AUSCOPE VLBI OPERATIONS AT UTAS

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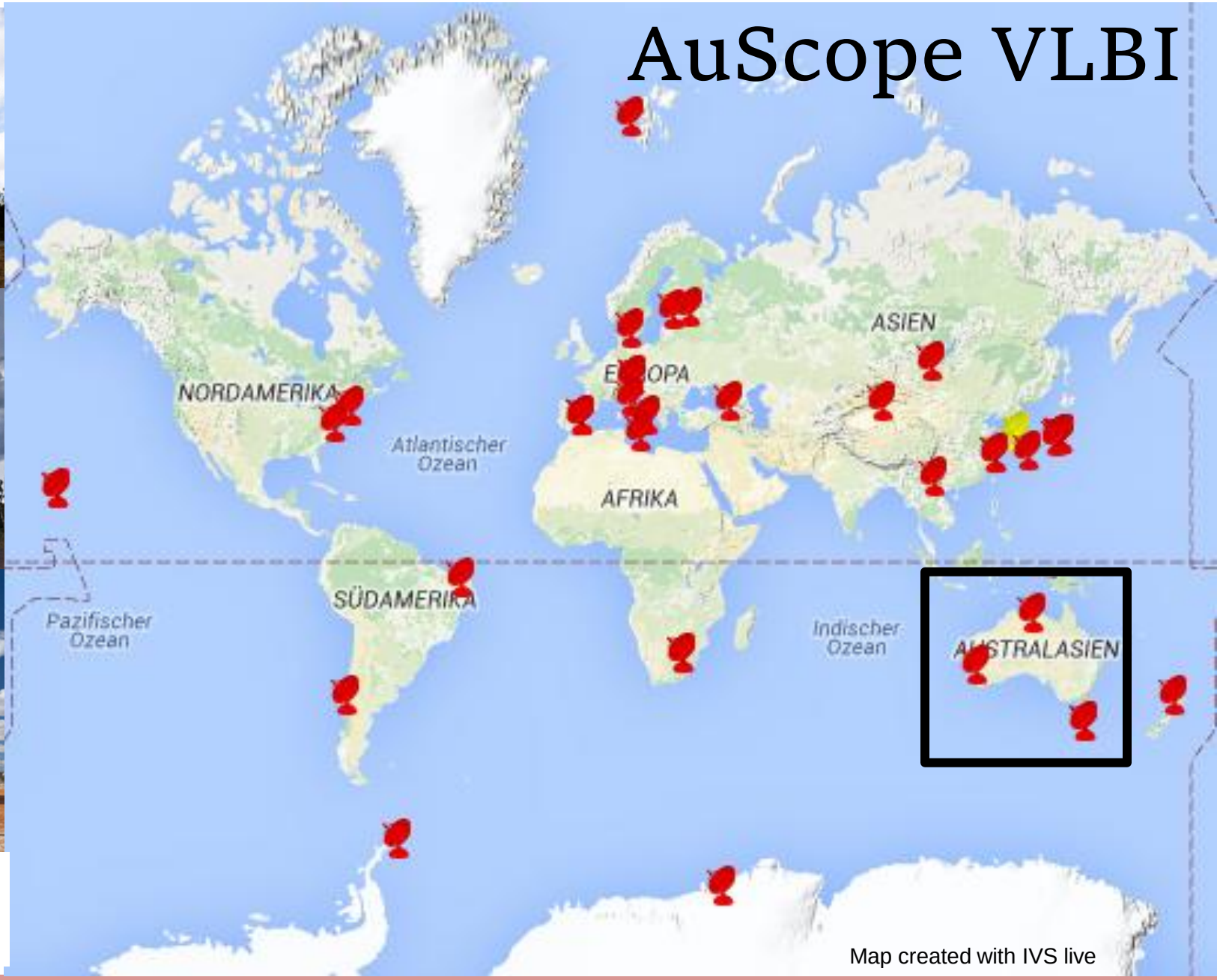
Australian Government
Geoscience Australia

AuScope

UNIVERSITY of TASMANIA

AuScope

AuScope VLBI



Map created with IVS live

AUSCOPE VLBI - STATUS

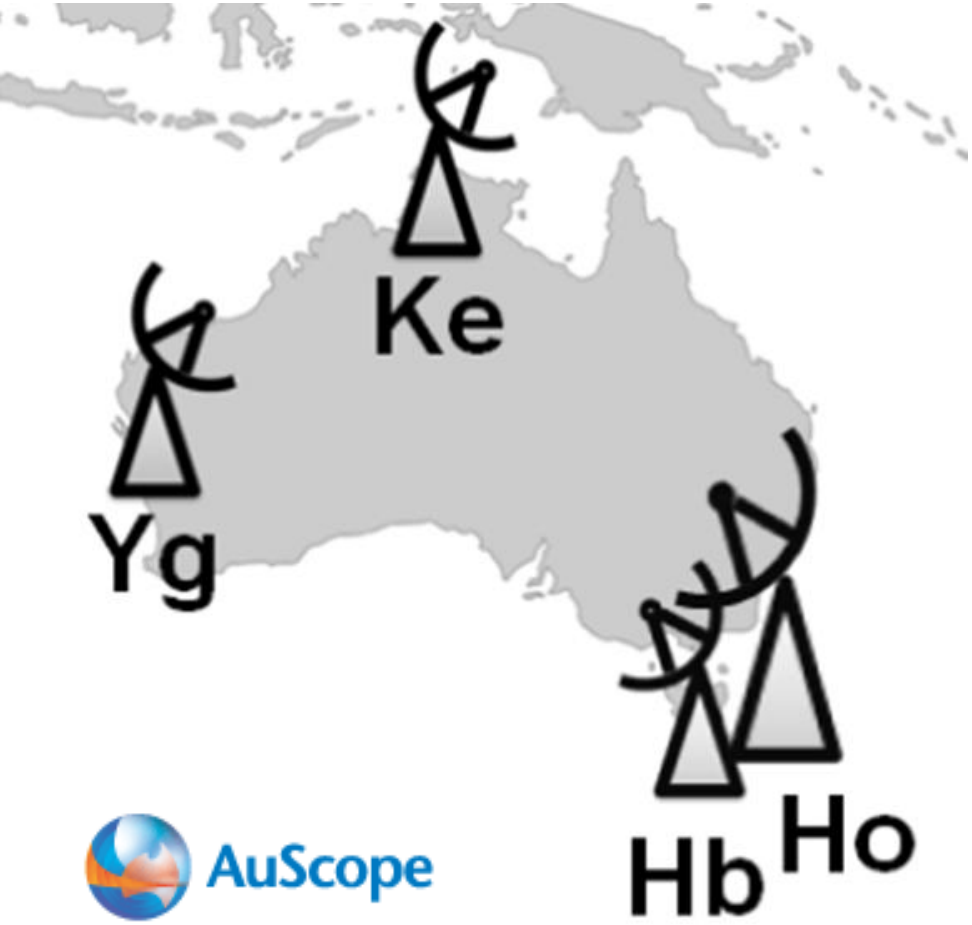
- Jim Lovell has left
- (staff) funding for 3 years at UTAS: Jamie McCallum (Manager) and Lucia McCallum
- Aims:
  - VLBI operations
  - Implementation of new VGOS system
  - Challenges: 24/7 operations, tens of TB of data/day/station
- We need to build a new group
- And we aim for a better integration into academic system.

TODAY

I want to …

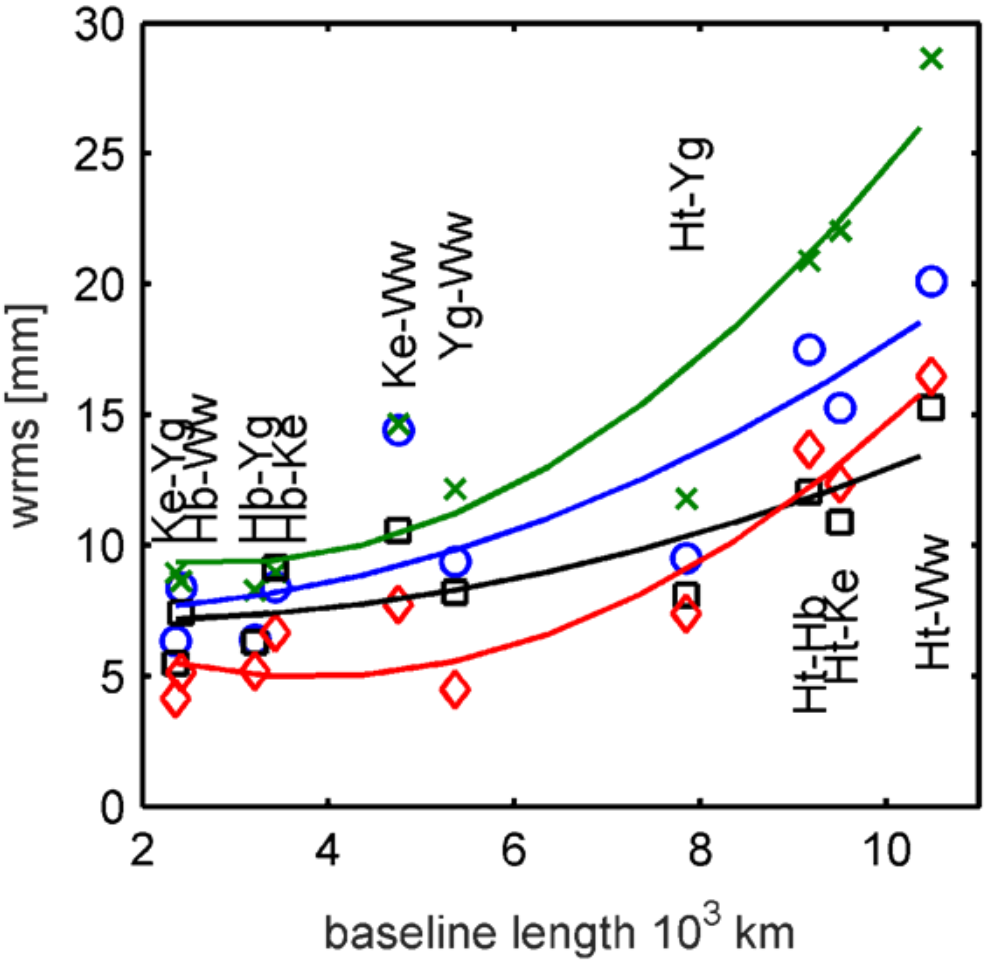
- communicate what we are doing
- dentify topics for possible collaborations with you.

(DAILY) VLBI OPERATIONS



- AuScope VLBI network with the busiest geodetic antennas worldwide (226 experiments planned in 2016)
- All sites remotely operated from UTAS
- 26m legacy antenna Ho
- We now have the full expertise, from scheduling via correlation to analysis

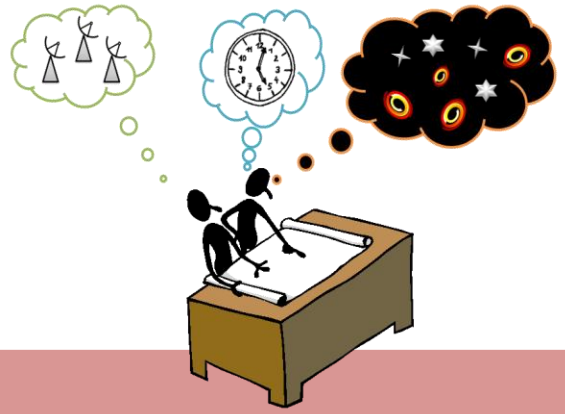
AUSTRALs



Plank et al., JoG, 2017

Precision of Australian baselines

Hb-Ke: 9 mm → 7 mm (13 in IVS)
Hb-Yg: 8 mm → 5 mm (9 in IVS)
Ke-Yg: 9 mm → 4 mm (9 in IVS)



VLBI 'ON DEMAND'

- AUSTRALs (scheduled in Vienna, correlated in Shanghai)
- HOB – series (great to detect systematics)
- OHIG/Antarctica series (antennas + know how)
- Chang'E lunar lander observations
- Astronomy
  - Ecliptic plane survey to support Chinese space mission (Fengchun)
  - Relativity experiments
  - RadioAstron
- Addtional AUSTRALs for Astrometry (with Ht)
- More?

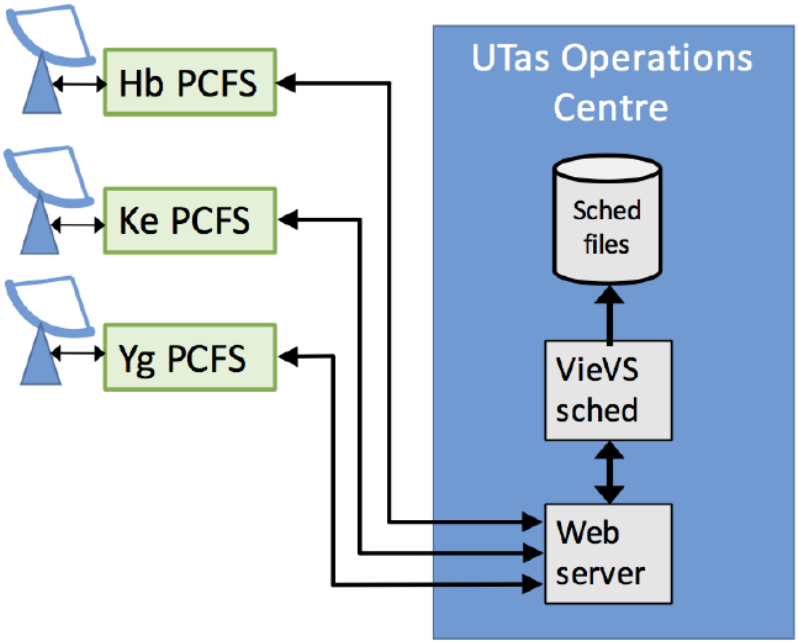
'FORCED' IMPROVEMENTS

- Overhaul the staid mode of operations
  - Need to convince global partners
- Mode: do it and show that it works.
- Our experience is that we improve when we have to.
- … the only way to face the future challenges

DYNAMIC OBSERVING (DO)

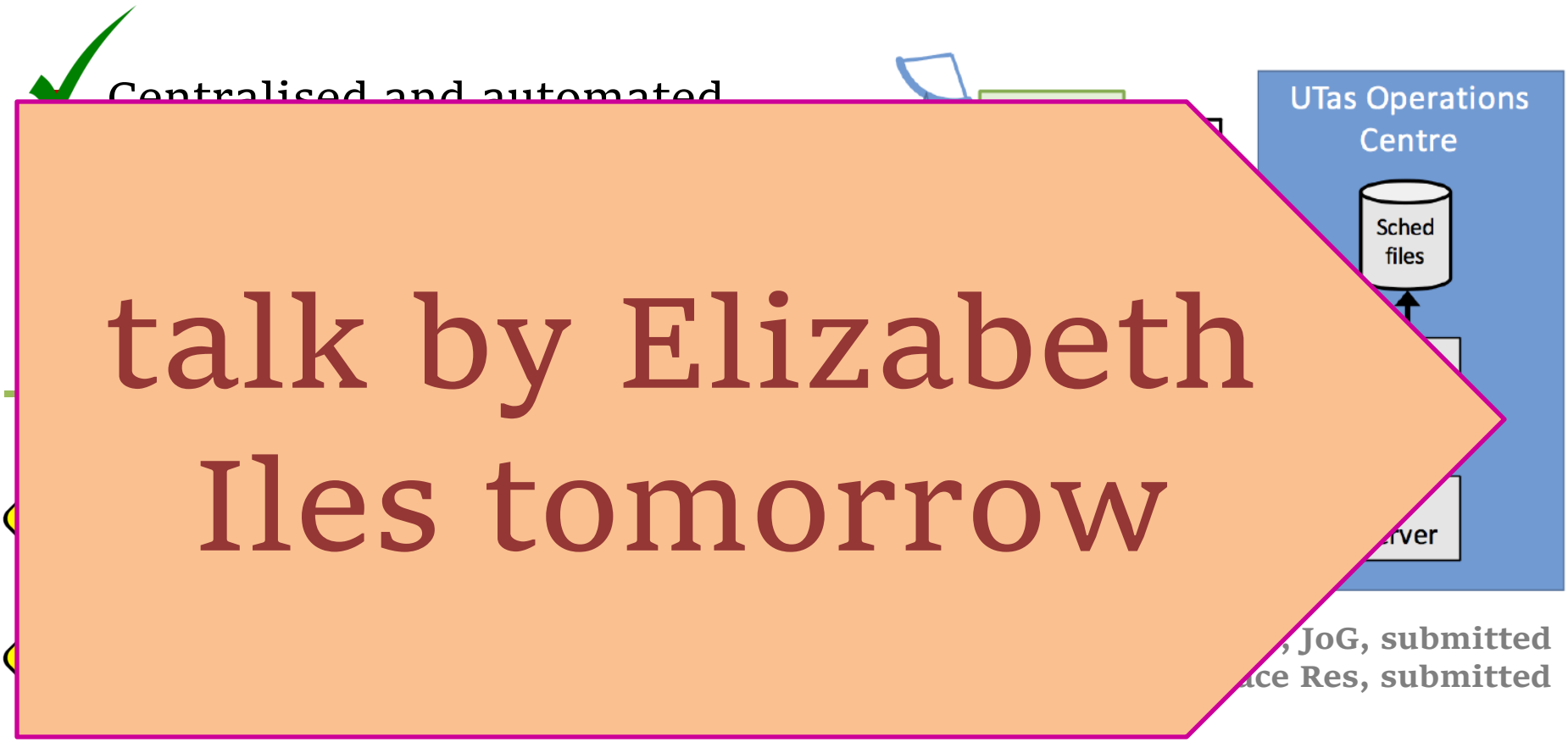
- ✓ Centralised and automated scheduling and operation mode.
- ✓ Tested with the AuScope array + Ht (RSA)

- Automated data transport
- Automated correlation
- Automated analysis



Lovell et al., JoG, submitted
Iles et al., Adv Space Res, submitted

DYNAMIC OBSERVING (DO)

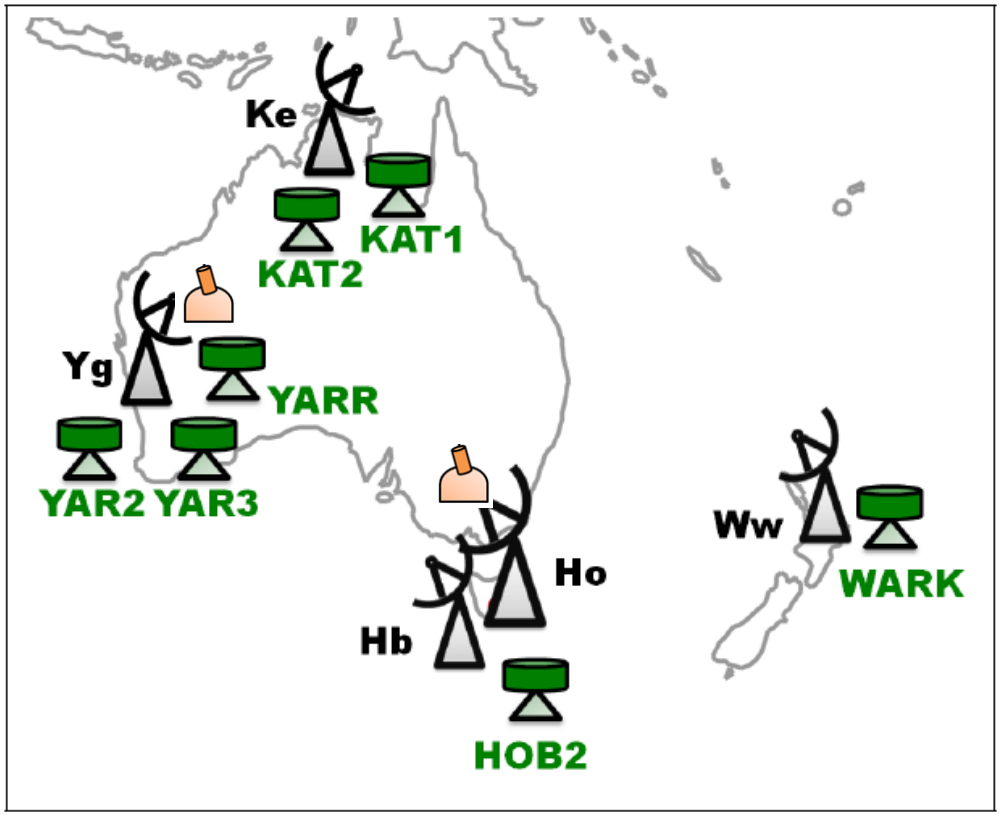


talk by Elizabeth Iles tomorrow

Automated analysis

INTER-TECHNIQUE TIES

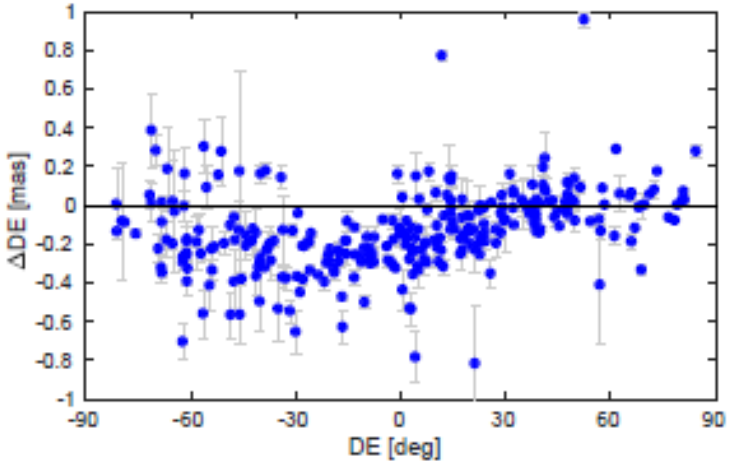
- Uniquely (for VLBI) high cadence time series
- We can observe on demand (CONT-like)
- Australian TRF combination GNSS+VLBI+SLR?
- Multi-technique troposphere?
  - Modern VLBI observations have much more observations



HOB SERIES

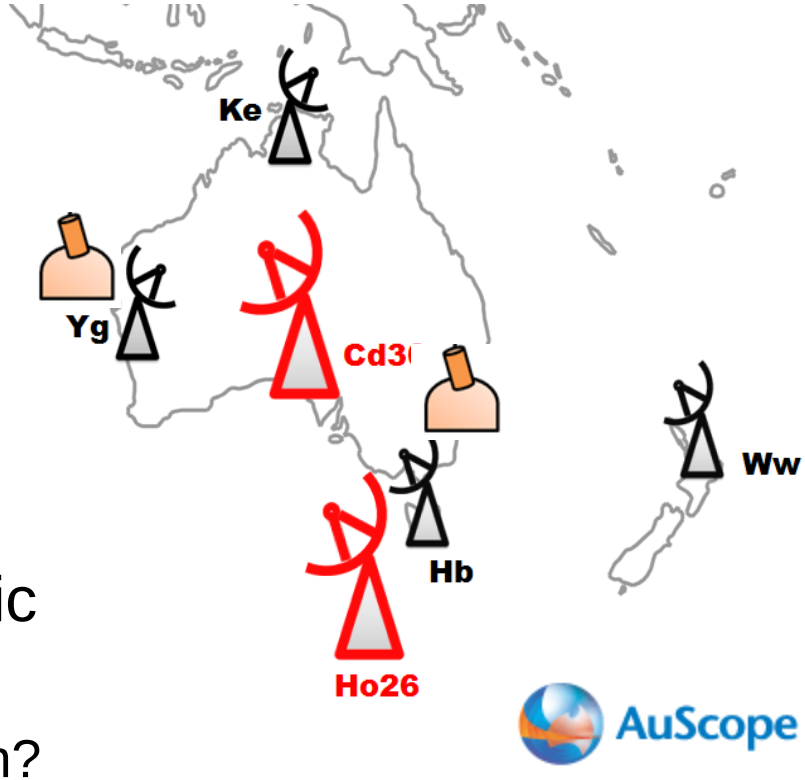
- Investigate systematic differences between local (HOB) and standard experiments.
- 14-weeks observing campaign (HOB – AUG)
- < 1mm repeatability in HOB.
- Phasecal issue with Hb. Erroneous calibration signal?
  - Responsible for huge systematic effect in ICRF3?

McCallum et al., EVGA, 2017
Mayer et al., EVGA, 2017



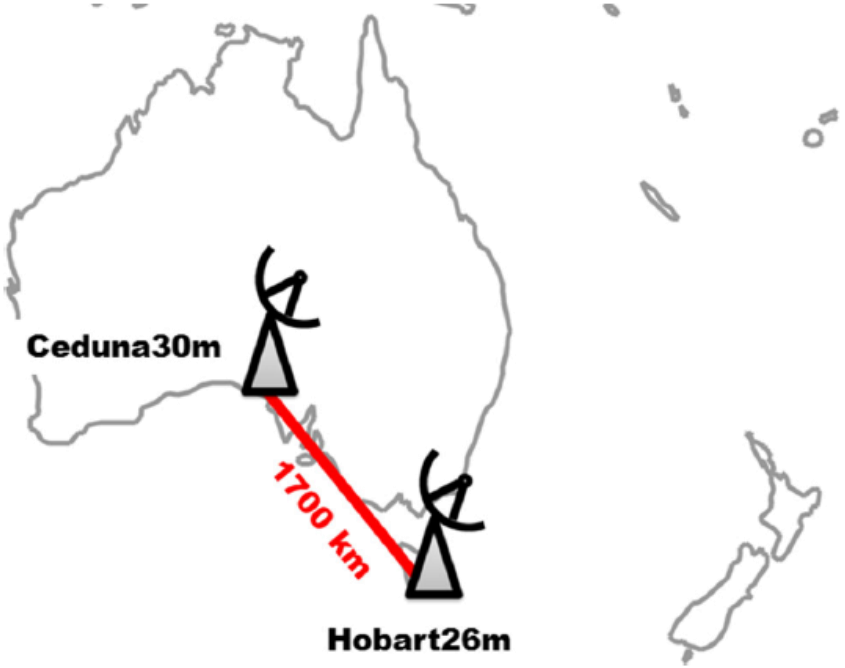
VLBI SATELLITE TRACKING

- Australia has a good geodetic ground station network and expertise
  - Successful tests for GPS L-band tracking [Plank et al., JoG 2017]
  - First observations of APOD using AuScope [Sun et al., submitted]

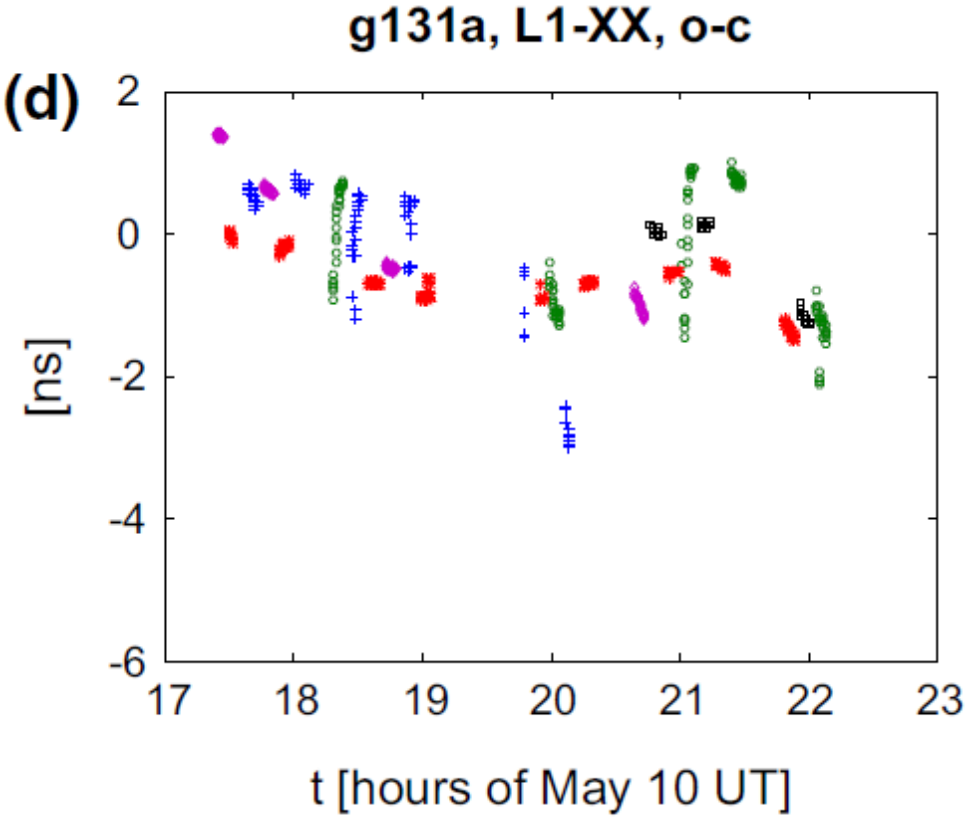


- We a keen to do more on this topic
  - happy to share data
  - new observations? – APOD follow on?

1ST TIME SERIES OF VLBI OBSERVATIONS OF GNSS SATELLITES



Plank et al., JoG, 2017



VGOS

- New receivers for Hb, Ke, Yg
  - Will replace S/X on current 12m antennas
- Timeline
  - Hb first, aiming for Cont17
  - Ke, Yg will follow in 2018

AUSCOPE VGOS - SPECS

- Wideband 2.2-13.5 GHz
  - IF converter box
  - DBBC3 with 3 IF à 4 GHz dual-polarisation
  - Fixed frequencies
    - 2.9-7 GHz
    - 6-10 GHz
    - 9.5-13.5 GHz
- Recorder: FlexBuff
  - 16 Gbps sustained tested
- Phasecal
- No cable cal (at this stage)

AUSCOPE VGOS - STATUS

- Three production feeds arrived in June 2017
- Network upgrade at Hobart
  - 10 Gbps switch at Flexbuff (for correlation)
- Backend / downconverter unit ready
- Some issues with DBBC3
  - Currently only 2 IF single polarisation
- Receiver / sub-reflector geometry
- Phase calibration / calibration
  - Local Hb-Ho fringe tests
- Tests with NAOJ soon

- New team, slightly more optimisitc for long-term plans.
- (Daily) operations as core business.
- Aim to build academic group
  - Two PhD scholarships open
- We are quite flexible in operations and are happy to contribute to your experiments.
- Current research:
  - VGOS-style observations: higher data rates, scheduling, data handling
  - Automation in operations (Dynamic observing)
  - VLBI Satellite observations
  - Systematic errors (Hb phasecal)
- VGOS

AUSCOPE AND THE AOV

- Thank you for a great collaboration!
  - AUSTRALs
  - Common sessions (very informal and easy)
  - AOV sessions support
- VGOS tests
- Improve scientific use of AUSTRAL sessions
- Dynamic observing (EOPs)
- Satellite observations
- Academia / Student exchange


Photo: J. Lovell
THANK YOU FOR YOUR ATTENTION!
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AuScope