/4

VGOS VLBI2010 GLOBAL OBSERVING SYSTEM

- GGOS goals of 1mm and 0.1 mm/yr
- More observations/hour through small & fast telescopes
- Compensate loss of sensitivity with higher bandwidth (broadband)
- at least three regularly observing stations on each major tectonic plate

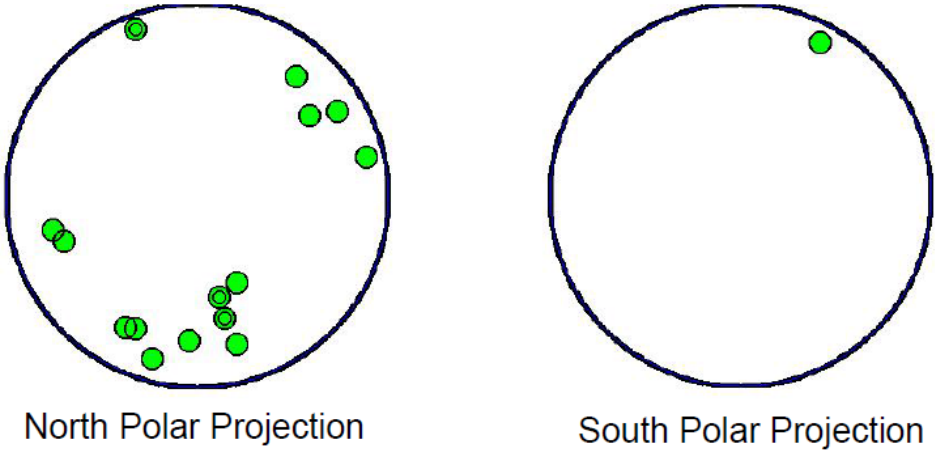

Figure 6. Projected VGOS broadband network at the end of 2017. Concentric circles represent sites that incorporate two broadband antennas.

http://ivscc.gsfc.nasa.gov/technology/vgos-docs/VGOS_Observing_Plan_140213.pdf

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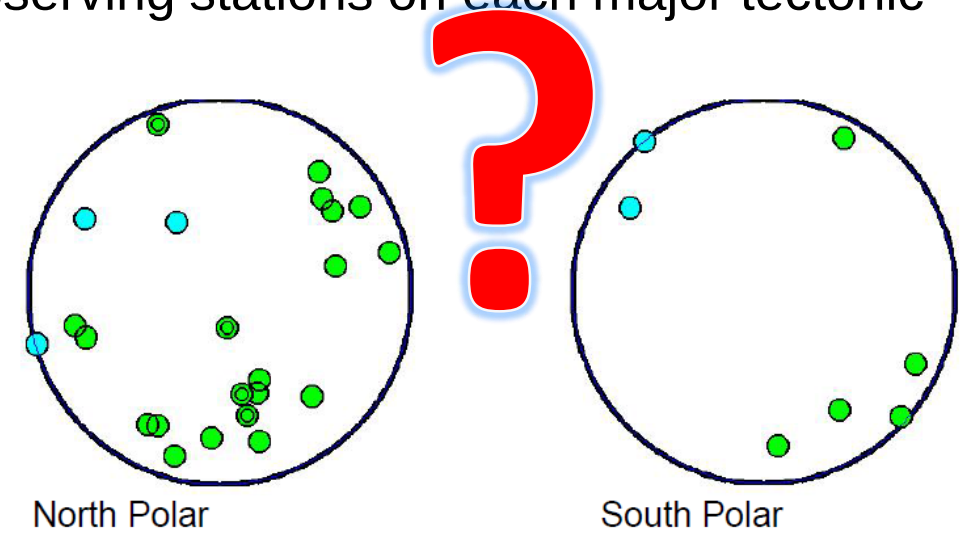

Figure 7. Projected VGOS broadband network for the end of 2019. Concentric circles represent sites that incorporate two broadband antennas. Cyan dots represent new NASA sites hypothetically placed in Colombia, California, and Alaska in the Northern Hemisphere and Brazil and Argentina in the Southern Hemisphere.

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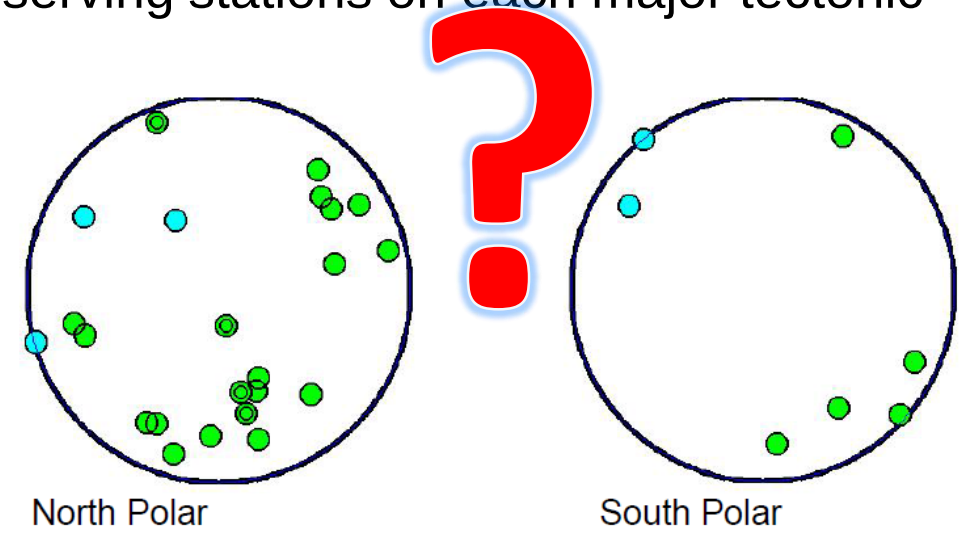
Hobart goes VGOS!

Hb will be upgraded with a broadband feed & 16 Gbps sampler/recording system in mid 2015.



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we now have funding to upgrade all three telescopes to broadband as a result of a recent ARC funding

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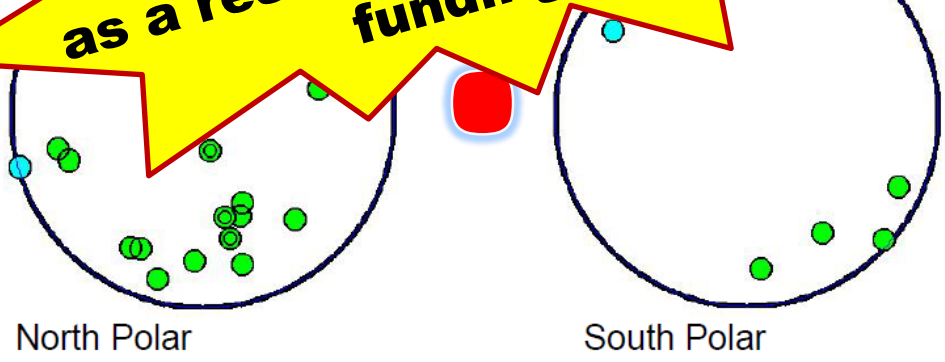

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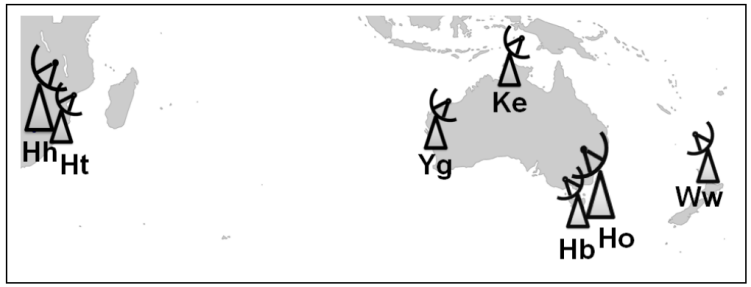
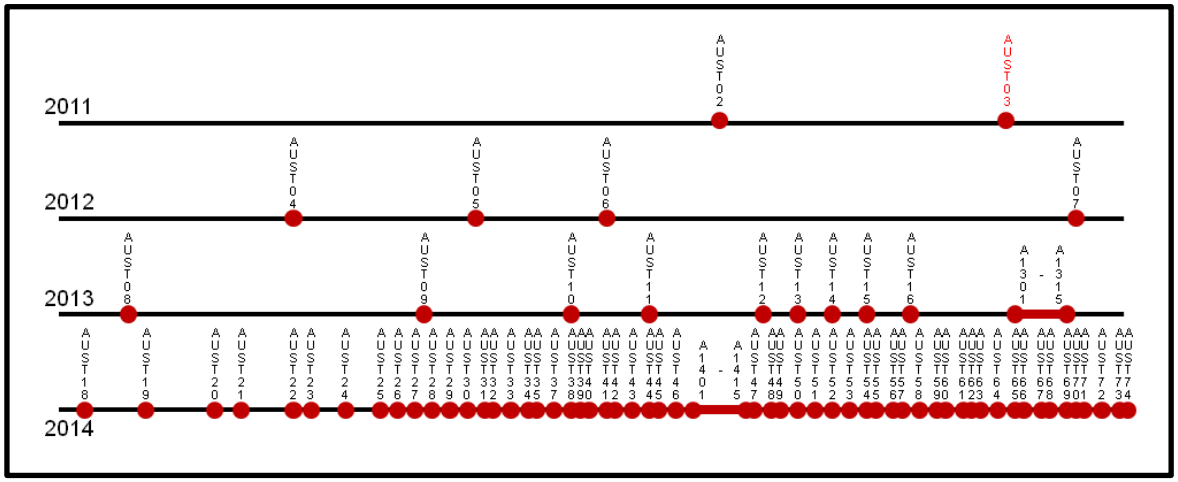
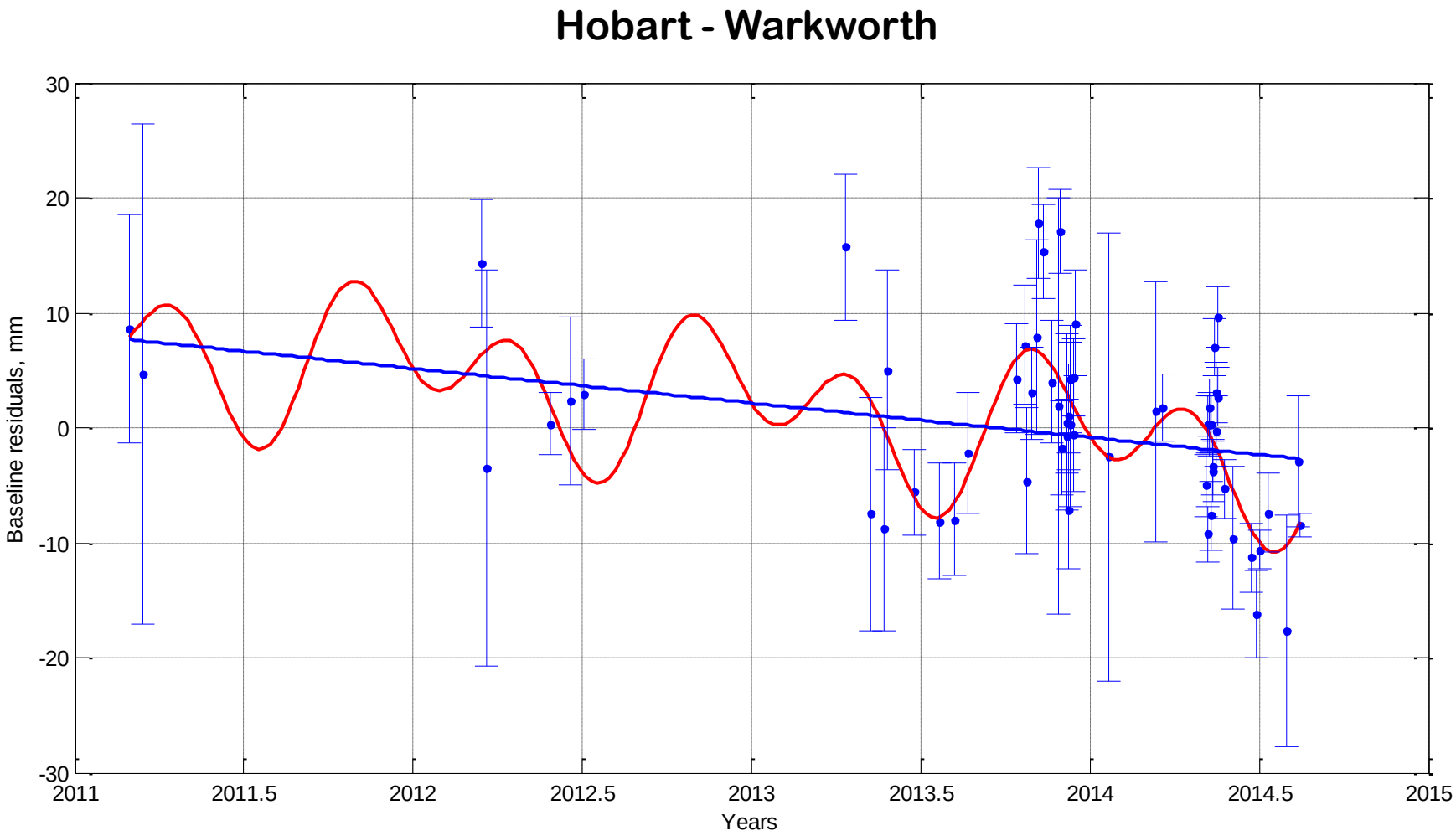
AUSTRALs



- Scheduled by us (Vienna University of Technology)
- Observed by us
- Correlated by us (in Curtin)
- Autonomous data flow until analysis



AUSTRAL BASELINES



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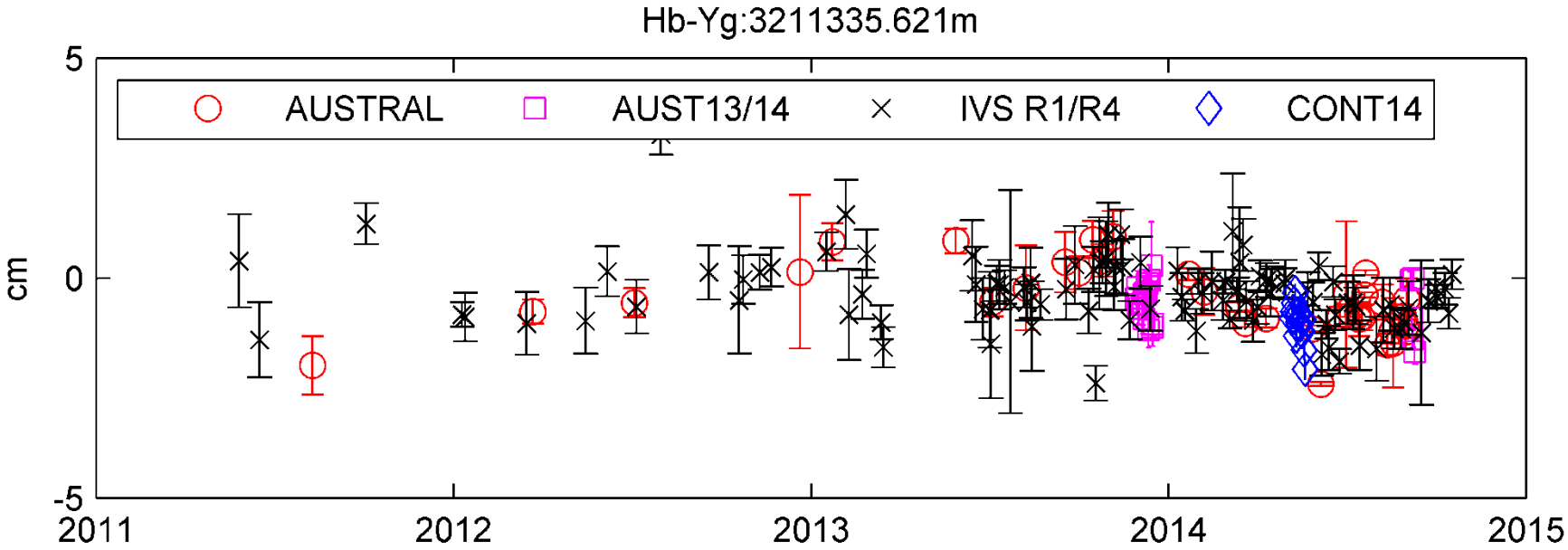

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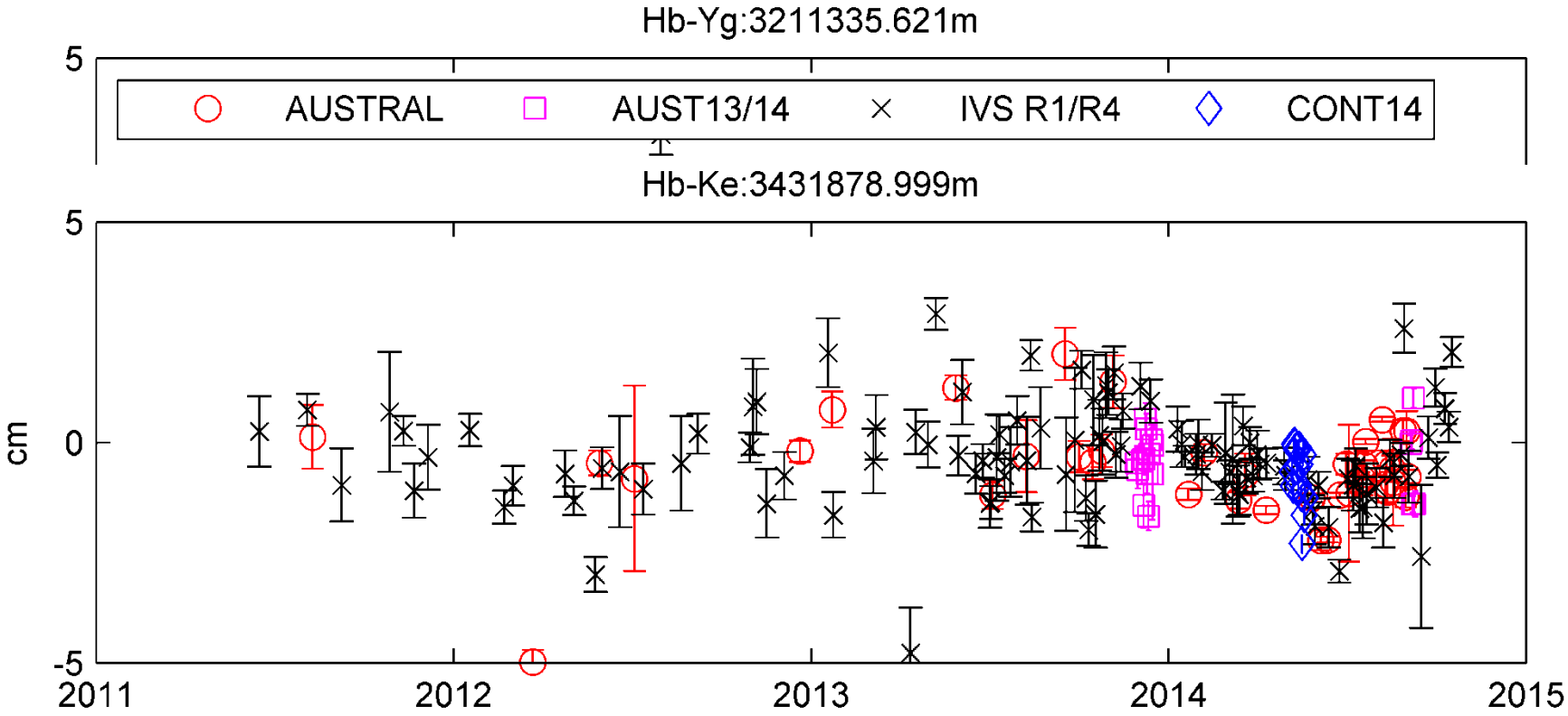
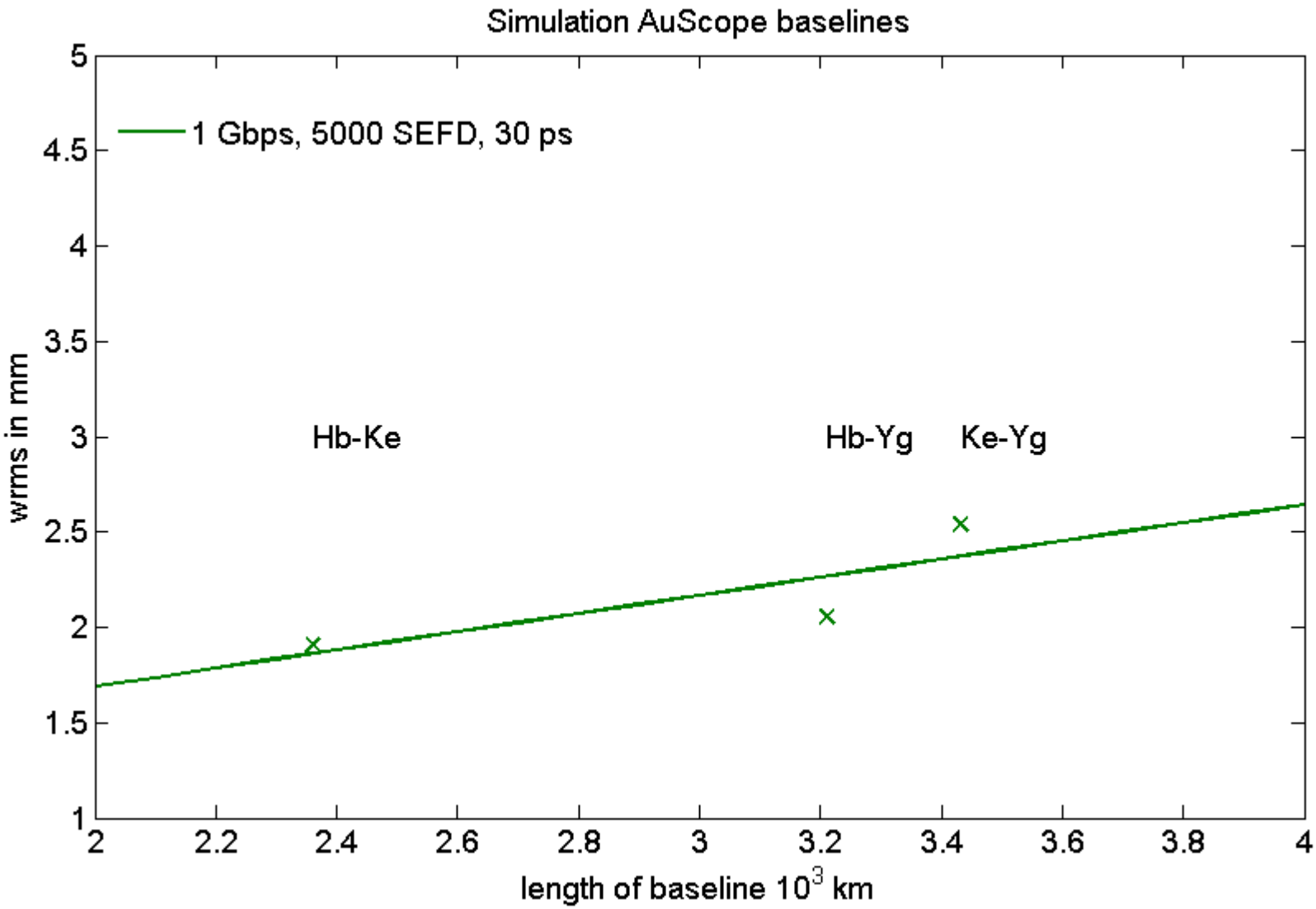


PRE-VGOS OBSERVATIONS



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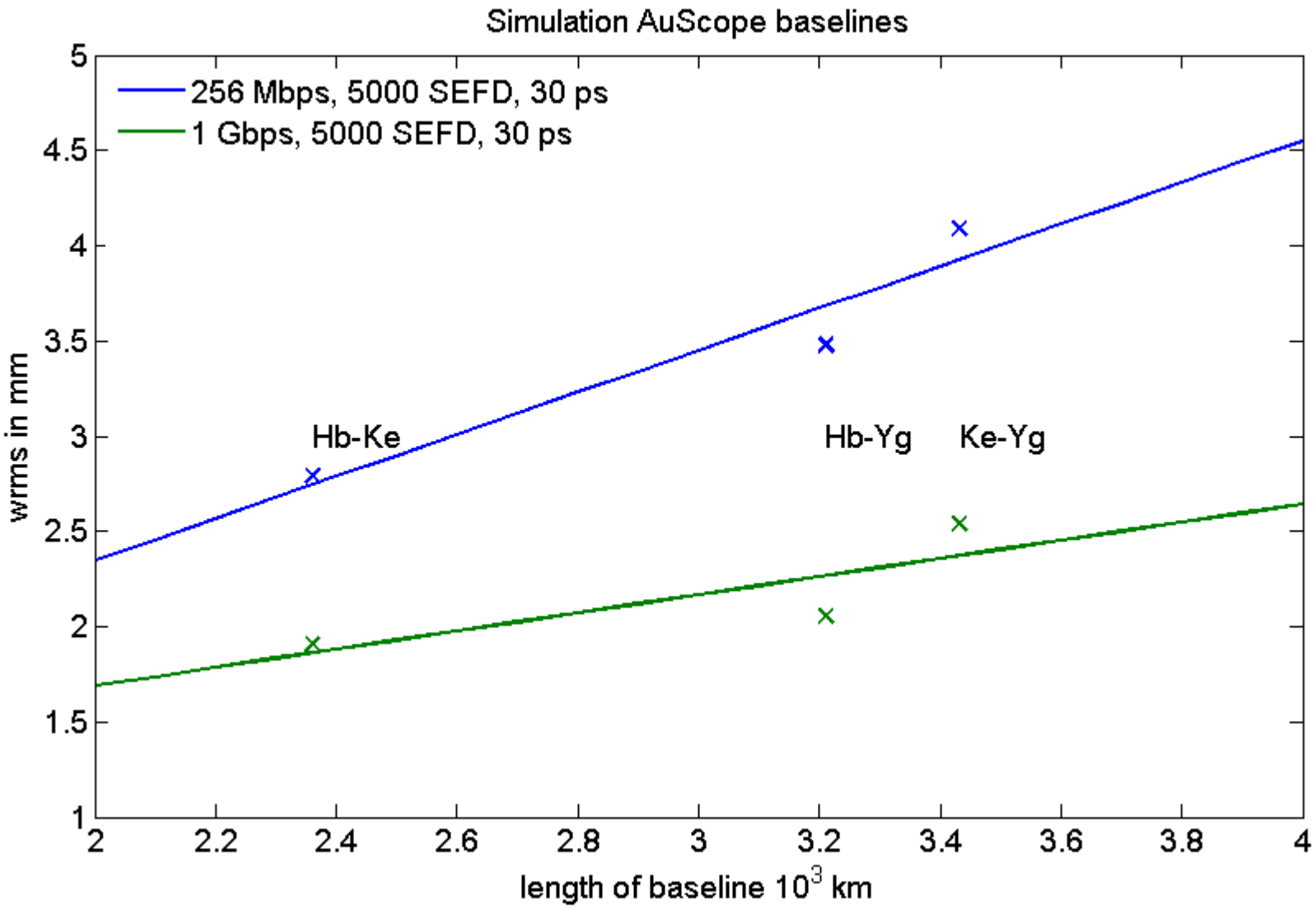

PRE-VGOS OPERATIONS

- We remotely control all our telescopes from the UTAS campus in Hobart, using the e-Control software.

  VGOS goal: shared observations with telescopes all over the world

- Operational developments concerning data storage, transfers (shipping, e-transfer), and module logistics.

  VGOS goal: only e-tranfers

GGOS STATIONS

- ITRF2013 will include all 3 AuScope sites
- All AuScope sites are co-located sites
  - Hb, Ke: VLBI+GNSS
  - Yg: VLBI+GNSS+SLR
- Research on local ties
  - VLBI-GPS

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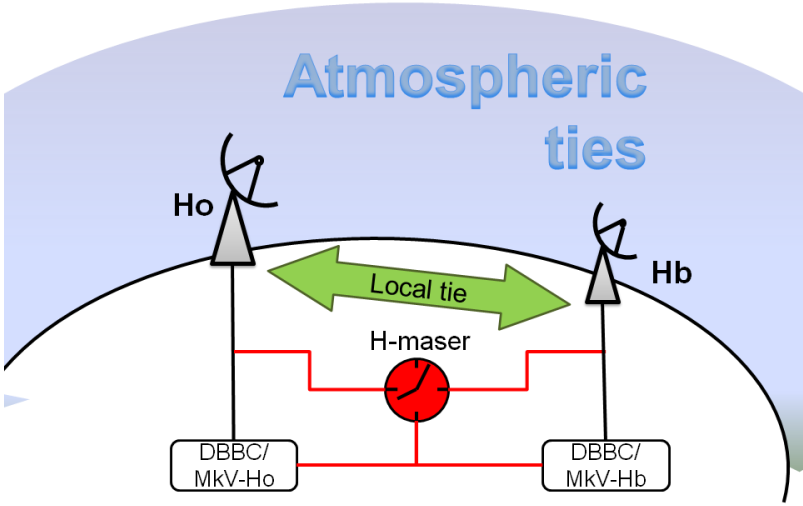
  - VLBI-VLBI

Sibling Telescopes

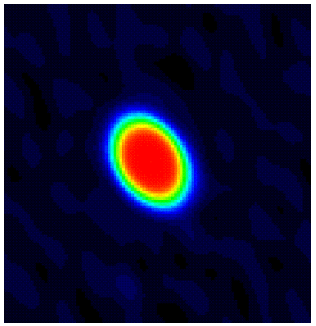
How to connect the new Hb VGOS-antenna to the legacy Ho antenna? + VGOS Twin telescope observing strategy



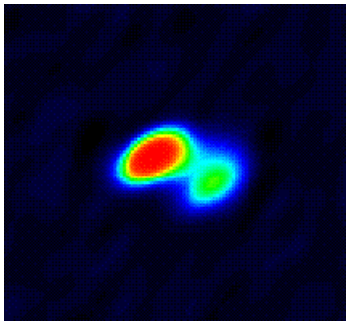
BROADBAND AND QUASAR PHYSICS

- Quasars are not perfect point sources.
- Source structure is a big unknown for the VGOS system.
- At UTAS we perform research in that area.

S-band



X-band



Imaging of source 1504-166 with the AuScope antennas.

VieVS
Vienna VLBI Software

We have added a source structure simulator to the Vienna VLBI software.

SUMMARY

- VLBI is an essential technique for GGOS.
- The AuScope VLBI array significantly improves global VLBI results. But more needs to be done.
- New Zealand / Australia take a key role in establishing a homogeneous network and cover the Pacific and Australian tectonic plates.
- The AUSTRAL observations greatly improve the time series of our stations and are an excellent testbed for transition to the upcoming VGOS.

THANK YOU FOR YOUR ATTENTION!

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