Impact of different observing rates on geodetic results

M. Schartner[1] (matthias.schartner@geo.tuwien.ac.at), J. Böhm[1]
[1]TU Wien, Higher Geodesy, Department of Geodesy and Geoinformation, Wien, Austria

TU WIEN VieSched++ Vienna VLBI and Satellite Software

Introduction

Simulation study
- effect of different observing rates on schedules and estimated parameters
- six rates between 128 and 4096 Mbit/s

Weight factors
- VieSched++ schedules by evaluating every possible combination of scans
- each possible scan is given a score based on optimization criteria $score_i$
- the total score is a weighted sum of individual scores → **weight factor** ω_i
- scan with the highest score gets scheduled

$$score_{scan} = \sum \omega_i \cdot score_i$$

Scheduling

- created using VieSched++
- multi-scheduling tool varying weight factors (and subnetting)

CONT17: 225 versions (4 parameters)
T2129: 500 versions (5 parameters)
INT: 12 · 121 versions (2 param.)

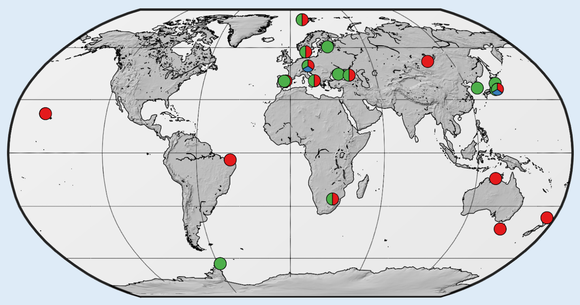
→ Total of **13.062 schedules**

Simulations

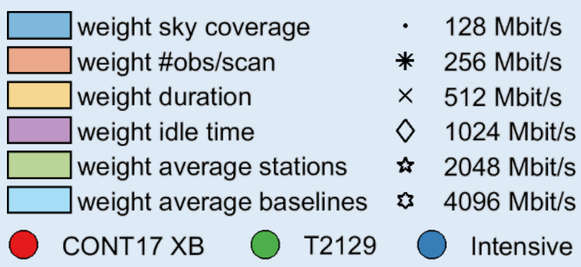
- generated using VieVS
  - troposphere: $C_n = 1.8 \cdot 10^{-7}\ m^{-1/3}$
  - clock: $1 \cdot 10^{-14}\ s$ @ $50\ min$
  - white noise: $30\ ps$
- 500 simulations per 24h schedule
- 100 simulations per 1h schedule

→ Total of **3.046.200 simulations**

Networks



Legend

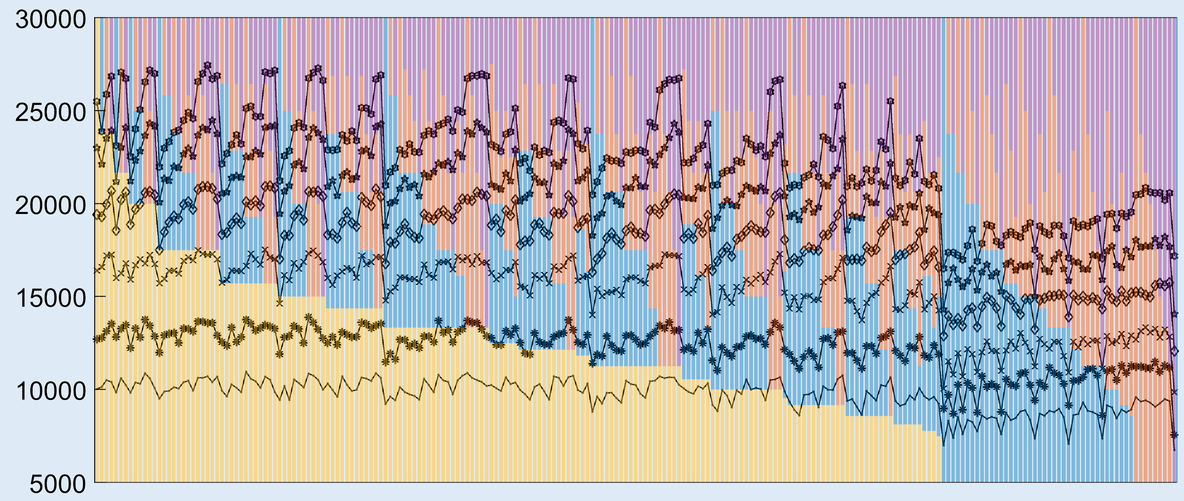


Plot explanation

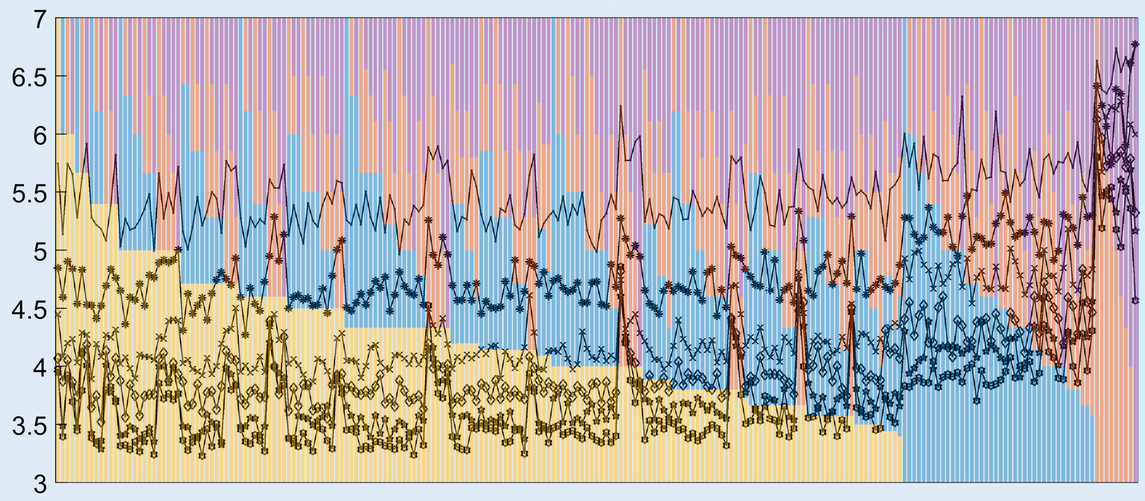
- only relative relation between weight factors is important
- **every column represents one schedule** created using different weight factors
- colored bars represent the fraction of weight factor used to create this schedule
- **black markers show result** gained from this schedule
- marker shape indicates which observing rate was used to generate this schedule
- in case of Intensive sessions, twelve schedules over the whole year are created and the average is shown
- the black line connects results of one observing rate (smoothened for T2129)

CONT17 XB

#observations

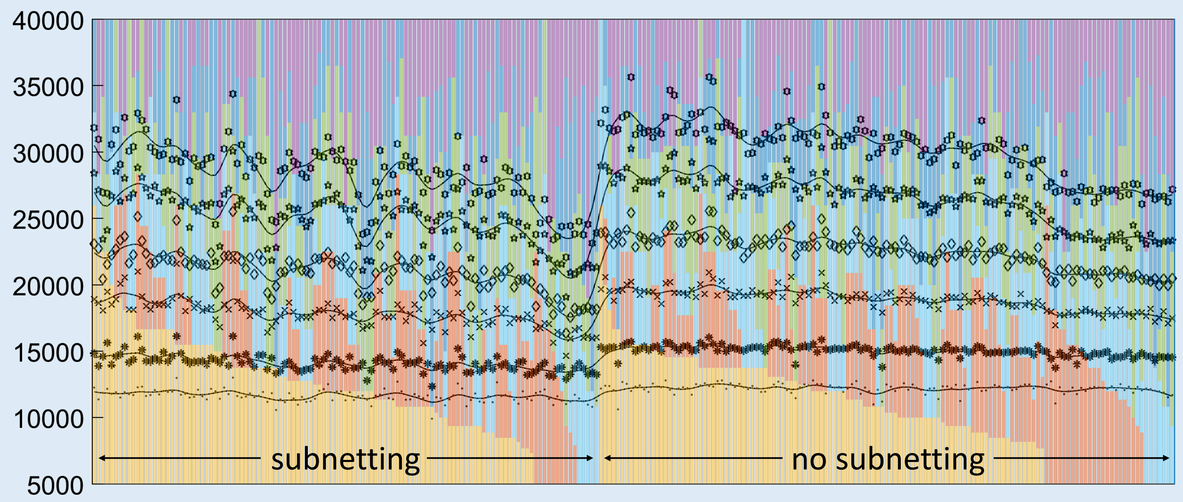


mean 3d station coordinate repeatabilty [mm]

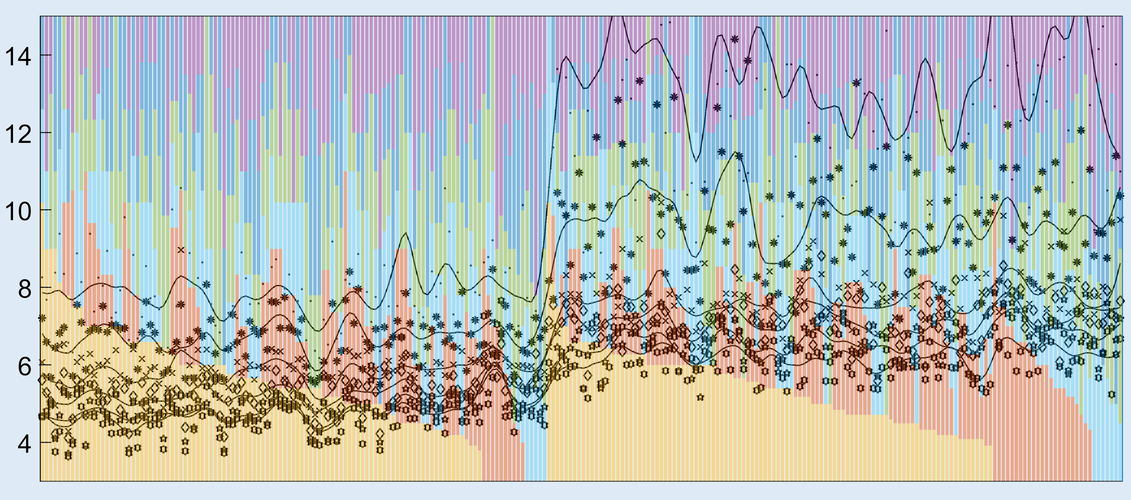


T2129

#observations

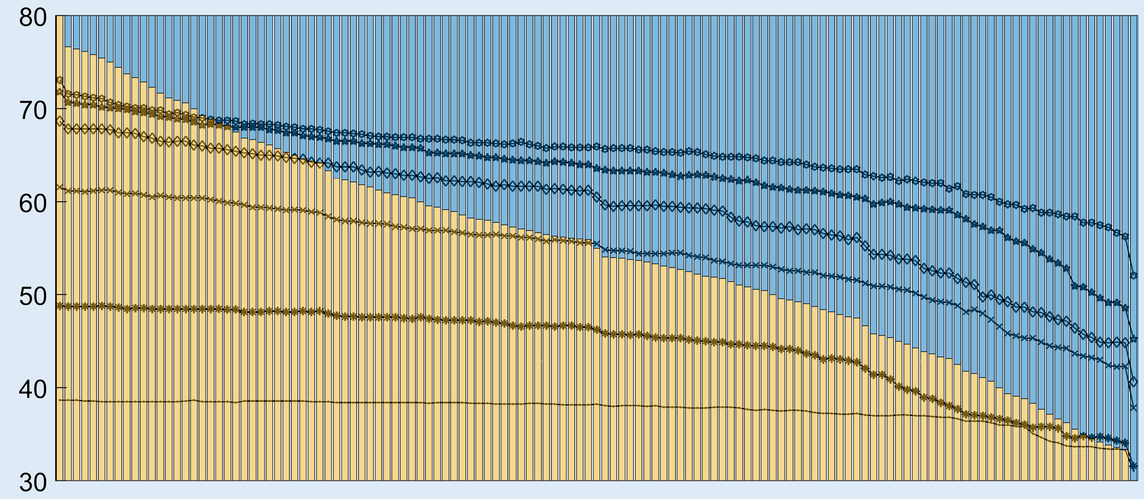


mean 3d station coordinate repeatabilty [mm]

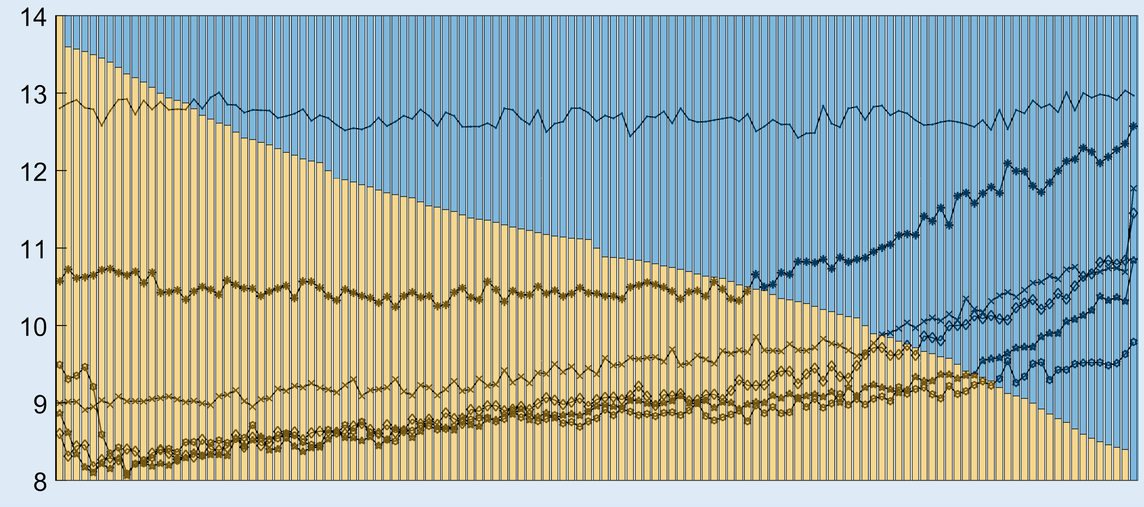


Intensive (Wn-Is)

#observations



dUT1 formal error [µs]



Conclusion

General

- VieSched++ together with VieVS can be used to generate **thousands of schedules** and to create and analyze **millions of simulations**
- both software packages are freely available at https://github.com/TUW-VieVS
- although we only show results for CONT17 XB, T2129 and an intensive network this work is already done for **various other networks and sessions**

CONT17 XB

- duration weight factor is most important for high observing rates
- result gets significantly worse if one weight factor (especially duration) is not used
- low weight on sky coverage leads to a high number of observations but a poor result
- if the schedule is only generated based on #obs/scan and idle time weight factor the result gets very bad → combination of different optimization criteria is important

T2129

- duration weight factor is most important (this is true for most networks)
- enabling subnetting leads to fewer observations but better result
- the result is noisy on high observing rates → beneficial to create multiple schedules

Intensive

- duration weight factor is more important than the sky coverage weight factor
- a high number of observations leads to the best result
- clear improvement can be seen when increasing the data rates up to 1024 Mbit/s