

About the Collocation of Water Vapour Radiometers, Solar Spectrometer, Radiosondes at the Fundamental Station

Wetzell

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Motivation

- The water vapour in the atmosphere contributes significantly to the tropospheric refraction. Geodetic observations, in particular observations in the microwave domain as GPS and VLBI are suffering from the inhomogeneous distribution.
- Even if the analysis models care for the influence, it seems still to be of interest to observe independently the water vapour and its influence to the observations with Water Vapour Radiometers and other devices.
- Collocation Experiment
 - Gain experience with WVR (precision, system. errors)
 - Preparation for contribution to CONT05, collocation selected IVS network stations)

Experiment at the FSW



- Period April 4 to 22, 2005
 - Core period April 13- 20
- Collocation of
 - 3 WVR ETH type
 - BKG and ETH
 - 2 WVR Radiometrics
 - BKG/Univ. Dresden
 - Univ. FAF
 - 1 Solar Spectrometer
 - ETH
 - Balloon Radiosondes
 - BKG/ETH



Water Vapour Radiometer



Water Vapour Radiometers

- 2 Radiometrics
 - Univ. FAF
 - Univ. Dresden/BKG
- 3 ETH-type WVR
 - ETH
 - BKG

Operation in April 2005

1 Radiometrics reliable
(3mm)

1 Radiometrics failed

1 ETH system o.k (6mm)

2 ETH instable

Solar Spectrometer “GEMOSS”



- GEMOSS: Prototype of a “GEodetic MOBILE Solar Spectrometer”
- Developed at the ETH by Alexander Somieski
- Based on “Differential Optical Absorption Spectroscopy”
- Simultaneous observation of H₂O adsorption lines between 728 and 915 nm

Balloon Radiosondes



- Temperature-, humidity-, pressure profiles
- Periods from April 11 to 20 at 12:00 and 24:00 UTC
- Some profile observations were successful, some were not continuous, even some failed

Geodetic Space Techniques

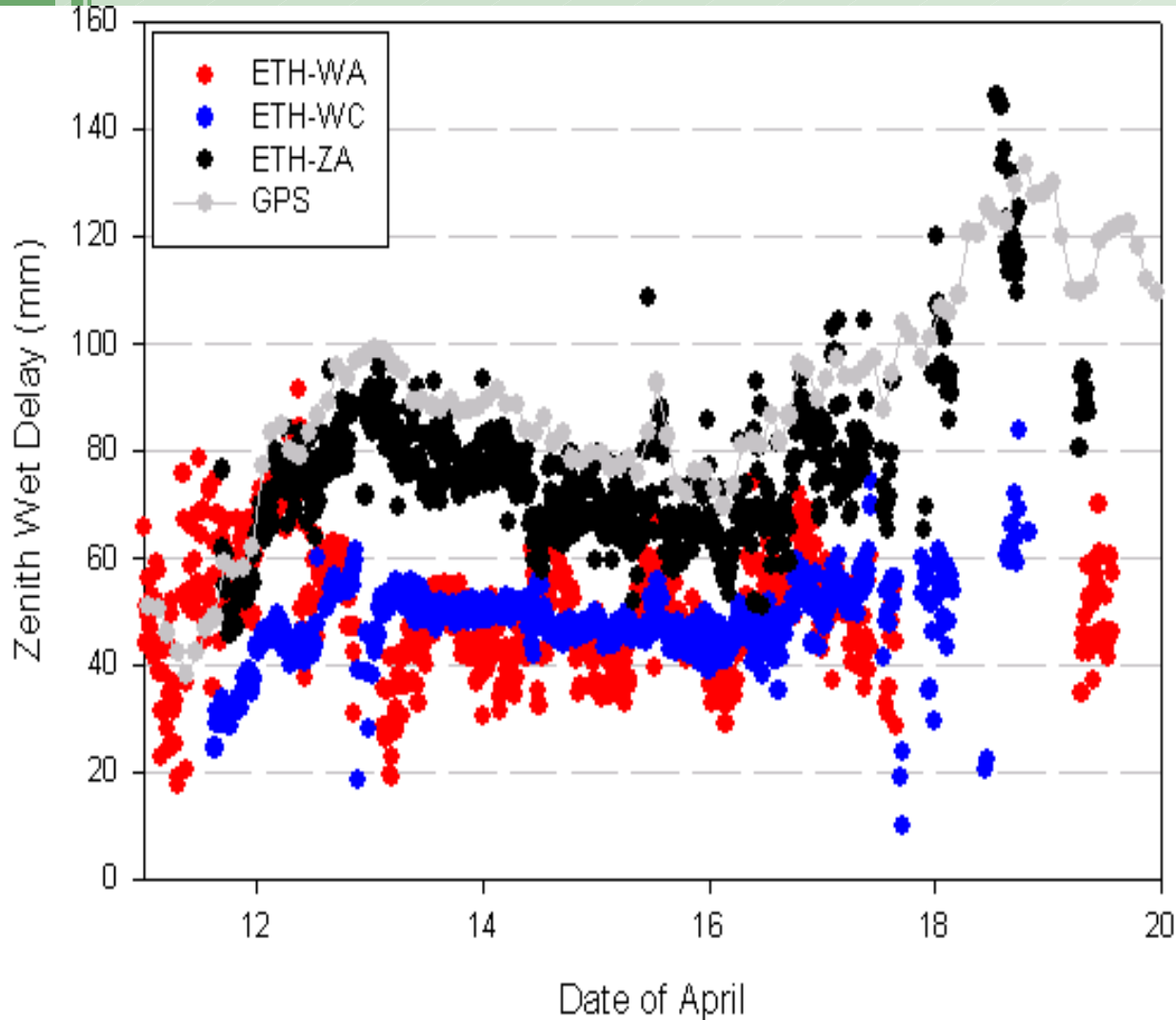


- Geodetic VLBI
 - IVS observing program
IVS R1 and R4
 - Regular observations 24h
- GPS
 - IGS, EUREF
GREF
 - Continuous observations

Internal Workshop

- Internal Workshop at the Univ. FAF at July 26, 2005
 - Participants:
 - Univ. BW: Hans Heister, Petra Häfele
 - ETH: Beat Bürki
 - FS-W: Wolfgang Schlüter, Walter Schwarz, Stefan Riepl, Jungho Cho (Guest, Korea Astronomy and Space Science Institute)
 - MPIfR: Alan Roy, Helge Rottmann, Ute Teuber
 - IRAM: Michael Bremer
 - HartRAO: Ludwig Combrinck, Attie Combrinck
 - Discussion of the observations
 - Comparison of the Results
 - GPS-Results from GFZ-Solution
 - VLBI- IVS Solution from Vienna
 - Discussion how to support CONT 05 at Hartebesthoeck

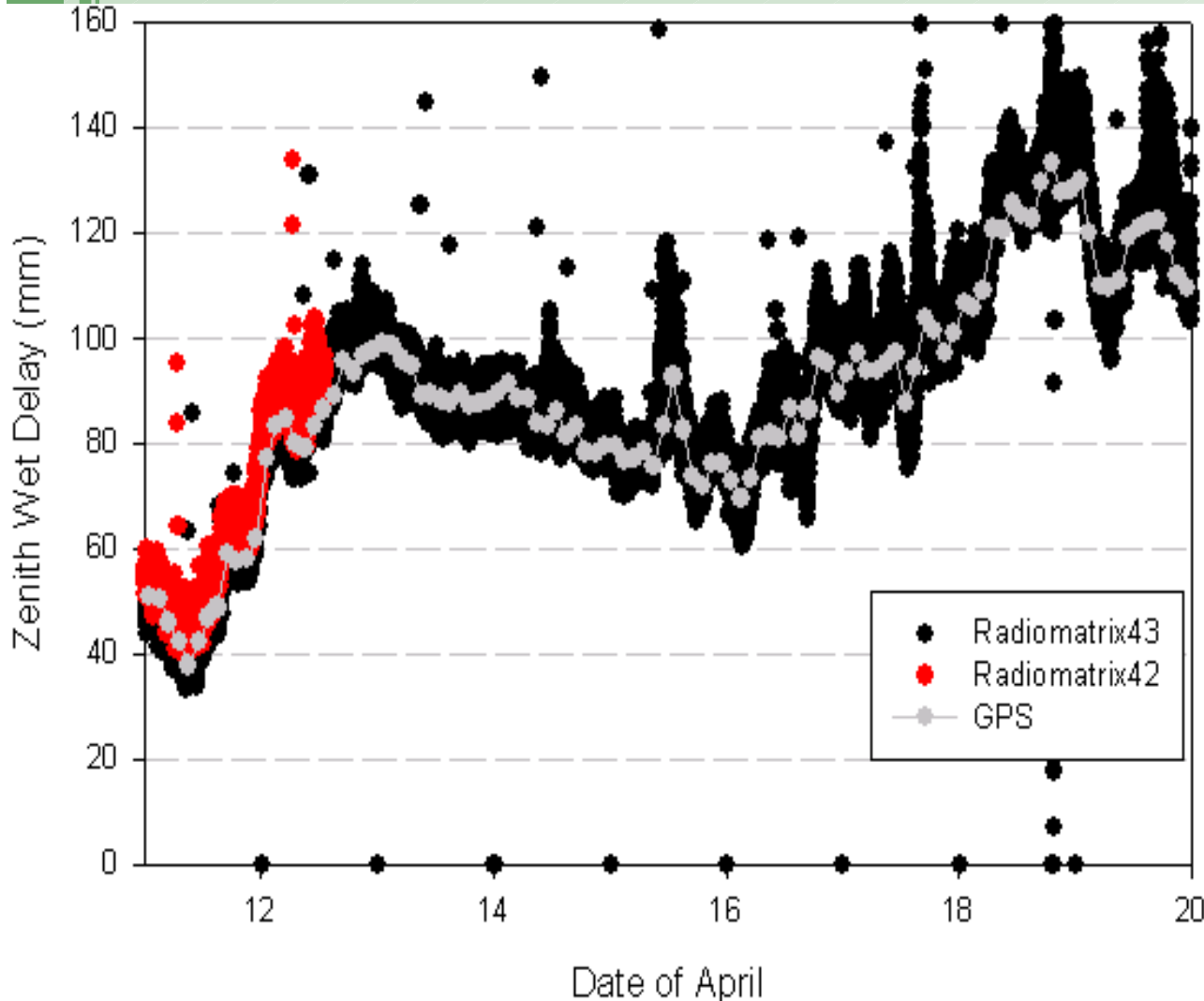
Comparison of ZWD from GPS and ETH-type-VWR



ETH WVR:

- RMS: ~ 6-8 mm
- Resolution ~6min
- Different offsets: ~1-4 cm
- failures

Comparison of ZWD from GPS and Radiometrics WVR



Radiometrics:

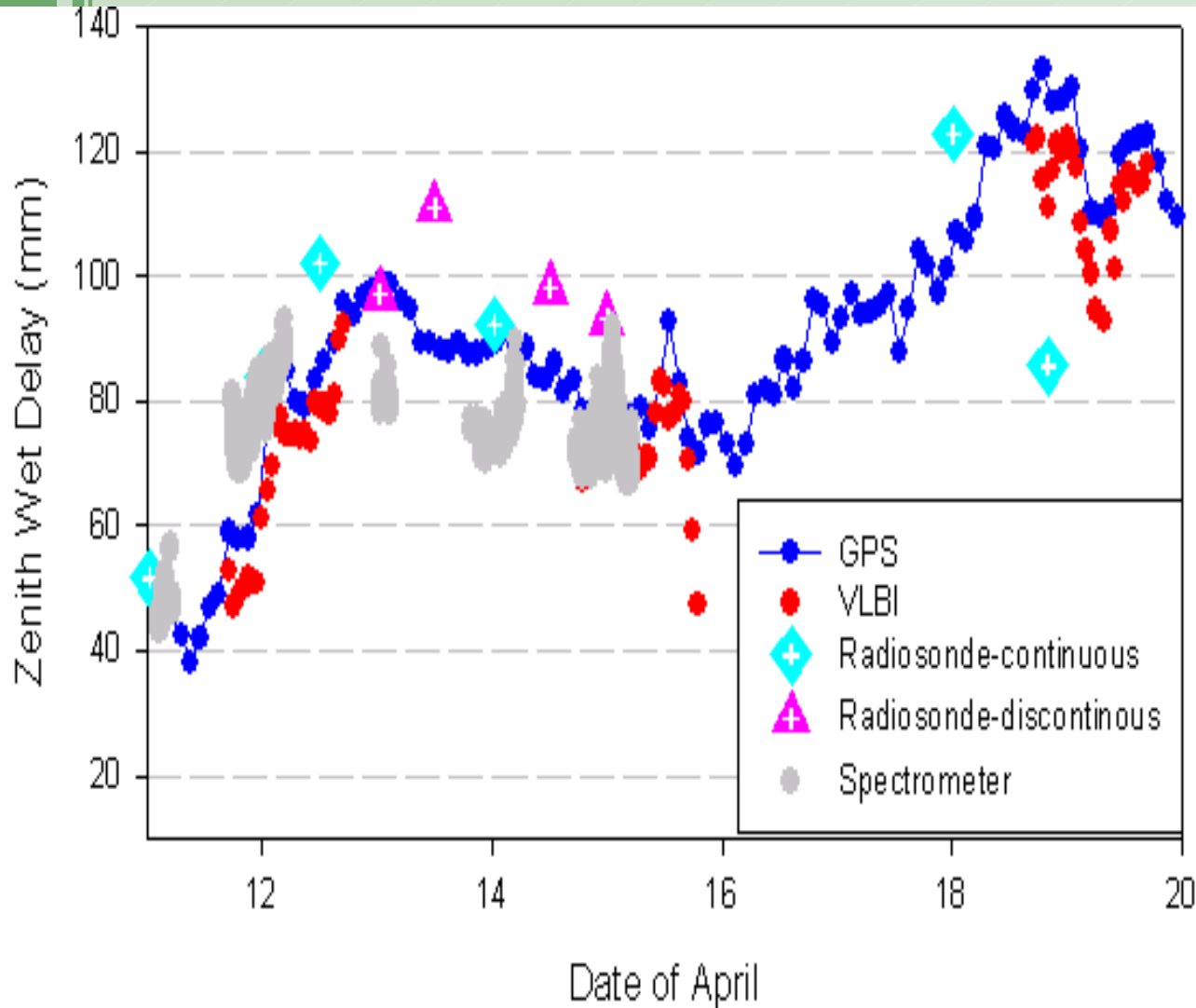
- RMS: ~3-4mm
- Resolution 5min

- R42 Azimuth drive failed
- Offset between R43 and R42

~ a few mm

- Offset R43 to GPS: not really significant

Comparison of ZWD from GPS and VLBI and Radiosonde and Solar Spectrometer



GEMOSS

RMS a few mm

High resolution in time

Offset 1-2 cm

Radiosondes

Offsets 1cm to GPS

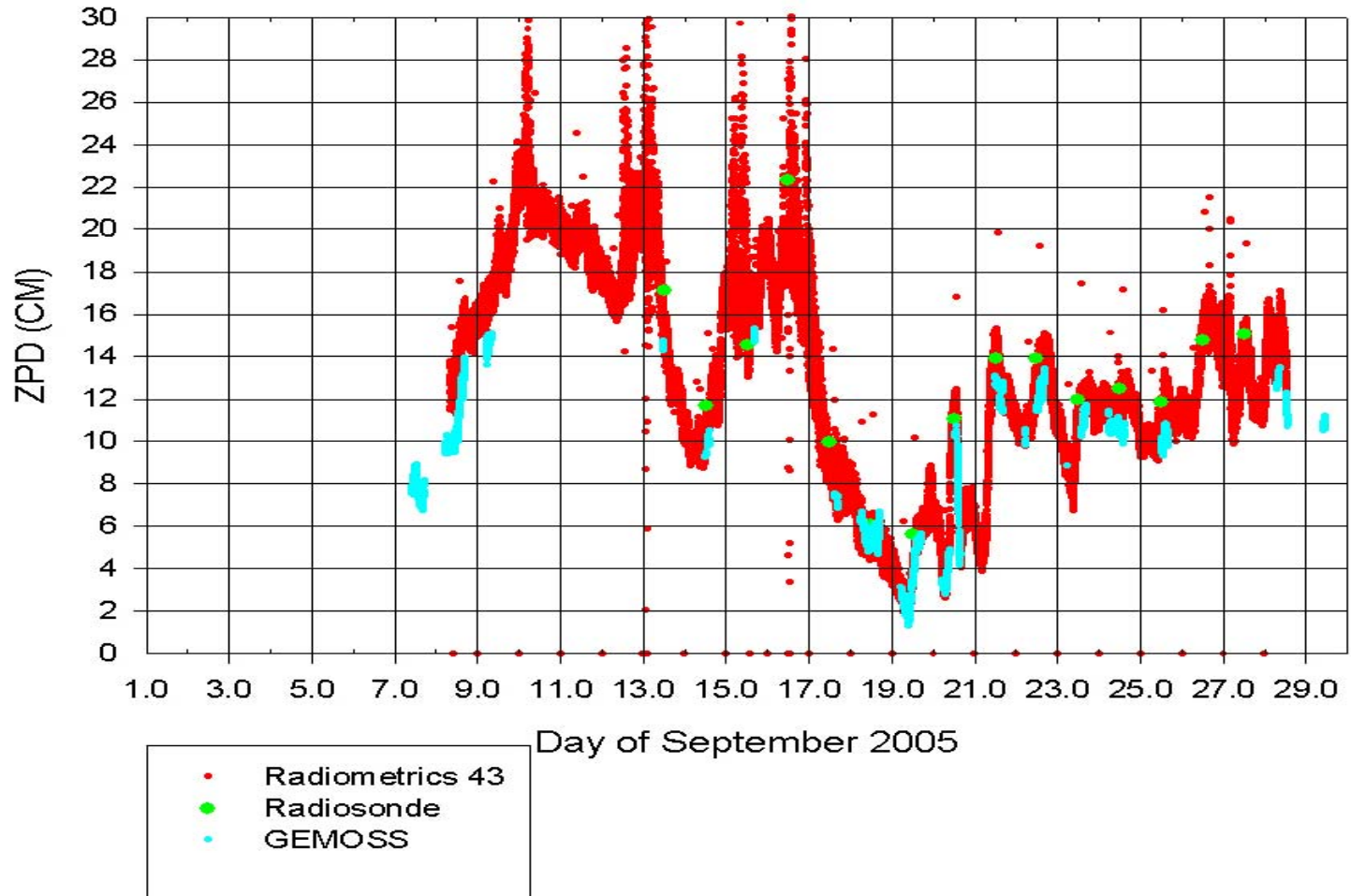
One value per launch

Conclusions

- Radiometrics, RMS $\sim 3-4\text{mm}$, small offset (significant?)
 - Best agreement with Radiosondes, GPS, etc.
- ETH type systems, RMS $\sim 6-8\text{mm}$
 - Systematic biases $\pm 1-2\text{cm}$ (ZA) between various techniques
 - WA and WC failed
- GEMOS bias of $\sim 1-2\text{ cm}$ vs. GPS, for calibration ?
- Support for CONT 05
 - for Wettzell R42, GEMOSS, Radiosondes
 - for Kokee Park R43
 - for Hartebesthoek
 - ETH type ZA + Radiosondes (+ETH type WC)

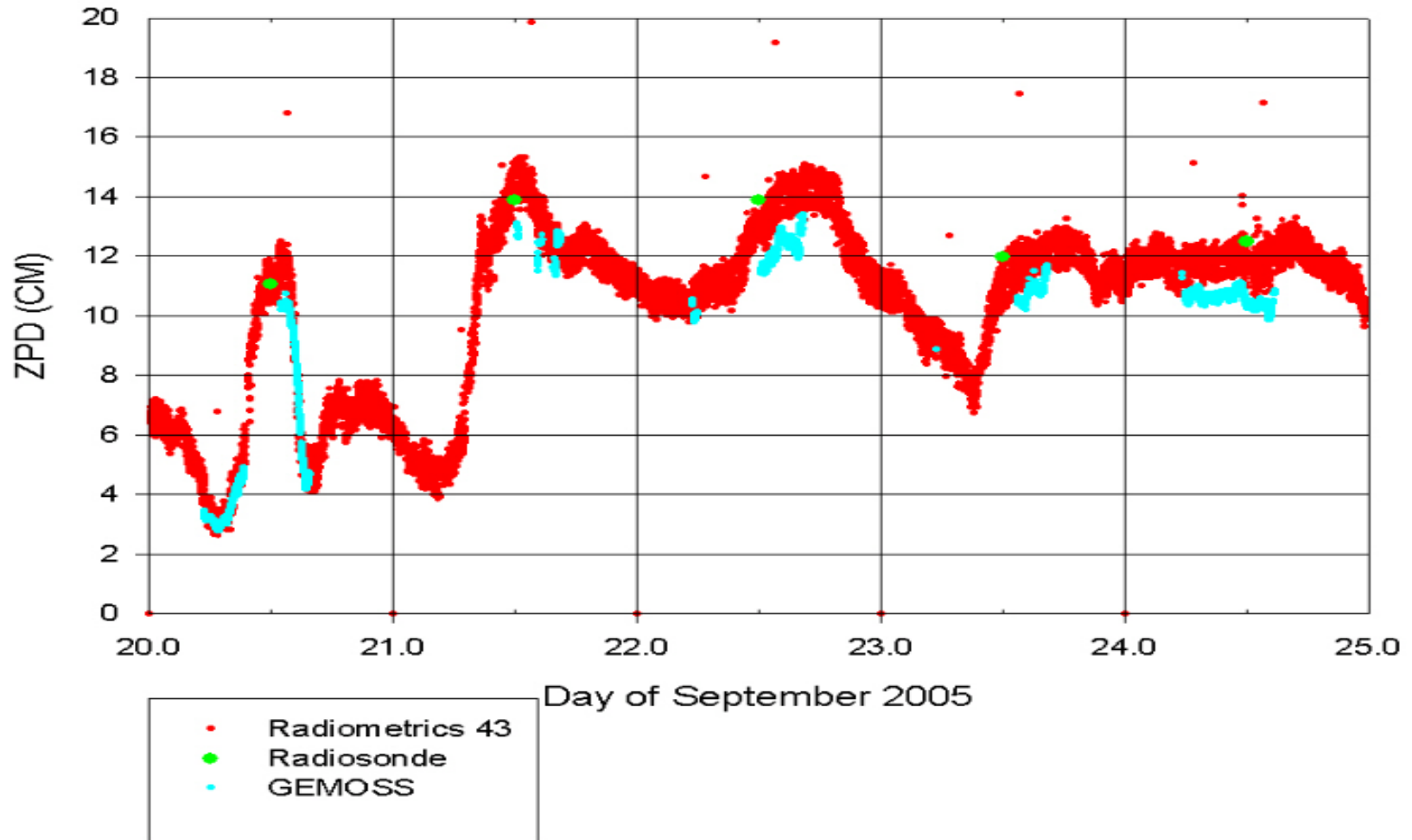
All techniques need more investigation for improvement, which is worth as they have higher timely resolution as VLBI and GPS!

CONT05: ZWD observations at FSW

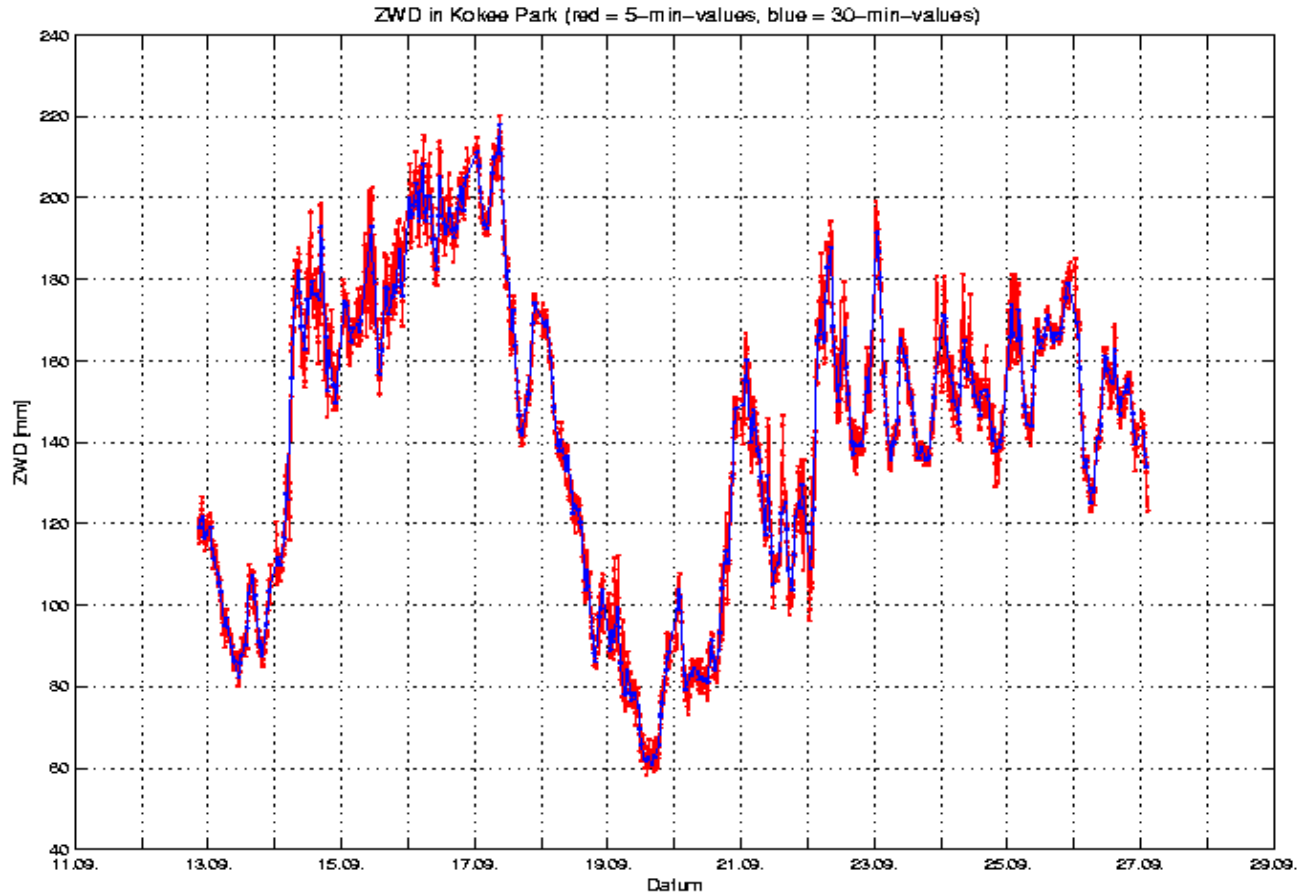


CONT05

CONT05



CONT05: WVR-Observation at Kokee Park



TWIN Telescope for Wettzell

- VLBI 2010
- Support from FS Wettzell
 - Two identical radio telescopes (12m)
 - For permanent operation in the frame of IVS
 - Realisation 2008-2011
- Implementation of VWRs?