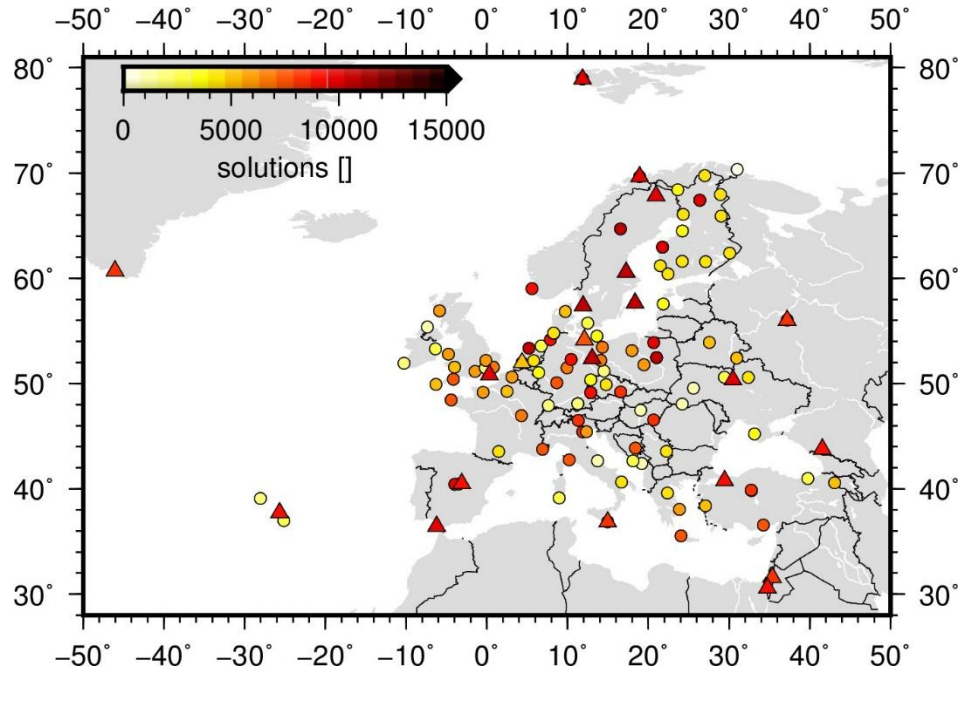


An update of GFZ's contribution to EUREF

Benjamin Männel

Covilha, June 24, 2025

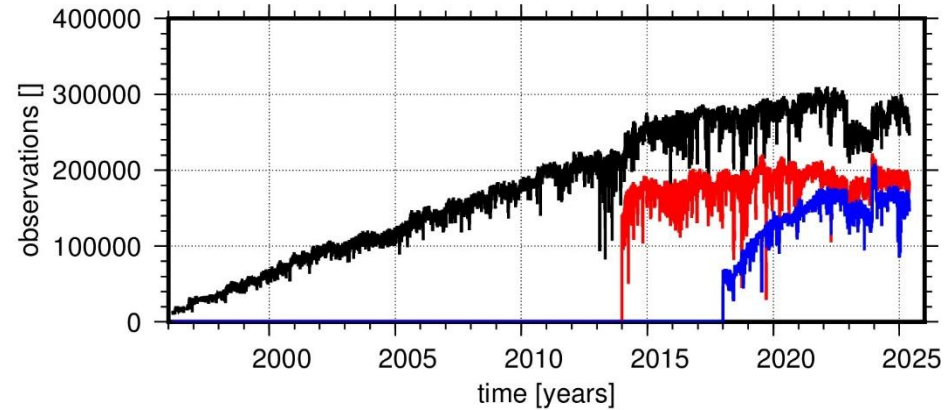
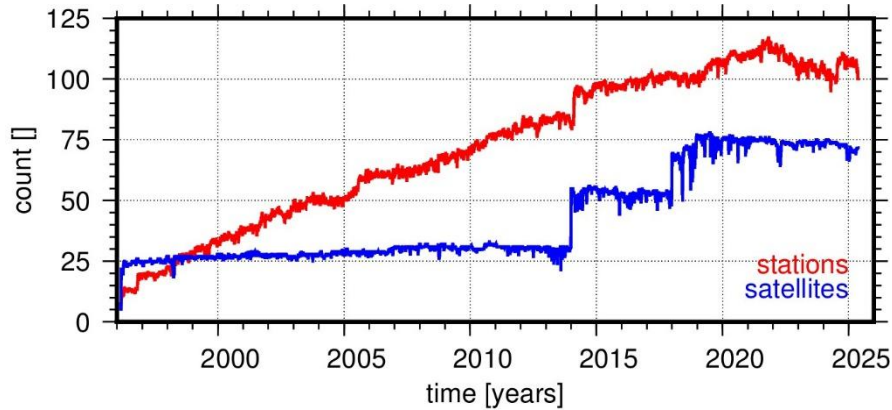
Station network



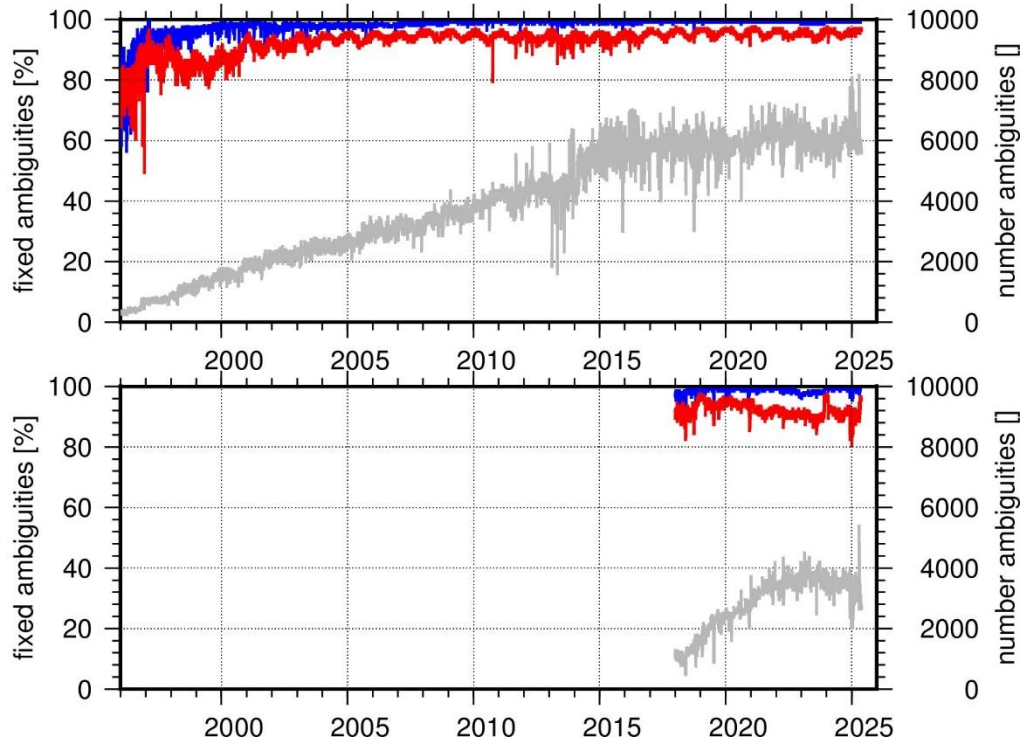
Station network

Observations	Ionosphere-free linear combination formed by undifferenced GPS, GLONASS (2014+), Galileo observations (2018+); 300s sampling rate (30s for pre-cleaning) ; 3° elevation cutoff-angle, elevation-dependent weighting applied
Modelling	➤ GFZ orbit & clock products (operational, repro3) ➤ GPT2 meteo values mapped with VMF3 (Landskron & Böhm et al. 2018) ➤ Second-order ionospheric correction applied ➤ EPN20 antex (type-mean) & IGS20 reference frame ➤ Gravity field: GOCO6s (Kvas et al., 2019) ➤ Ocean tides: FES2014b (Carrere et al. 2016) ➤ HF-EOP: Desai-Sibois model (Desai and Sibois 2016) ➤ Mean pole tide according to IERS 2018
Ambiguities	Resolved for GPS and Galileo
Estimated parameters	Station coordinates (minimum constraint w.r.t. IGS20), 1h troposphere delay (no re-computation for weekly solution) and 24h gradients, receiver clocks
Software	EPOS.P8, metadata management via semisys.gfz-potsdam.de

Stations, satellites, and observations

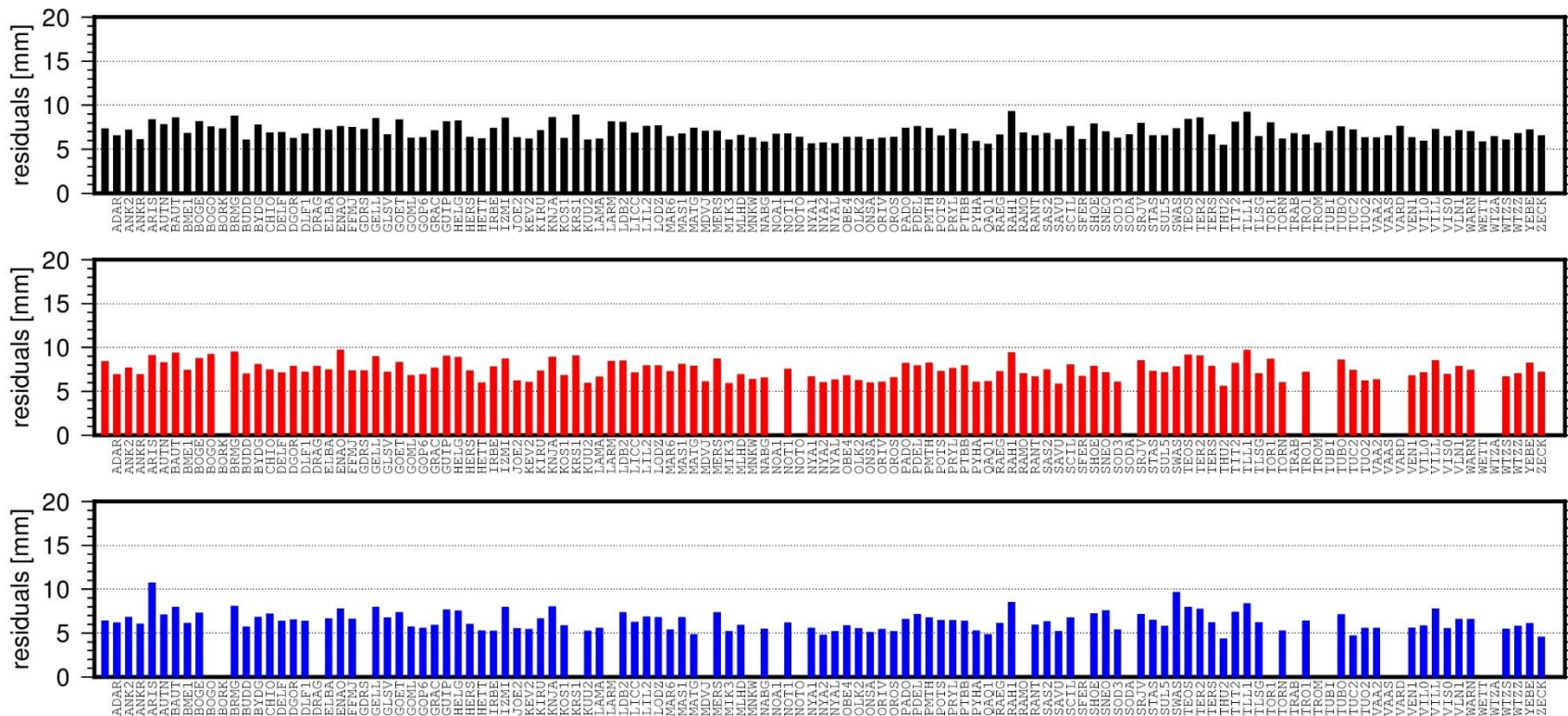


Ambiguity resolution

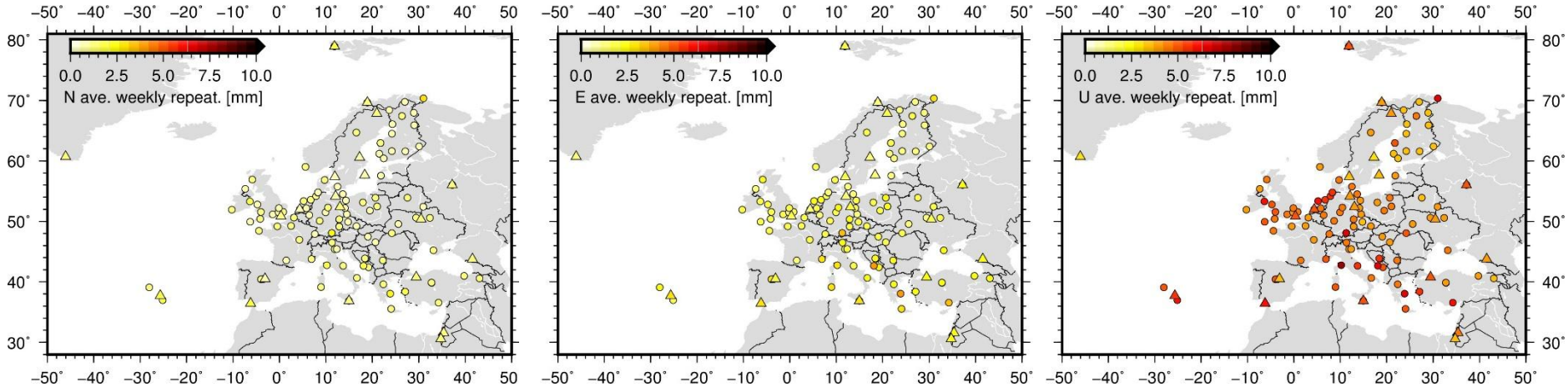


- Ambiguities (grey) and ratio of fixed widelane (blue) and narrowlane (red) ambiguities
- Seasonal pattern in ratio of fixed narrowlane ambiguities

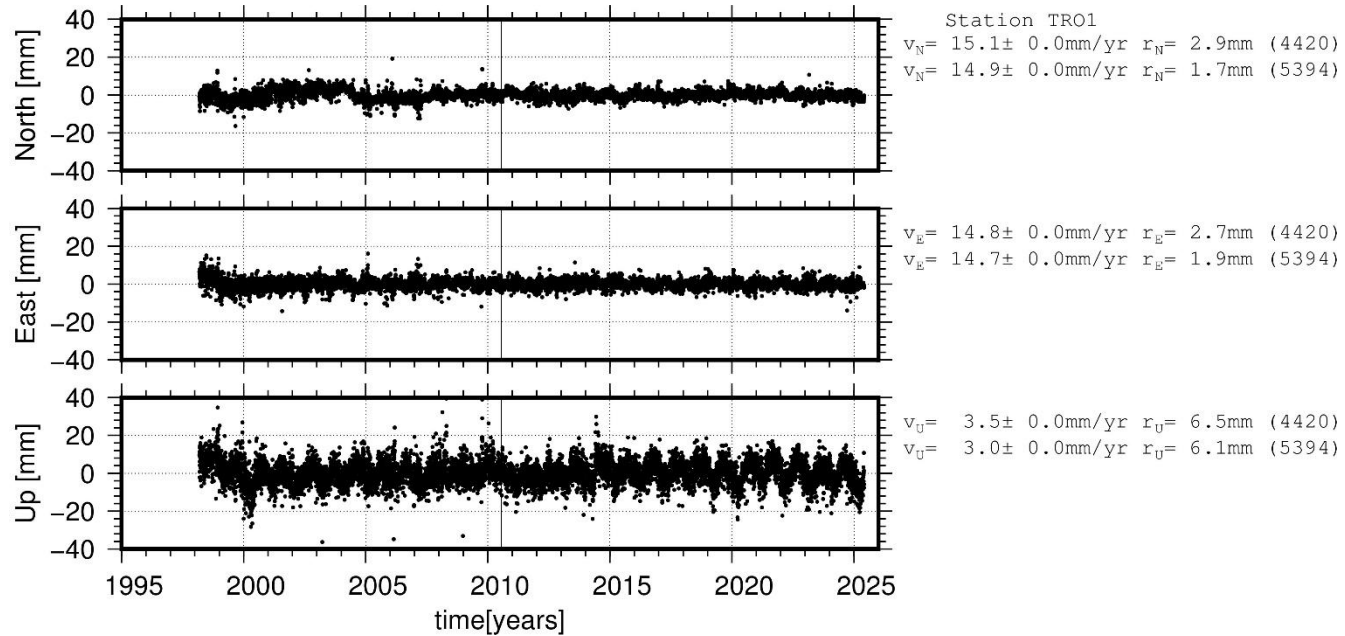
Observation residuals



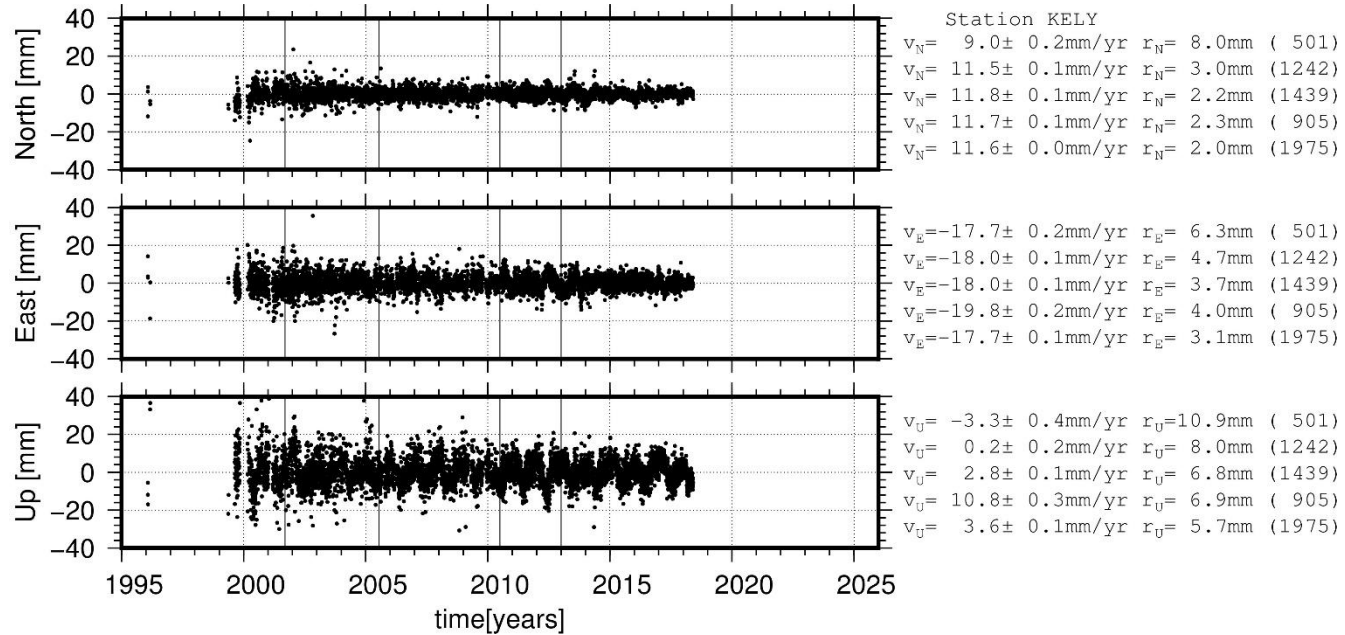
Coordinate repeatabilities



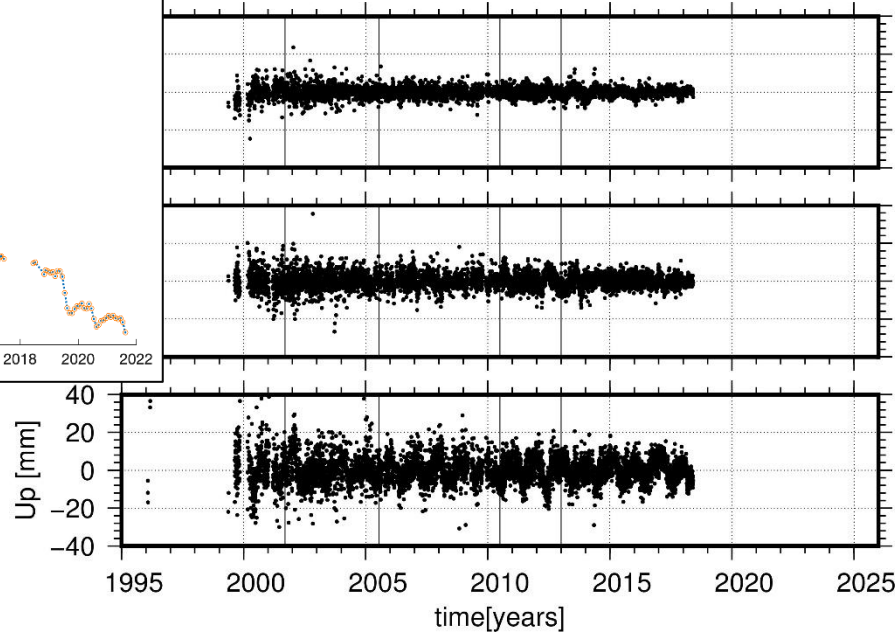
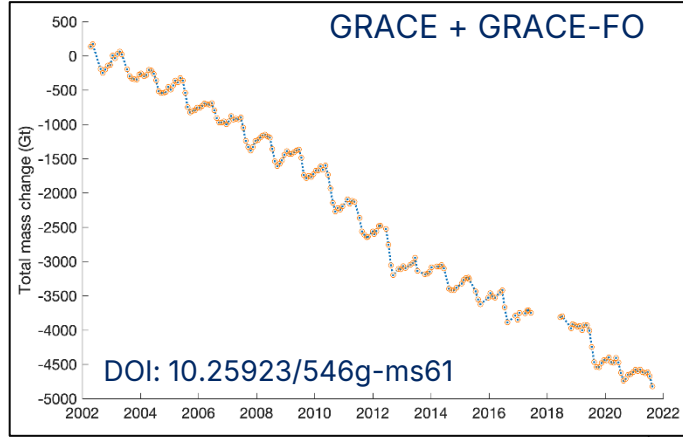
Station time series



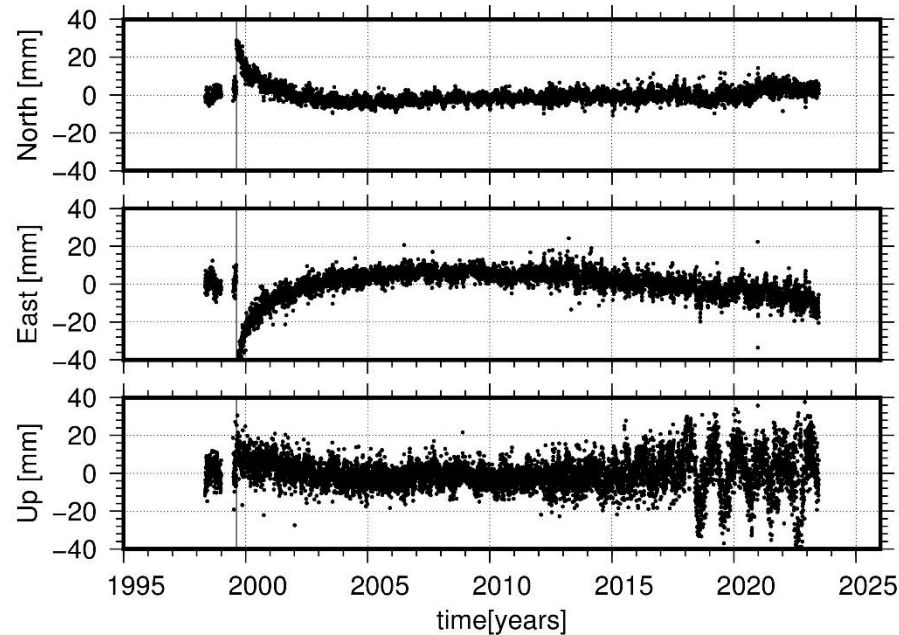
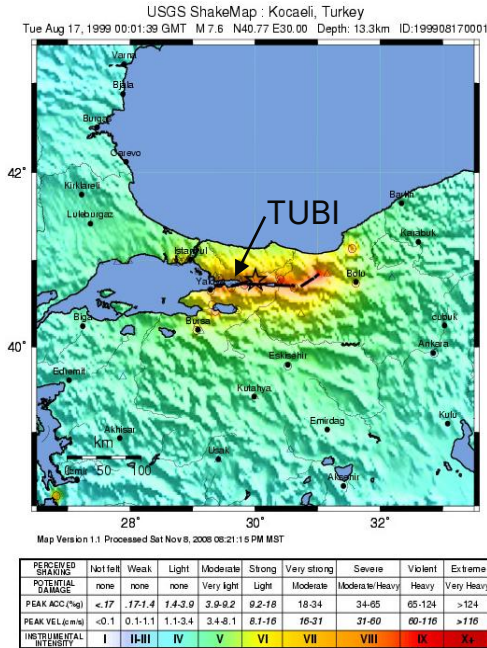
Station time series



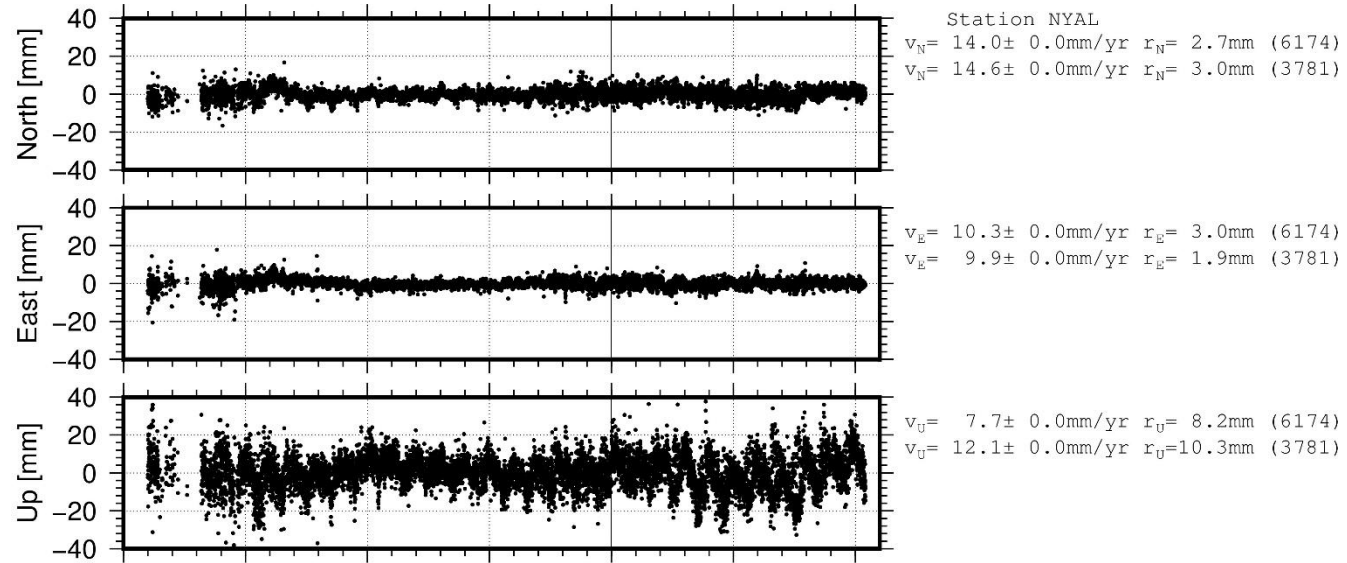
Station time series



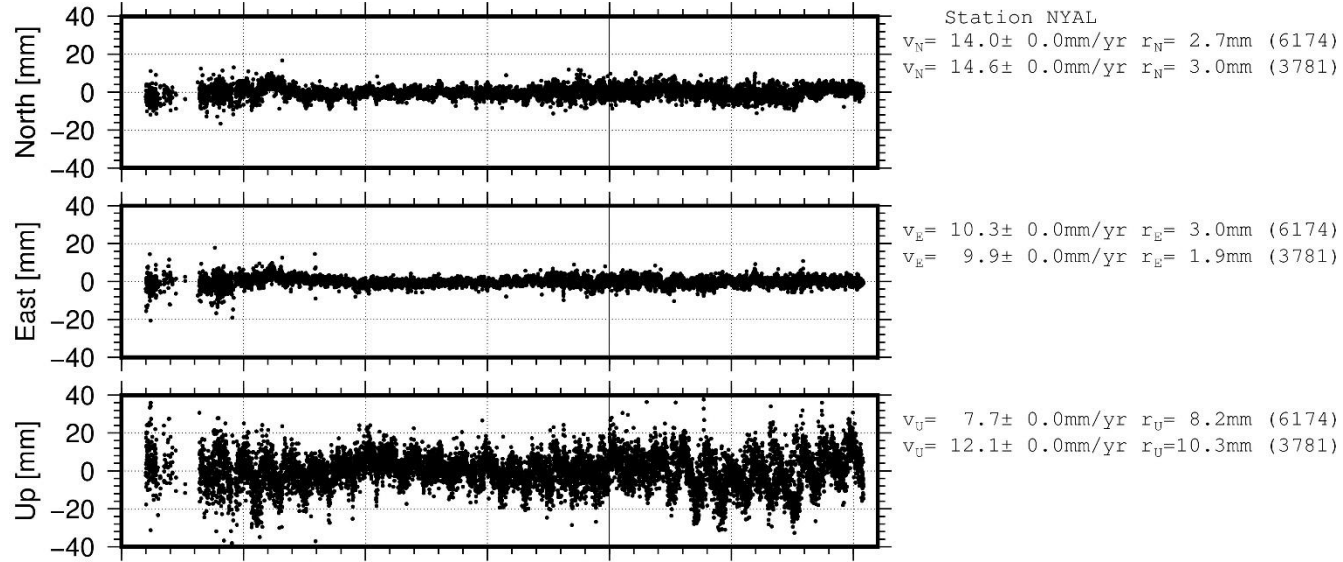
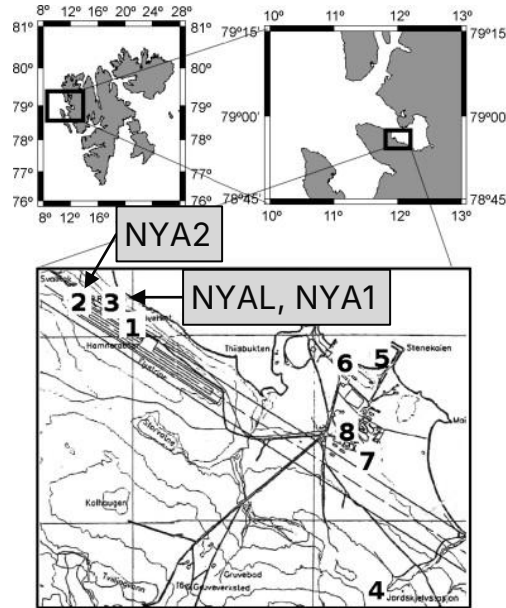
Station time series



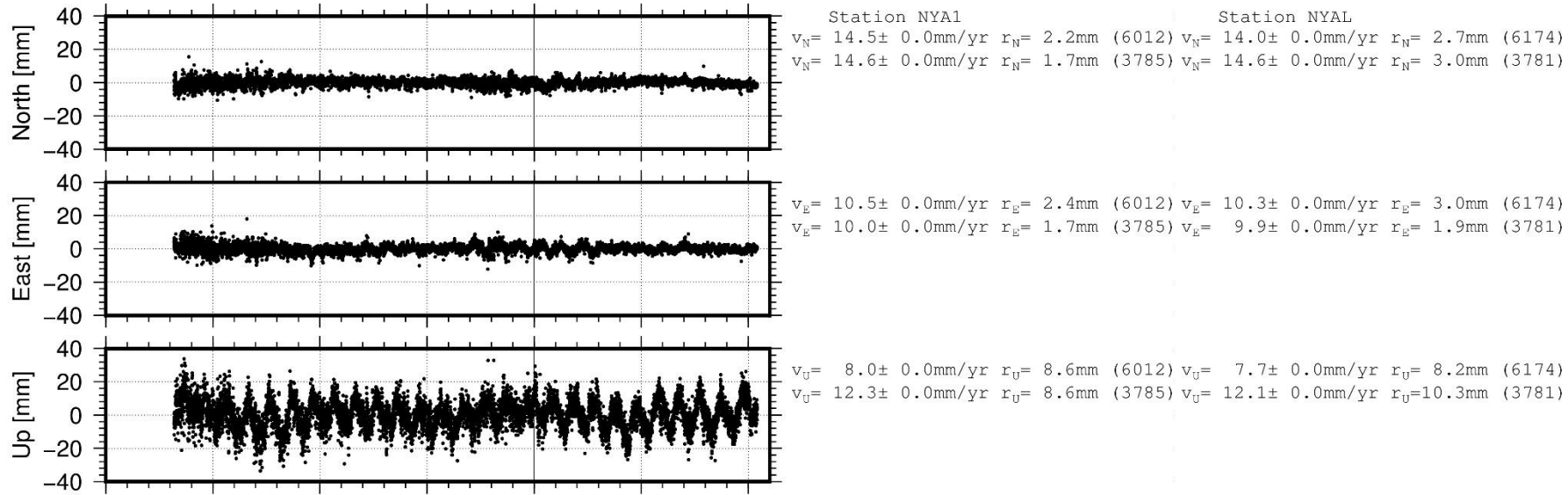
Station time series



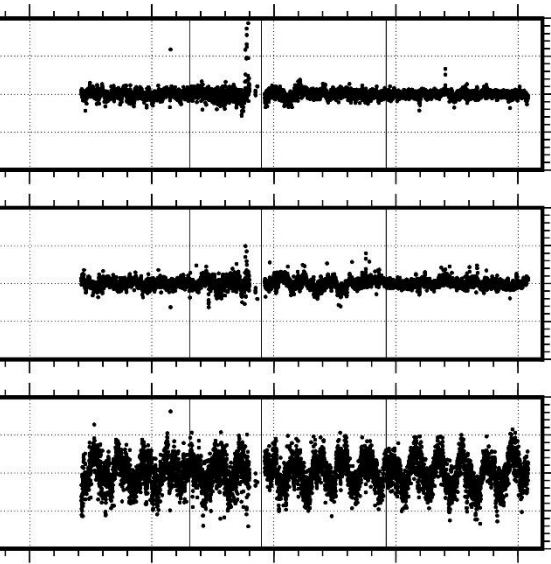
Station time series



Station time series



Station time series



Station NYA2	Station NYA1	Station NYAL
$v_N = 14.8 \pm 0.0 \text{ mm/yr}$ $r_N = 1.9 \text{ mm}$ (1604)	$v_N = 14.5 \pm 0.0 \text{ mm/yr}$ $r_N = 2.2 \text{ mm}$ (6012)	$v_N = 14.0 \pm 0.0 \text{ mm/yr}$ $r_N = 2.7 \text{ mm}$ (6174)
$v_N = 14.5 \pm 0.1 \text{ mm/yr}$ $r_N = 3.6 \text{ mm}$ (885)	$v_N = 14.6 \pm 0.0 \text{ mm/yr}$ $r_N = 1.7 \text{ mm}$ (3785)	$v_N = 14.6 \pm 0.0 \text{ mm/yr}$ $r_N = 3.0 \text{ mm}$ (3781)
$v_N = 14.4 \pm 0.0 \text{ mm/yr}$ $r_N = 1.9 \text{ mm}$ (1803)		
$v_N = 13.9 \pm 0.0 \text{ mm/yr}$ $r_N = 1.3 \text{ mm}$ (2101)		
$v_E = 10.6 \pm 0.0 \text{ mm/yr}$ $r_E = 1.8 \text{ mm}$ (1604)	$v_E = 10.5 \pm 0.0 \text{ mm/yr}$ $r_E = 2.4 \text{ mm}$ (6012)	$v_E = 10.3 \pm 0.0 \text{ mm/yr}$ $r_E = 3.0 \text{ mm}$ (6174)
$v_E = 10.3 \pm 0.1 \text{ mm/yr}$ $r_E = 3.1 \text{ mm}$ (885)	$v_E = 10.0 \pm 0.0 \text{ mm/yr}$ $r_E = 1.7 \text{ mm}$ (3785)	$v_E = 9.9 \pm 0.0 \text{ mm/yr}$ $r_E = 1.9 \text{ mm}$ (3781)
$v_E = 10.9 \pm 0.0 \text{ mm/yr}$ $r_E = 2.6 \text{ mm}$ (1803)		
$v_E = 9.8 \pm 0.0 \text{ mm/yr}$ $r_E = 1.6 \text{ mm}$ (2101)		
$v_U = 6.6 \pm 0.2 \text{ mm/yr}$ $r_U = 7.6 \text{ mm}$ (1604)	$v_U = 8.0 \pm 0.0 \text{ mm/yr}$ $r_U = 8.6 \text{ mm}$ (6012)	$v_U = 7.7 \pm 0.0 \text{ mm/yr}$ $r_U = 8.2 \text{ mm}$ (6174)
$v_U = 9.5 \pm 0.4 \text{ mm/yr}$ $r_U = 8.0 \text{ mm}$ (885)	$v_U = 12.3 \pm 0.0 \text{ mm/yr}$ $r_U = 8.6 \text{ mm}$ (3785)	$v_U = 12.1 \pm 0.0 \text{ mm/yr}$ $r_U = 10.3 \text{ mm}$ (3781)
$v_U = 9.8 \pm 0.1 \text{ mm/yr}$ $r_U = 7.5 \text{ mm}$ (1803)		
$v_U = 12.6 \pm 0.1 \text{ mm/yr}$ $r_U = 7.9 \text{ mm}$ (2101)		

Summary

- GFZ processing running on EPOS.P8, EPN repro3 products submitted, operational weekly solutions
- Few deviations from EPN AC guideline
- Coordinate time series contain geophysical signals, while some variations need further investigation