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Hb-Ho: Observations with the sibling telescope in Hobart

Lucia Plank, Jim Lovell, Jamie McCallum — University of Tasmania, Australia
Johannes Böhm, David Mayer — Technische Universität Wien, Austria

Introduction

TWO VLBI TELESCOPES AT ONE SITE, EITHER AS TWIN (TWO IDENTICAL TELESCOPES) OR AS SIBLING TELESCOPE (ONE LEGACY AND ONE VGOS ANTENNA), WILL BE COMMON WITHIN THE IVS NETWORK IN ITS TRANSITION TO VGOS.
WE USE THE SIBLING TELESCOPE IN HOBART AND DEDICATED EXPERIMENTS TO INVESTIGATE NEW OBSERVING AND ANALYSIS STRATEGIES. OUR TARGETS ARE THE PROPER CONNECTION OF THE LEGACY AND THE VGOS SYSTEM, THE LOCAL TIE, AS WELL AS THE CHANCE TO DISCOVER UNKNOWN SYSTEMATICS.

Improved Analysis

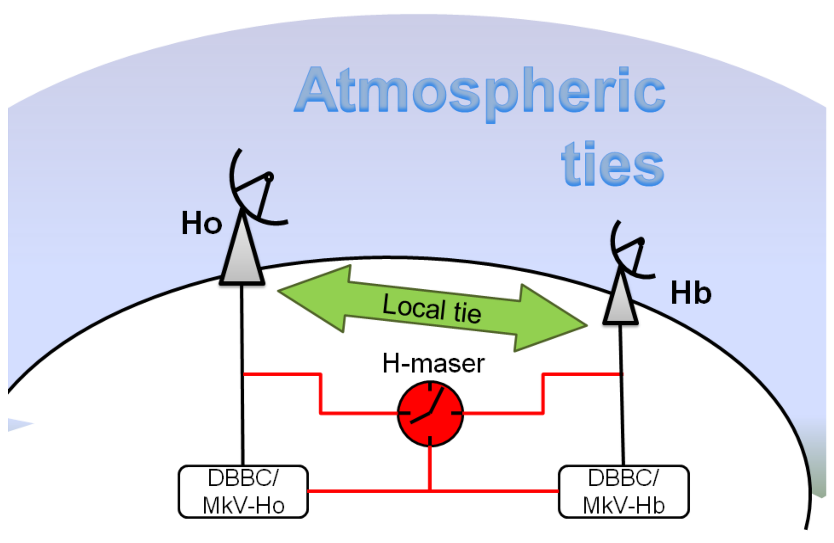

Figure 2: The HbHo Sibling telescope offers new possiblities in the analysis.

Both antennas of the HbHo Sibling telescope are connected to the same **frequency maser**.
In addition, **station positions** can be combined, the measurement of the **local tie** can be used, and the information about common delays through an almost identical **atmosphere** can be introduced in to the processing (Figure 2).

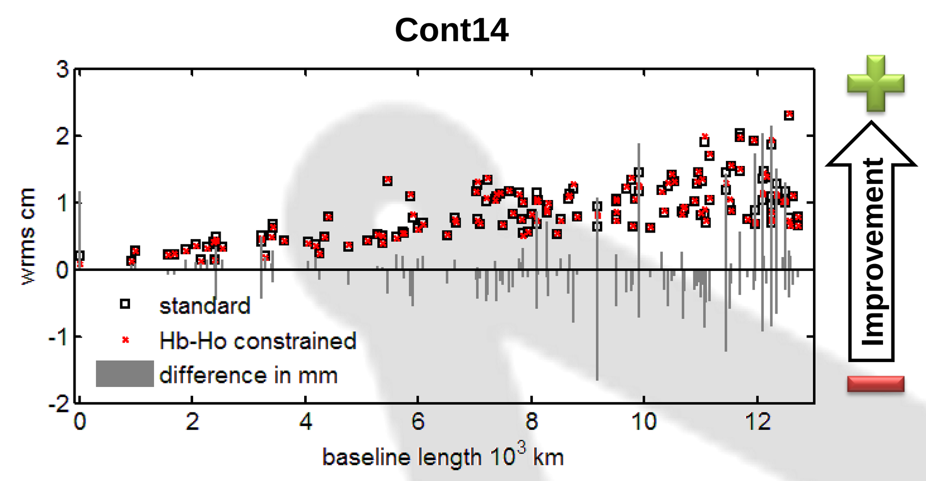

Figure 3: Differences in baseline length repeatabilites when analysing the Cont14 data with constraints of 1mm between the Hb and Ho stations.

We enabled the option of connecting co-located stations in the analysis with the Vienna VLBI Software (VieVS). This was realised by adding pseudo observations to the design matrix.
Analysing the Cont14 dataset we find some clear improvements for longer baselines but generally slightly worse wrms in baseline lengths (Figure 3).

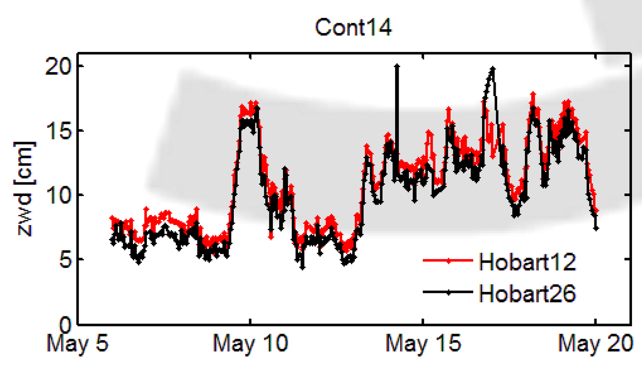

Figure 4: The comparison of zenith wet delays during Cont14 shows good agreement between the two antennas at Hobart.

The analysed data further shows good agreement between the estimated zenith wet delays at Ho and Hb (Figure 4).
We will investigate how this redundant information can be used best to improve the analysis, i.e. as additional constraints for the troposphere or for station heights.

Local Tie?

The analysis of common Hb-Ho sessions reveals a wrms of 8 mm for the local baseline with possible systematics. The weighted mean is 5 mm offset from the surveyed local tie (Figure 1).

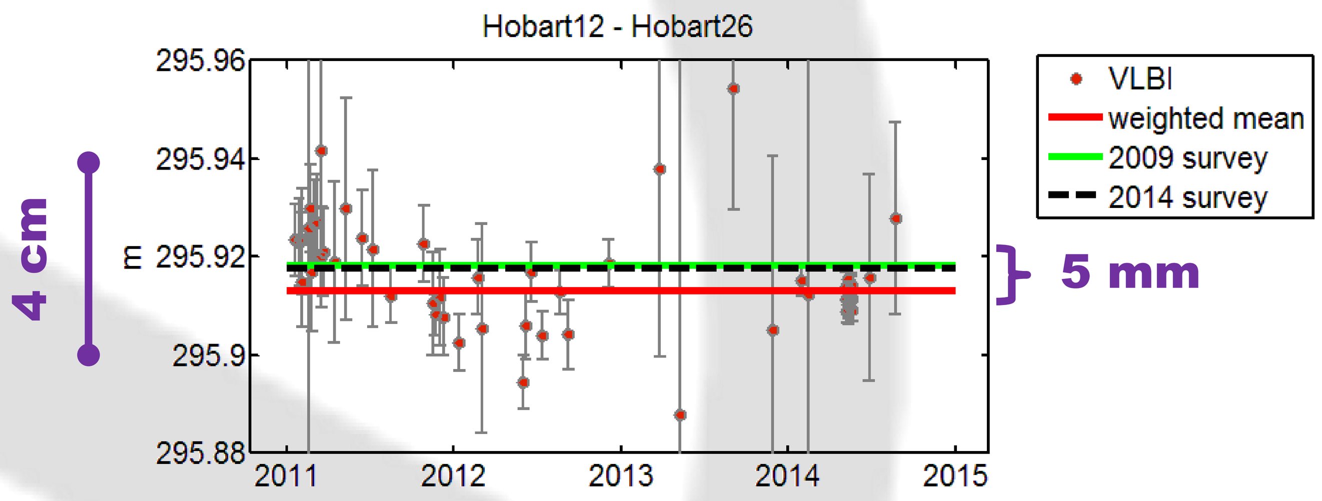

Figure 1: Session-wise estimated baseline length and formal uncertainty between Hobart12 (Hb) and Hobart26 (Ho).

Aust65

On November 29 2014, aust65 was performed with the antennas in Katherine (Ke), Yarragadee (Yg), Warkworth (Ww) and the sibling telescope in Hobart, Hobart12 (Hb) and Hobart26 (Ho). Hereby, Hb and Ho did redundant observations, i.e. they observed the identical sources at identical epochs.

SCHEDULING

To realise identical observations, the sensitivity in terms of antenna target SEFD of the large 26m dish was set to the lower values of the 12m antenna. Without the need to adjust the slew speeds or schedule one antenna as tag-along, we got 456 common observations. In total, Hb had 463 scheduled observations and Ho 458, using the Austral observing mode with 1Gbps recording.

ANALYSIS

After correlation (at Curtin University) we ran fourfit and created a database. Using NμSolve, the ionospheric correction was added to the level 4 NGS-card files. The subsequent analysis was done with VieVS, showing different results with changing analysis options (Figure 6). Especially the HbHo baseline is very noisy and we are working on further improvements.

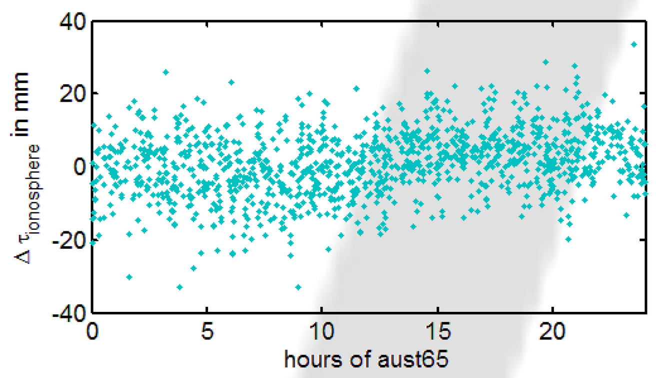

Figure 5: Differences in the ionospheric delay for reduntant observations of the Hb ant Ho antennas.

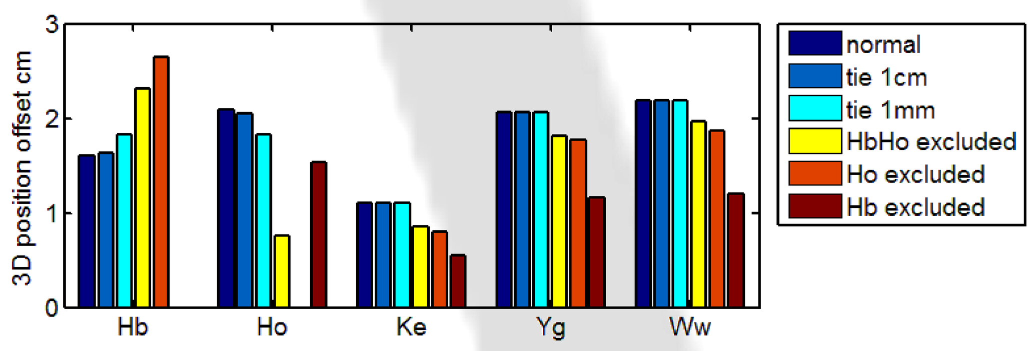

Figure 6: Estimated 3D station position offsets in aust65 using different analysis options.

NEXT STEPS

A first test in deselecting some bad channels has not improved the quality of observations for the HbHo baseline yet. More work needs to be done here.
The next step will be to improve the ionospheric solution, to be identical for both antennas (Figure 5).

Outlook

The Hobart26 antenna was added to the regular AUSTRAL sessions once a month in 2015.
A continuation of regular sessions on the HbHo baselines may help to understand the possbile periodic signal in the present time series.

In the project *Sibling Telescopes* *(funded by the Austrian Science Fund)* **we will further investigate**
- *optimal scheduling strategies for sibling telescopes*
- *improved analysis methods (e.g. phase delay solution) and*
- *the local tie measured with VLBI.*

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AuScope
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