

VERA UM

October 3-4, 2016, Mitaka

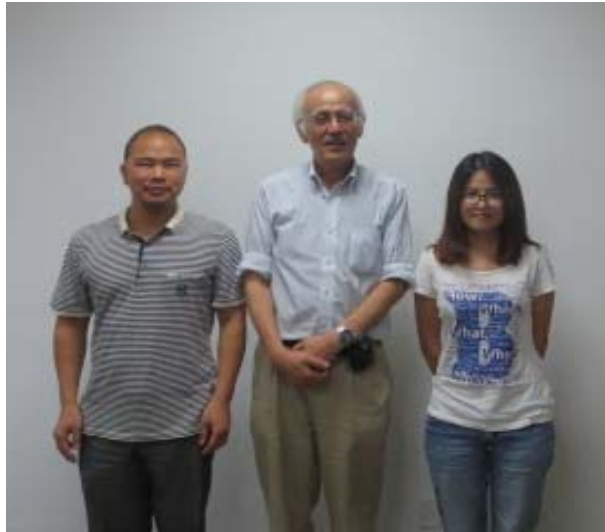
Tropospheric Delay and Loss correction by Water Vapor Radiometer

N. Kawaguchi

Visiting Professor of

Shanghai Astronomical Observatory

Thanks for our observations



VLBI observation of the M 81 core with the CVN in X-band and the Pseudo-Closure Analysis

Noriyuki KAWAGUCHI^{1,2,*}, Wu JIANG^{1,3,4} and Zhi-Qiang SHEN^{1,3}

¹Shanghai Astronomical Observatory, Chinese Academy of Sciences, 80 Nandan Road, Shanghai 200030, China

²National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan

³Key Laboratory of Radio Astronomy, Chinese Academy of Sciences, Shanghai 200030, China

⁴University of Chinese Academy of Sciences, Beijing 100049, China

CVN observation was published (2015.12)
KaVA data are being analyzed.

VLBI observations of a flared optical quasar CGRaBS J0809+5341

Tao AN^{1,2,3}, Yu-Zhu CUI^{1,2}, Zsolt PARAGI⁴, Sándor FREY⁵, Leonid I. GURVITS^{4,6} and Krisztina É. GABÁNYI^{5,7}

¹Shanghai Astronomical Observatory, Chinese Academy of Sciences, 200030 Shanghai, China

²School of Electrical and Electronic Engineering, Shanghai Institute of Technology, 201418, Shanghai, China

³Key Laboratory of Radio Astronomy, Chinese Academy of Sciences, 210008 Nanjing, China

⁴Joint Institute for VLBI ERIC, Postbus 2, 7990 AA Dwingeloo, the Netherlands

⁵FÖMI Satellite Geodetic Observatory, PO Box 585, H-1592 Budapest, Hungary

⁶Department of Astrodynamics and Space Missions, Delft University of Technology, Kluyvenweg 1, 2629 HS Delft, the Netherlands

⁷Konkoly Observatory, MTA Research Centre for Astronomy and Earth Sciences, PO Box 67, H-1525 Budapest, Hungary

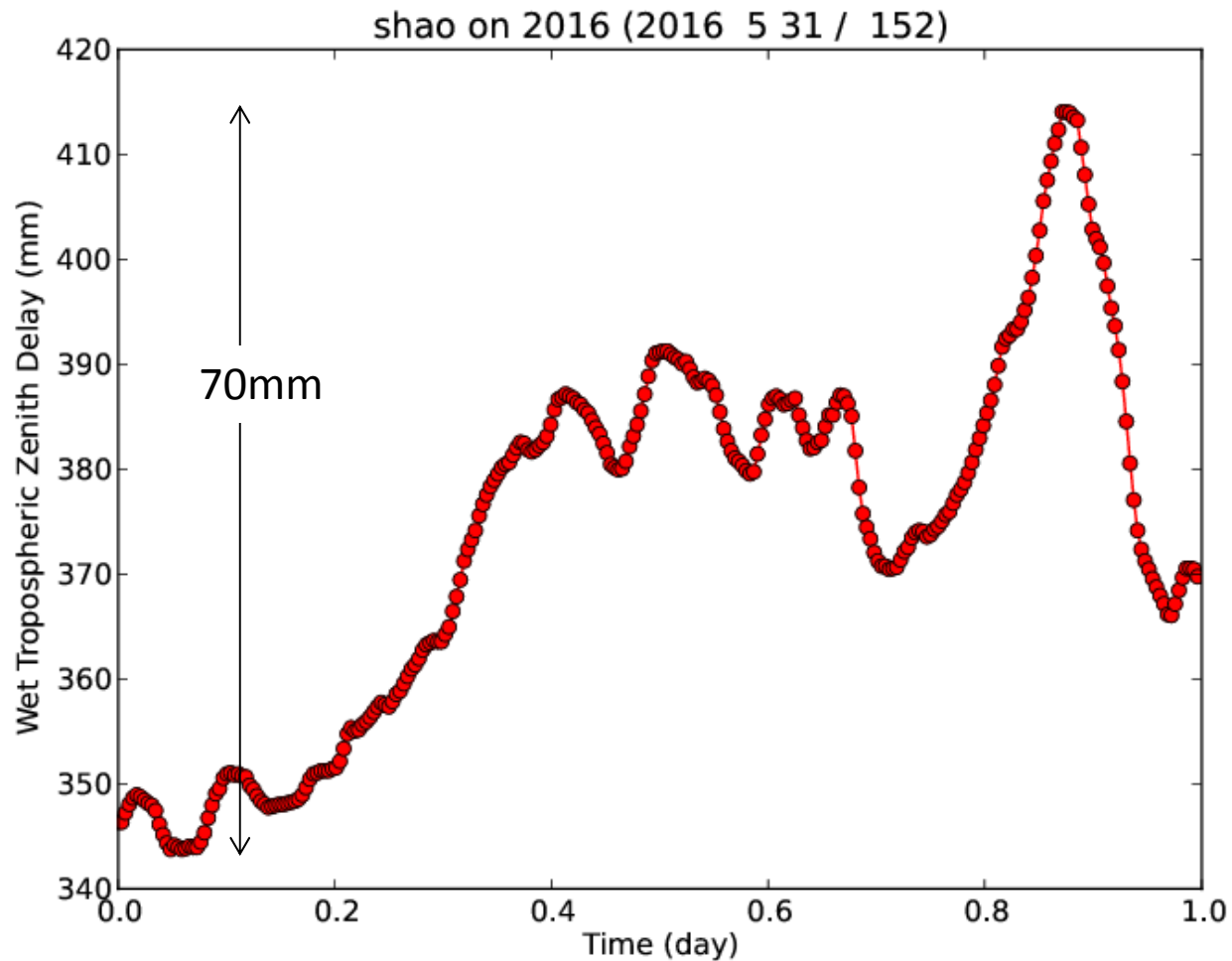
Published in the last week!

Wet delay correction Tools

Method	Time Scale	Remarks
GPS	300 seconds	Available all around the world (328 stations are registered.) Limited to the zenith direction Delay only
Ray Trace	3 hours	Available all around the world (241 stations are registered.) Omnidirectional Delay (and absorption)
Water Vapor Radiometer	10 seconds	No VLBI/WVR stations in Japan Omnidirectional Delay and Absorption Phase compensation

GPS EPL in Shanghai

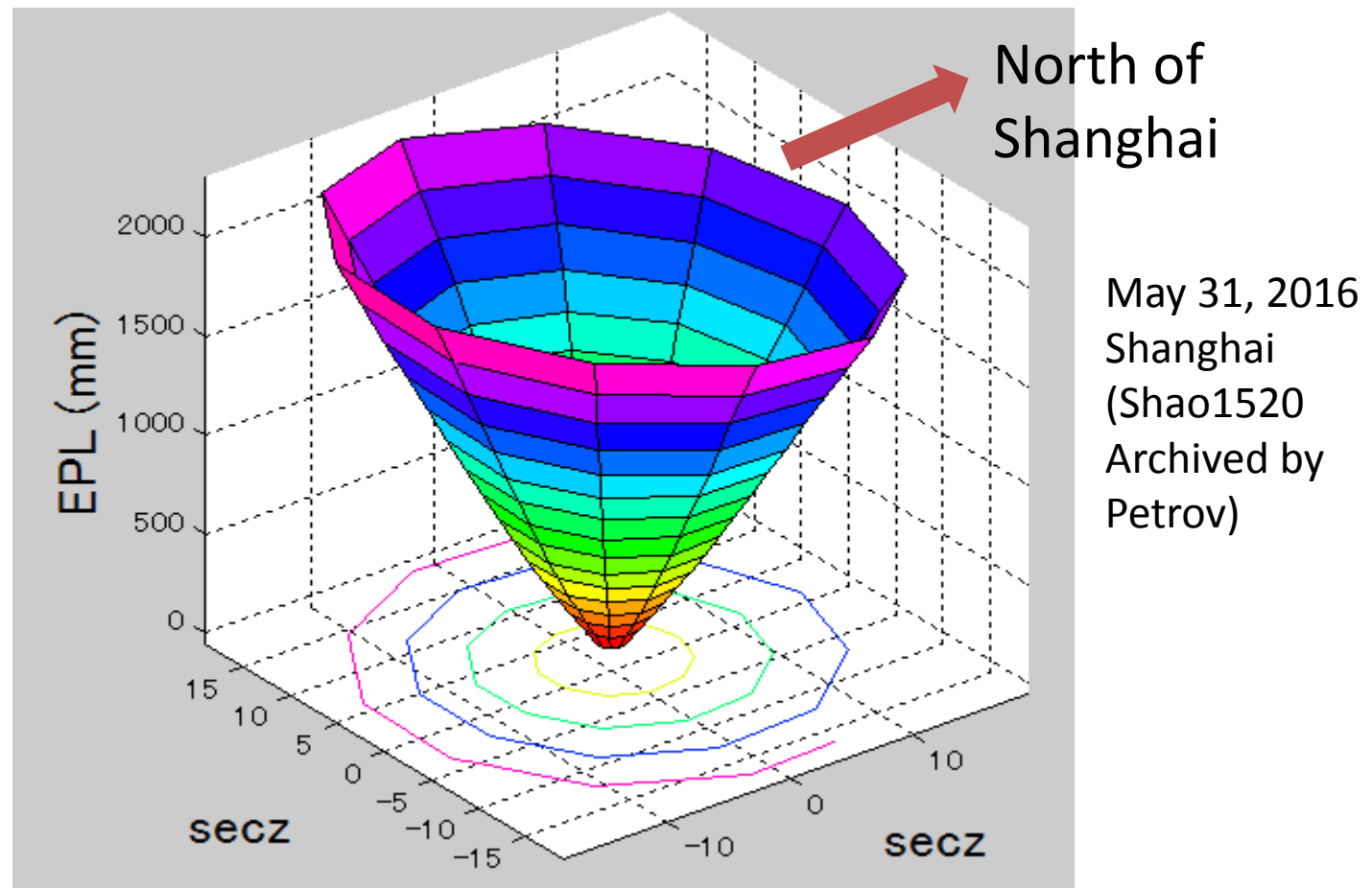
A 70-mm change of excess path was observed on May 31, 2016.



By Bo Zhang

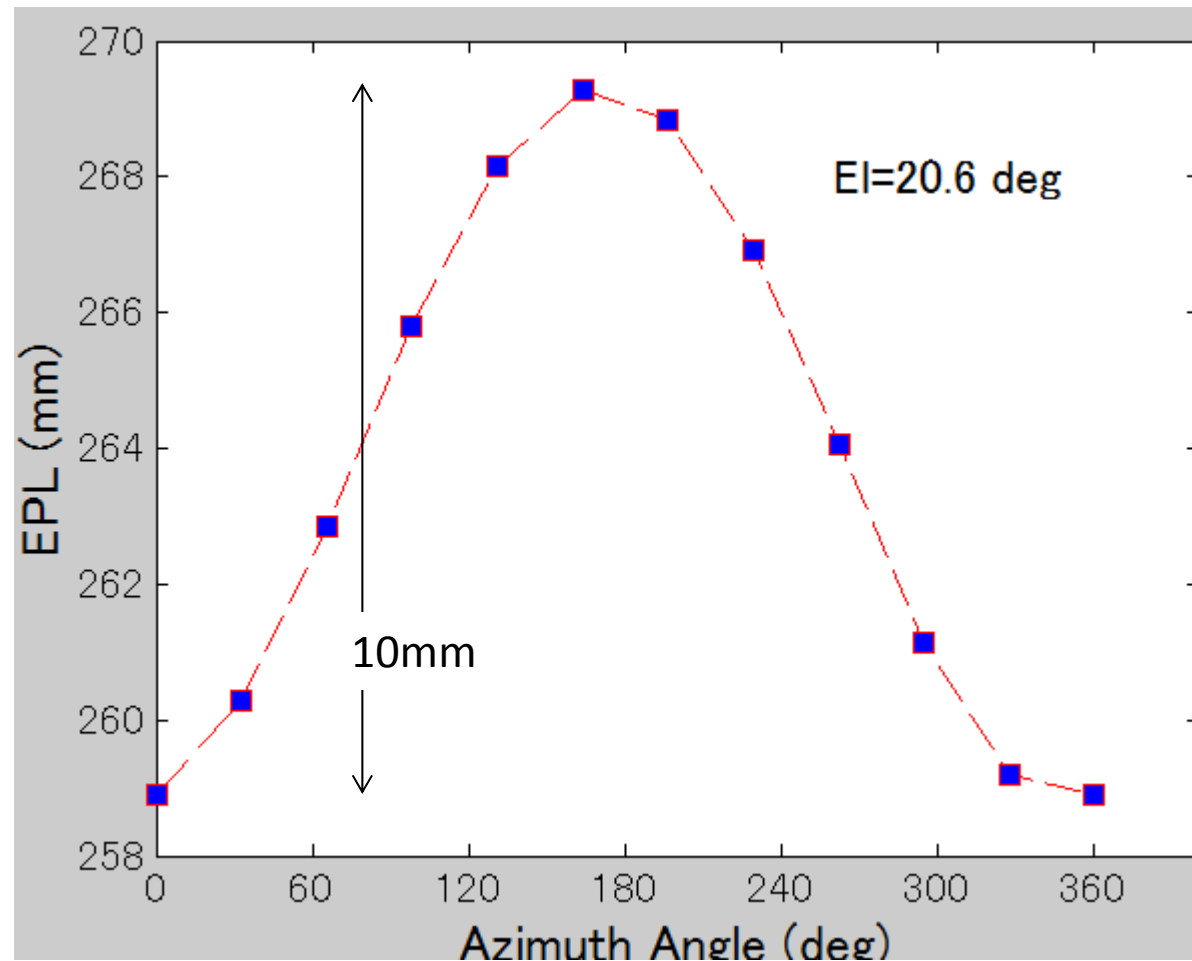
Azimuth Dependence by Ray Trace

A 10-mm azimuth dependence was observed at 20-degree elevation.



Azimuth Dependence at $El \approx 20$ deg

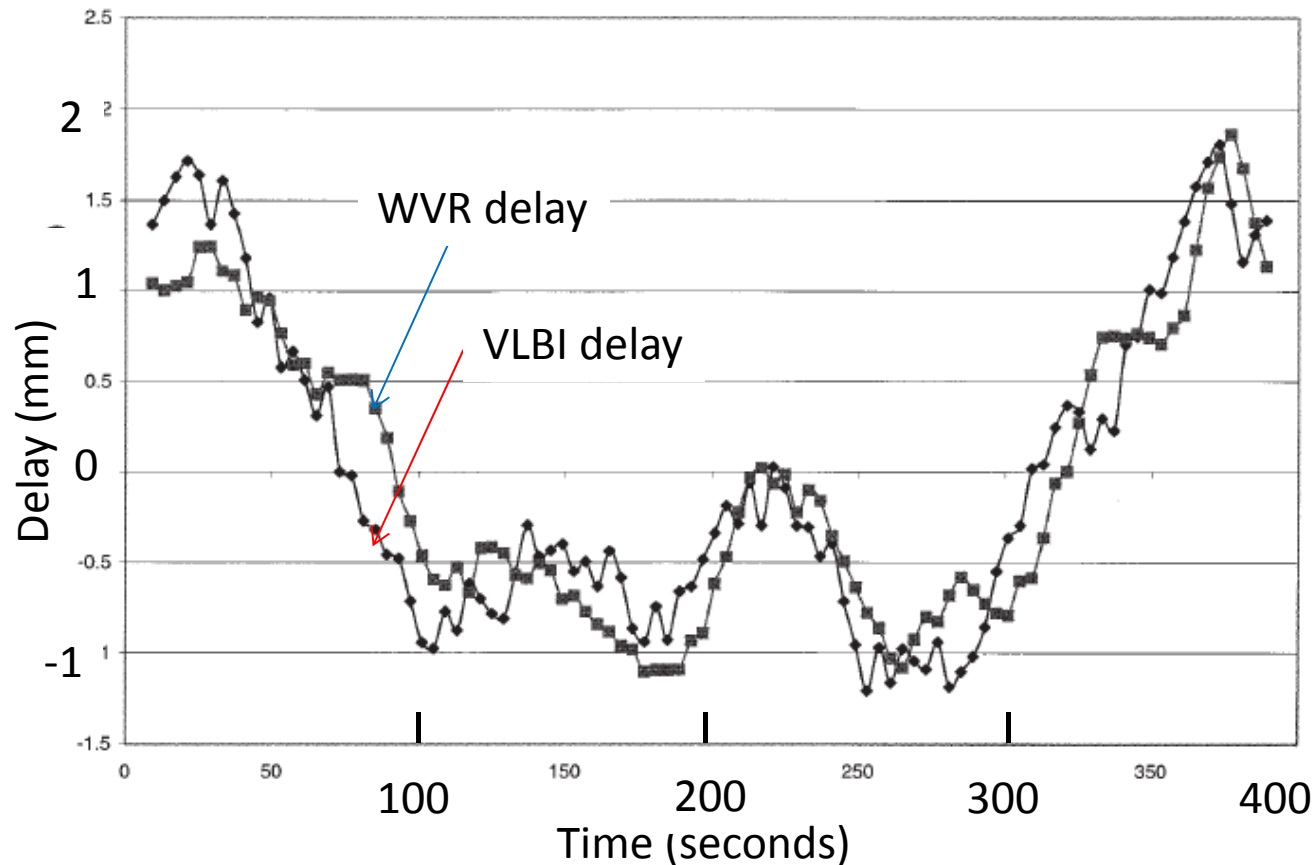
The 10mm change is disregarded in geodetic measurement by VLBI in which the zenith delay is corrected by GPS zenith delay.



Sub mm phase tracking by WVR

A WVR is possible to trace changes of excess path delay with an accuracy better than 1 mm.

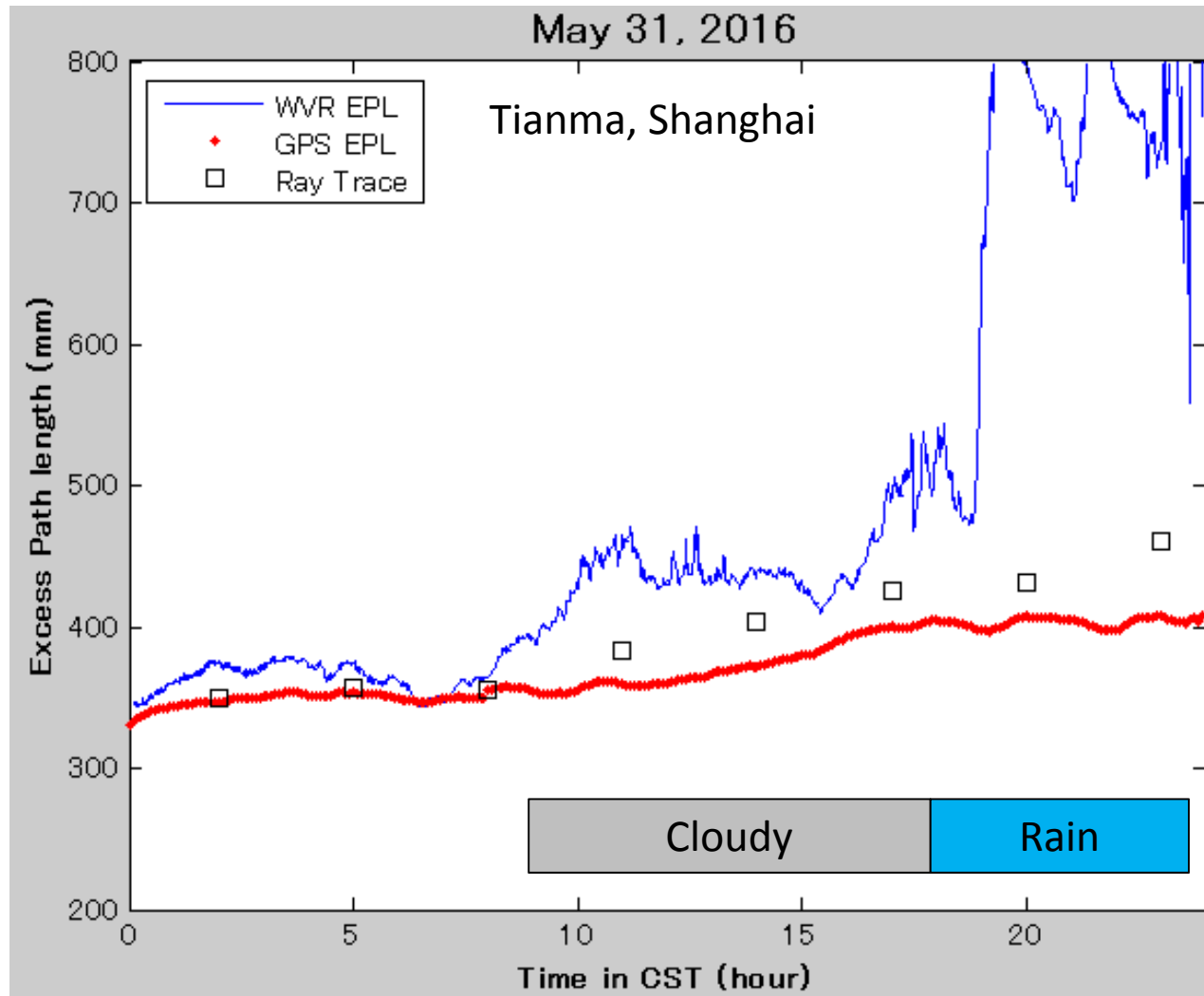
Tahmoush and Rogers_2000



WVR in SHAO

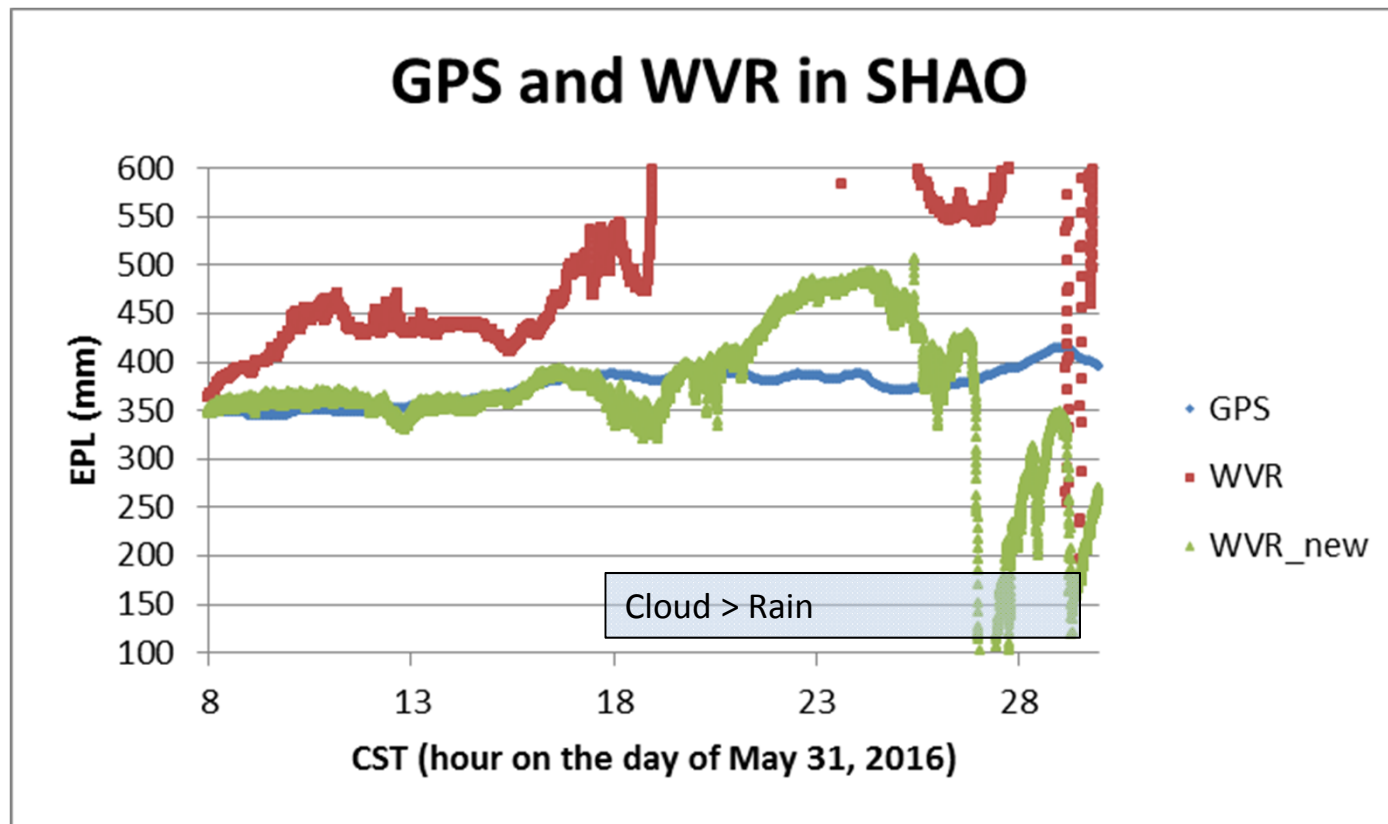


GPS, Ray-trace and WVR delay



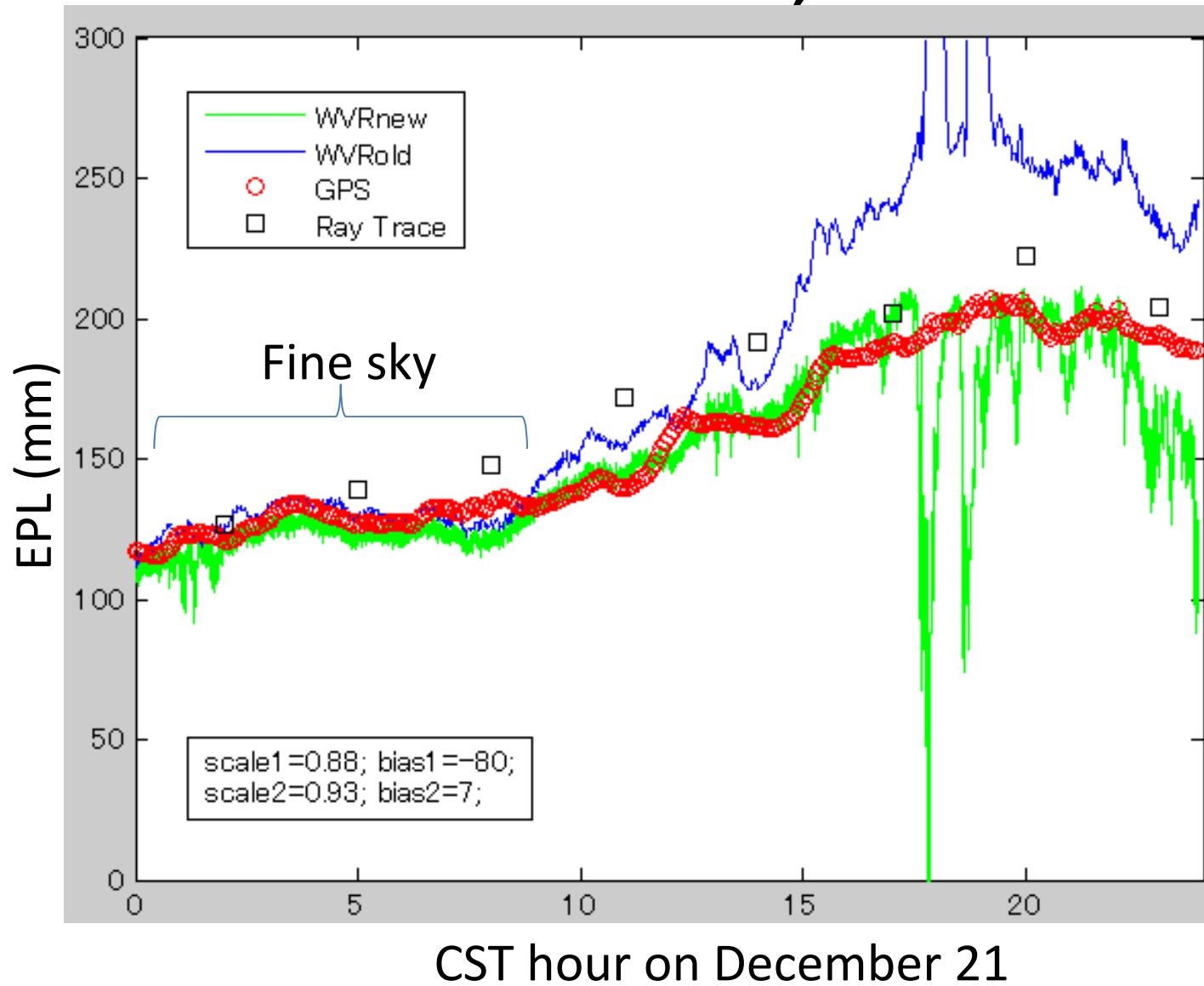
EPL measured on differential Tb

$$EPL(mm) = 7.94 \times \Delta T_b(K)$$



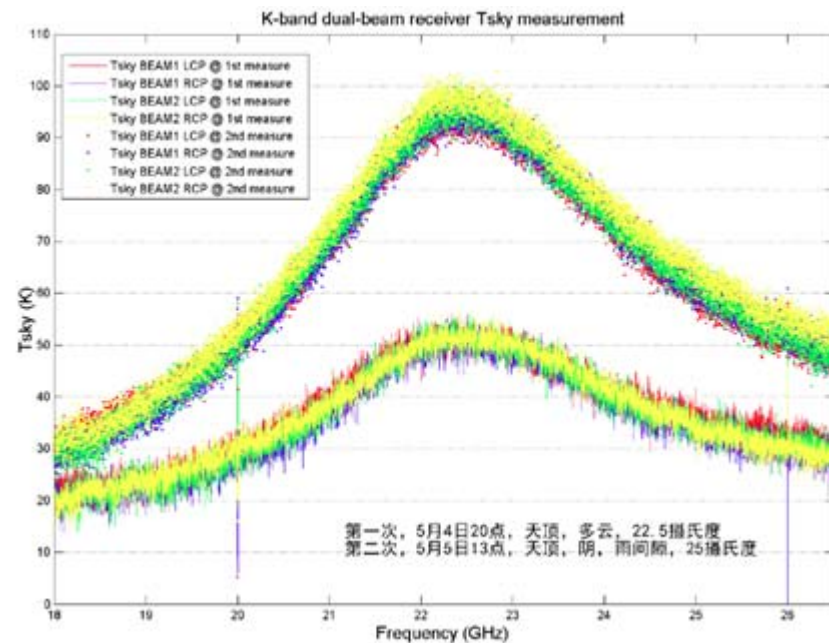
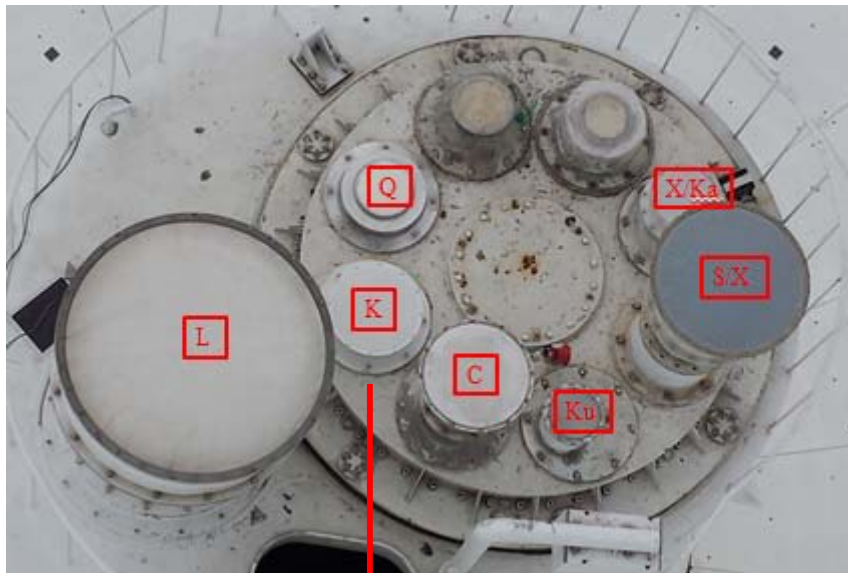
EXCEL: GPS_WVR_sheet1

December 22, 2015



A new receiver on Tianma 65m

We can clearly see the water vapor resonance on a signal received by new receiver.



By Li Bing

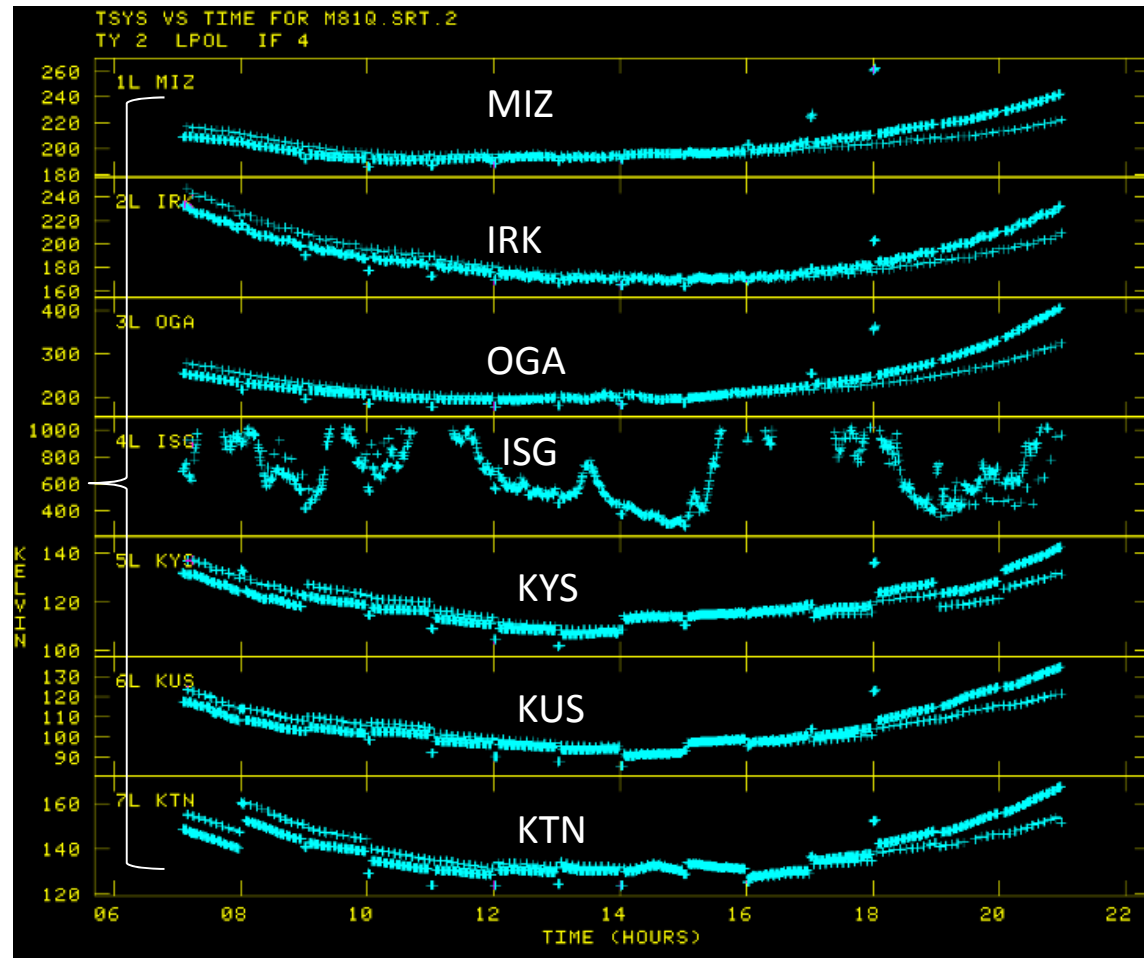
Absorption Correction

- SecZ method is introduced to VERA
 - At a start and an end of an observation
 - Note on the difference between KVN and VERA.
- T_{sys}^*
 - At every scans
 - A hot load is the reference.

Troubles in Hot Load Calibration ?

KaVA open-use observation on M81 (Kawaguchi, Jiang and Shen)

System
Noise
Temperature



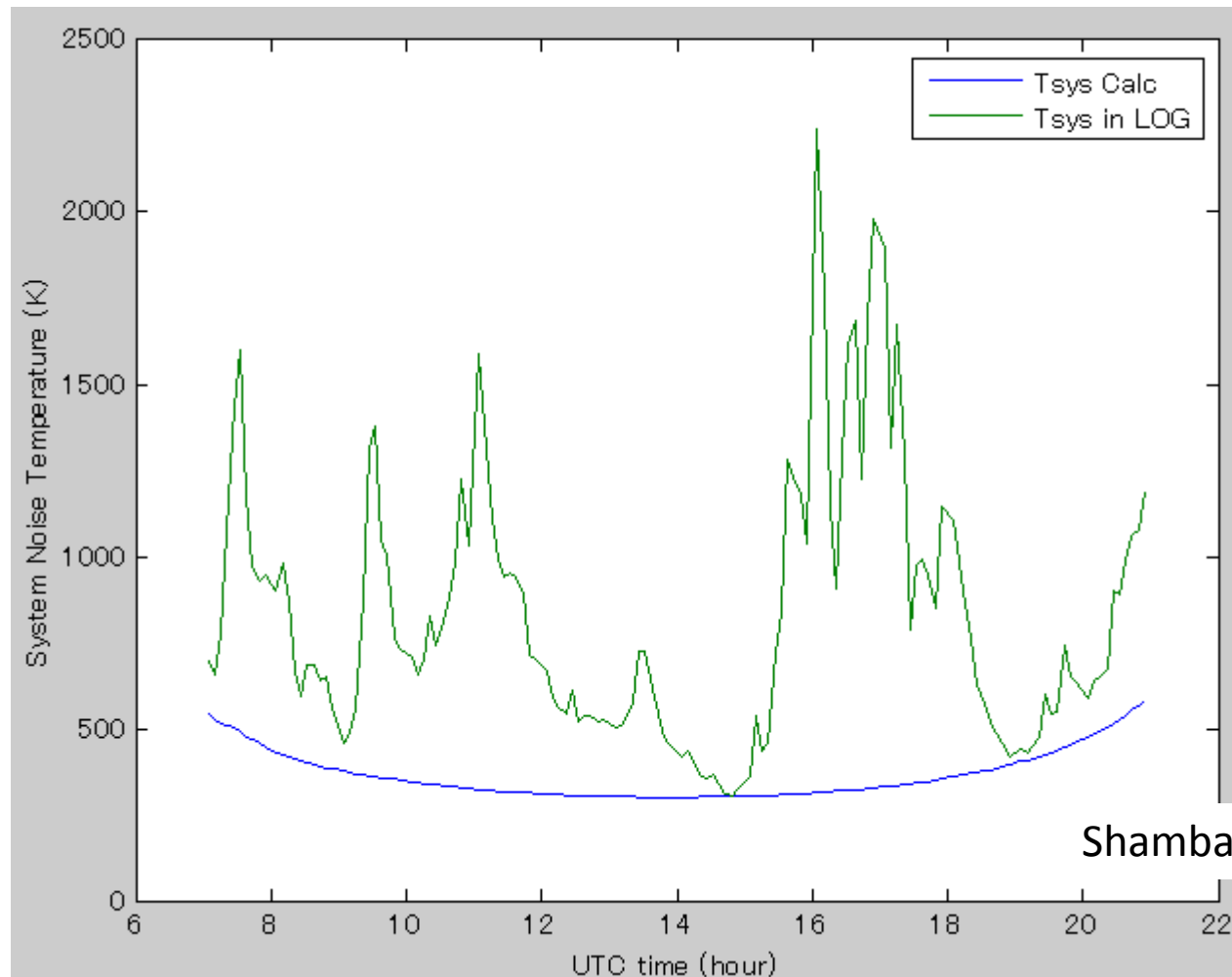
Tsys record
on 43GHz

Ishigaki

Step
changes

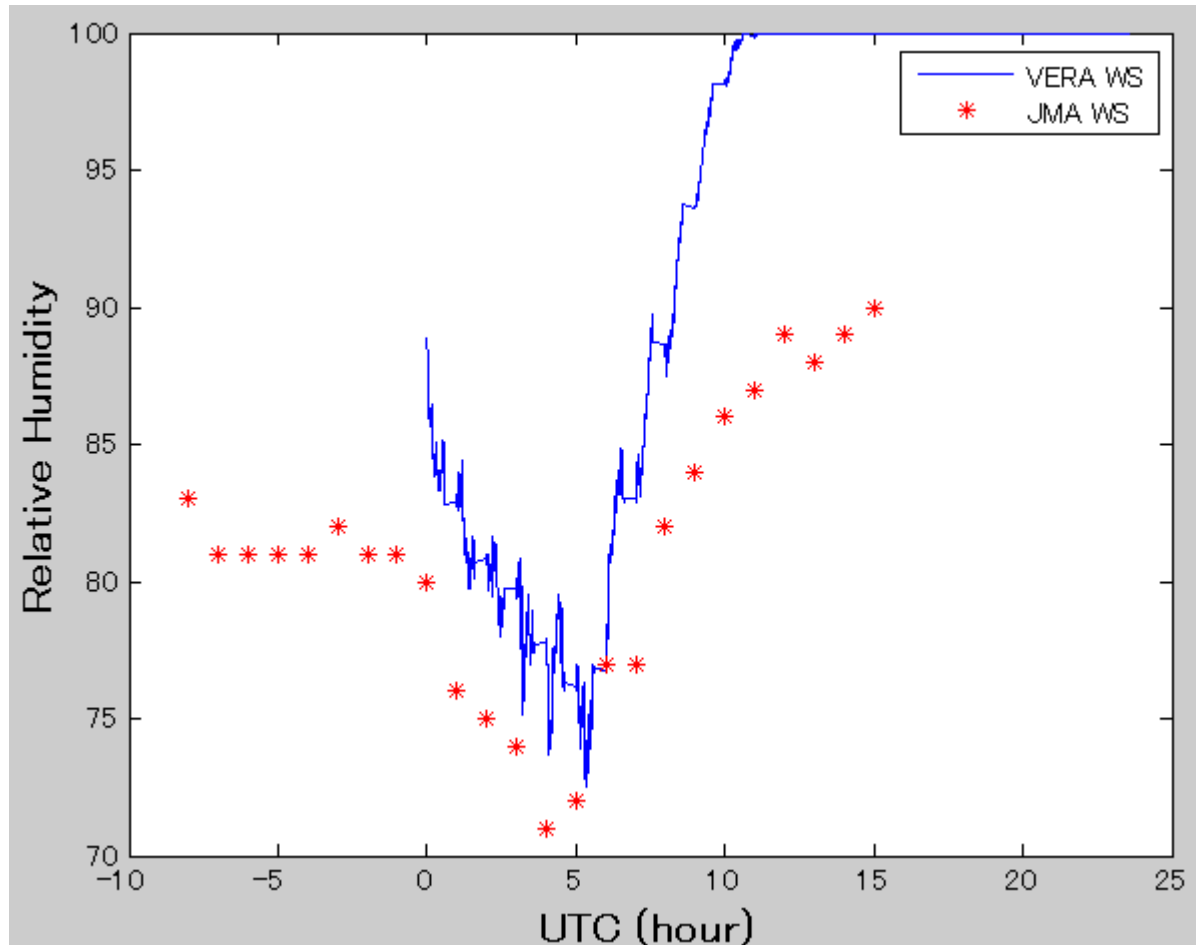
Tsys* calculation by WX data for ISG

Ishigaki Tsys data on 2015/080 in LOG and CALC



Is humidity of ISG OK?

2015056.WS.ISG (KaVA Open-Use for YuZhu Cui)



Concluding Remarks

- SHAO WVR works well only at a fine weather, no cloud and no rain.
- A water vapor spectrometer shall be an important radiometer in future.
 - Phase compensation (VERA/KVN/CVN compatibility)
 - Absorption correction (no secZ)
- Ground weather data is useful to recover troubles on hot load calibration.
 - VERA humidity data reliable?