GEODETIC AND NON GEODETIC APPLICATIONS
PERFORMED BY WUT LAC

EUREF Permanent GPS Network 4th Local Analysis Centres Workshop
18-19 September, 2003 Graz, AUSTRIA
The basic responsibilities of our GPS Analysis Centre include:

- processing selected part of permanent EUREF network
- processing periodic campaign CEGRN and CEGRN2, Extended SAGET, EUVN
- processing local and regional campaigns for geophysical and geodetic needs in the area of Poland
- processing tropospheric zenith delay and TEC.
Data acquisition system at the Józefosław observatory

ASTROGEODETIC OBSERVATORY JÓZEFOŚLAW

GLOBAL POSITIONING SYSTEM
- TRIMBLE 4000SSE
- ASHTECH Z-18 GPS-GLONASS
- SNR 8000
- TRIMBLE 4000 CORSTATION
- RTCM 104
- DGPS RTK

GRAVITY MEASUREMENTS
- ZZG Absolute Gravimeter
- Tidal Gravimeter
- A/D converter

ASTROMETRIC LATITUDE SERVICE

GRAVITY MEASUREMENTS ON MERIDIAN BASELINE
- Server PC/LINUX
- METEO-SET
- METEOROLOGICAL MEASUREMENTS

WARSAW UNIVERSITY OF TECHNOLOGY GPS ANALYSIS CENTRE

INTERNET connection
- ICMM NWPM
- METEO-data from IMWM

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The functional scheme of system of data processing GPS observation, applied in WUT EUREF LAC
Short description of strategy:

- software: Bernese 4.2
- orbits, ERP - IGS final
- BOR1, WTZR, ONSA constrained (X,Y -0.1 mm, Z-1 mm)
- no a priori tropospheric model, Dry-Niell as mapping function
- troposphere modelled each 1 hours/each station (absolute and relative constraints 5 m )
- ionosphere only modelled for ambiguity resolution step
- tidal displacement: IERS96 convention, ocean loading applied
- geopotential model: JGM
- DE200 planetary ephemeris applied
- adjustment: weighted least squares
Results of data processing and analyses

GPS Observation Analyses

Changes of the coordinates obtained from day-to-day GPS data processing

B = 52° 05' 50.185724"  \eta = 0.000087" (0.0027 m)

L = 21° 01' 53.532235"  \eta = 0.000153" (0.0029 m)

H = 141.4437 m  \eta = 0.0083 m
Results of data processing and analyses

GPS Observation Analyses

Changes of the coordinates obtained from 1-hour GPS observations filtered to $3\sigma$
General scheme of computational strategy applied until week 1220 GPS in the Local Analysis Center WUT EUREF- so called „old” computational strategy. In the presented solution the TZD values were determined in a single process with station coordinates estimation. This solution’s advantage was relatively short computational time and storing the normal equations with the station coordinates data only.

The main disadvantage are the station coordinates for which the TZD values were determined. Recorded in the SINEX TRO format, they were characterized by different values for each observation day, although they belonged to the same GPS week.
Scheme of the new strategy of GPS observations study applied in WUT LAC. The main change introduced in the study is stations’ coordinates and the determined tropospheric parameters storing in the normal equations file. The tropospheric parameters are estimated only after completion of the computational process on the last day of the week.

At first, the weekly solution is generated (stations’ coordinates – the official product of WUT LAC). The tropospheric parameters are determined using the obtained values, considered as error-free, and applying ADDNEQ software and the prepared in advance normal equations files. The computational process is longer but the determined tropospheric parameters (TZD) are burdened with smaller errors. It my numeric analyses' were conducted was on approximating from about 40 station EUREF / IGS
The figure presents TZD obtained according to the new and old computational strategies for Józefoslaw station.
The figure presents TZD differences obtained according to the new and old computational strategies for HOFN station (Iceland).
The figure presents TZD differences obtained according to the new and old computational strategies for Józefoslaw station.
Temporal plot of RMS error change of TZD calculation for Józefosław station. The figure presents results obtained from WUT EUREF final solution – blue and yellow - WUT EUREF old strategy. Application of the new strategy of TZD computation resulted in increase of the solution precision from 0.9 mm to 0.7-0.8 mm.
Temporal plot of RMS error change of TZD calculation for HOFN station. The figure presents results obtained from WUT EUREF final solution – green and red - WUT EUREF old strategy.
Plot of TZD differences obtained according to WUT EUREF final and WUT-PPP solutions. The series of TZD differences includes the first half of the 2003. The series of differences ranges from -0.15 to 0.15. The difference of about -0.9 m that occurred on modified julian day 52776 is an uncorrected computational error.
Plot of RMS error change of TZD calculation for Józefosław station. The figure presents results obtained from PPP solution – dark blue and WUT EUREF final. Application of PPP solution causes increase of the error of TZD calculation only up to the level of 3 mm as compared with 1 mm obtained from WUT EUREF solution.
Scheme of one hour GPS processing strategy.
Ionospheric maps got with study one hour GPS observation. 2003.04.04
Antarctic ionospheric maps obtained from the GPS observations, 2003.04.29.
The figure presents differences TEC obtained from TOPEX, CODE, JPL and WUT one hour ionosphere model (HIM).
Conclusions and future

• To improve the study of one hour GPS observations.
• The conduct the exact analyses’ of calculacion the TZD with GPS and GLONASS observation.
• The conduct in process the analysis of the PPP strategy to the calculation TZD.