

The impact of different reference frame realization strategies on GNSS coordinate time series in Antarctica

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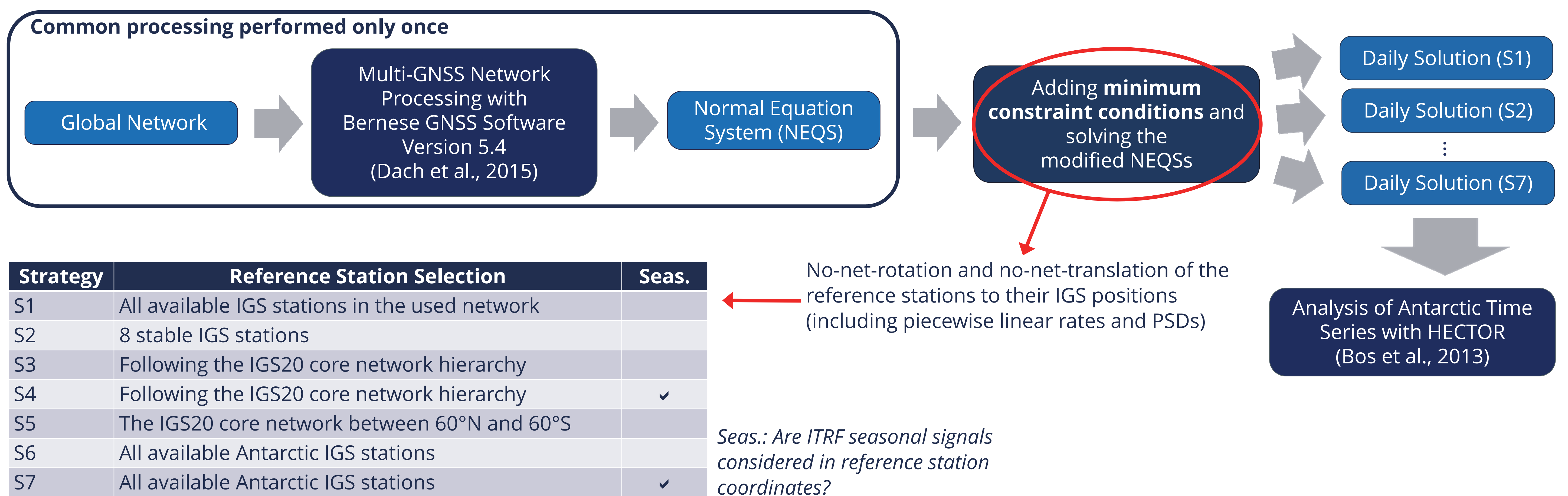
Motivation

- New consistently reprocessed coordinate time series of all available GNSS data on bedrock in Antarctica now available (GIANT-REGAIN: Buchta et al. 2025)
- The 4 participating analysis centers used partly different processing schemes, such as **various strategies to realize the Igb14 reference frame**.
- Comparing the 4 solutions revealed **systematic differences on secular trends**.

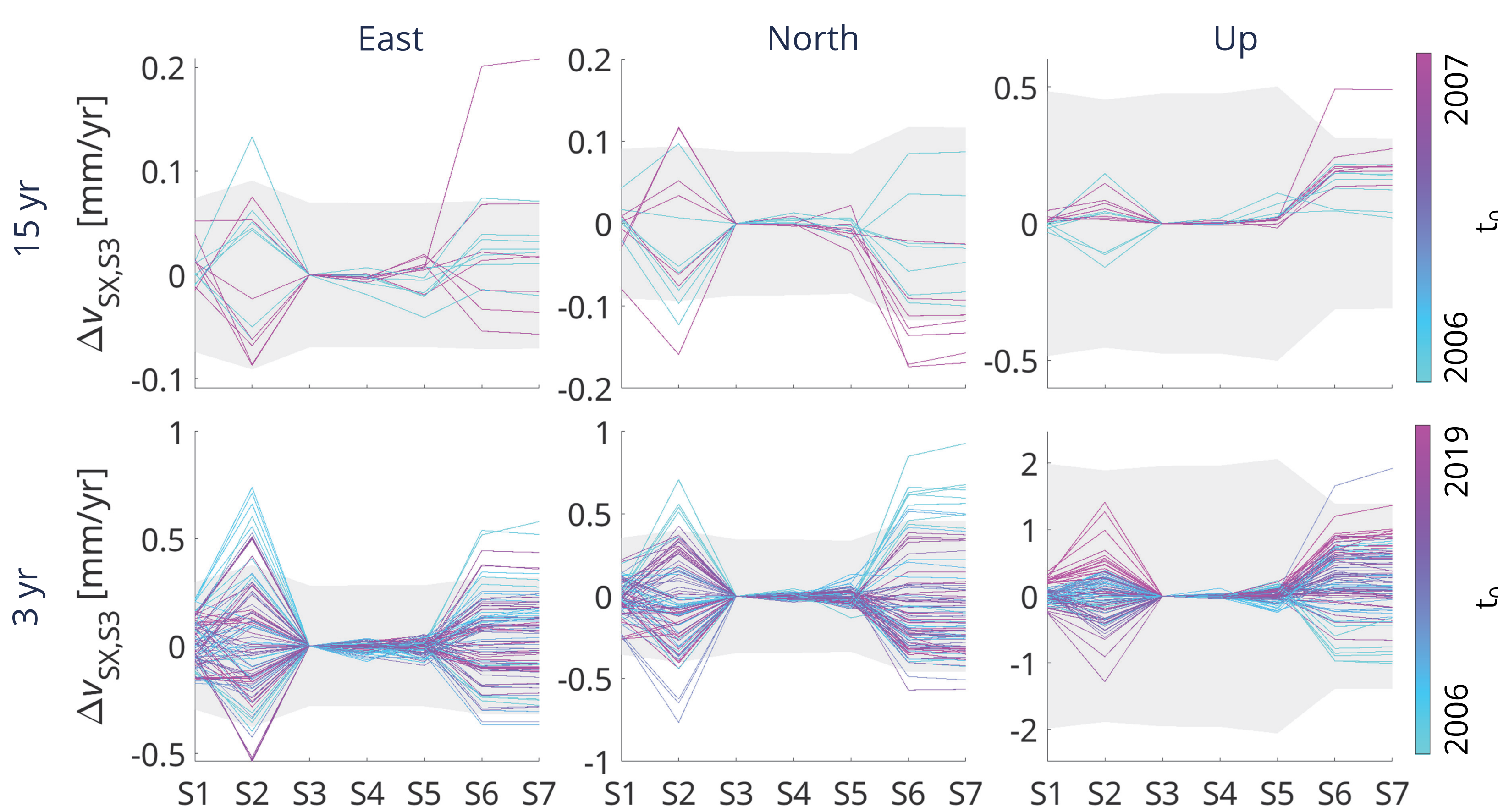
Objective

Assess and isolate the effect of reference frame realization strategies on resulting coordinate time series and inferred parameters.

Method

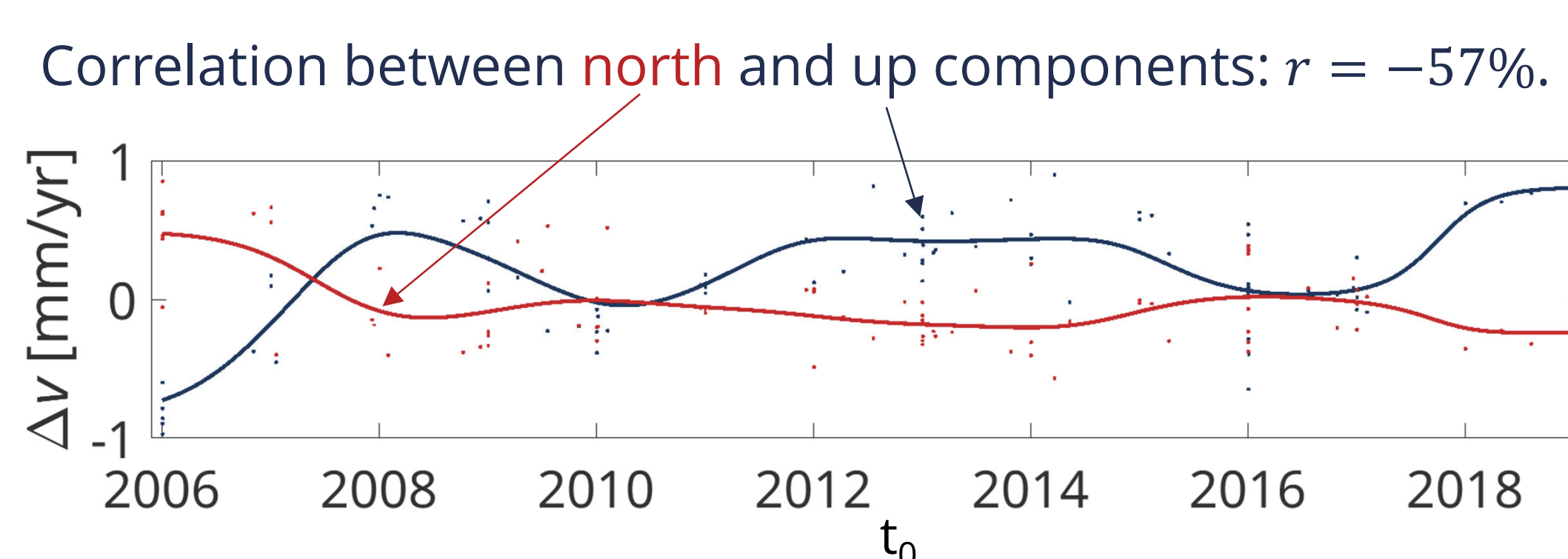


Results



Differences of derived linear rates Δv between the strategies indicated on the x-axis and S3. Each line represents one time series of one station. For this comparison, we cut them in periods of 15 and 3 years. The color of the line represents the start time t_0 of this cut time series. The mean standard deviation $\bar{\sigma}_v$ over all time series of each strategy is shown in gray.

Dependence of $\Delta v_{S6,S3}$ on t_0 for linear rates derived from 3 year long time series.



Discussion

- The linear rate is affected by the choice of the strategy on interannual timescales. Effects on up and north component are anticorrelated.
 - This can be attributed to **an interannual movement of the Center of Network along the z-axis** due to common-mode signals from geodynamics.
 - These common-mode signals are strongest in **regional networks**. Therefore, they **are not well suited for estimating linear rates**.
- Including seasonal signals in reference coordinates is irrelevant for global and regional processing with the goal to derive linear rates.
- The spread of linear rate differences Δv **between commonly used global strategies** compared to the error standard deviation ($\text{RMS}(\Delta v)/\bar{\sigma}_v$) amounts to up to **40% laterally and less than 10% vertically**.
 - On lateral components, the reference df error is quite relevant.
- This is mainly a **systematic effect** and **must be considered on top to formal uncertainties**.
- Paper to be submitted in the fourth quarter of 2025