

Name of research institute or organization:

**Institute of Geodesy, University of the Bundeswehr Munich,
Germany**

Title of project:

MATRAG – Modelling of Alpine Tropospheric Delay by Radiometers and GPS

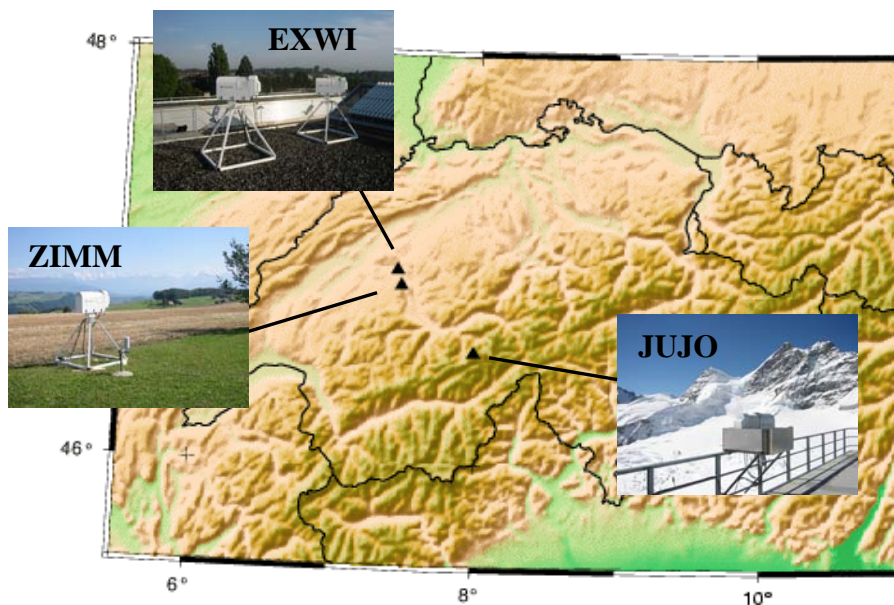
Project leader and team

Prof. Dr.-Ing. Matthias Becker, project leader
Petra Haefele

Project description:

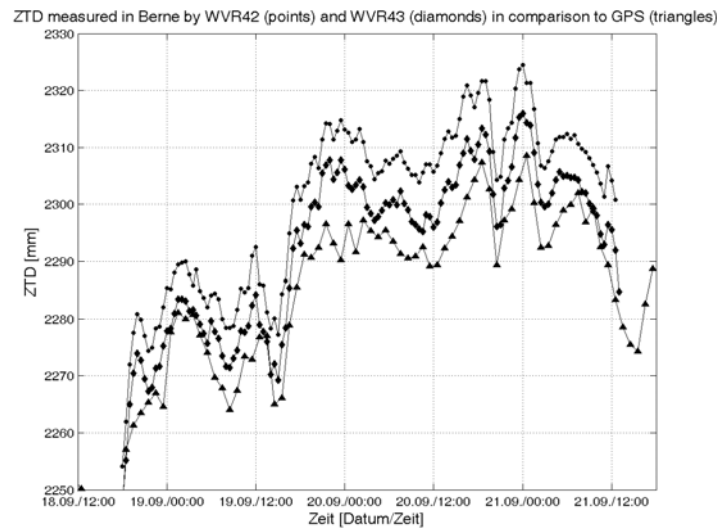
Tropospheric delay is one of the main error sources in precise GPS positioning nowadays. This limiting factor mainly deteriorates the height component, which still has a worse repeatability than the position coordinates. This may be due to the fact, that other error sources of the GPS signal are absorbed in the tropospheric parameters during GPS processing. The tropospheric delay can be separated into a hydrostatic and a wet component. The hydrostatic component in zenith direction is called ZHD (zenith hydrostatic delay) and can be precisely determined by surface pressure measurements. The ZWD (zenith wet delay), however, can not be sufficiently modelled by surface measurements due to the irregular distribution of water vapor in the atmosphere. Ground based Water Vapor Radiometers (WVR) represent an independent technique to measure the atmospheric integrated water vapor contents along a given line of sight as well as the integrated liquid water.

By means of measurements of the wet tropospheric delay with WVR's in the Alpine region, the height accuracy of GPS is to be estimated as well as systematic errors in the GPS signal. Within the project MATRAG, water vapor has been observed at the three permanent GPS stations Berne (EXWI), Jungfrauoch (JUJO) and Zimmerwald (ZIMM) of the Swiss GPS network AGNES with two Radiometrics WVR's in September 2003.

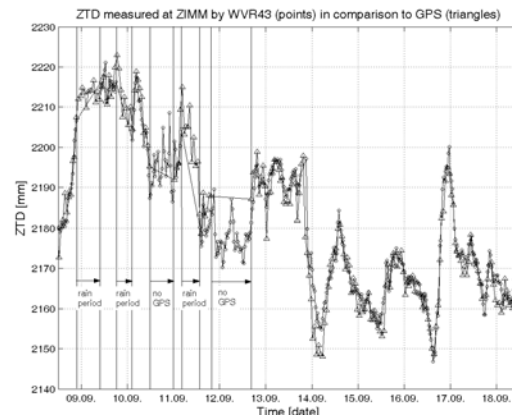
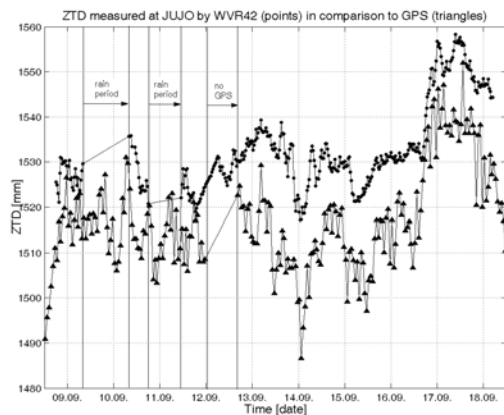


The GPS site at the HFSJG is of particular to this research as the tropospheric delay due to the high altitude is rather small and so systematic biases occurring at lower altitudes should be diminished to a great extent there.

At station EXWI on the roof of the University of Berne, the two Radiometers have been measuring simultaneously for the first three days to evaluate a possible bias between them and between GPS and Radiometer. Additionally, the Radiometer of the Institute of Applied Physics of the University of Berne, ASMUWARA, served as a reference for the ongoing measurements.



The following ten days the baseline ZIMM – JUJO with a height difference of about 3000 m has been observed. The figures below show the ZTD at ZIMM and JUJO observed by WVR in comparison to the GPS-estimated ZTD.



In these first results we find a mean bias of 1.8 ± 3.0 mm for station ZIMM and 16.9 ± 5.8 mm for station JUJO. For station ZIMM, the days 252, 253, 254, 256 and for station JUJO the days 252, 253, 254, 255 have already been excluded because of bad WVR data due to rain periods.

The finishing three days of the campaign, the instruments again have been set up at the University of Berne to check if the initial bias has changed. Presently, the biases determined during the calibration epochs in Berne are modelled and will be implemented to improve the WVR data.

Ongoing research deals with the validation of the GPS estimates with the improved radiometer results and also with the estimation of gradients from both the WVR and GPS data. Besides, the WVR results will be introduced into the GPS processing software to see possible achievements in precise height estimation on baselines with large height differences.

Key words:

Water Vapor, Zenith Path Delay, Tropospheric Modelling, GPS Height Estimations

Collaborating partners/networks:

High Altitude Research Station Jungfrauoch (Prof. Erwin Flueckiger), Swiss Federal Office of Topography (Dr. Elmar Brockmann), Institute of Applied Physics, University of Berne (Prof. Dr. Nikolaus Kaempfer, Dr. Christian Maetzler, Dr. Lorenz Martin), Astronomical Institute, University of Berne (Dr. Werner Gurtner)

Address:

Institute of Geodesy
University of the Bundeswehr Munich
D-85577 Neubiberg

Contacts

Prof. Dr.-Ing. Matthias Becker
Tel.: +49 89 6004 3427
Fax: +49 89 6004 4090
e-mail: matthias.becker@unibw-muenchen.de

Petra Haefele
Tel.: +49 89 6004 4502
Fax: +49 89 6004 4090
e-mail: petra.haefele@unibw-muenchen.de

URL: <http://www.bauw.unibw-muenchen.de/institute/inst9/>

