Analysis at Geodetic Observatory Pecný (GOP)

❑ Modified "unofficial" version of the Bernese GPS software, derived from version 5.0 (and additional scripts)

❑ Routine processing tools developed as the extended BPE

❑ Current status: DORIS implemented, (semi)automatic processing developed, many precision tests done.

❑ Achieved precision of the solutions looks almost comparable or slightly worse in comparison to IGN, LCA solutions. The achieved precision is probably maximum, using models currently available in Bernese GPS software.

❑ Implementation of a new models could probably improve the precision, first of all in the orbit modeling, which is currently not well suited for LEO dynamics. Improvement of the orbit dynamics is the next logical step of the future software evolution. This step is technicaly very difficult and needs a lot of work and a lot of time, improvement cannot be achieved quickly. Use of current, already quite a good level of processing, in the framework of IDS should be discussed

Basic processing strategy

❑ Input data:CDDIS, centre of mass and ionosphere corrections from file applied

❑ Range rate is transformed into the "difference between two pseudoranges". The reason is to be as closed to GNSS processing as possible. This transformation is a simple multiplication of range rate by the negative value of the observation time interval

$$\Delta\rho = - V*\Delta t$$

❑ The solution minimize sum of the "pseudorange" square residuals and not range rate residuals, which is the difference from the IGN,LCA processing

❑ In fact the other groups minimize the sum of squared rang rate residuals v_i, while we minimize the sum of squared Δt_i v_i ,which means that we implicitly use different weighting in the case of the processing of data with different observation intervals (e.g. 7 and 10 s)

Basic models used in gopwd03 solution

- ❑ Gravity EIGEN-GL04C 100X100

- ❑ Apriori coordinates ITRF2005, apriori ERP IERS C04 model, Initial orbits LCA

- ❑ Subdaily pole model IERS 2000

- ❑ Nutation IAU80

- ❑ Earth tides IERS 2000

- ❑ Ocean tides OT_CSRC

- ❑ Apriori troposphere : Saastamoinen with dry Niel map. Function

- ❑ Estimated troposphere: wet Niel map. Function

- ❑ Planetary Ephemeris DE405

- ❑ Eq. of motion pol. deg. 10, integration interval 0.025 hour

- ❑ Var. equations pol. deg. 10, integration interval 0.2 hour

- ❑ Apriori RMS 4 mm (~ 0.4 mm/s for 10 s observation interval)
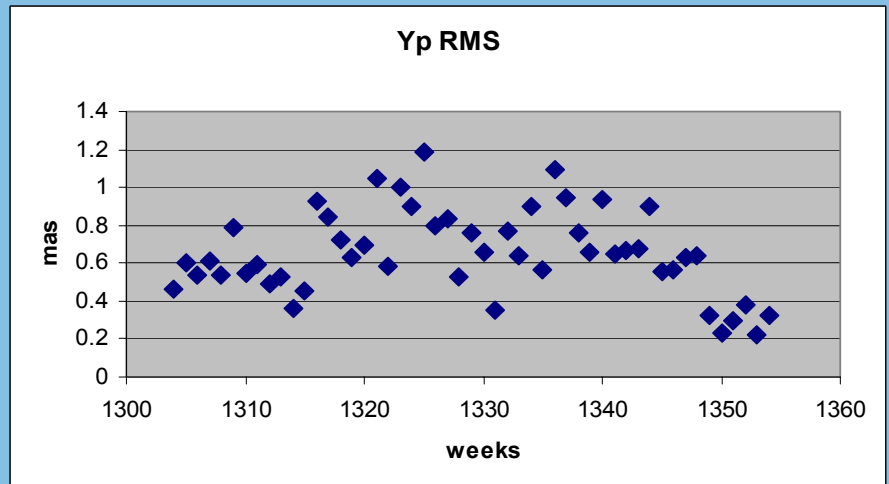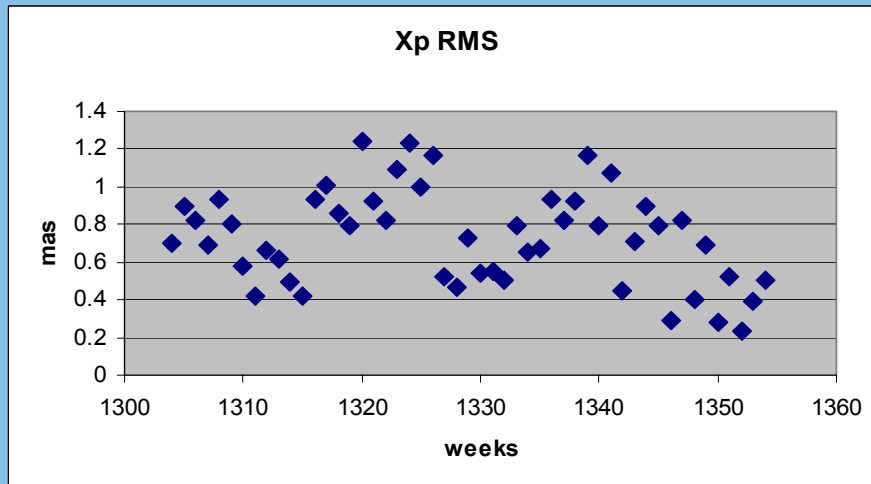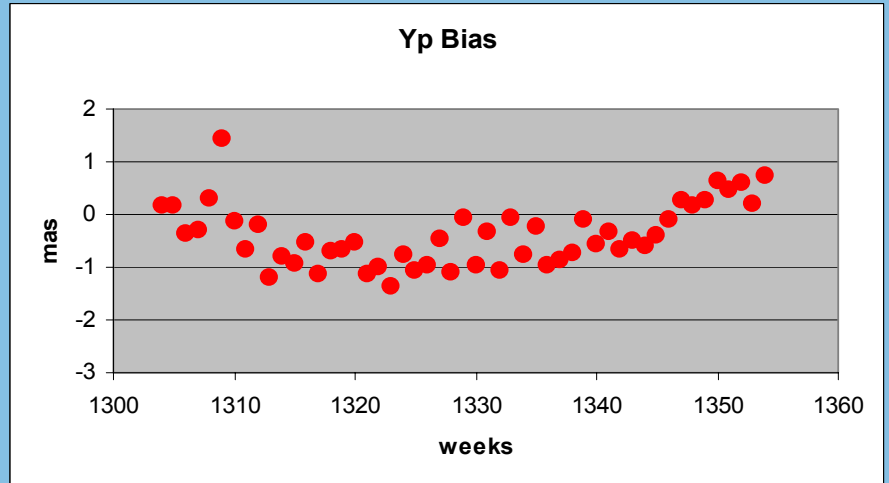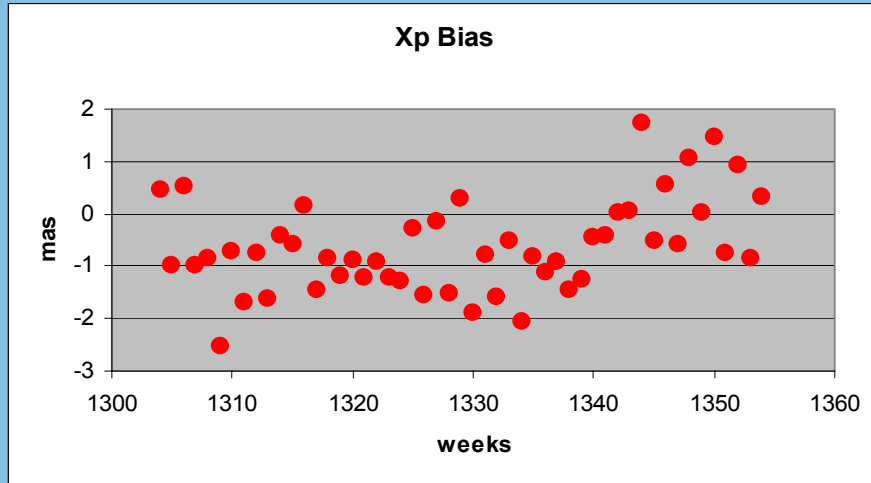
Estimated parameters and constraints

- ❑ **Station coordinates, apriori constraints 10 m**

- ❑ **X,Y pole, apriori constraints 500 mas – one value per day and linear behavior between**

- ❑ **Beacon frequency offset constant per path**

- ❑ **Troposphere tot. zen. Delay, constant per path**

- ❑ **Orbit parameters**

Orbit parameters

- ❖ **Arc length 1 day (longer arcs processing is impossible with current models)**

- ❖ **Six Kepler initial elements**

- ❖ **Reduced dynamics - Empirical and Stochastic parameters**

- ❖ **no exact models for non-conservative forces**

- ❖ **Empirical constant parameters in Sun and Y-direction, per arc**

- ❖ **Empirical harmonic parameters in Sun and Y-direction, per arc – only for Jason and TOPEX**

- ❖ **Stochastic parameters in along-track direction, every 15 minutes, constraints 10^{-5} m/s – only for SPOTs and Envisat**

X,Y pole comparison vs. IERS C04 model

- **gopwd03 solution**

Orbit comparison vs. LCA