



TEST OF GLOBAL ALIGNMENT OF THE NKG EPN SOLUTION

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INTRODUCTION

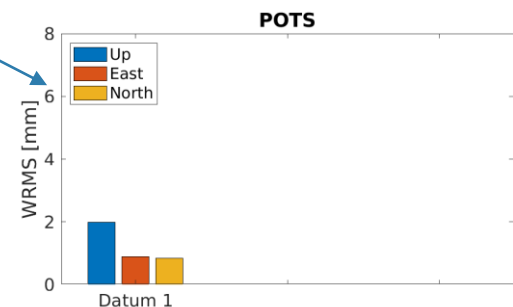
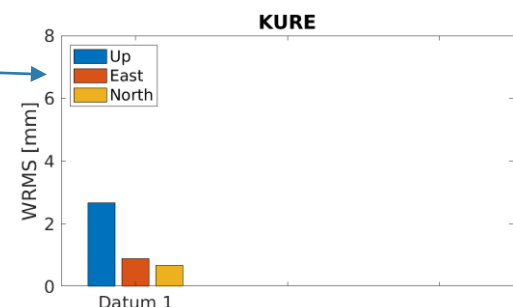
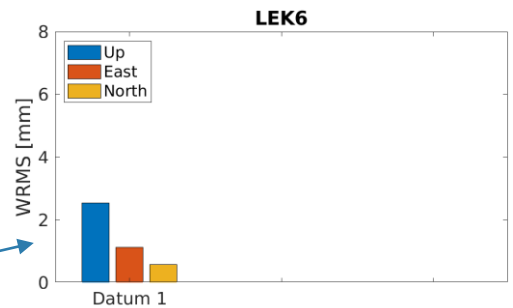
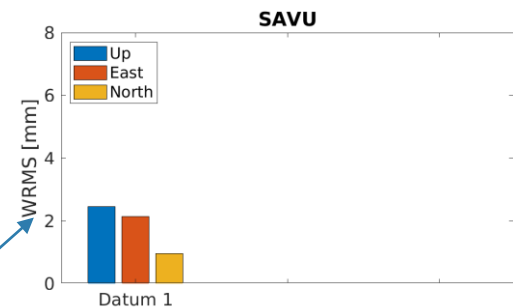
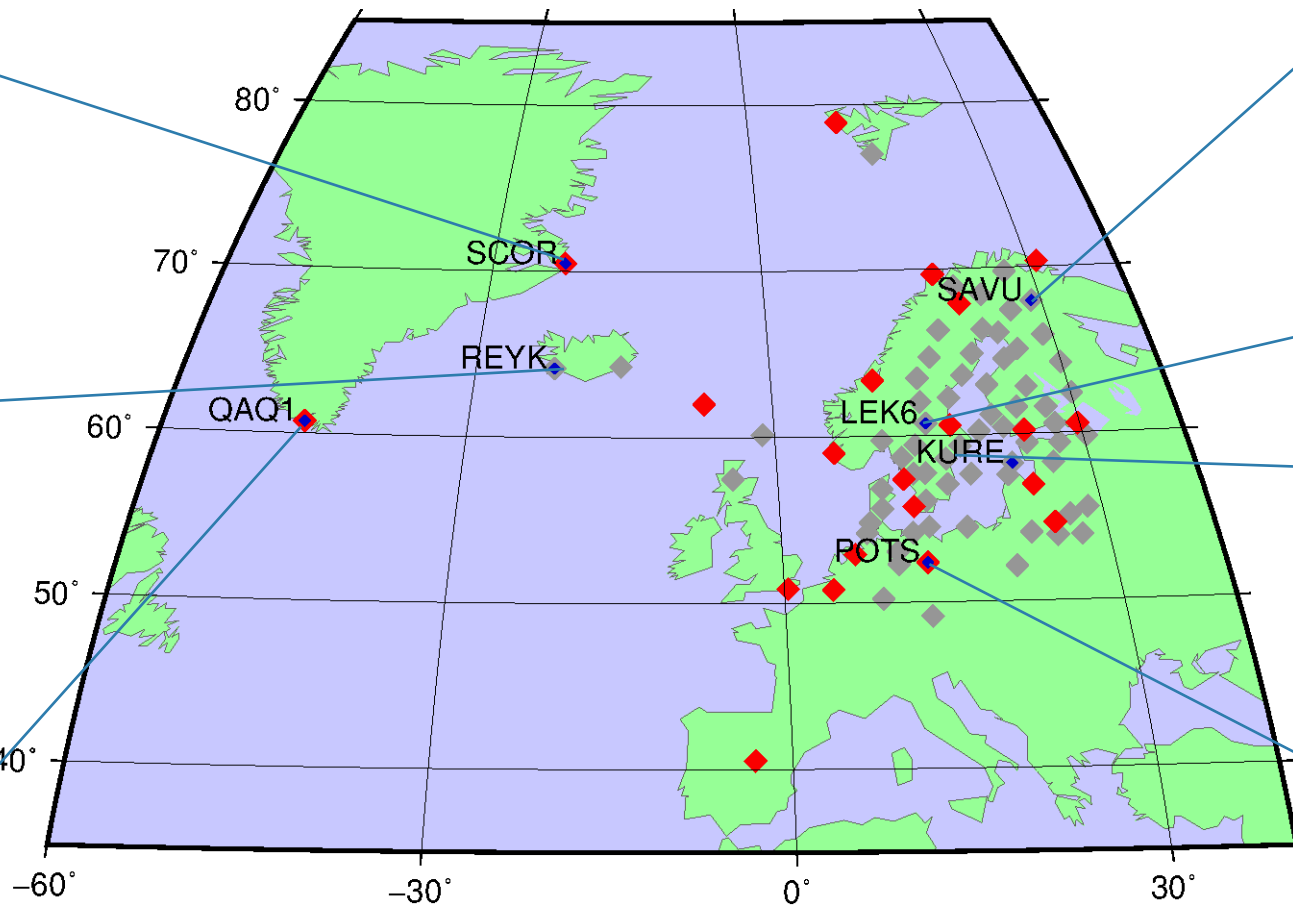
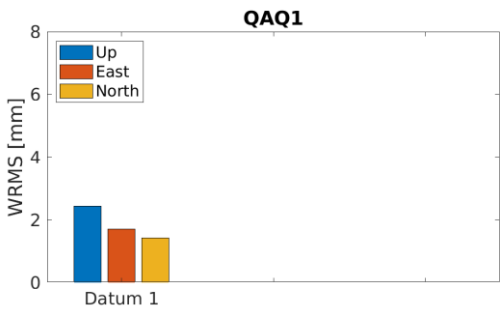
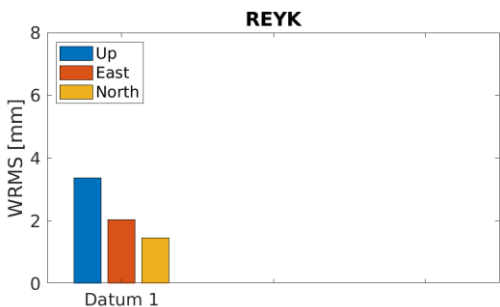
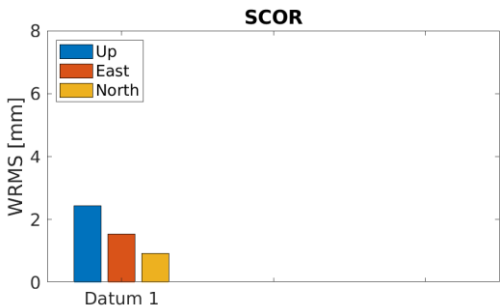
- In local and regional GNSS solutions, e.g., the solutions produced by NKG, the datum is defined regionally
- This works fine in the center of the network, but the results can get worse close to the edges of the network
 - Especially true if there is no datum stations close to the edges
 - For example, this can be an issue if we in the NKG solutions do not use any datum stations in Iceland and Greenland (may have non-linear motions, thus not suitable for the datum definition)
- **Solution: extend the network, maybe even to a global solution**
 - Disadvantage: a lot of more stations to process and handle
- **Alternative solution: global alignment**
 - Combine the local solution with an existing global solution
 - Define the datum globally (or in an extended area)



FIRST EXAMPLE: DEMONSTRATING THE EDGE EFFECTS

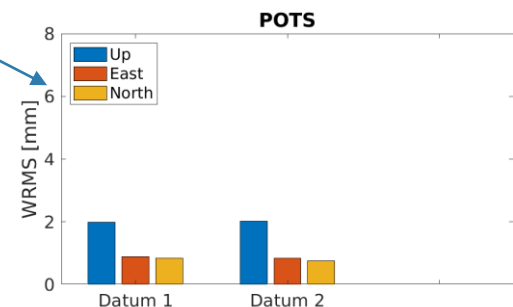
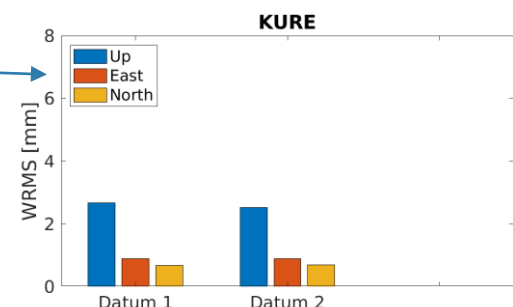
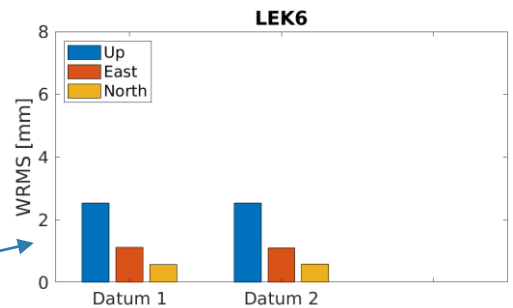
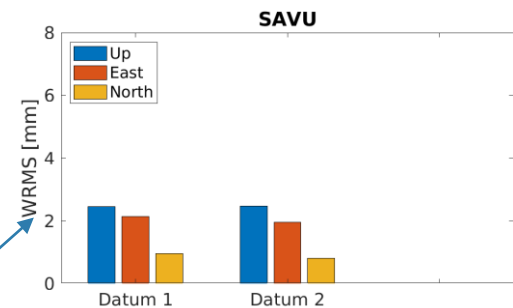
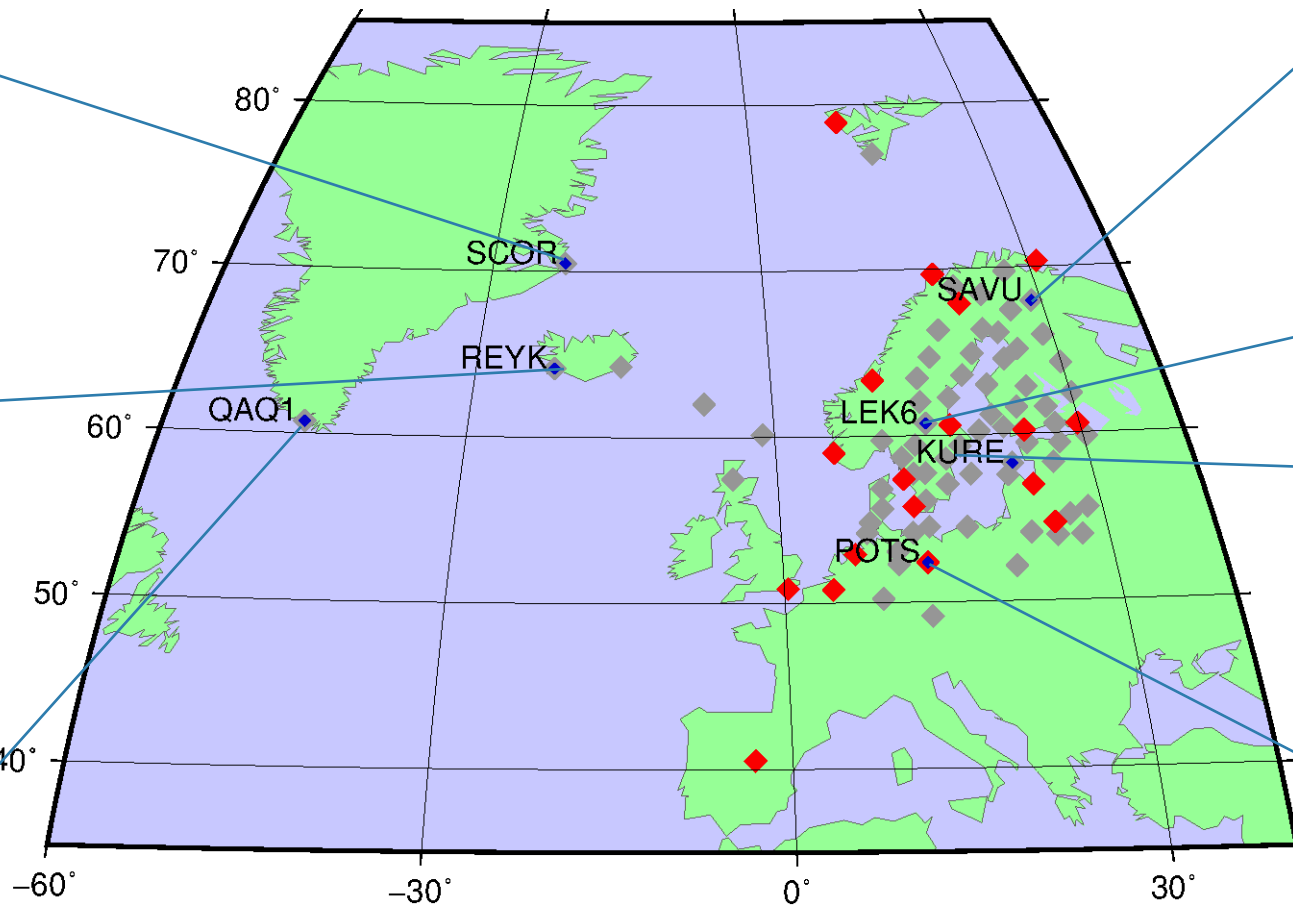
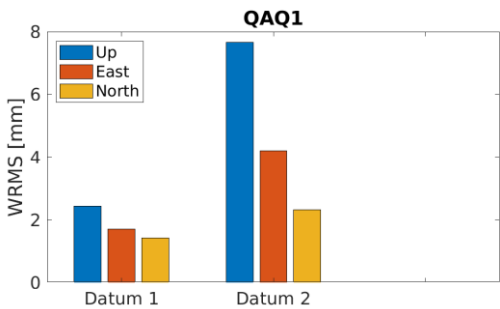
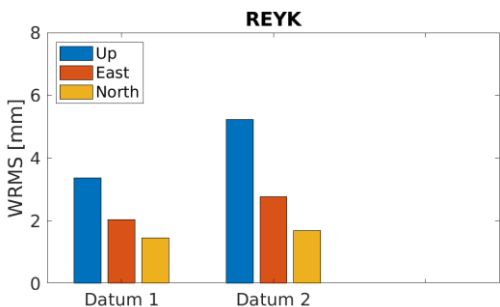
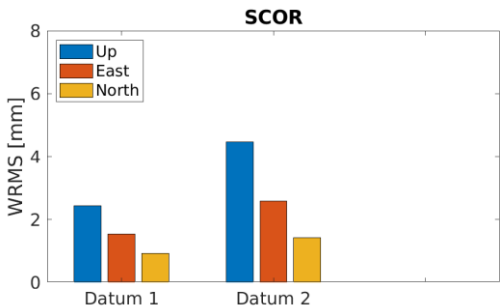
- We tested applying two different datums to the NKG EPN solution
- 20 February – 21 May 2022 (GPS week 2198-2210)
- Datum realization (7 parameters) done with the CATREF software
- Datum 1: relatively well distributed, including two stations in Greenland
- Datum 2: no datum stations in Iceland and Greenland
- Checked the effect on the repeatabilities of the station coordinates

DATUM I: WELL DISTRIBUTED



- ◆ Station not in datum
- ◆ Datum station

DATUM 2: WITHOUT GREENLAND

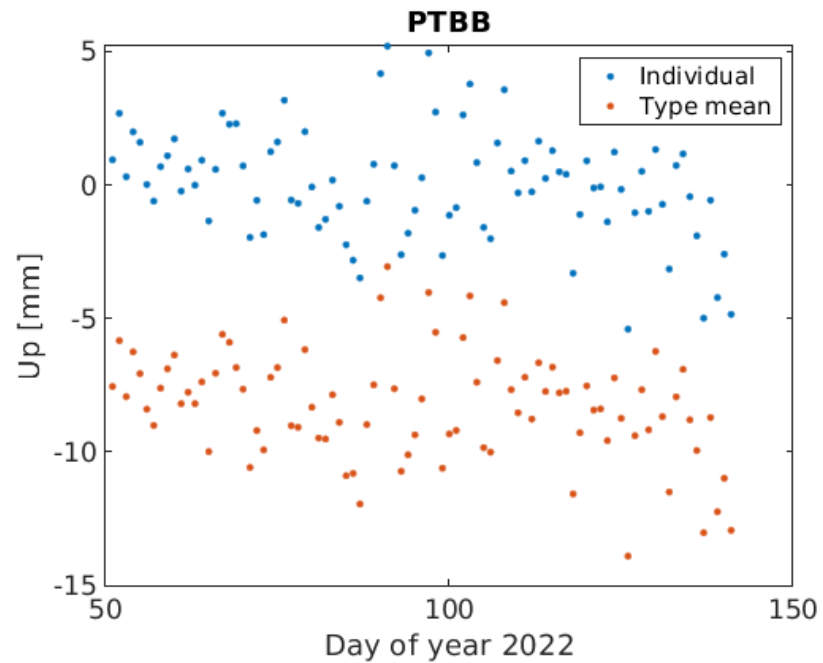
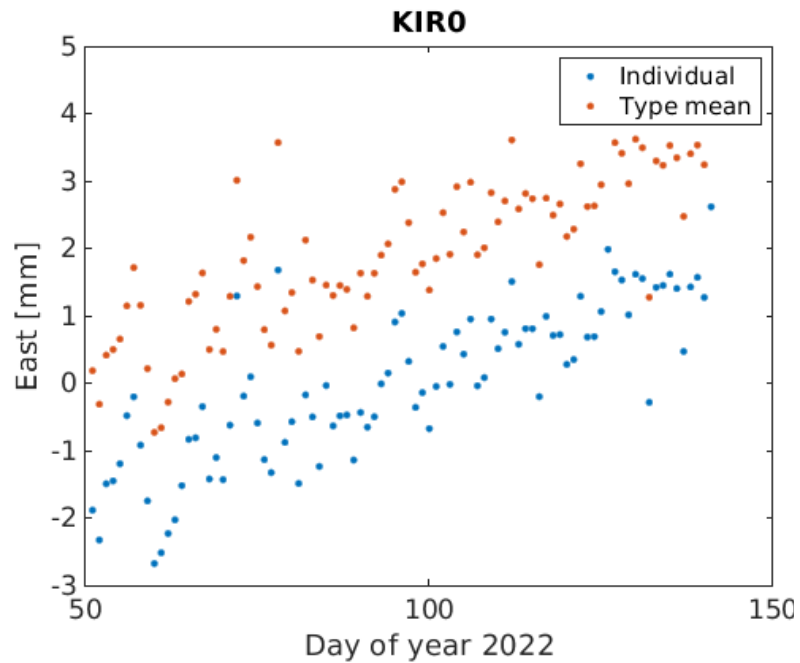


Worse results in Greenland and Iceland, otherwise no effect

GLOBAL ALIGNMENT

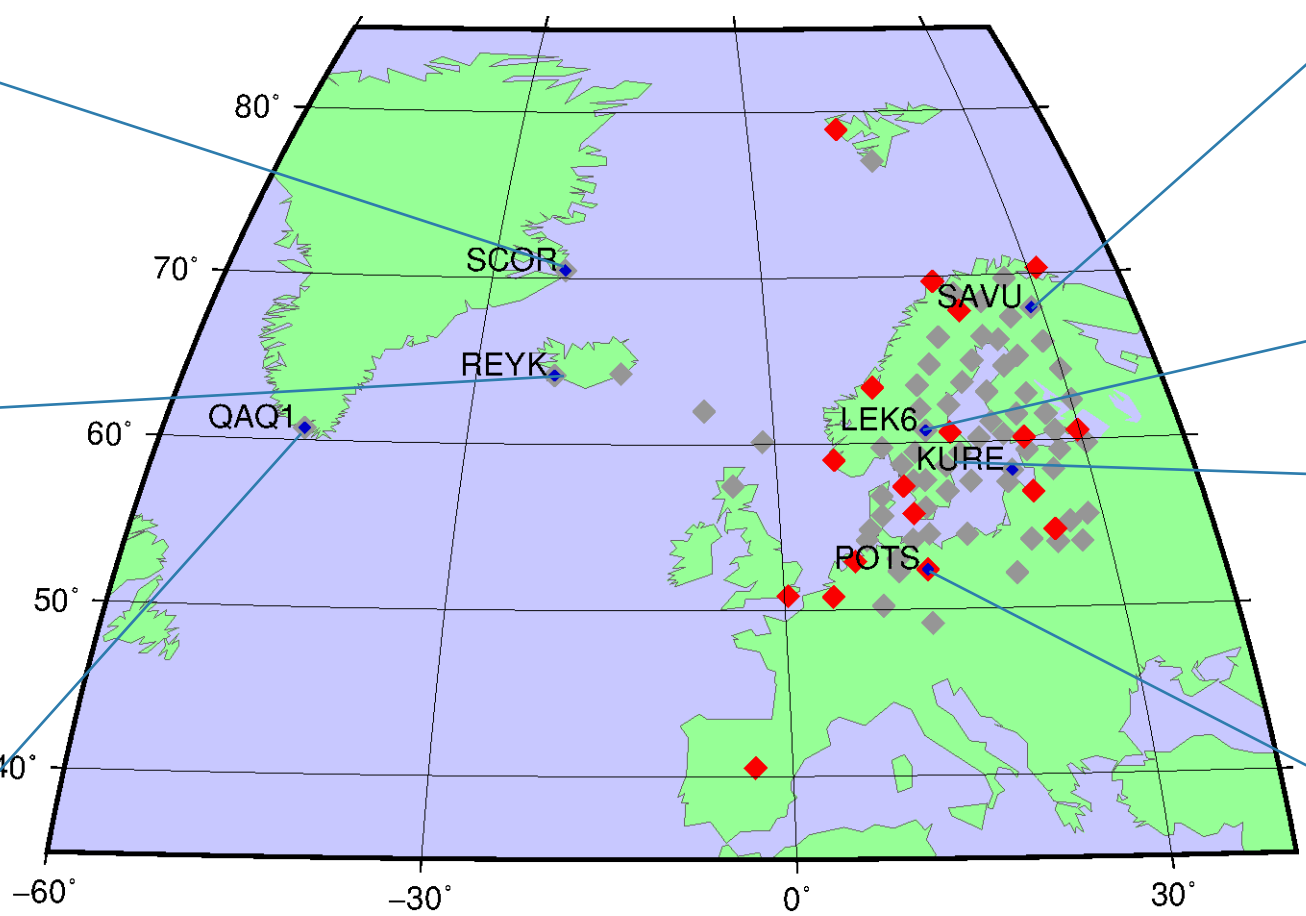
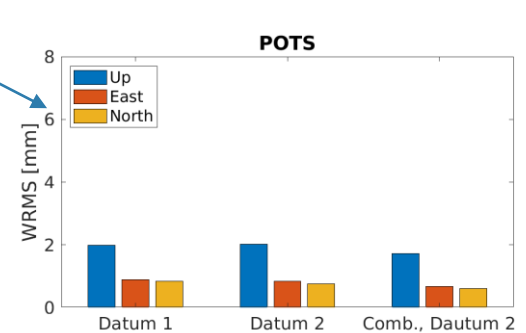
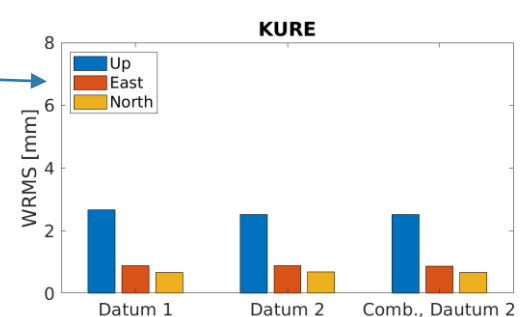
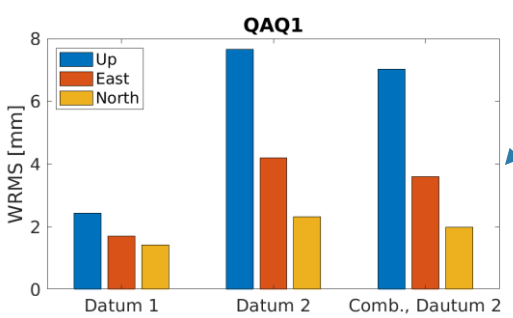
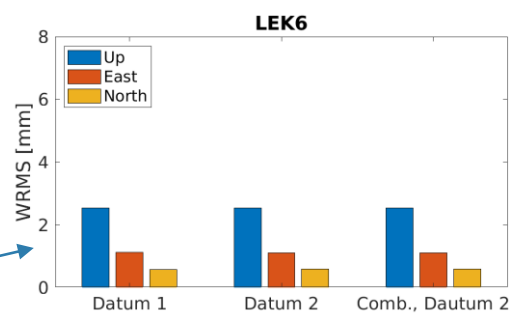
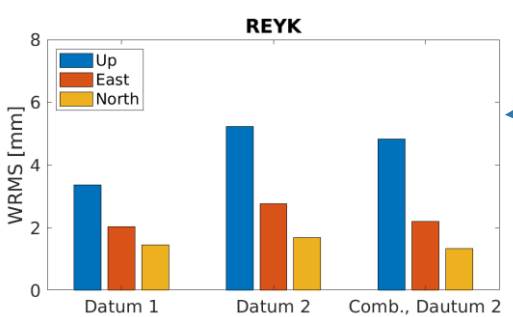
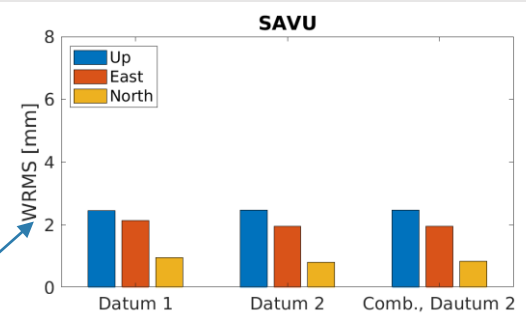
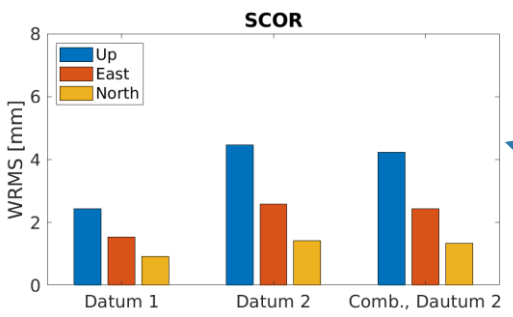
- For global alignment, it is important that the regional and global solutions are consistent
- We tested combining the NKG EPN solution with the global CODE rapid solution
 - Both solutions use GPS+GLONASS+Galileo
 - Both are produced with the Bernese software
 - Analysis settings are relatively similar
 - Several common stations
- One important difference:
 - Operational NKG EPN solution uses individual antenna calibrations (when available)
 - CODE only use type mean calibrations
 - To be consistent, we reprocessed the NKG EPN solution for the period 20 February-21 May, 2022, using type mean antenna calibrations
- Combination and datum realization done with CATREF

DIFFERENCES BETWEEN INDIVIDUAL AND TYPE-MEAN CALIBRATIONS



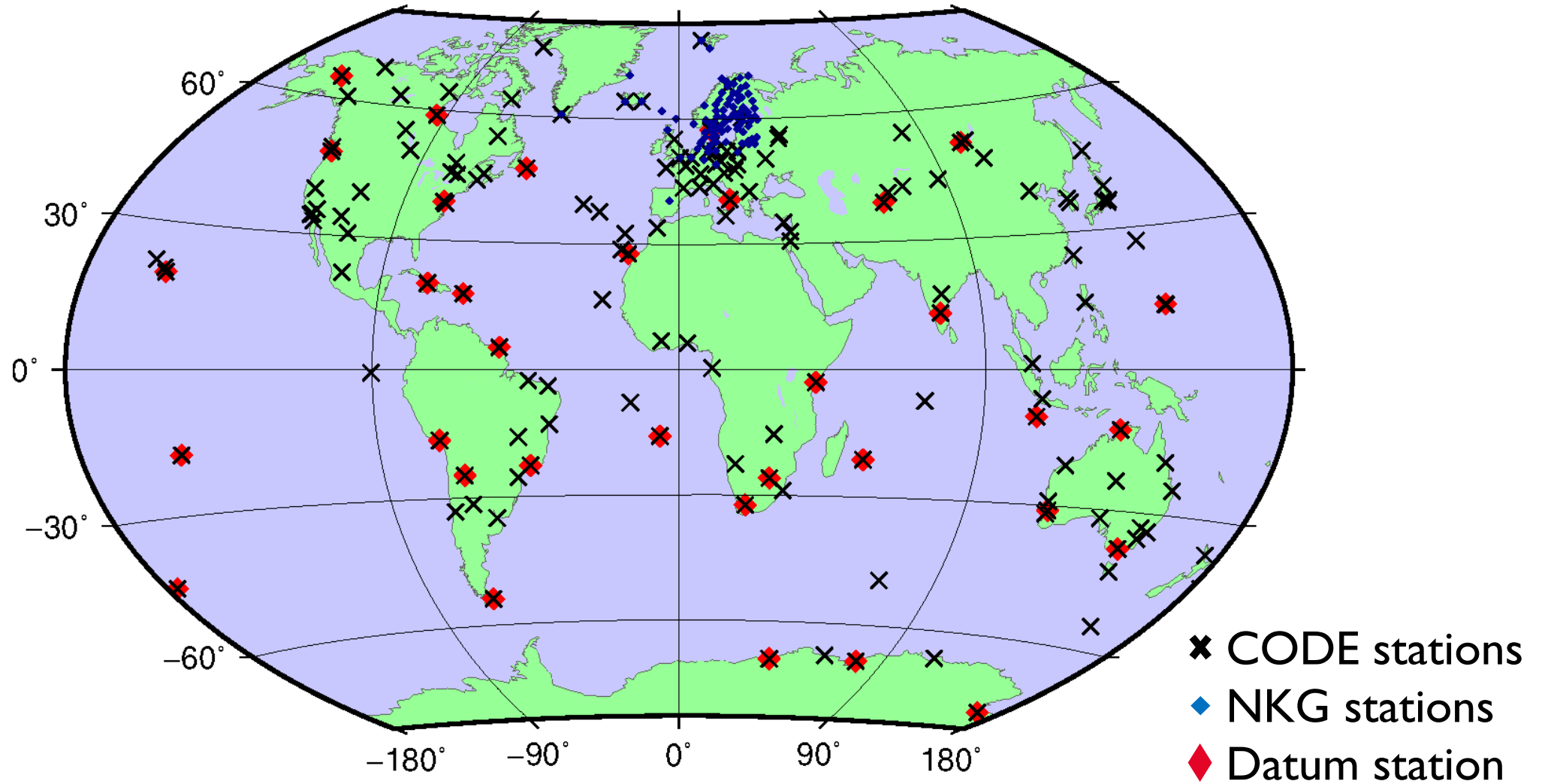
- Examples of coordinate time series when for the NKG EPN solution with individual (blue) and type mean (red) antenna calibrations
- Both stations occur in both the NKG EPN and CODE solutions, thus it is important to use the EPN NKG solution with type mean calibrations

COMBINED SOLUTION: DATUM 2

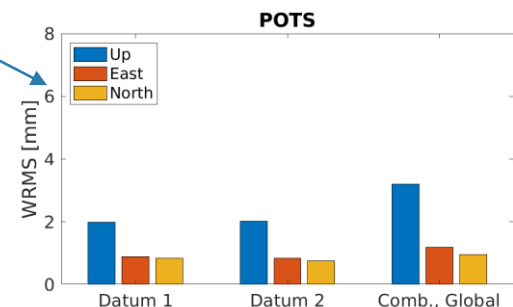
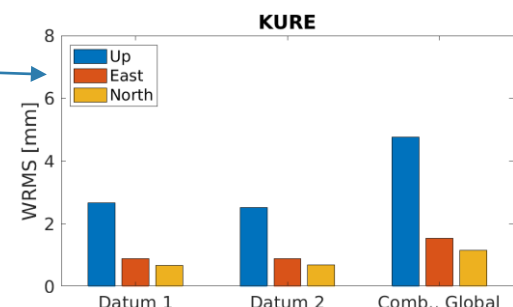
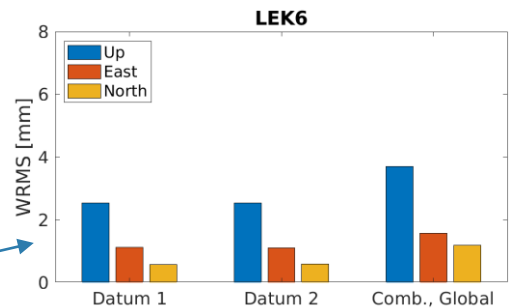
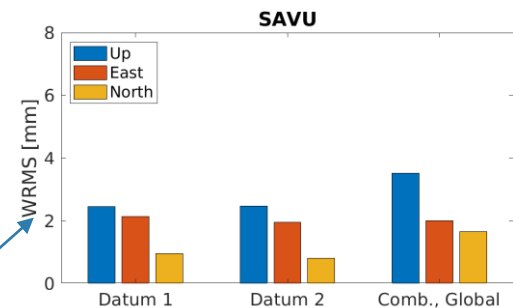
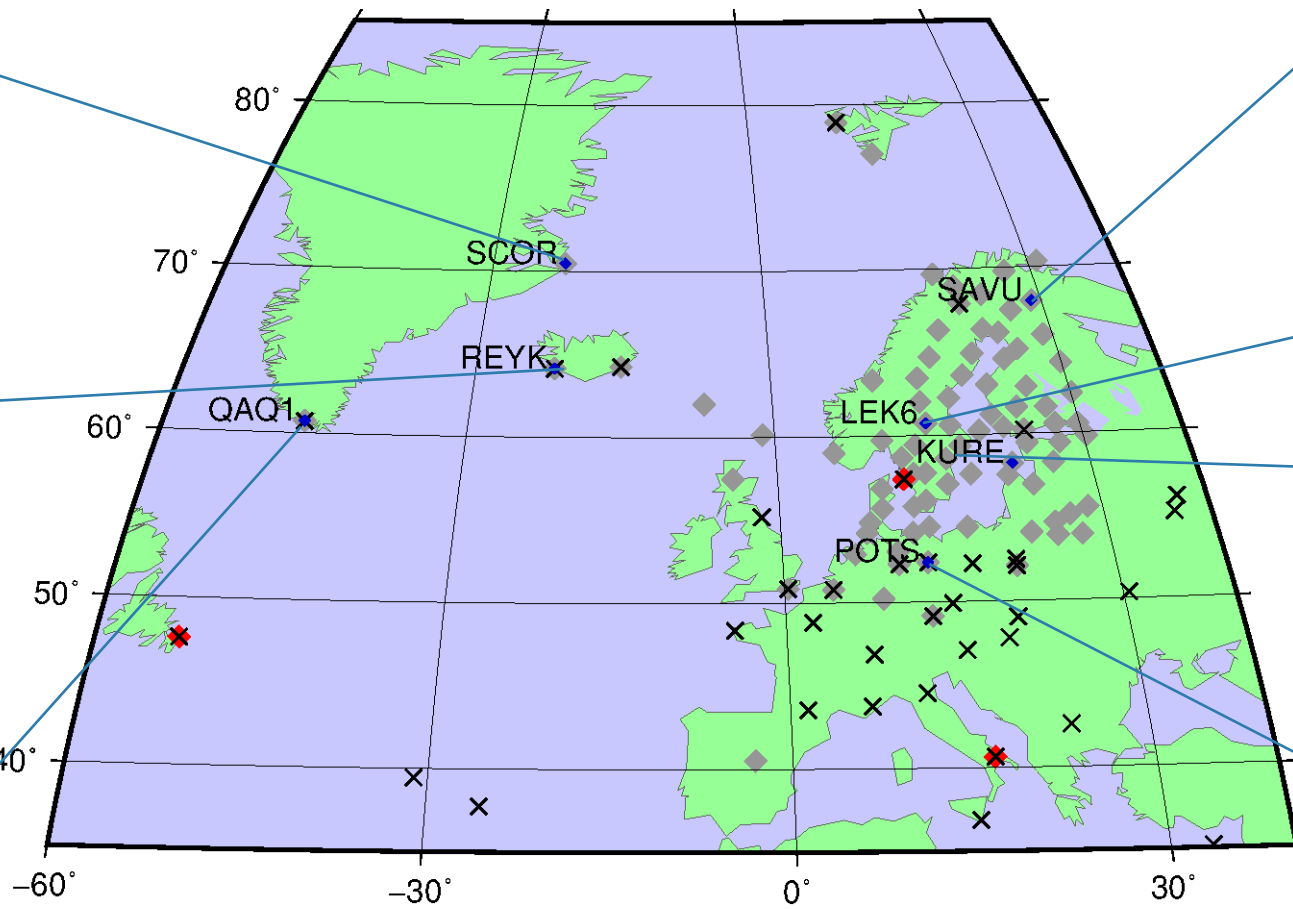
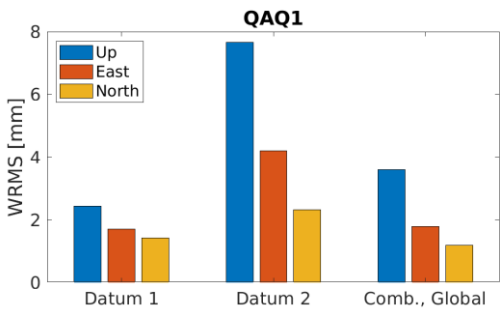
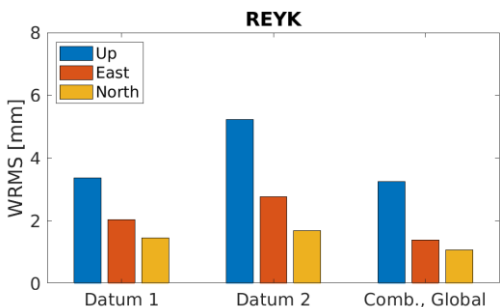
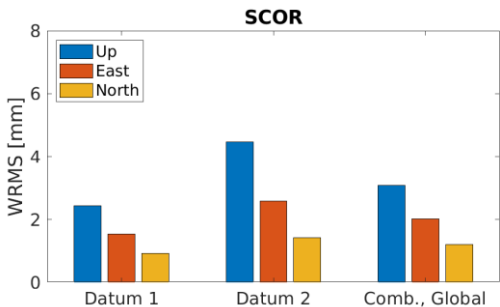


- Applying Datum 2 to the combined solution
- As expected, no major differences

GLOBAL DATUM



COMBINED SOLUTION: GLOBAL DATUM

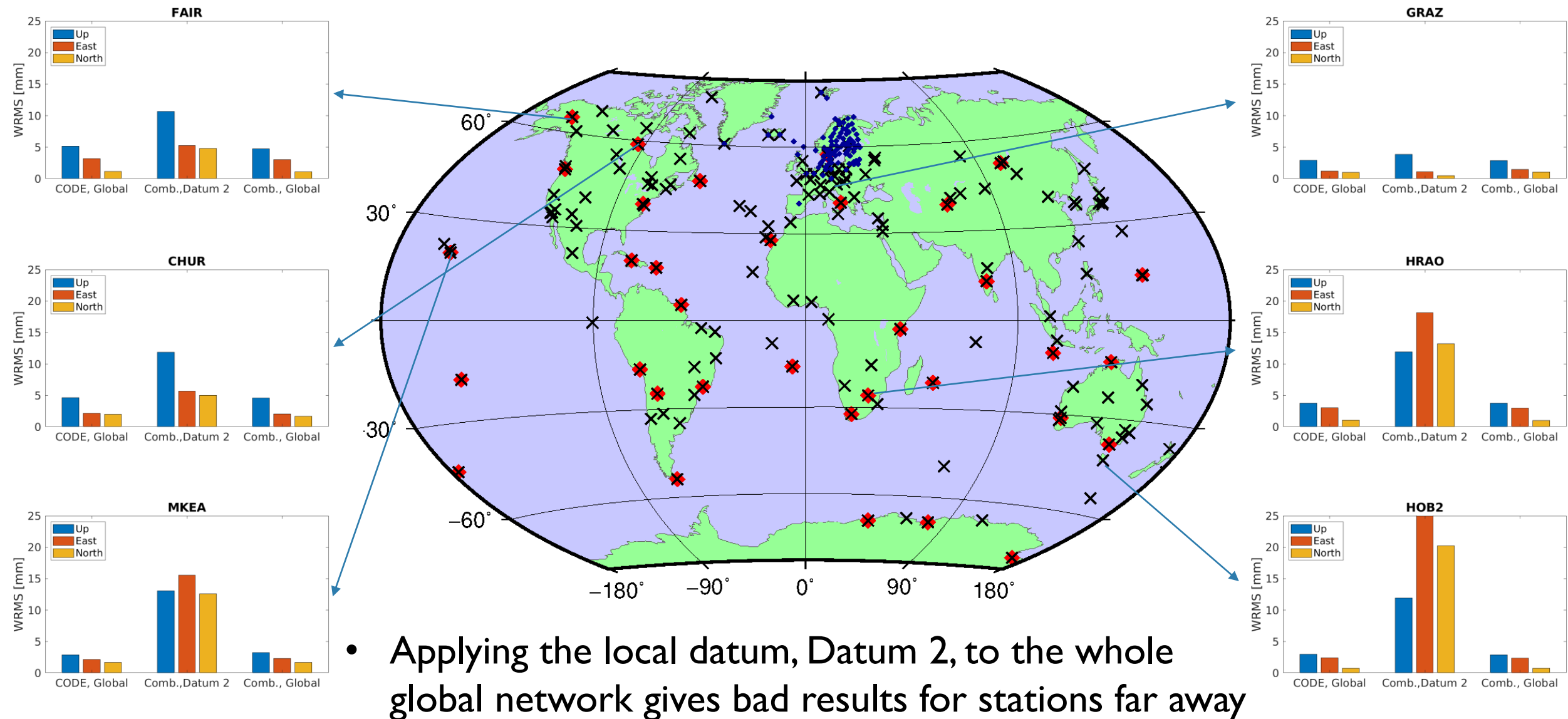




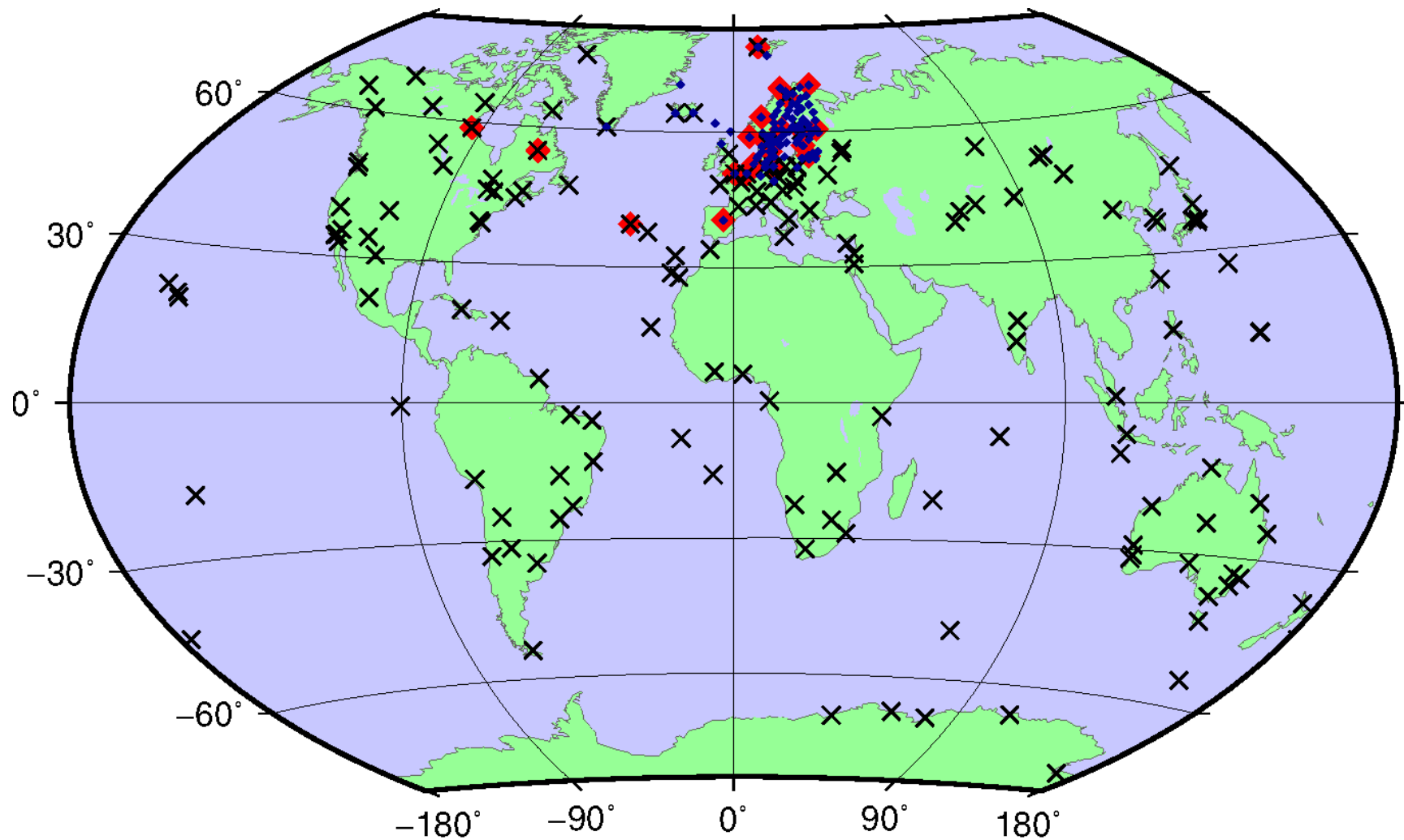
EFFECTS OF APPLYING A GLOBAL DATUM

- The global datum gives worse repeatabilities than the regional one for the stations in the center of the NKG EPN network
 - This is expected since, e.g., loading effects generally are affecting a global solution more than a regional solution
- The edge effects seen in Greenland and Iceland for Datum 2 not visible when applying the global datum

EFFECT OF DATUM ON SOME GLOBAL STATIONS

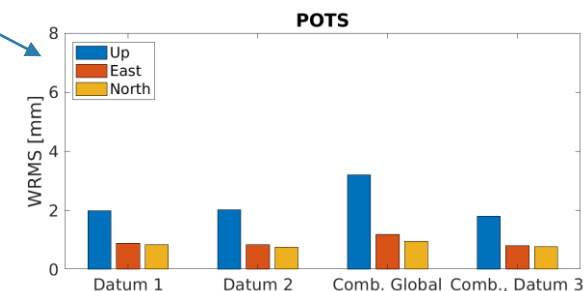
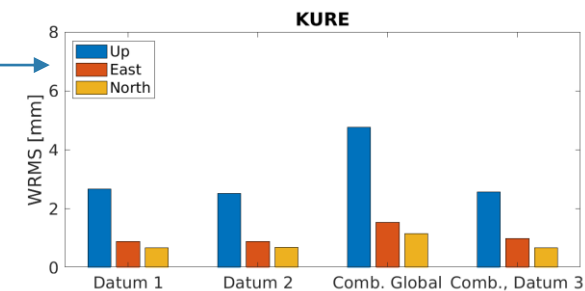
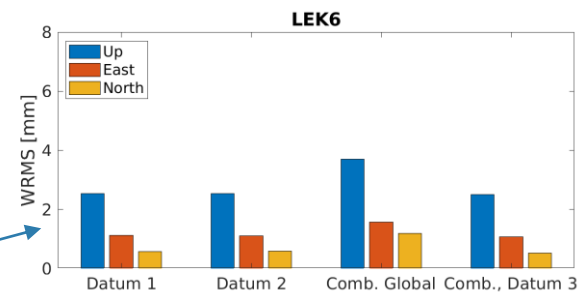
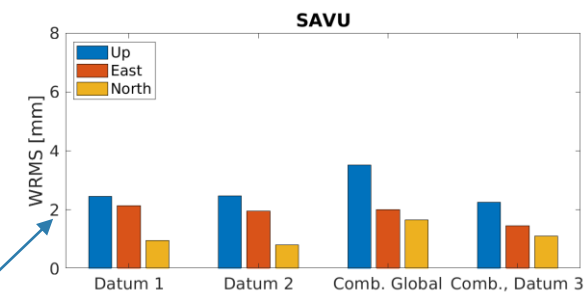
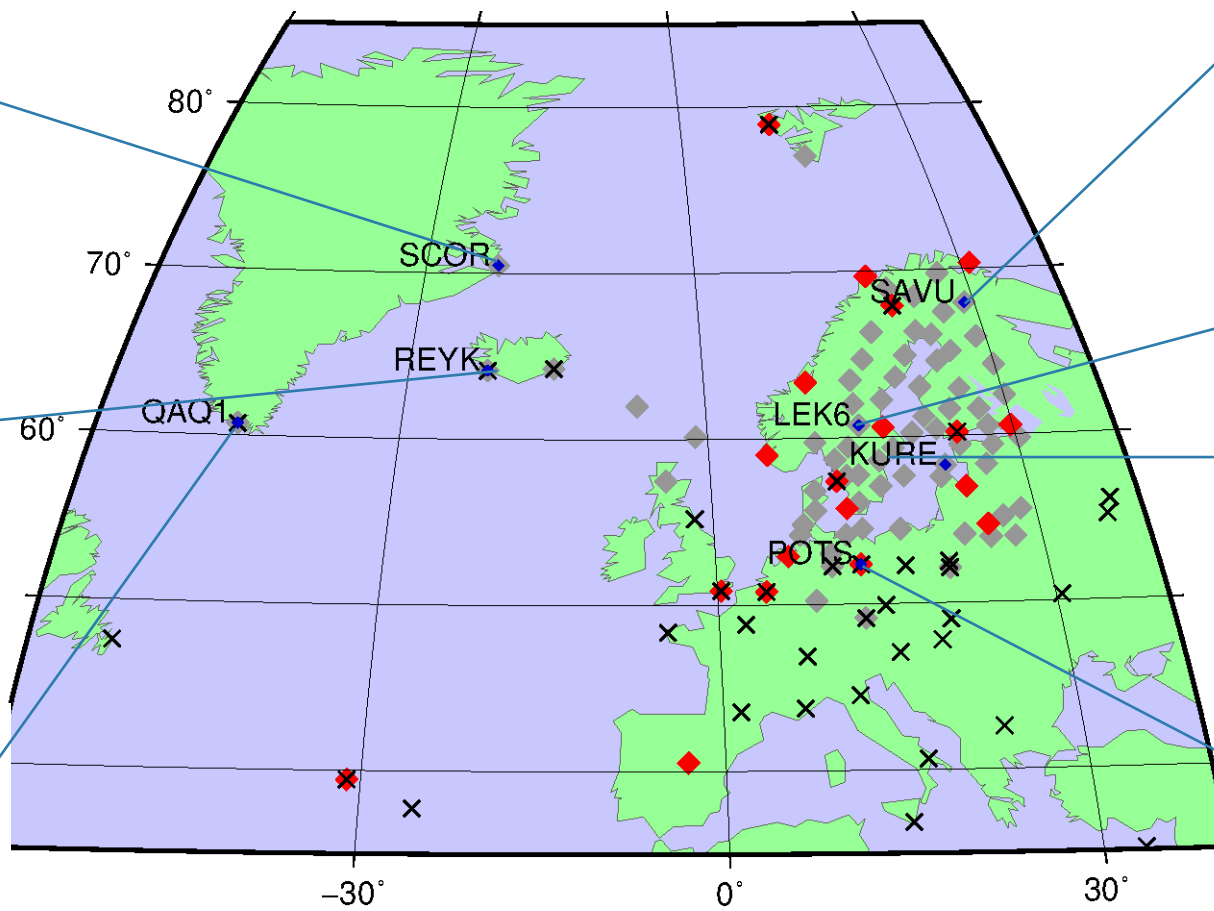
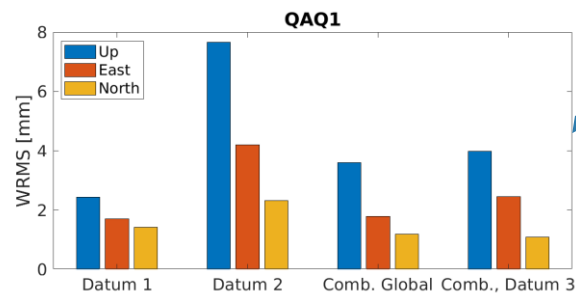
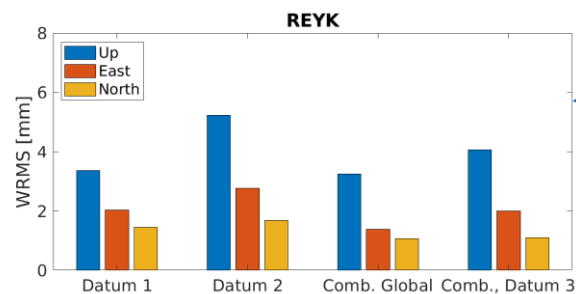
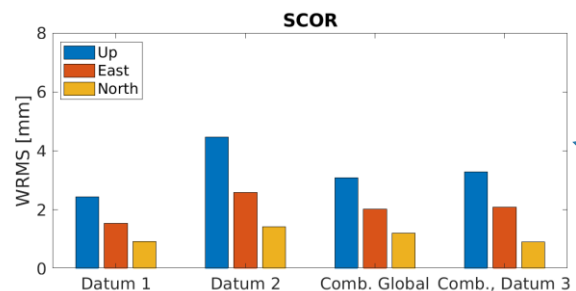


DATUM 3: DATUM 2 + 3 STATIONS



- Test of adding two additional stations in Canada and one in the Azores to Datum 2

COMBINED SOLUTION: DATUM 3



- Results are improved in Greenland/Iceland compared to Datum 2

CONCLUSIONS

- Applying a regional datum can lead to significant effect 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