# Mitigation of unmodelled non–tidal atmospheric pressure loading into parameters of a global GNSS solution

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# Outline

Description of the experiment

APL and GNSS–derived coordinates

APL and GNSS–derived troposphere

APL and GNSS–orbits

Summary and Conclusion

# Description of the experiment

- Recent CODE reprocessing effort based on existing screened observation files:
  - Time interval:
    January 1996 to May 2003 GPS–only solution
    May 2003 to December 2010 GPS+GLONASS solution
  - fully consistent with IGS08.ATX and IGS08.SNX

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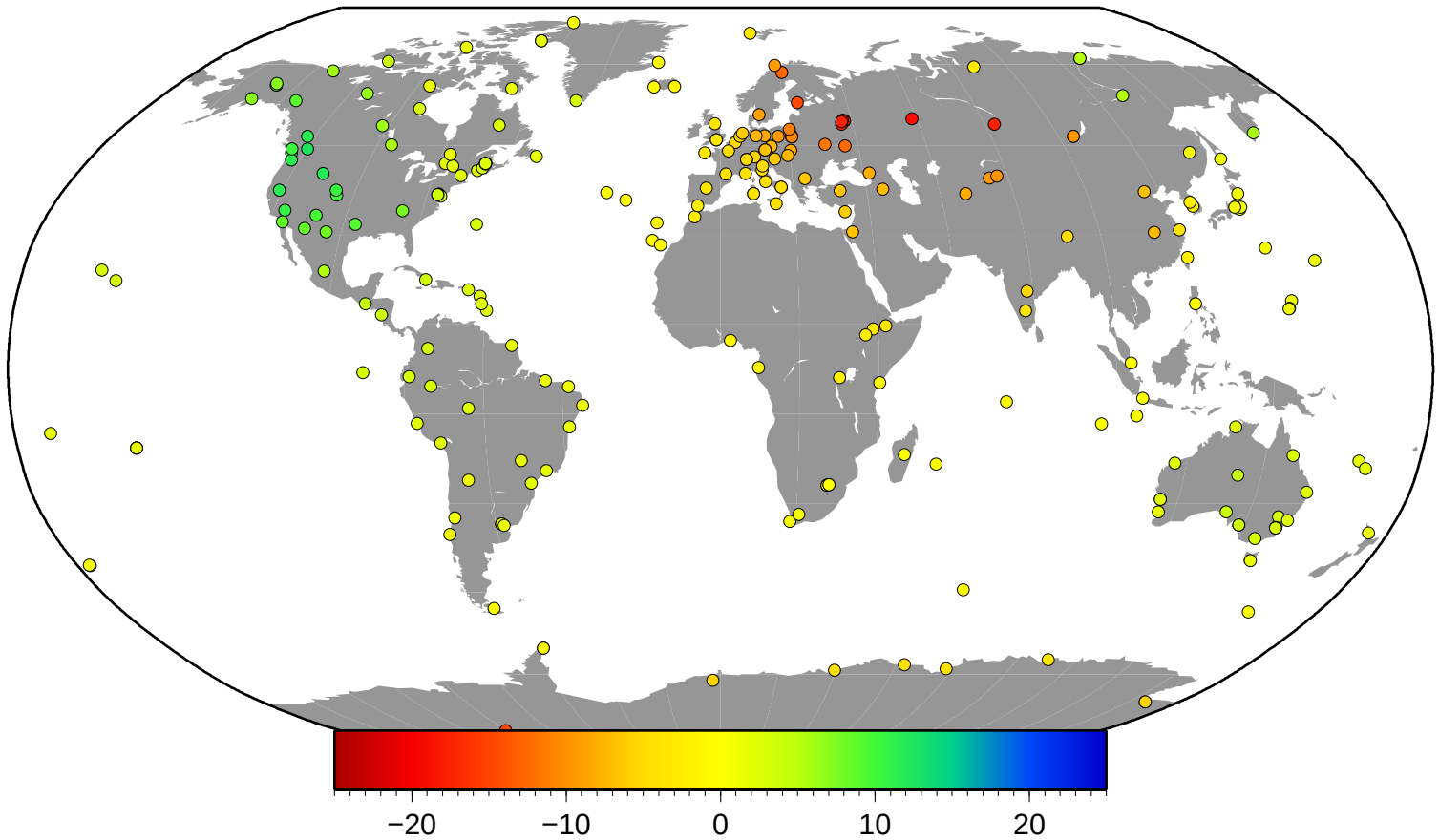
  21. January: most active APL in all stations of the network
  29. May: least active APL in all stations of the network
- For these two days all APL corrections are summed in the processing program for each station.

# APL and GNSS–derived coordinates

Mean APL corrections for each station
extracted from Vienna model during data processing

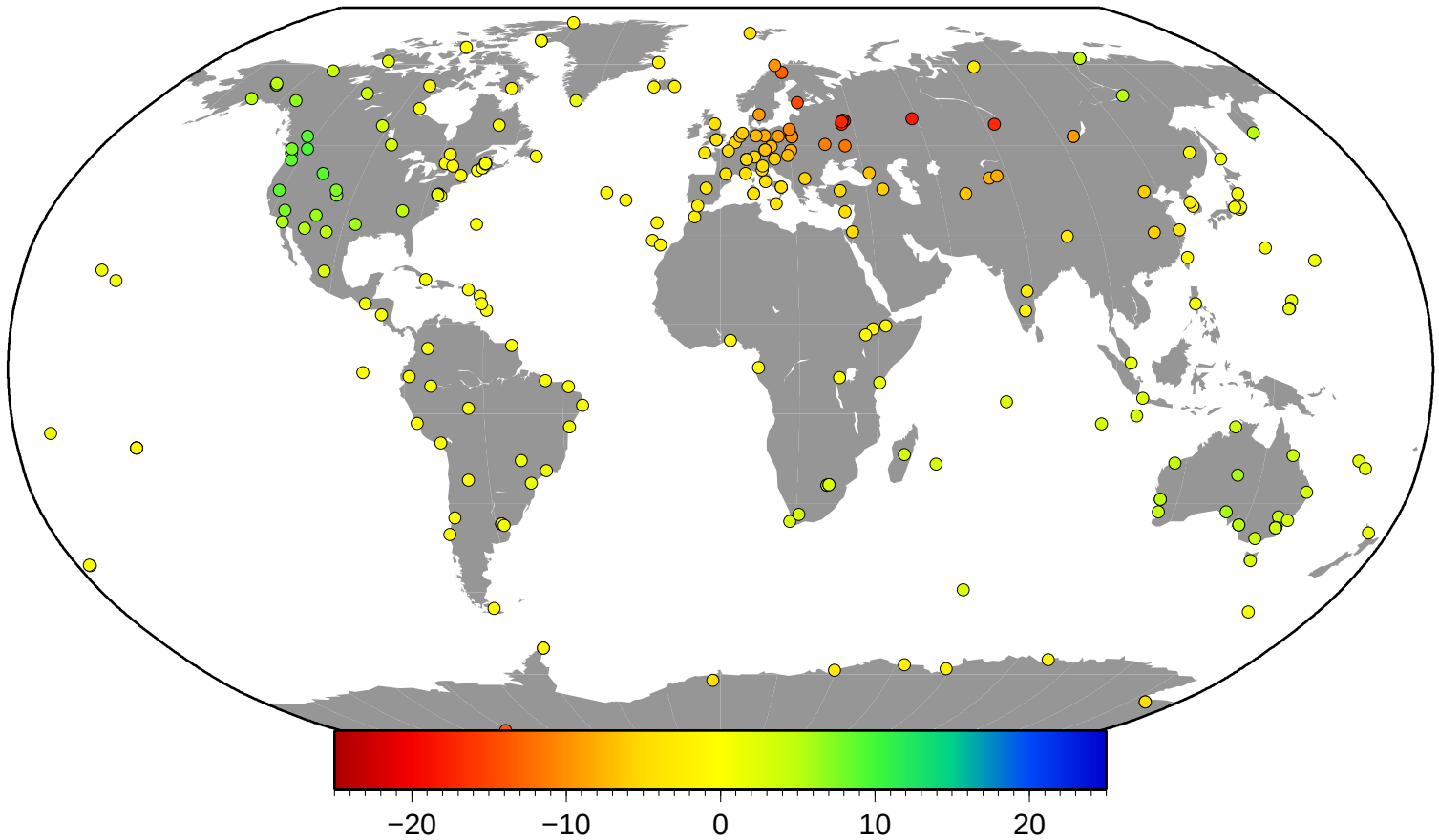



vertical component

21. January 2010

# APL and GNSS–derived coordinates

Coordinate difference between solutions
applying/not applying APL corrections

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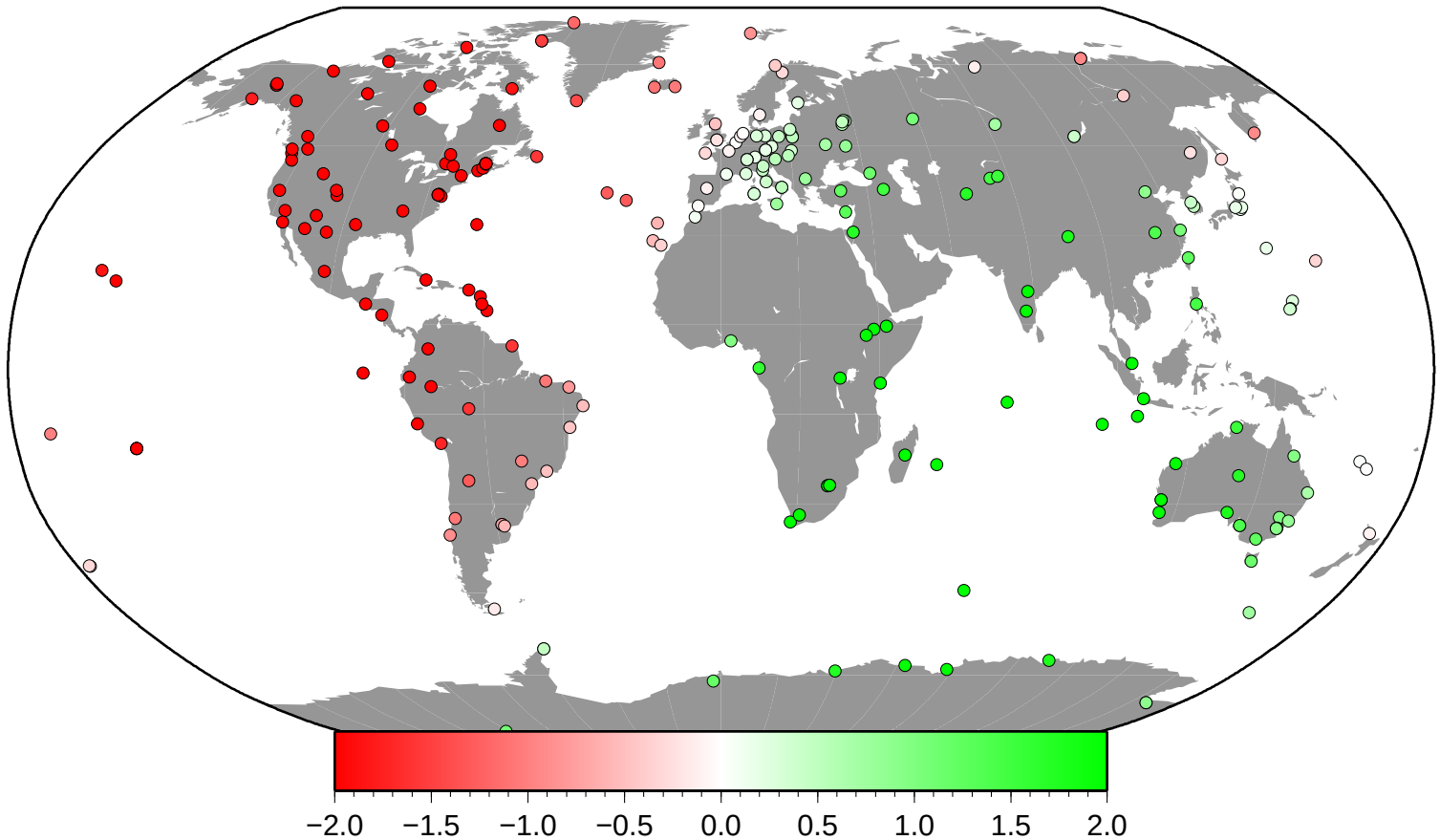
# APL and GNSS–derived coordinates

Coordinate difference between solutions
applying/not applying but correcting for APL effect

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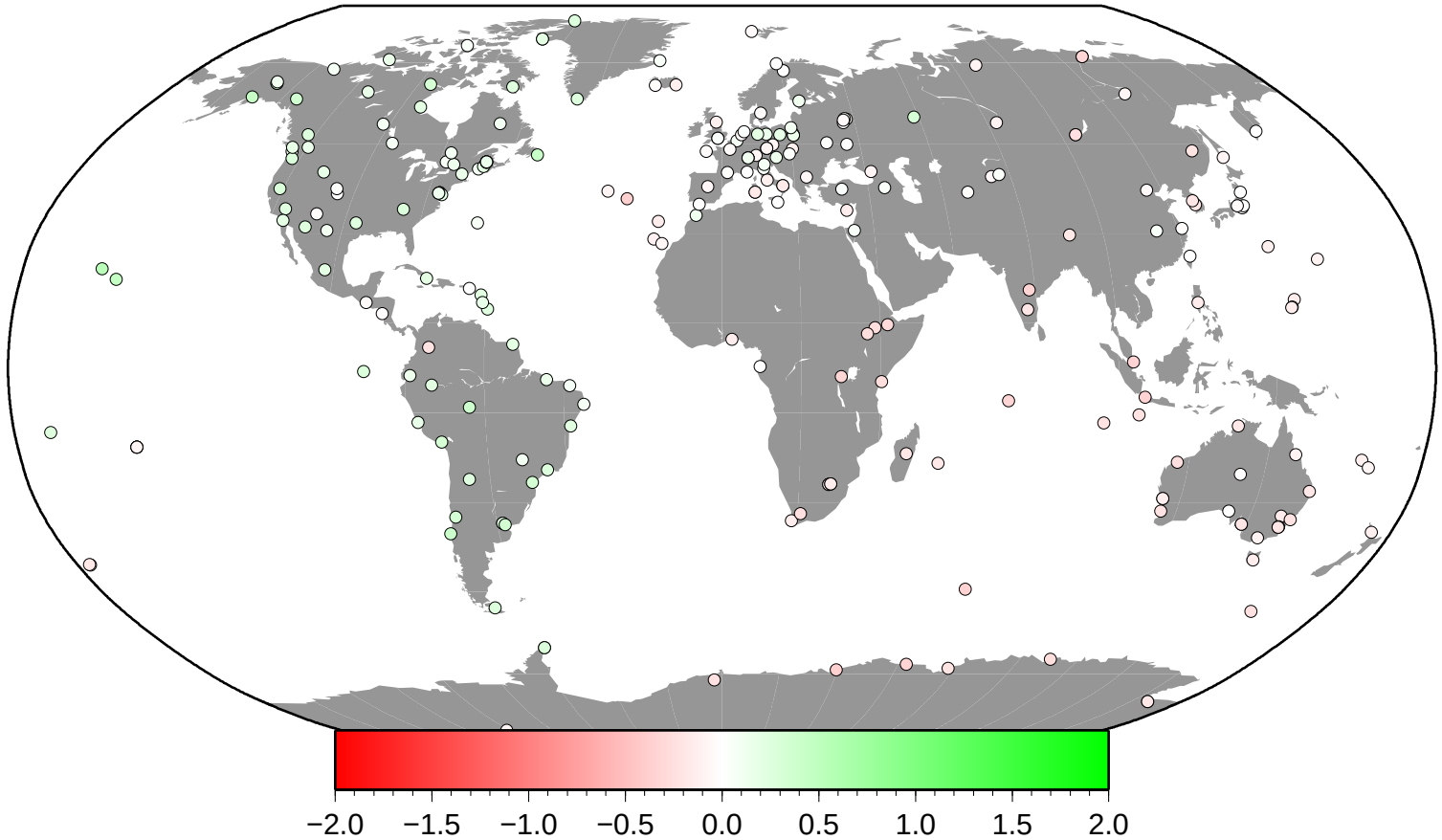
# APL and GNSS–derived coordinates

Residuals of a Helmert–transformation between solutions applying/not applying but correcting for APL effect

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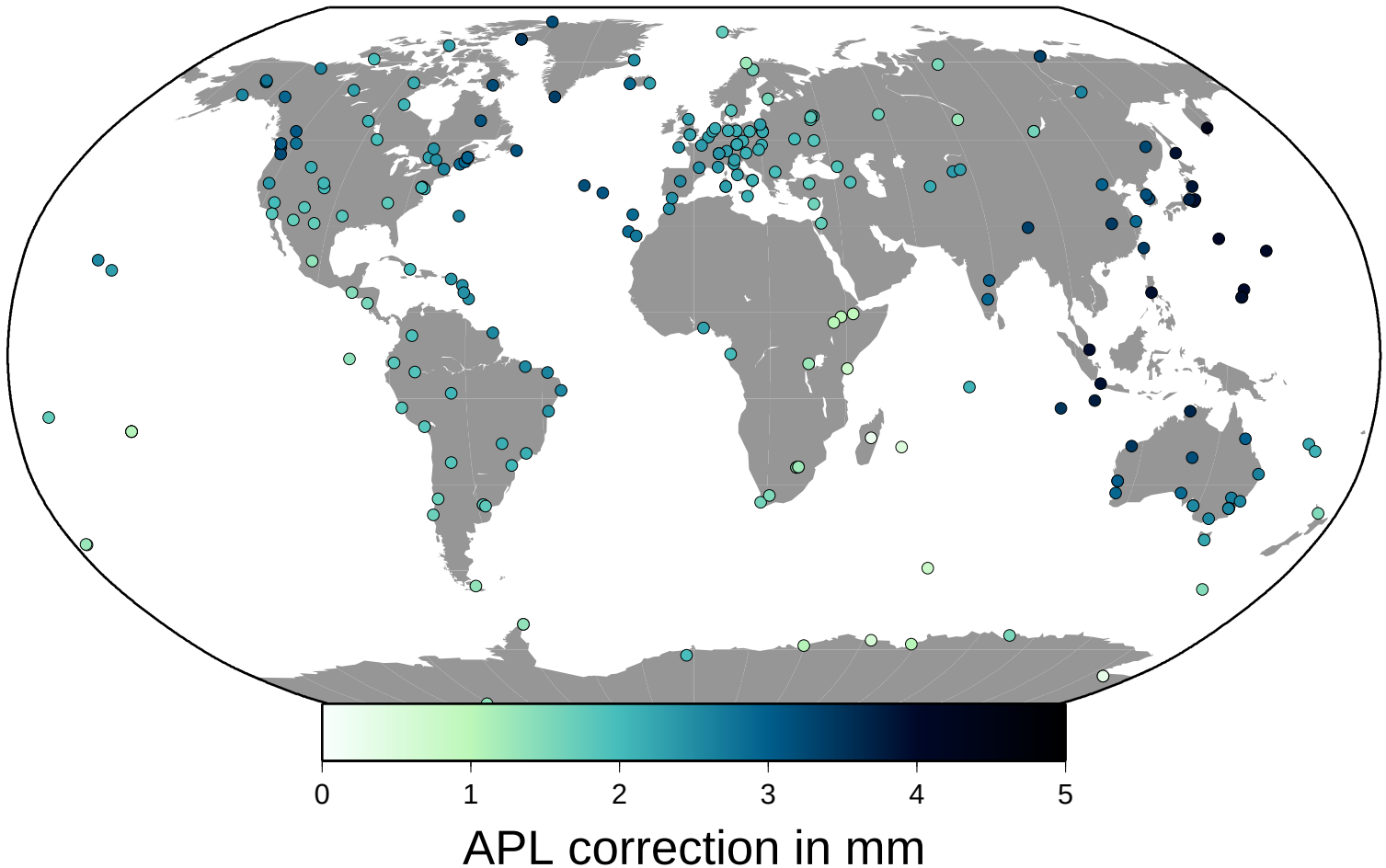


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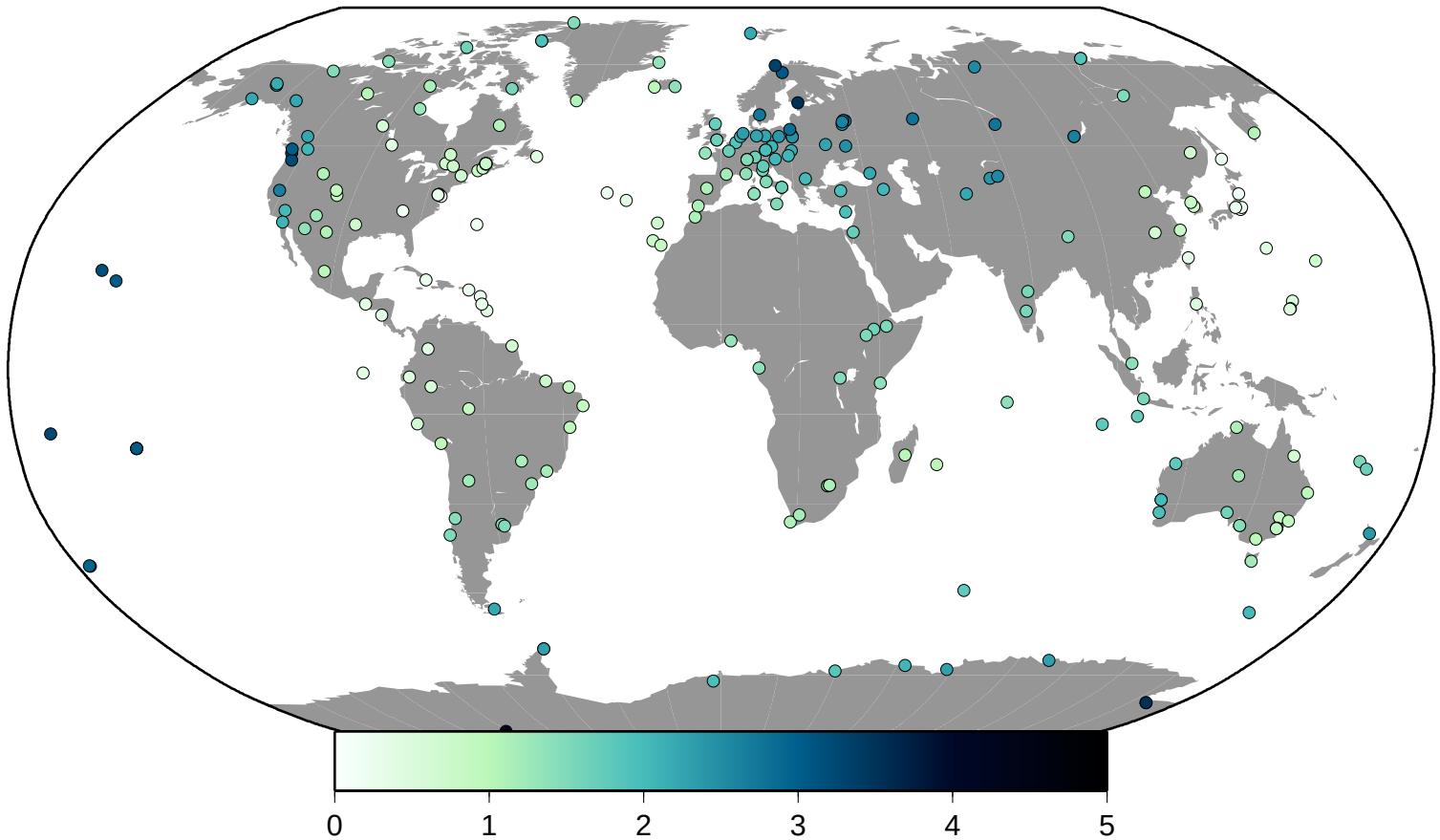


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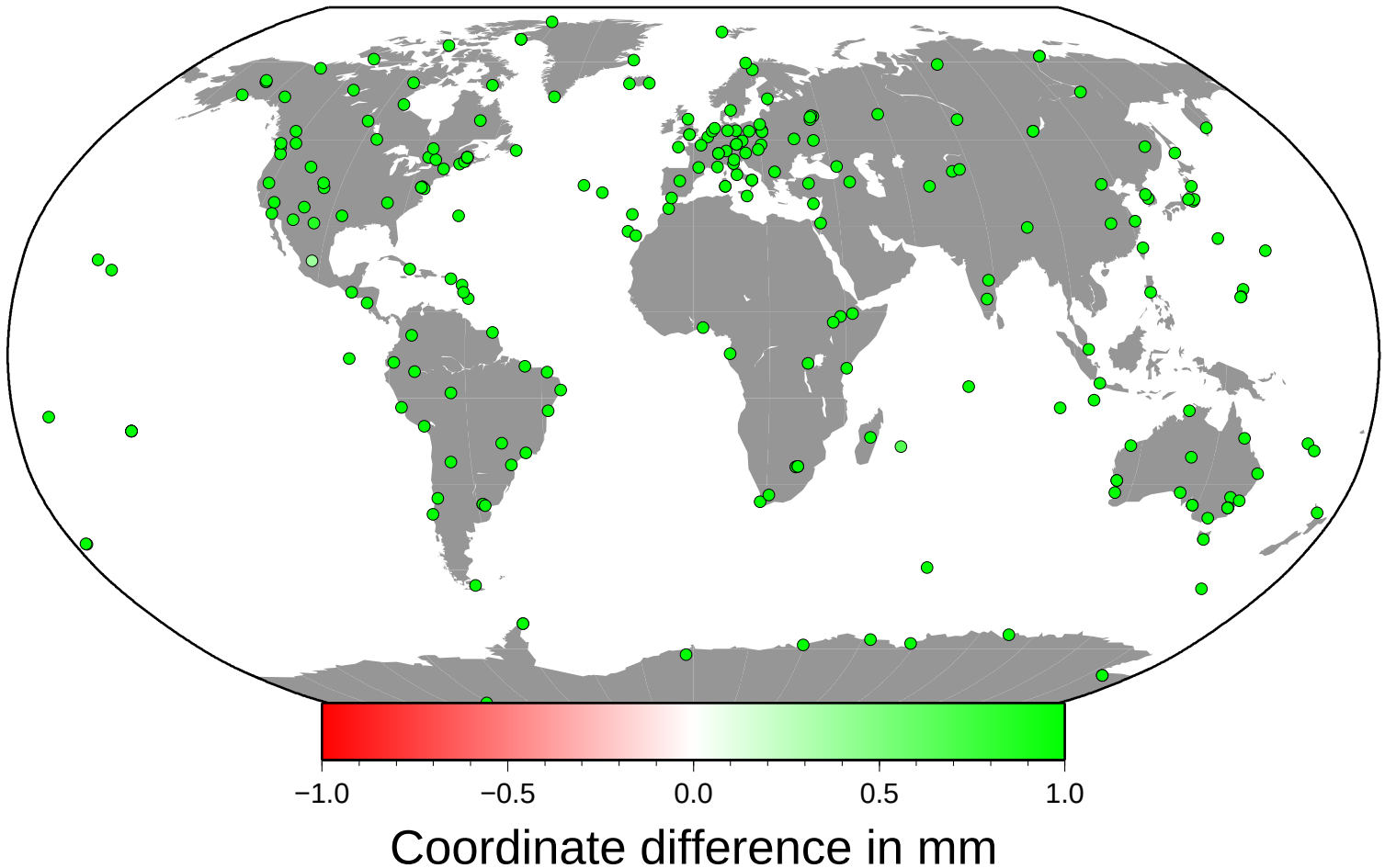


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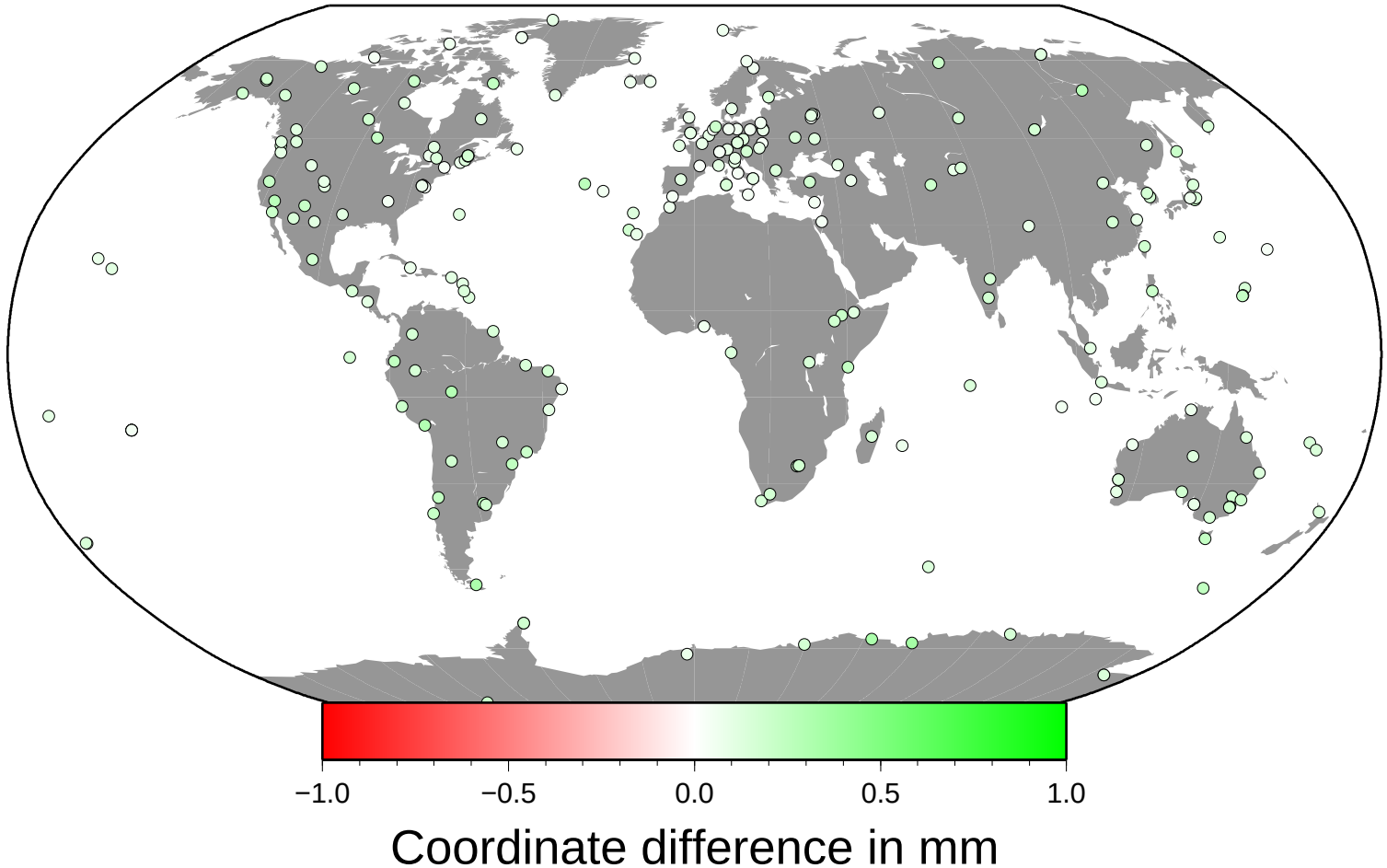


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# APL and GNSS–derived coordinates

RMS of coordinate comparison

# APL and GNSS–derived coordinates

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- Difference of the solution without applying APL corrections...

| 21. January 2010 | | | 29. May 2010 | | |
|---|---|---|---|---|---|
| $RMS_N$ | $RMS_E$ | $RMS_U$ | $RMS_N$ | $RMS_E$ | $RMS_U$ |
| 1.1 mm | 1.4 mm | 5.3 mm | 0.6 mm | 0.4 mm | 1.5 mm |

...with respect to the solution applying the APL corrections on observation level.

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- Difference of the solution without applying but correcting for the APL effect...

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| $RMS_N$ | $RMS_E$ | $RMS_U$ | $RMS_N$ | $RMS_E$ | $RMS_U$ |
| 1.8 mm | 2.5 mm | 1.7 mm | 0.5 mm | 0.4 mm | 0.2 mm |

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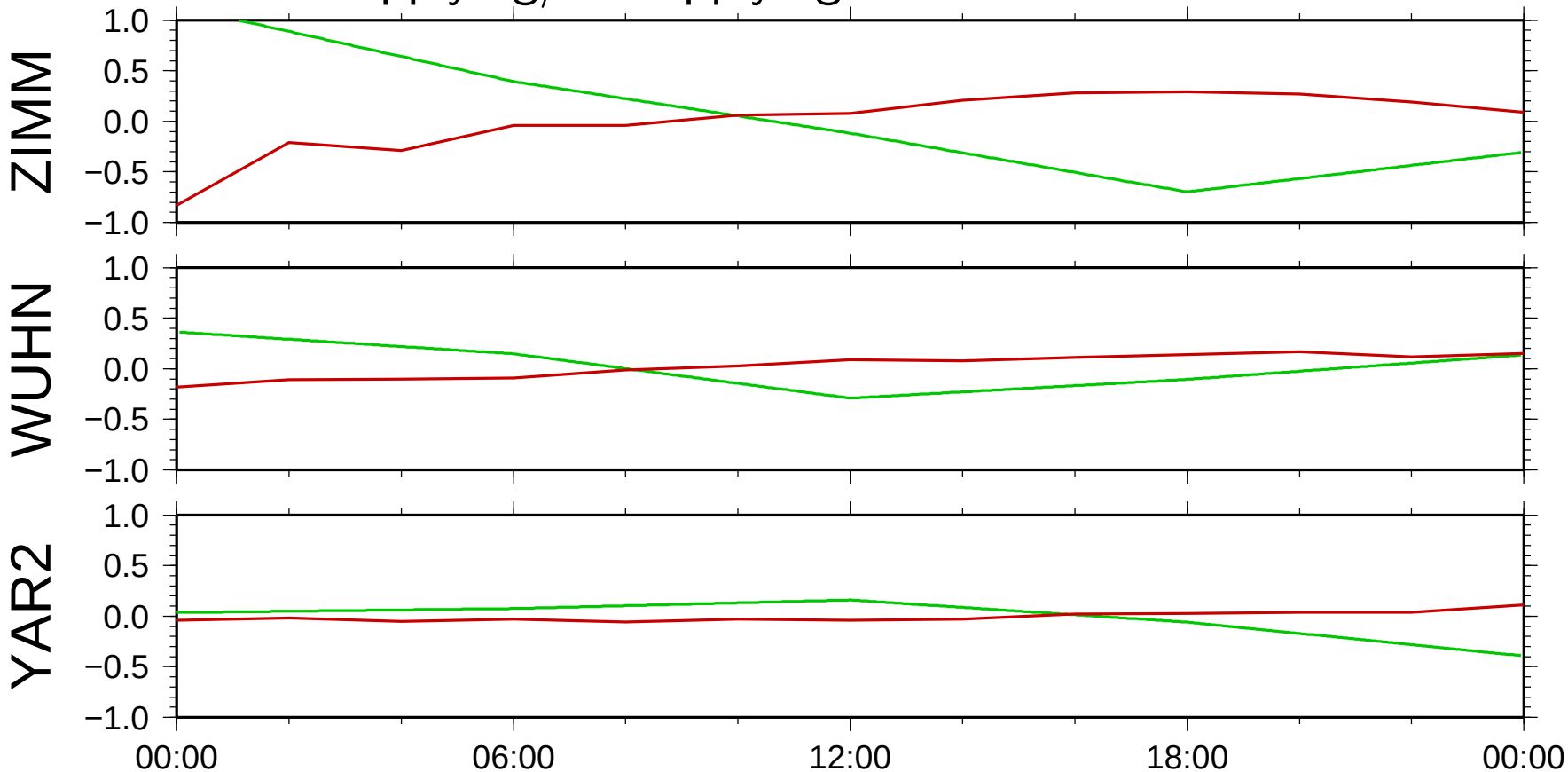
# APL and GNSS–derived troposphere

Differences between troposphere estimates from solutions applying/not applying APL corrections




units: mm

red: difference of troposphere estimates, green: APL effect

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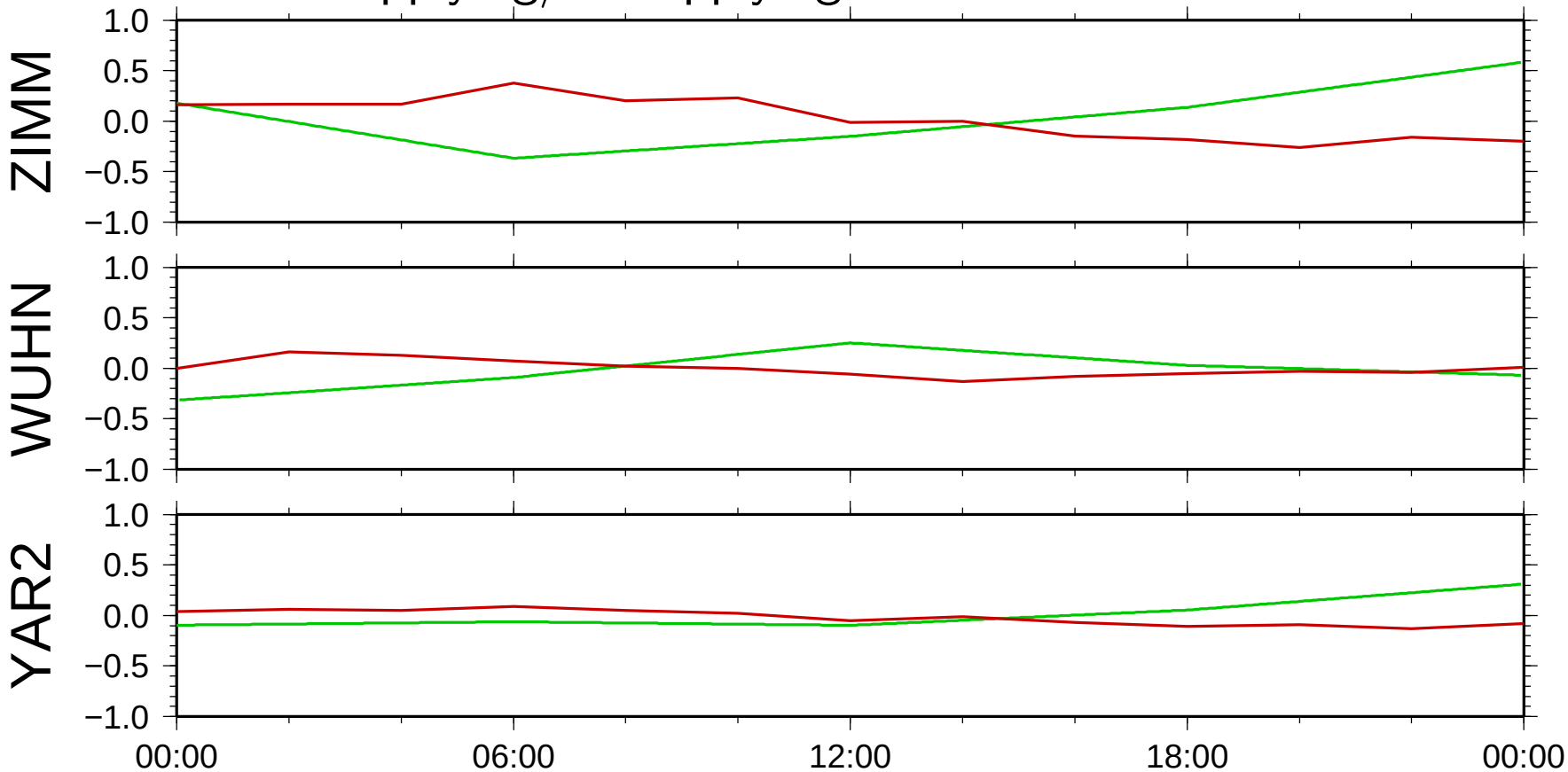


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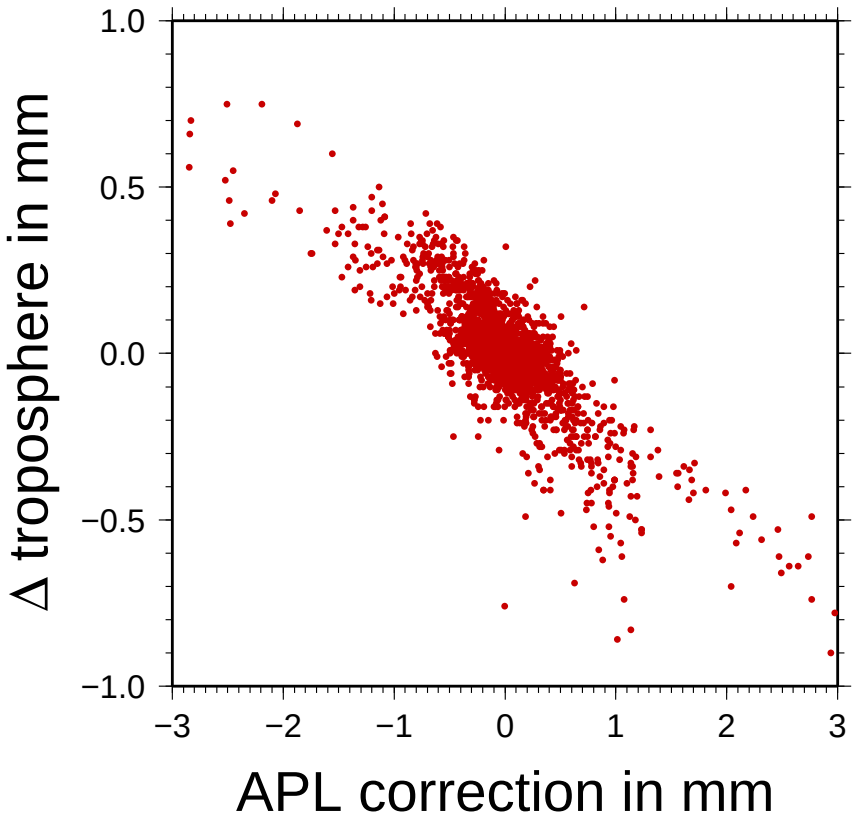
Differences between troposphere estimates from solutions applying/not applying APL corrections versus APL correction

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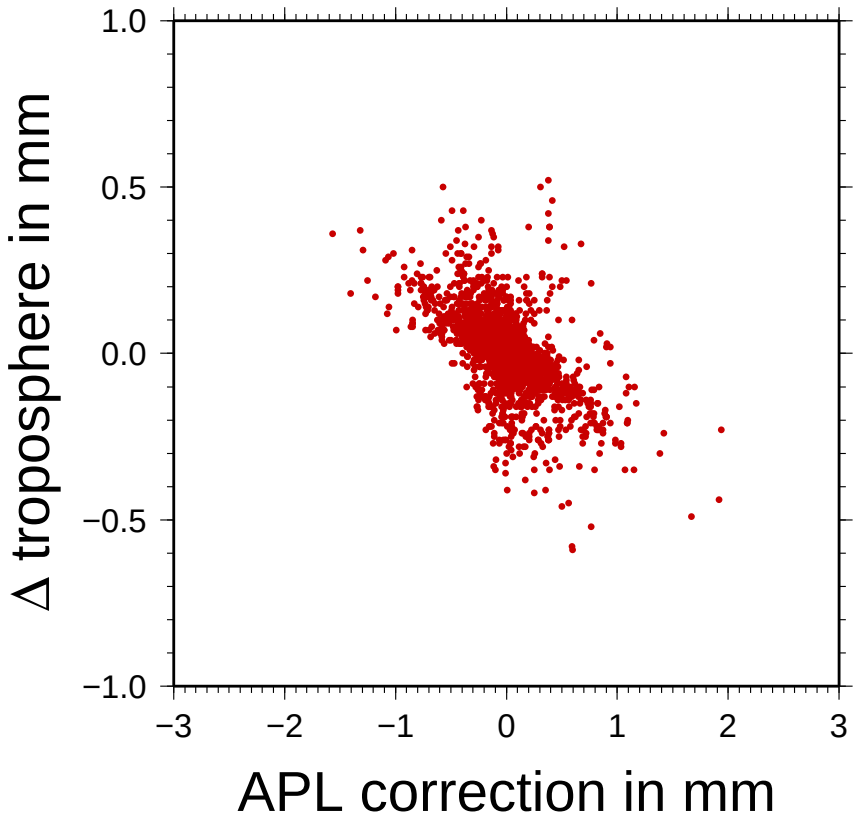


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# APL and GNSS–orbits

RMS of Earth-fixed satellite positions

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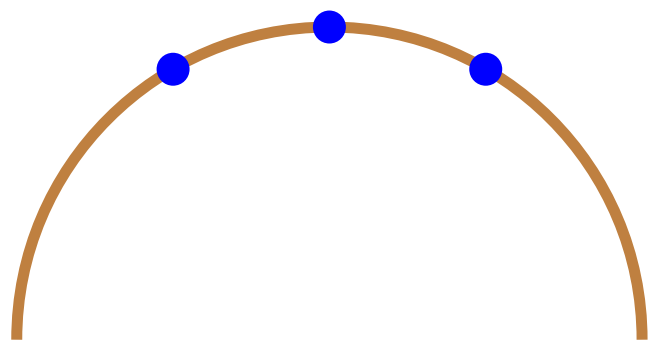

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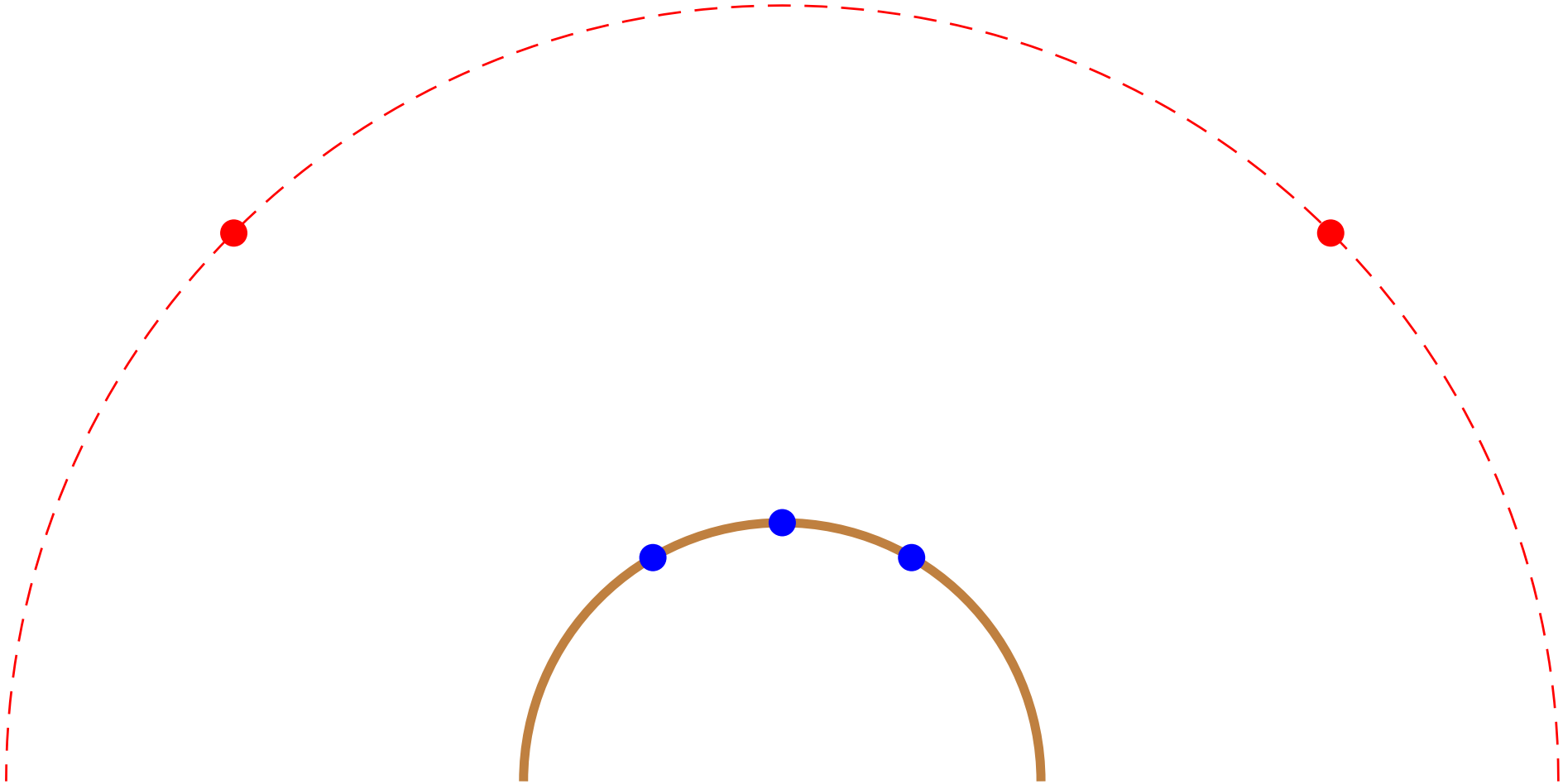

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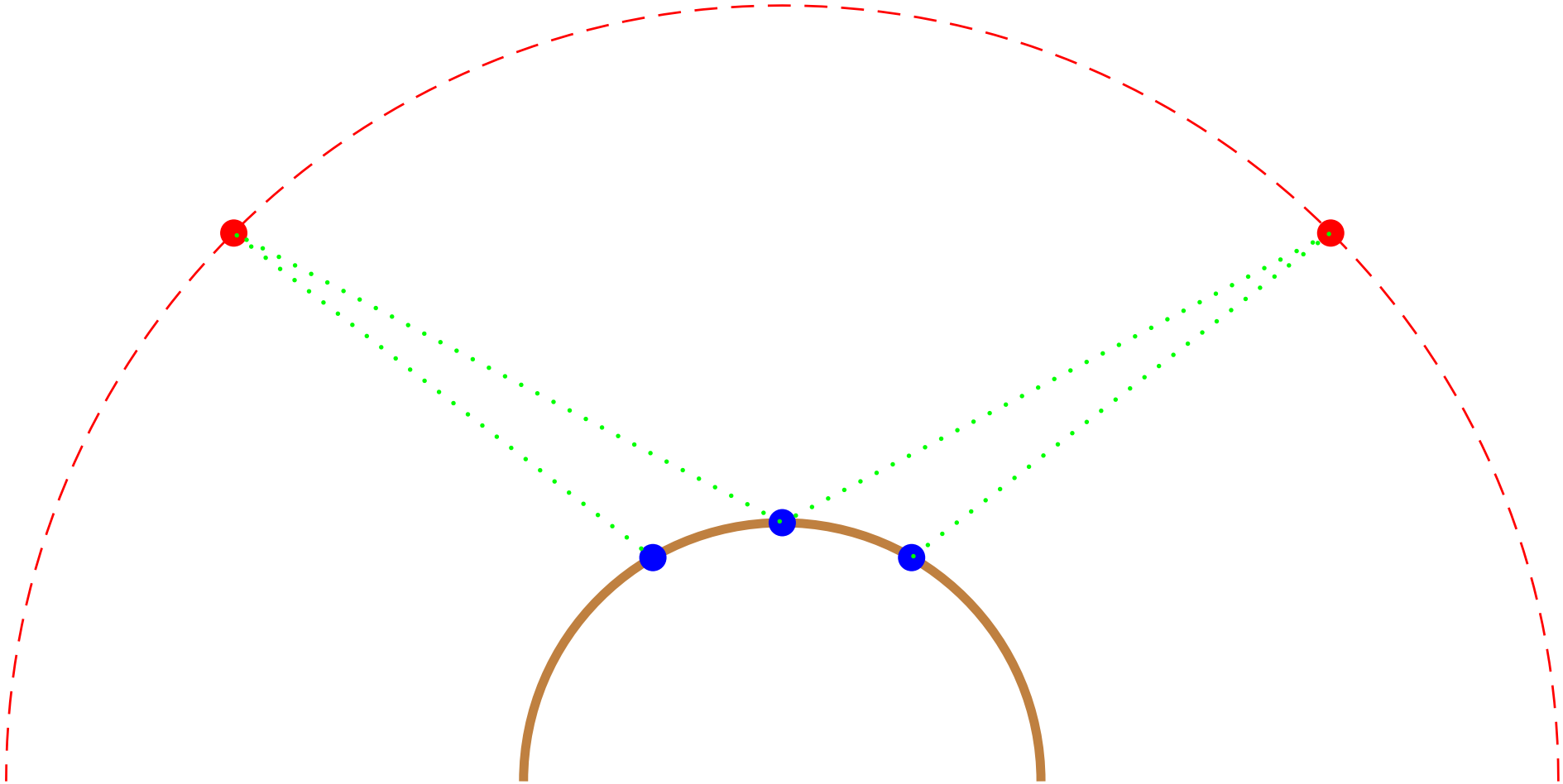

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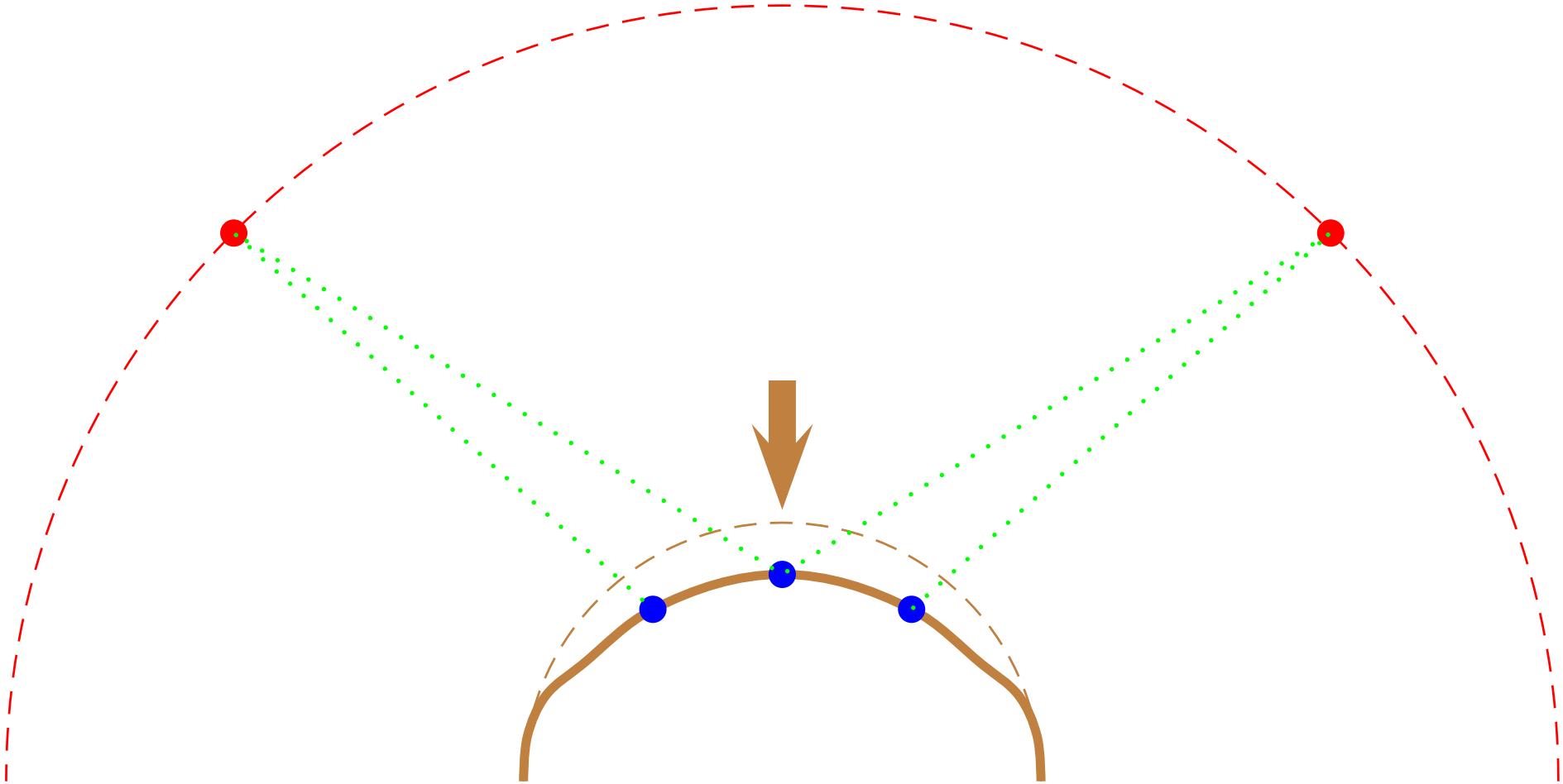

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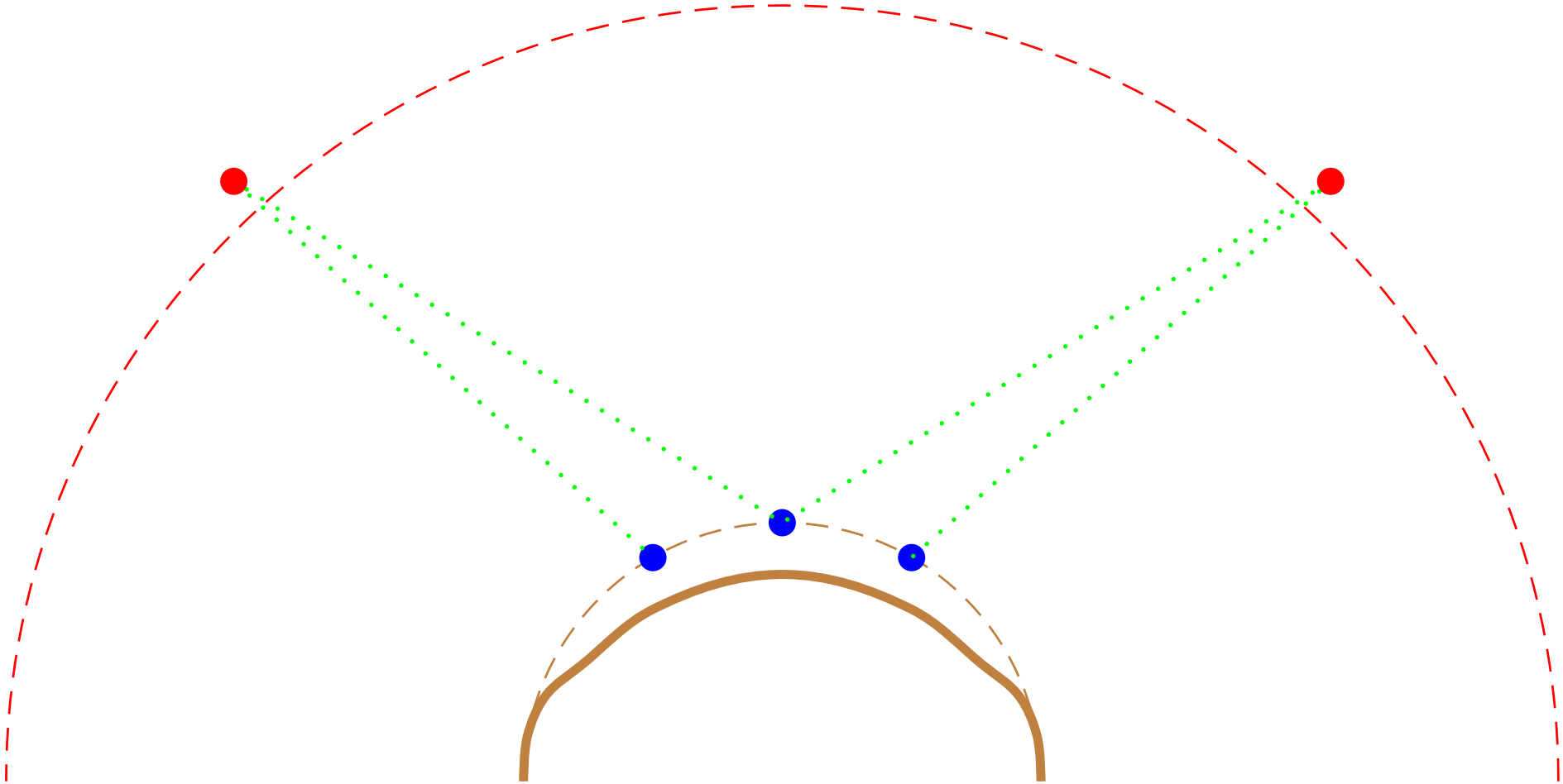

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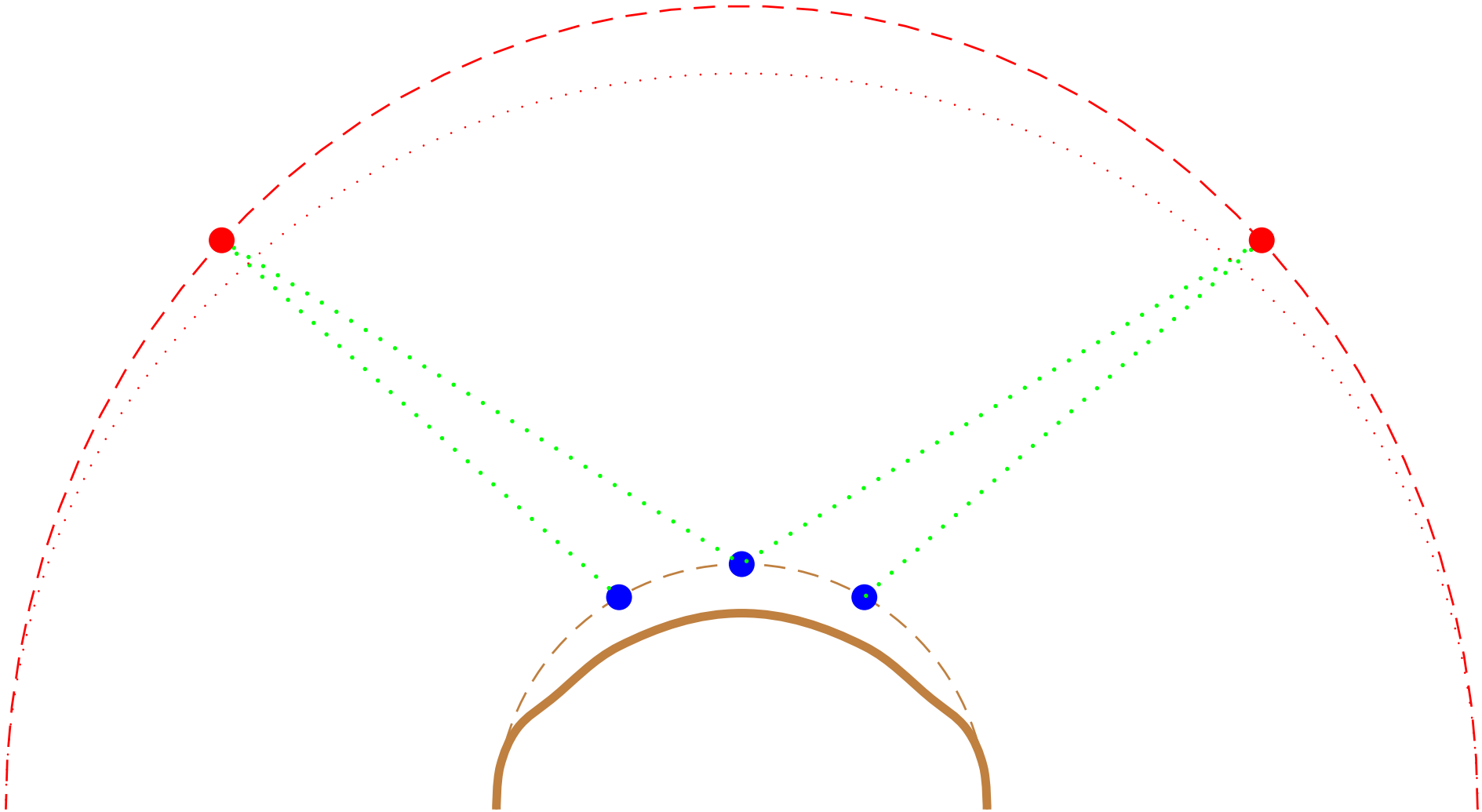

# APL model for IGS(–like) processing

Conclusion: APL must be corrected on observation level

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Resulting requirements:

1. High quality model is needed that corresponds to the quality of the state-of-the-art GNSS processing.
2. The model must consistently cover the time span from 1994 to present.
3. The model must be easily accessable by any user for any station (preferable grids).
4. The model is required at least for the final processing at the analysis centers (three days delay).

# Summary and Conclusion

Conclusion: APL must be corrected on observation level
because an unmodelled APL-effect mitigates
in different parameters of the GNSS analysis.

The results can also be interpreted as a general error mitigation study that act in the same way for comparable (unmodelled) effects in the GNSS analysis.

# THANK YOU
## for your attention

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`http://www.bernese.unibe.ch/publist`