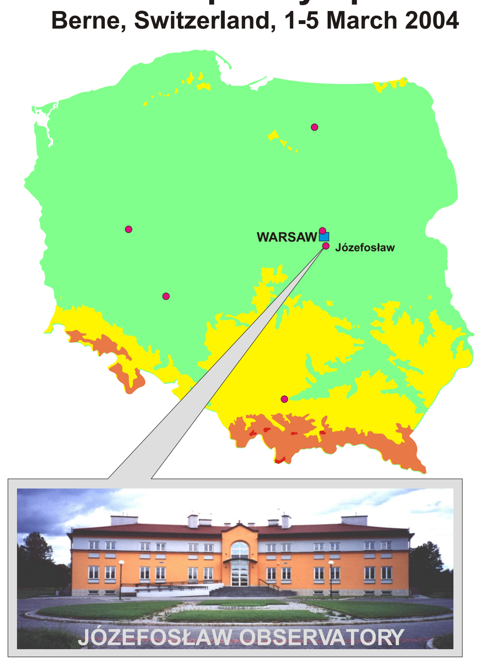
10 Year IGS
Workshop & Symposium
Berne, Switzerland, 1-5 March 2004



ACTIVITIES OF THE ASTROGEODETIC OBSERVATORY IN JÓZEFOSŁAW IN THE LAST DECADE

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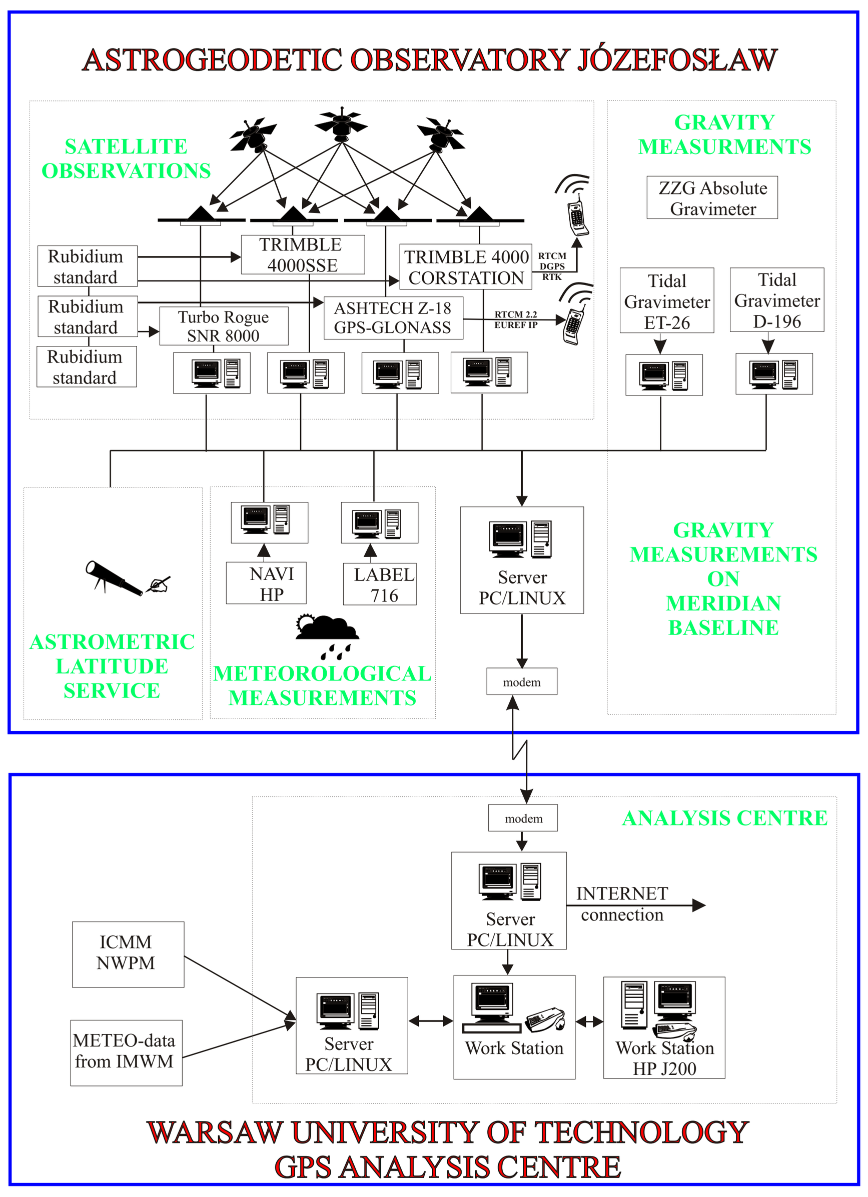
Introduction

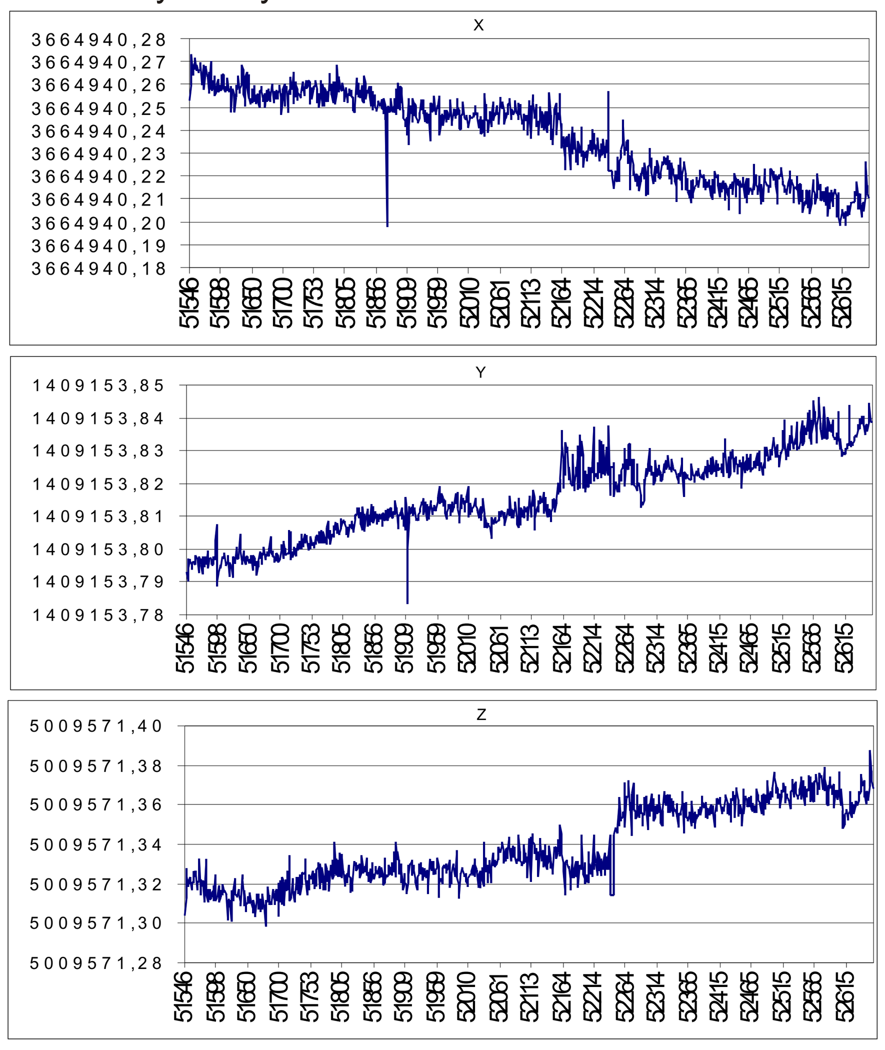
Astrogeodetic Observatory in Józefosław which belongs to the Institute of Geodesy and Geodetic Astronomy of the Warsaw University of Technology started to permanent observations in 1958. First of them was time service started in February 1958, coordinated by BIH. From 1959 astrometrical measurements have been done with aim to determine the parameters of the Earth rotation. In 1991 the Observatory was joined to the International GPS Service for Geodynamics (IGS) and started to operate as a permanent one in 1993. There have been performed many observations and scientific researches, such as: GPS in the frame of IGS/IGLOS/EUREF; tidal observations; absolute gravity measurements; changes of the vertical, based on the gravimetric measurements; astrometric observations and meteorology.
Studies on RTK and DGPS measurements using mobile phone for data transmission are performed since 1998. WUT EUREF Local Analysis Centre, one of the 16 Local Analysis Centres acting in Europe, is a very important part of the Observatory. The Centre makes continuous service of one-week solution in the frame of EUREF network, processes national and international GPS campaigns, models ionosphere and troposphere parameters, compute tidal components and changes of the vertical according to astrometric and gravimetric measurements. This paper presents current state of the art of the Observatory's activities and deals with the acting of it and operating of the WUT EUREF Local Analysis Centre.

Data acquisition system at the Józefosław



Józefosław GPS time series from WUT solutions

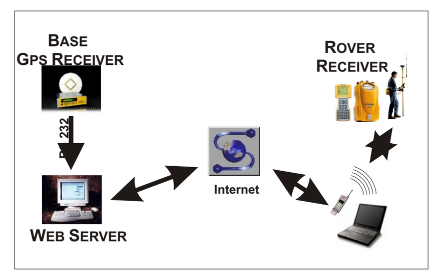
The Analysis Centre Consistes of two sections, the EUREF Analysis Centre and CERGOP Data Processing Centre. The EUREF Local Analyses Centre has been engaged 1996 in day-to-day.



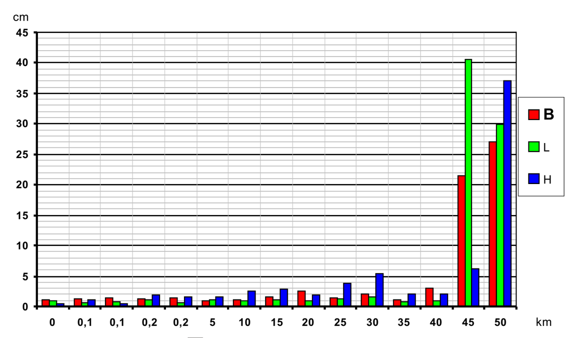
Distribution RTK measurments using of RTCM 2.2 by Internet

Base station

Rover equipment



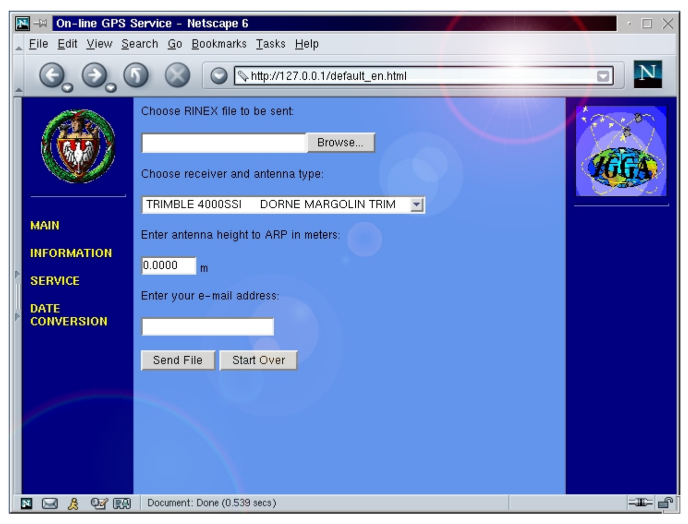
Scheme distribution RTCM correction by internet



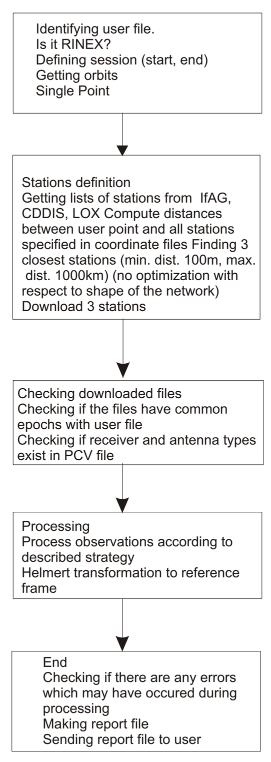
Test measurment

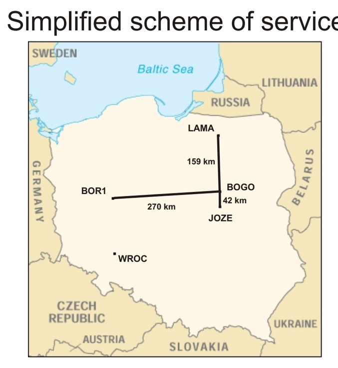
Automatic GPS service

New project started in our Institute will put into operation a service which enables users to process automatically their own GPS data through our Internet Web site.
The user is requested to fill out the form (on the right) and send RINEX file to our computer. Then our system begins downloading all necessary things to make processing, process data and afterwards sends results back to the user.
It is based on Bernese 4.2 GPS Processing Software. We do not use BPE and original panels (only main programs are used). Script which controls automated processing, prepares all necessary input files and some others things have been written in Perl language.
Strategy includes:
- entire processing is carried out in network mode (star strategy with user station at the center)
- closest station is fixed/heavily constrained
- using Bulletin A Earth Orientation Parameters
- using the best available orbits at the time of request
- ambiguity resolution QIF
- tropospheric parameters are set up according to session length
 (session length is divided into 2 hours intervals whithin which one tropospheric parameter for each station is estimated.

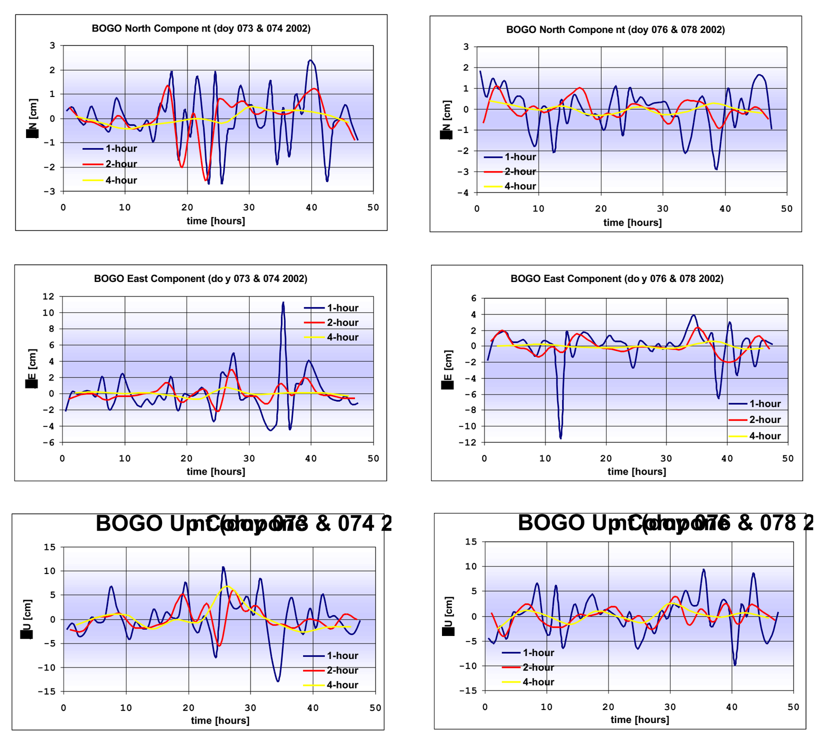


We have performed some tests to find out what would be expected accuracy of this service.
We chose four Polish stations: BOR1, JOZE, LAMA and BOGO and treated BOGO as station submited by the user.
We expect that main users will be surveyors who will submit several hours observation files.
Therefore three different session lengths (but not very long) have been tested: 1, 2 and 4 hours sessions.
The figures on the below show changes of the components: north, east and up for 4 days (73, 74, 76, 78 of 2002) of the station BOGO. Days 073 and 074 were computed using CODE final orbits and days 076, 078 were computed using CODE rapid orbits.





Simplified scheme of service.



Variant 1: CODE final orbits, Bulletin A ERPs and ITRF2000 coordinates used.

Variant 2: CODE rapid orbits, Bulletin A ERPs and ITRF2000 coordinates used.

Two tables below show expexted accuracy with respect to different session lengths.

Table below showsRMSs obtained from 1st variant for days 073 & 074

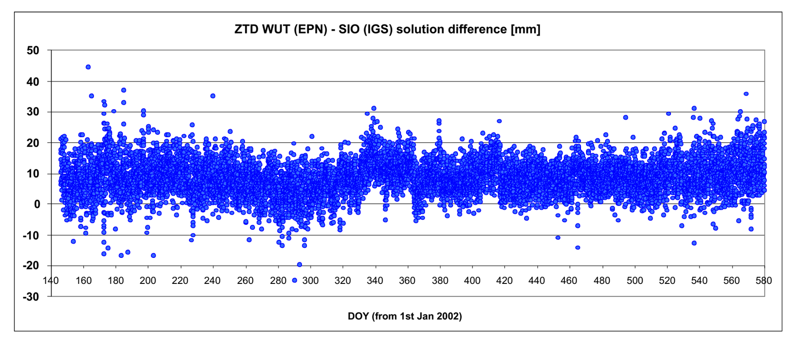
	RMS [cm]		
Interval	North	East	Up
1h	1.2	2.6	4.1
2h	0.9	1.1	2.5
4h	0.3	0.3	2.5

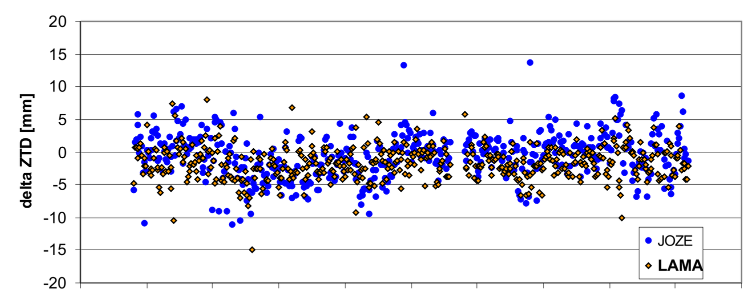
Table below shows RMSs obtained from 2nd variant for days 076&078

	RMS [cm]		
Interval	North	East	Up
1h	1.0	2.4	3.9
2h	0.5	1.0	1.9
4h	0.2	0.2	1.4

Investigation of ZTD behavior and IPW usefuness derived by GPS

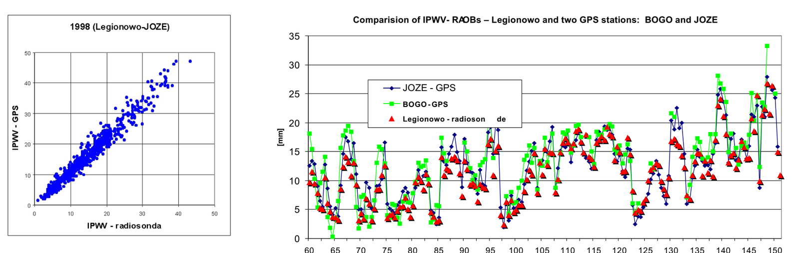
We use both standard ZTD products (IGS and EPN) and separate AC solutions (including WUT EPN LAC), tropospheric solutions of special projects (such as CERGOP) and our experimental tropo solutions. Combined ZTD (made of individual AC solutions) became one of the standard products of IGS (1998) and EPN (2001). Below we show some interesting quantities for this combinations.



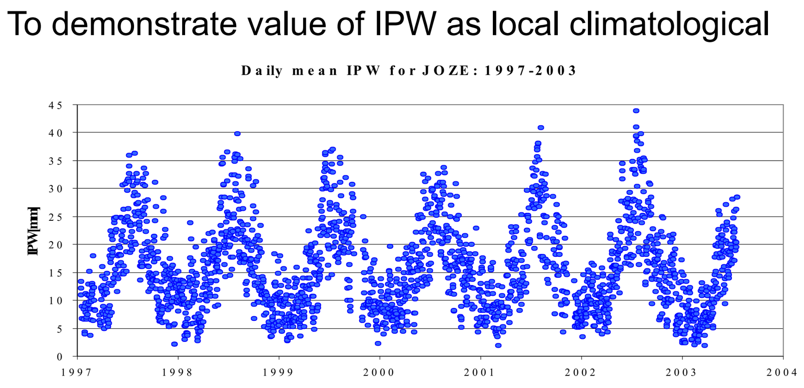


Differences of IGS and EPN ZTD combinations for two permanent stations in Poland

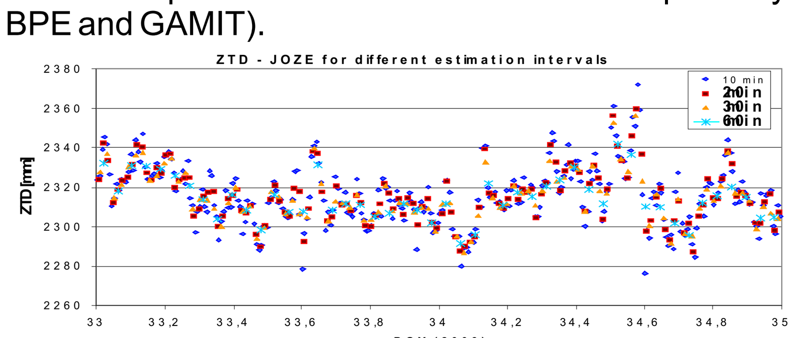
To asses ZWD accuracy radiosonde profile derived IWV were compared to post processed solutions



To demonstrate value of IPW as local climatological



Our most important project now is to start of NRT (near real time) tropospheric service based on fully automatic procedures based on Perl and parallely BPE and GAMIT).

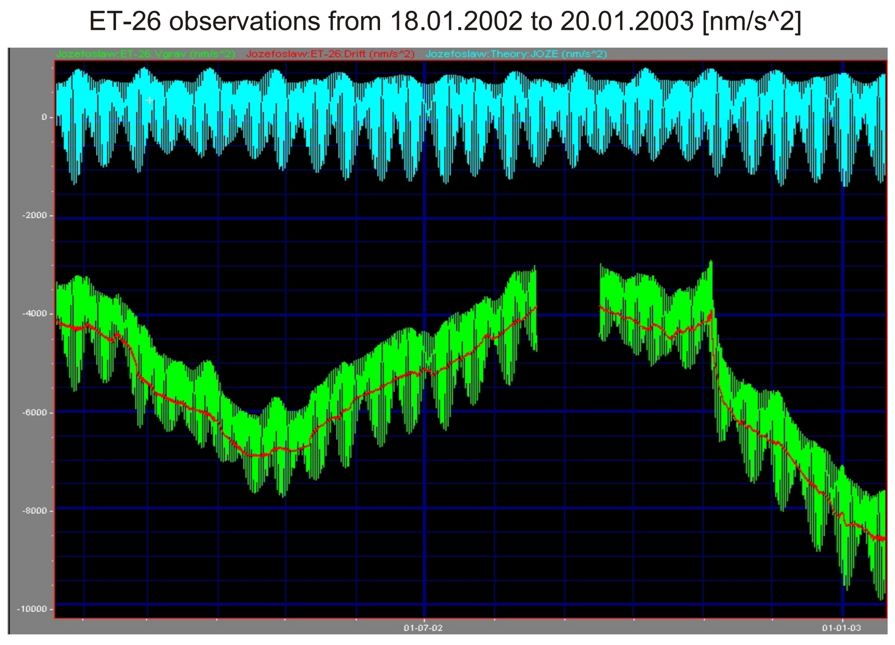


Experiment for the evaluation of potential time resolution of ZTD estimates in small network

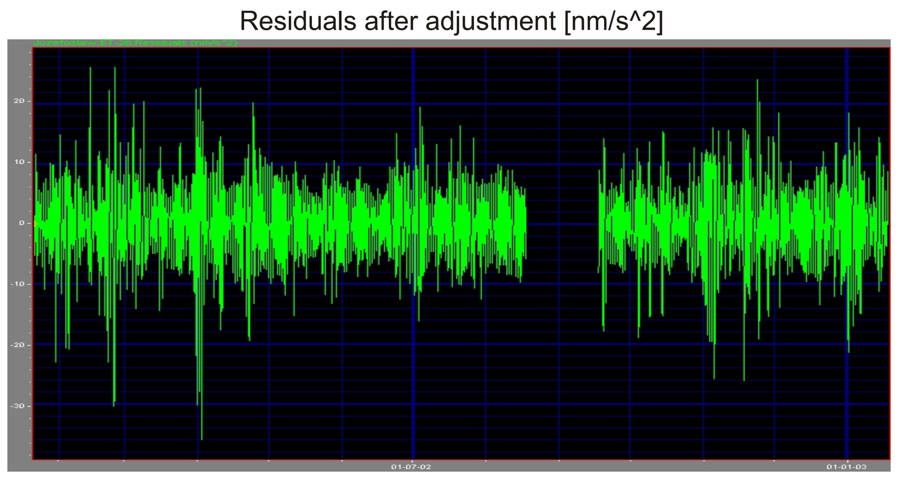
Tidal gravity measurment

Tidal gravity observations conducted with the help of two LaCoste& Romberg gravimeters, model D and model ET. Example of ET observations are shown.

ET-26 observations from 18.01.2002 to 20.01.2003 [nm/s^2]



Residuals after adjustment [nm/s^2]



Pre-analysis were made using TSOFT. The spikes, steps and small gaps were removed from the data. Additionally the sampling rate was changed from 1-minute to 1-hour using low-pass filter. This data was then analysed by ETERNA 3.4. Local pressure data was joint to the gravity observations with the regression coefficient of 3.45 hPa per nm/s^2. Instrumental phase lag was determined using ETSTEP. For ET-26 it is 203.7 seconds but was not considered in the alalysis. The results of analyses are:

from [cpd]	to [cpd]	wave	theor. ampl. [nm/s**2]	ampl.fac.	stdv.	ph. lead [deg]	stdv. [deg]
0.501370	0.911390	Q1	57.6947	1.15725	0.00583	0.4821	0.2882
0.911391	0.947991	O1	301.3333	1.15510	0.00115	0.7386	0.0572
0.947992	0.981854	M1	23.6864	1.15438	0.01046	0.8555	0.5195
0.981855	0.998631	P1	140.1867	1.15420	0.00266	1.1995	0.1325
0.998632	1.001369	S1	3.3136	1.30744	0.15937	-56.5023	7.0114
1.001370	1.004107	K1	423.6174	1.14104	0.00084	1.1235	0.0424
1.004108	1.006845	PSI1	3.3152	1.09110	0.11035	30.1070	5.7994
1.006846	1.023622	PHI1	6.0320	1.30814	0.05959	-6.8193	2.6100
1.023623	1.057485	J1	23.6950	1.15257	0.01425	1.2138	0.7085
1.057486	1.470243	OO1	12.9606	1.22149	0.02041	0.6759	0.9579
1.470244	1.880264	2N2	8.6771	1.18584	0.02357	6.5243	1.1391
1.880265	1.914128	N2	54.3293	1.19056	0.00490	1.2526	0.2359
1.914129	1.950419	M2	283.7542	1.18131	0.00096	1.9939	0.0468
1.950420	1.984282	L2	8.0212	1.06909	0.03389	2.4051	1.8161
1.984283	2.002736	S2	132.0054	1.18281	0.00209	1.7757	0.1011
2.002737	2.451943	K2	35.8676	1.20404	0.00699	2.5364	0.3327
2.451944	7.000000	M3	3.4285	1.09268	0.02294	0.2629	1.2029

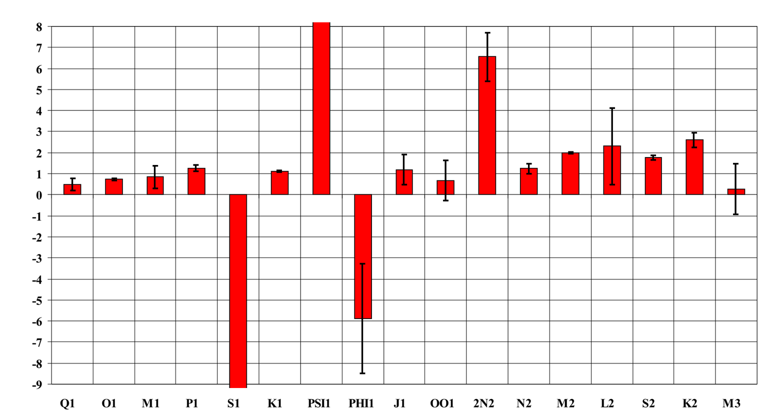
```
Adjusted meteorological or hydrological parameters:

no. regr.coeff.       stdv.  parameter   unit

 1  2435.62754    80.16887   airpress.  nm/s**2 / hPa

 Standard deviation:              6.086  nm/s**2
 Degree of freedom:                7923
 Maximum residual:               40.643  nm/s**2
 Maximum correlation:            -0.165  airpress. with Y-wave-2N2
 Condition number of normal equ.  2.163
```

Phase lead [deg]



Amplitude factor: