

TEST OF GLOBAL ALIGNMENT OF REGIONAL GNSS SOLUTIONS

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INTRODUCTION

- In regional GNSS solutions, e.g., the ones produced by EPN, the datum is defined regionally
- This could cause problems at the edges of the network, especially if there are no datum stations at the edges
- This can be an issue for the EPN solutions
 - Potentially non-linear motions in Iceland (due to e.g., earthquakes), Greenland and Svalbard (due to icemelting) makes stations in these areas not suitable for the datum
 - Problems with snow on northern latitude stations in winter
 - Other issues
- Solution would be to include more stations, from a larger area
 - Maybe even to a global solution
 - Disadvantage: more stations need to be processed
- Global alignment:
 - Combine regional solution with a global one
 - Allows to define the datum for using stations from a larger area (e.g., even globally)

EXAMPLE: EFFECTS OF THE DATUM REALIZATION

- Tests were done to investigate the edge effects of the datum definition
- NKG AC solution for EPN
- 2 January 21 May 2022 (GPS weeks 2191 2210)
- Datum realization (7 parameters) done with CATREF
- Tested two datums:
 - Datum I: relatively well distributed, including stations in Greenland and Svalbard
 - Datum 2: without stations in Greenland, Svalbard, and Iceland
- Checked the repeatabilities of the station coordinates







GLOBAL ALIGNMENT (I)



GLOBAL ALIGNMENT (II)

- For global alignment to work well, the regional and global solutions need to be consistent
 - For example, they should use the same antenna calibrations
- We tested combining the NKG EPN solution with the global CODE rapid solution
 - NKG EPN solution was reprocessed to use type mean antenna calibrations (instead of individual) to be consistent with CODE
 - Both solutions use GPS+GLONASS+Galileo
 - Both solutions are produced with the Bernese software
 - Analysis settings are relatively similar
 - Several common stations
 - 2 January 21 May 2022 (GPS week 2191-2210)
- Combination and datum realization (7 parameters) done with CATREF

GLOBAL DATUM



 Datum defined on 34 globally distributed stations

CODE stations
NKG stations
Datum station





Datum 1 Datum 2 Comb. Datum 2 Comb. Globa

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TIME SERIES OF THREE SELECTED STATIONS



TIME SERIES OF THREE SELECTED STATIONS (II)



Correlation coefficients, Up component

| | Global datum | Datum 2 |
|-----------|--------------|---------|
| VIS6-ONSA | 0.73 | 0.36 |
| VIS6-HETT | 0.57 | -0.05 |
| ONSA-HETT | 0.43 | -0.05 |

DATUM 3



 Datum defined on 34 globally distributed stations

CODE stations
 NKG stations
 Datum station





TEST ON OPERATIONAL NKG EPN SOLUTIONS

• Since GPS week 2238 (27 November 2022) the EPN has switched over to using type mean antenna calibrations (IGS20)

LANTMÄTER

- No need to reprocess anymore, could use the operational solution directly
- CODE final solution now also include Galileo
 - Can use this solution instead of the rapid one
- We made a test of combining the NKG EPN solution and the CODE final solution for the period 27 November 2022 –6 May 2023 (GPS weeks 2238 –2260)





CONCLUSIONS

- Applying a regional datum can lead to significant effects on the edges of the network
 - Especially if there are no datum stations close to the edge
- With global alignment combining the regional solution and a global one the datum can be extended, e.g., to a global datum
- With a global datum, the station position repeatabilities will be slightly worse compared to using a regional datum, however, the performance is similar for all stations (i.e., no edge effects)
 - A global datum is probably most interesting when analyzing long time series when long-term stability is more important than short-term repeatability