IMPLEMENTATION OF DORIS DATA ANALYSIS INTO THE BERNESE GPS SOFTWARE

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Doris data in Bernese software

Bernese GPS software – developed in AIUB

Input DORIS data: CDDIS 2.0 (2.1)

Transformation of Range rate to difference between two pseudoranges

$\Delta R = - T\ V$

Original idea: Create ΔR for both frequencies using ionosphere correction to reconstruct 400 MHz observation

Problem: Ionosphere correction from CDDIS file includes also other Effekts

Solution: no solution at least for old satellites, use one frequency and apply the ionosphere correction

In the beginning are used all the corrections from CDDIS files

GPS – like approach

One DORIS observation is divided into two parts (two pseudoobservations):

Beginning: 100 km   new ambiguity flag

End: 100 km + observation

$$\Phi_1 = \rho(t_1) + A \equiv 0$$

$$\Phi_2 = \rho(t_2) + A$$

$$\Delta\Phi \equiv \Phi_2 - \Phi_1 = \rho(t_2) - \rho(t_1)$$

- **Constant 100 km is used to have always a positive value**

- **Ambiguities A are eliminated before NEQ inversion**

- **In principle is possible in the case of new receivers use phase –like processing**

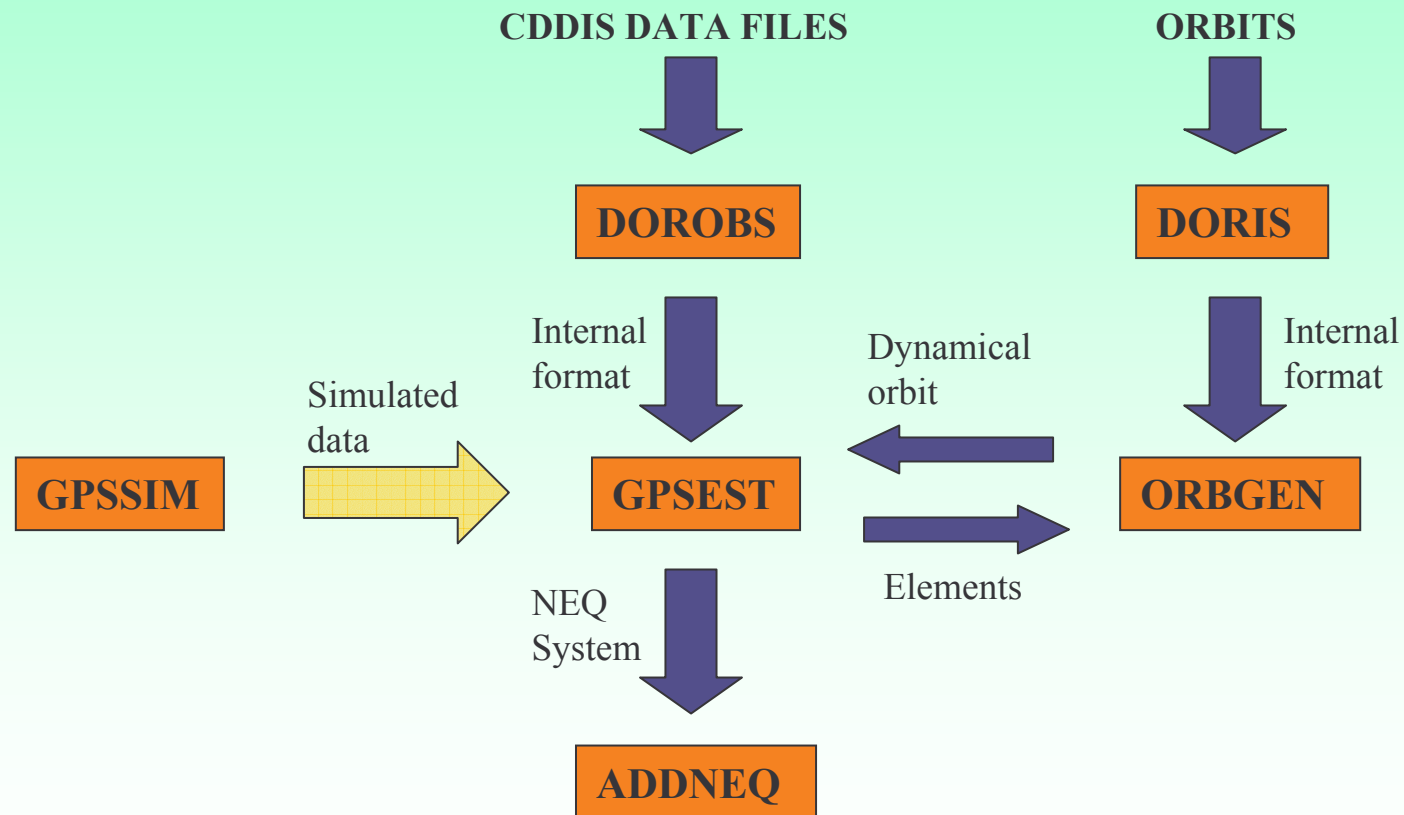**Beginning: 100 km   new ambiguity flag**

Next: 100 km + observation1

Next: 100 km + observation1 + observation2

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DORIS in Bernese software

CDDIS DATA FILES   ORBITS

DOROBS   DORIS

GPSSIM → Simulated data → GPSEST ← Dynamical orbit → ORBGEN

Internal format

Internal format

Elements

NEQ System

ADDNEQ

First testing campaign

- TOPEX/POSEIDON data (format 2.0)

- July 1995

- station coordinates estimated, orbit fixed

- Orbit estimated, network fixed

- One day Arcs

- 4 weekly, 1 monthly solution

- all CDDIS correction applied

- troposphere estimation – additional test

ORBIT FIXED, POSITIONNING

RMS in Monthly Positionning (cm)

	Formal	Determined from weekly solutions	Estimated – ITRF 2000 Helmert	Estimated – ITRF 2000
Longitude	1.2	3.0	9.9	10.6
Latitude	1.3	2.3	5.6	11.3
Height	1.5	2.5	4.2	8.0
3D	2.3	4.5	12.1	17.4

Helmert transformation of results (ITRF 2000)

Scale	0.0111 +- 0.0020 mm/km
Tx	-3.0 +- 13.1 mm
Ty	-26.3+- 13.0 mm
Tz	12.8 +- 13.1mm
Rx	0.00111 +- 0.00050 "
Ry	- 0.00022 +- 0.00053 "
Rz	- 0.00381 +- 0.00053 "

RESIDUALS, STATION ADEA 6.7. , ORBIT FIXED

station ADEA, 6.7. 95, 1. path

station ADEA, 6.7. 95, 2. path

station ADEA, 6.7. 95, 3. path

stantion ADEA, 6.7. 95, 4. path
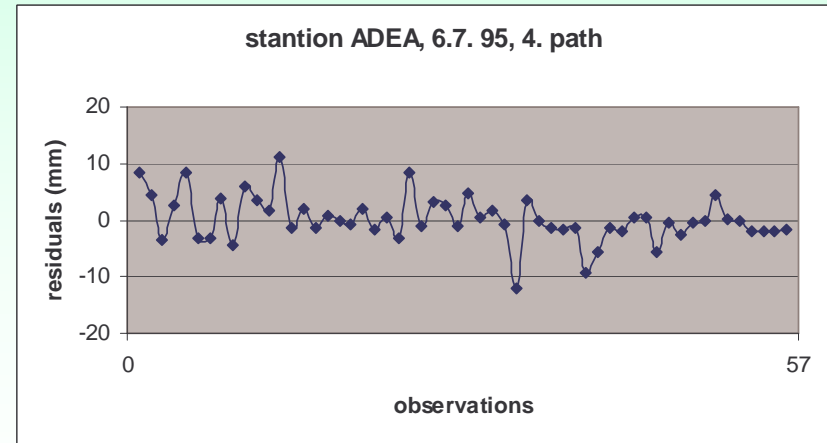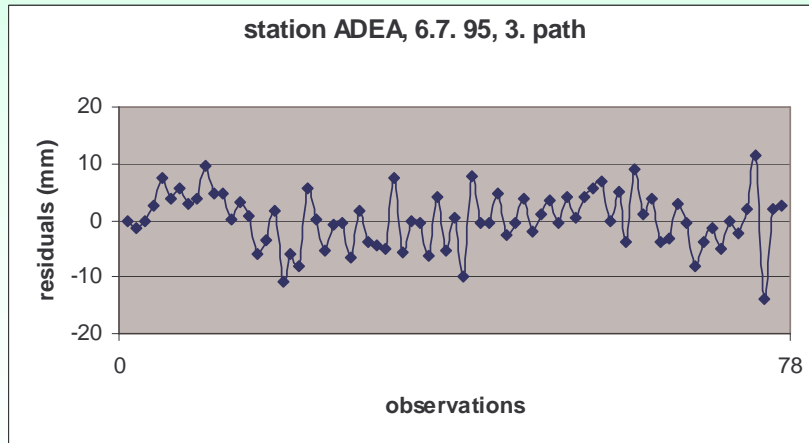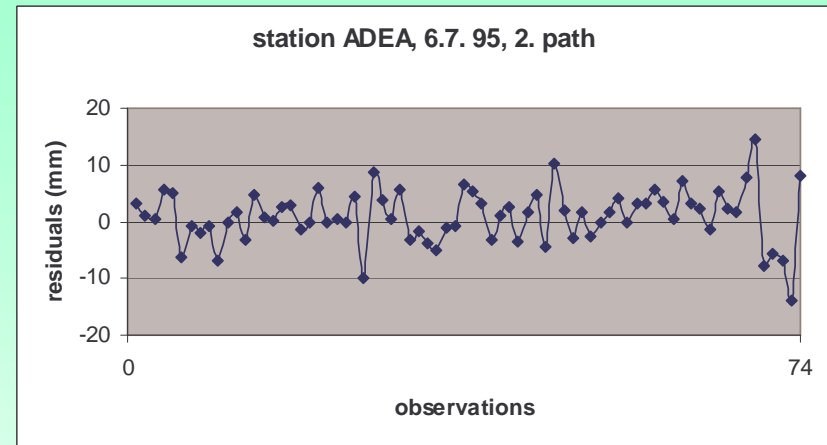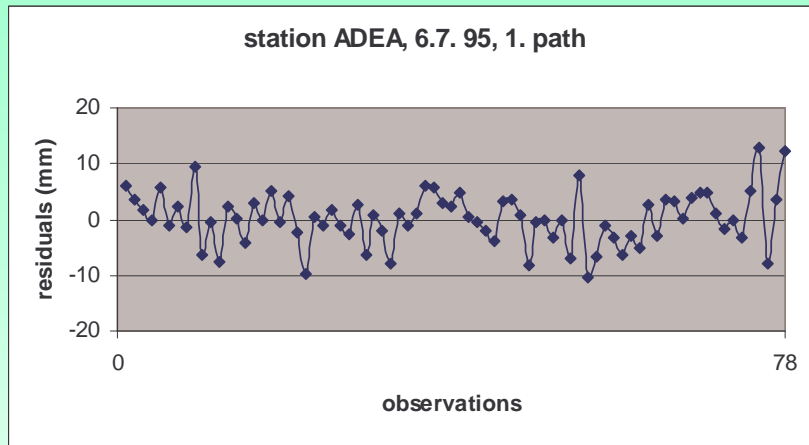
Orbit estimation – radial component

• Apriori aviso orbit – 2 cm radial precision

• STD orbit RMS with respect to apriori PRE (AVISO) – 3 cm for 1 day arc, 1 cm for 8 hours arc

• Bernese estimatimation – 7 cm RMS with respect to apriori STD orbit for 1 day arcs

• Estimated: initial Kepler elements, Solar pressure coefficients, Stochastic parameters (every 6 hours)

RMS in radial component (with respect to apriori)
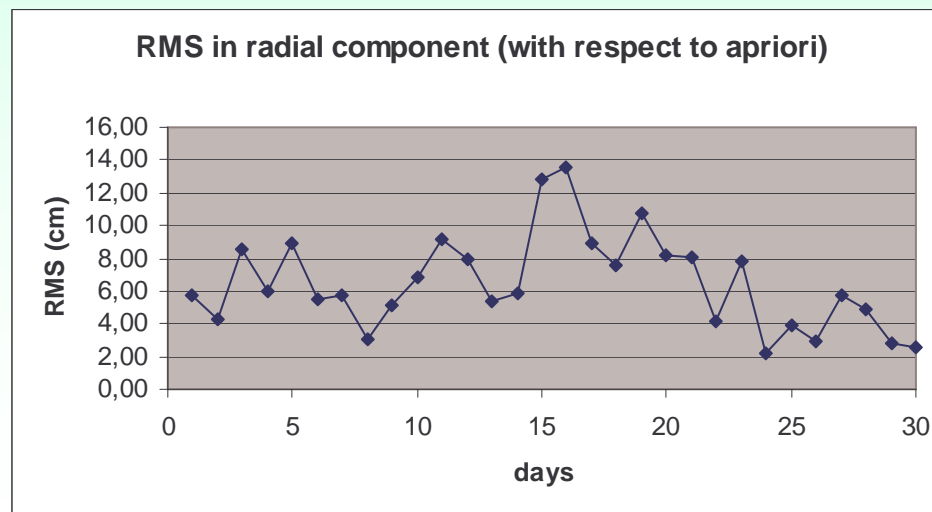
RMS of one observation

ANALYSIS	NETWORK	ORBIT	RMS0 (mm)
Daily	Estimated	Fixed	5.6
Monthly	Estimated	Fixed	6.5
Daily	Fixed	Estimated	9.7

- The most of intervals were 10 s.

- High RMS in the case of orbit estimation – low orbit model precision?

- Short arcs used for coordinates estimation – very small improvement

- Troposphere estimation – Formal RMS on the same level, result comparison to ITRF about 30% worse

Future plans

•Use the testing version of Bernese software in new Czech analysis centre at Geodesy observatory Pecny

• Include DORIS application in the official version of Bernese software