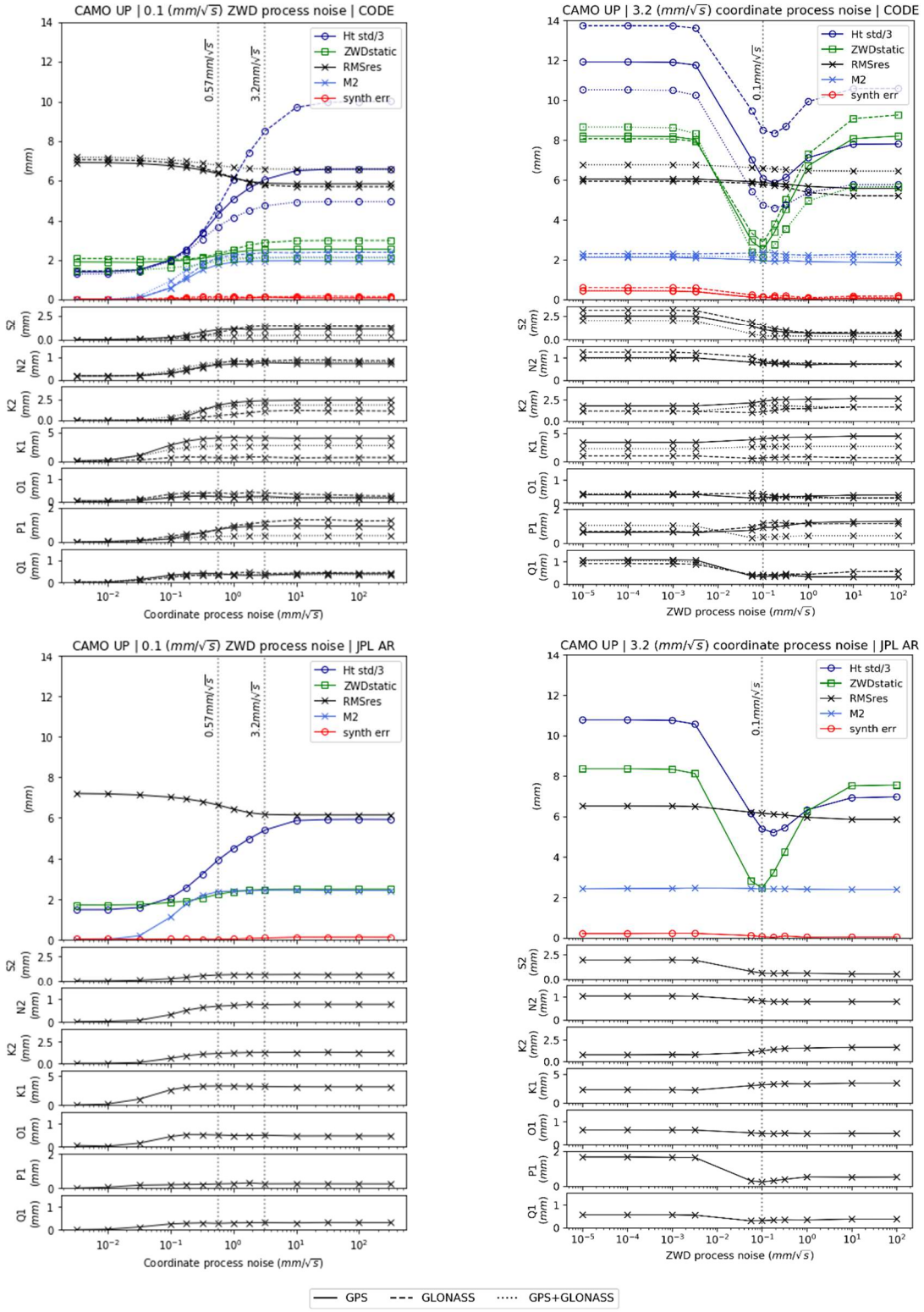



Figure S1. The effect of varying coordinate process noise (left) and ZWD process noise (right) at test site CAMO for the up component (2010.0 – 2014.0). This test was performed for all three constellation modes: GPS, GLONASS, GPS+GLONASS using CODE REPRO_2015 products (up) and GPS-only AR JPL (bottom).

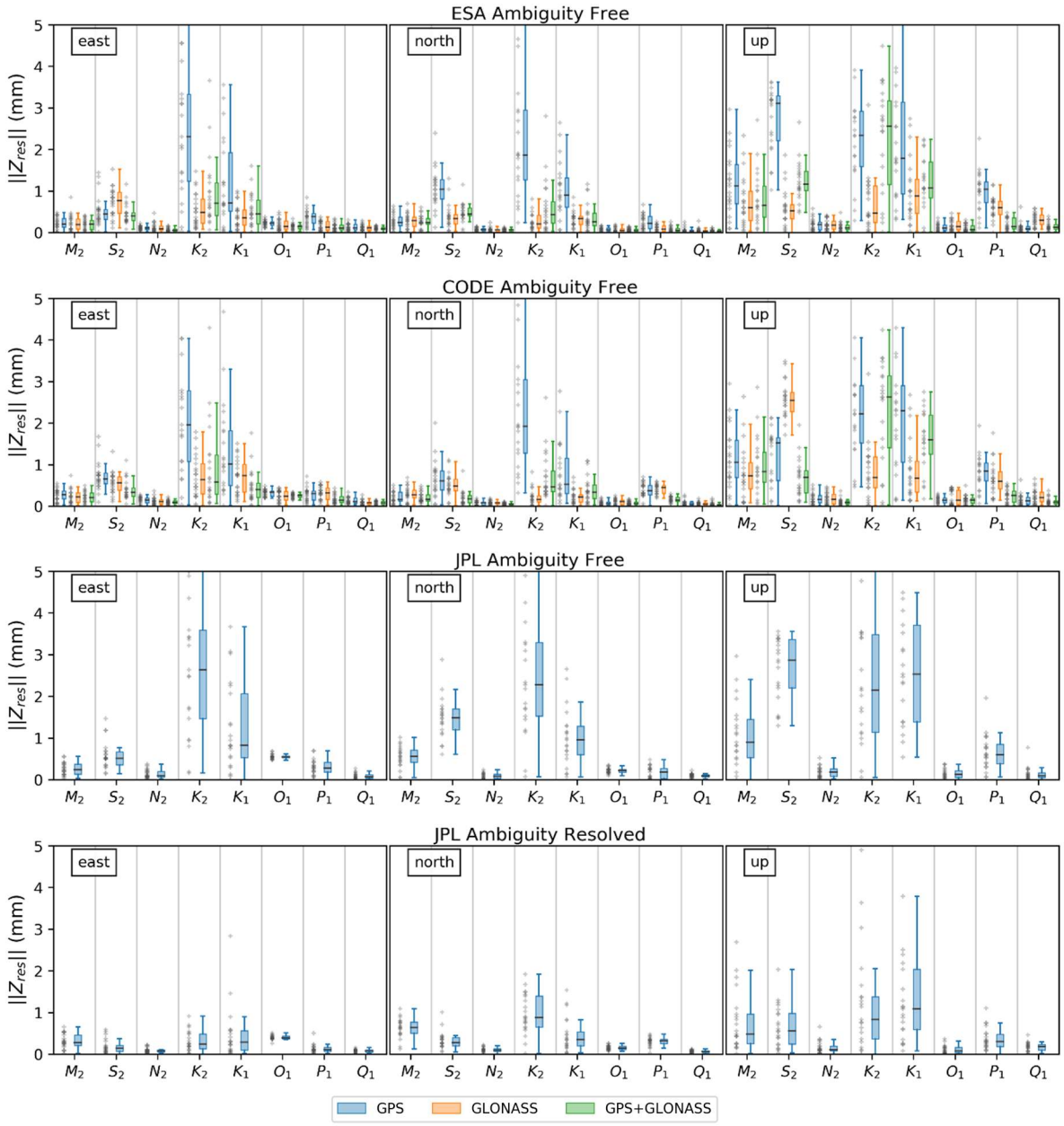



Figure S2. $\|Z_{res}\|$ per tidal constituent for east, north and up components (left, middle and right, respectively) relative to FES2014b_STW105d OTL values with CMC correction for JPL solutions. Grey crosses as per Figure 3. Top to bottom: ESA (GPS, GLONASS, GPS+GLONASS), CODE (GPS, GLONASS, GPS+GLONASS), JPL (GPS), JPL AR (GPS). Elevation cutoff of 7° was used for all solutions.

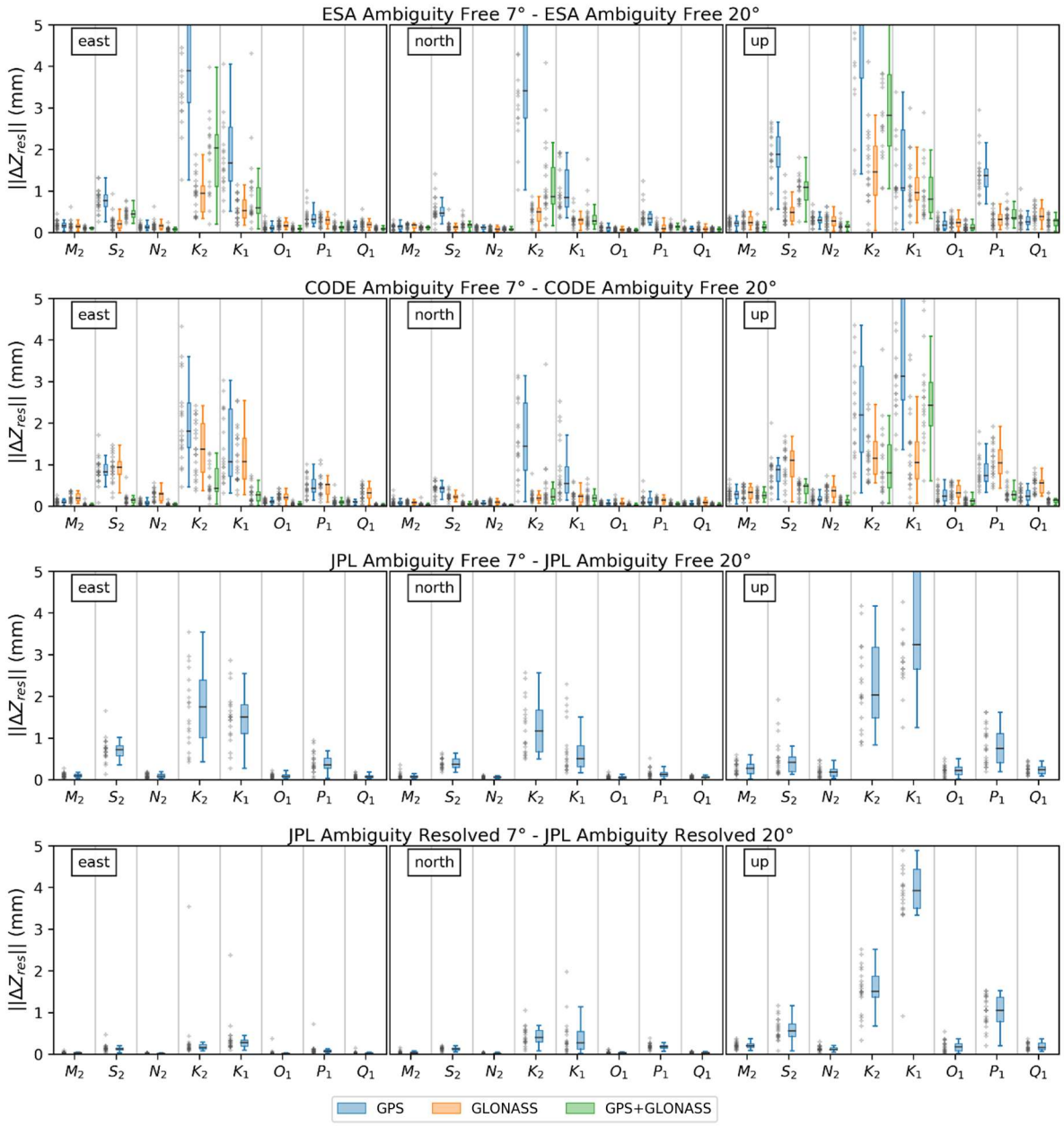
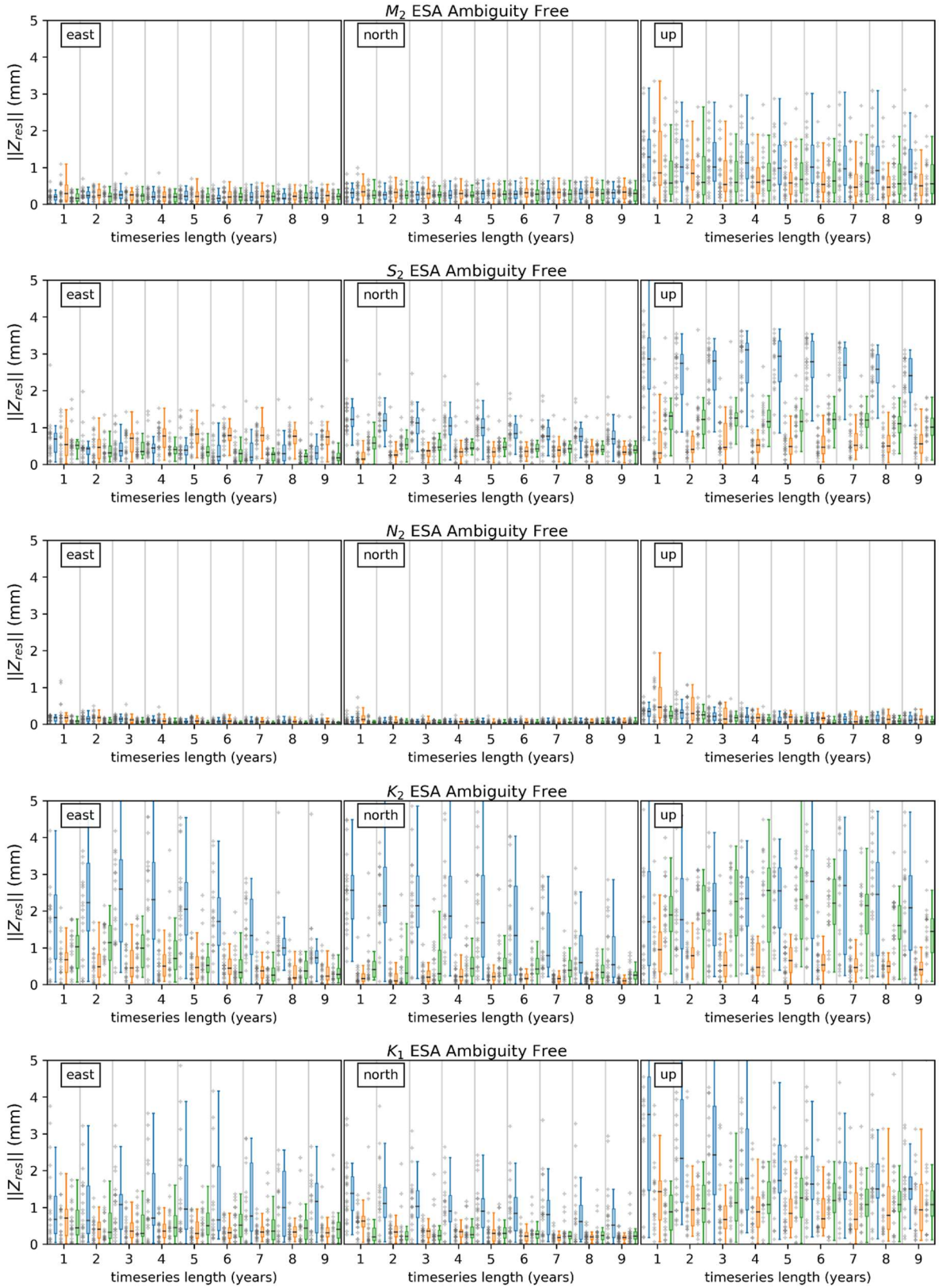



Figure S3. Magnitude of vector distance between estimated $Z_{res}$ values computed with 7° and 20° elevation cutoff angles, $\|\Delta Z_{res}\|$, within the same set of orbits and clocks (from top to bottom: ESA, CODE, JPL, JPL AR) for east, north and up *coordinate* components *(left, middle and right, respectively)*. Grey crosses are as per Figure 3.


$M_2$ ESA Ambiguity Free
$S_2$ ESA Ambiguity Free
$N_2$ ESA Ambiguity Free
$K_2$ ESA Ambiguity Free
$K_1$ ESA Ambiguity Free
east
north
up
$||Z_{res}||$ (mm)
timeseries length (years)

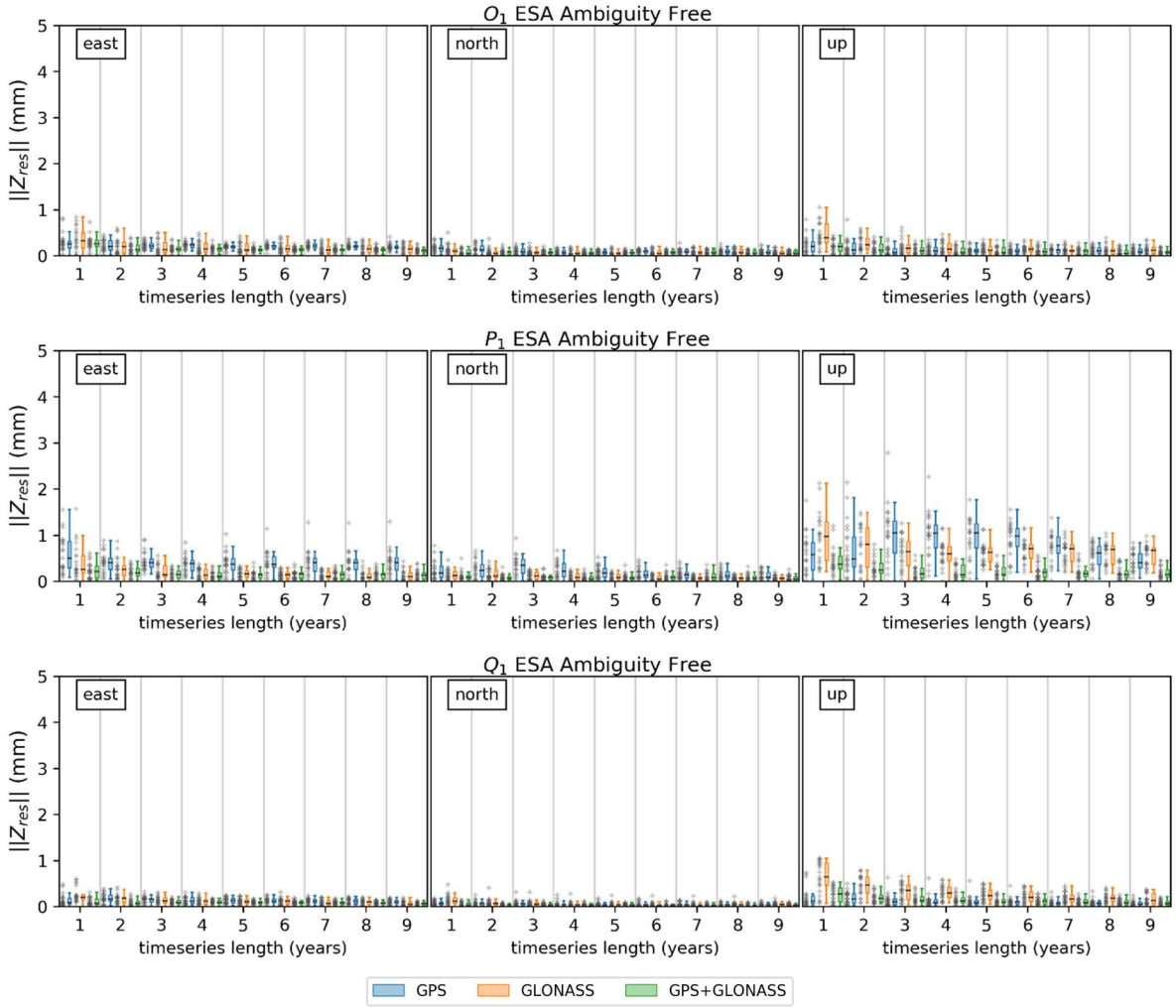



Figure S4. Dependency of estimated $||Z_{res}||$ and timeseries' length in years: GPS, GLONASS and GPS+GLONASS PPP solutions in blue, orange and green, respectively using ESA products. Note that 1 to 4 years of timespan use ESA repro2 while the rest uses a combination of ESA repro2 and ESA operational products. Grey crosses are as per Figure 3.

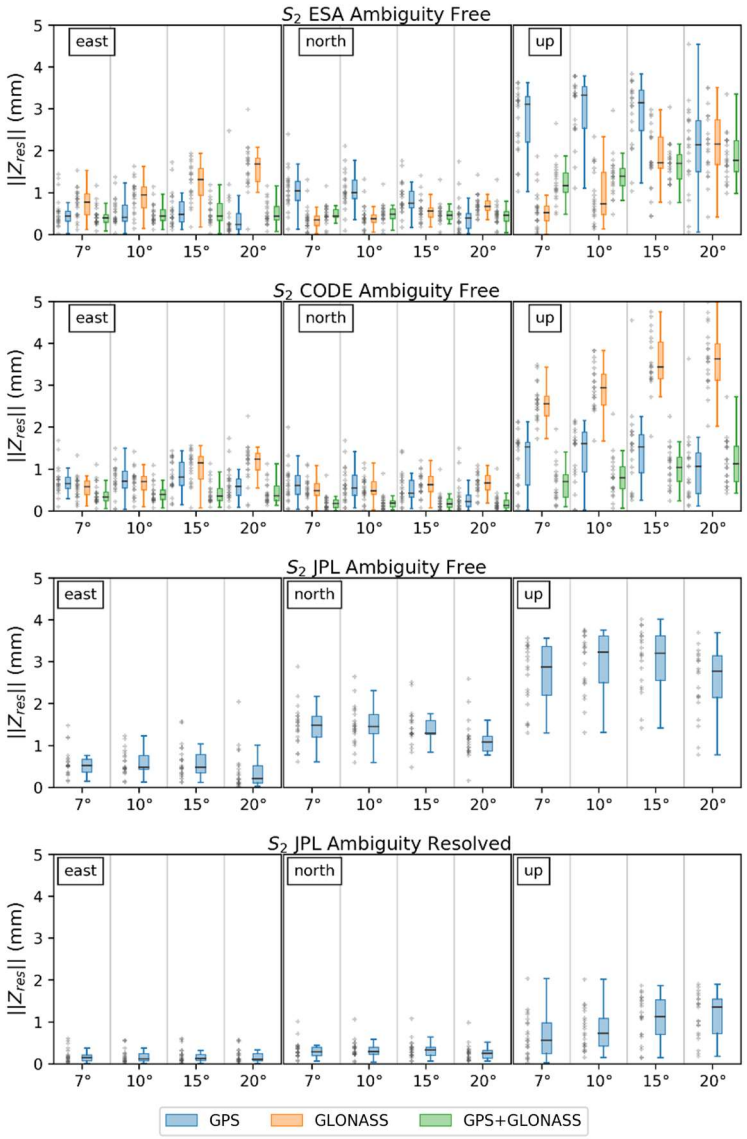



Figure S5. $S_2$ constituent as a function of elevation cutoff angle, computed with (top to bottom): ESA, CODE, JPL, JPL AR products. Grey crosses are as per Figure 3.

**On the synth err inconsistency:**

We repeated the test with insertion of harmonic synthetic displacement, with period of ~13.96, hours into station's nominal position according to Penna et al. (2015). We found that the signal was added to the resulting kinematic estimates on the stage of differencing of estimated coordinates and nominal coordinates (XYZ to ENU conversion module), introducing the synthetic signal into the timeseries. Essentially, estimated coordinates should be differenced with constant nominal coordinates (single nominal XYZ values). This shows the inversed relation of the extracted amplitude and process noise values: the process noise >= 0.57 mm/sqrt(s) is enough to completely ignore the 6 mm harmonic nominal and converge to the true value while smaller process noise will eventually limit the convergence to the nominal positions. In case of original test, the synthetic signal would be cancelled out by nominal signal in case of small process noise (e.g. 0.01 mm/sqrt(s)) resulting in absence of synthetic signal (maximum residual magnitude as in Penna et al. (2015,Fig. 3)). This additionally confirms that tidal cusps at Penna et al. (2015, p. 6546) are due to limitations of PSD computation method. However, we confirm absorption of synthetic signal by tropospheric gradients in case of static solution.

This test can be used to assess the robustness of the Kalman filter or square root information filter within software package for specific constellation mode, showing that GPS+GLONASS converge better in the presence of "bad" nominal position in comparison to single GPS or GLONASS, with the same values of coordinate process noise.

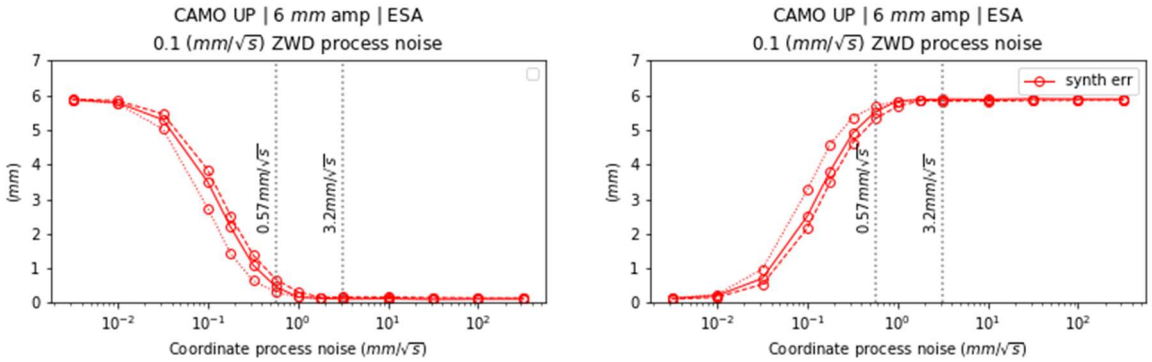



Figure S6. Effect of varying process noise on absorption rate of synthetic periodic displacement. The left plot was normalized with actual nominals before analysis as in Penna et al. (2015) (done by Gipsy6's routine), the right plot was normalized by constant nominal position. Solid line is GPS-only, dashed is GLONASS-only and dotted is GPS+GLONASS. The results of the same test are completely inversed.