

STUDY OF THE EARLY POSTSEISMIC PHASE OF TOHOKU-OKI EARTHQUAKE (2011) WITH KINEMATICS SOLUTIONS

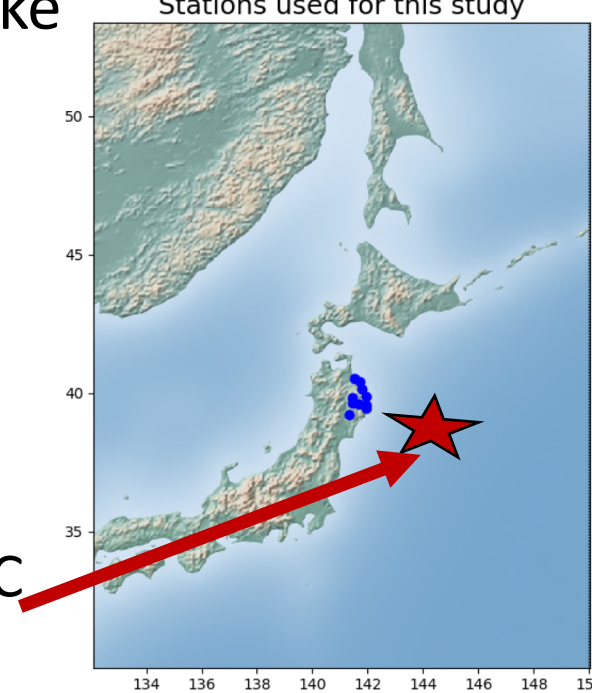
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Motivation:

- After large earthquakes some parts of the fault continue to slip as afterslip.
- High-rate solutions close to the fault record the early afterslip stage.
- Advanced signal processing allows to extract the geophysical signal of this early phase.

Japanese context:

- Second world seismic activity
- Dense GPS Network (GEONET)
- The M_w 9.1 Tohoku-Oki earthquake

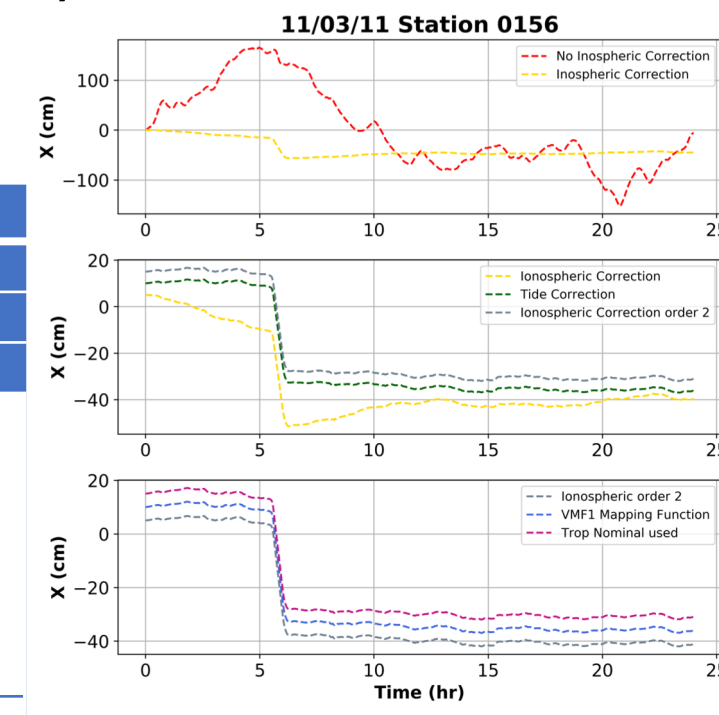


Tohoku-Oki
Earthquake
11/03/11
5h46 23s UTC

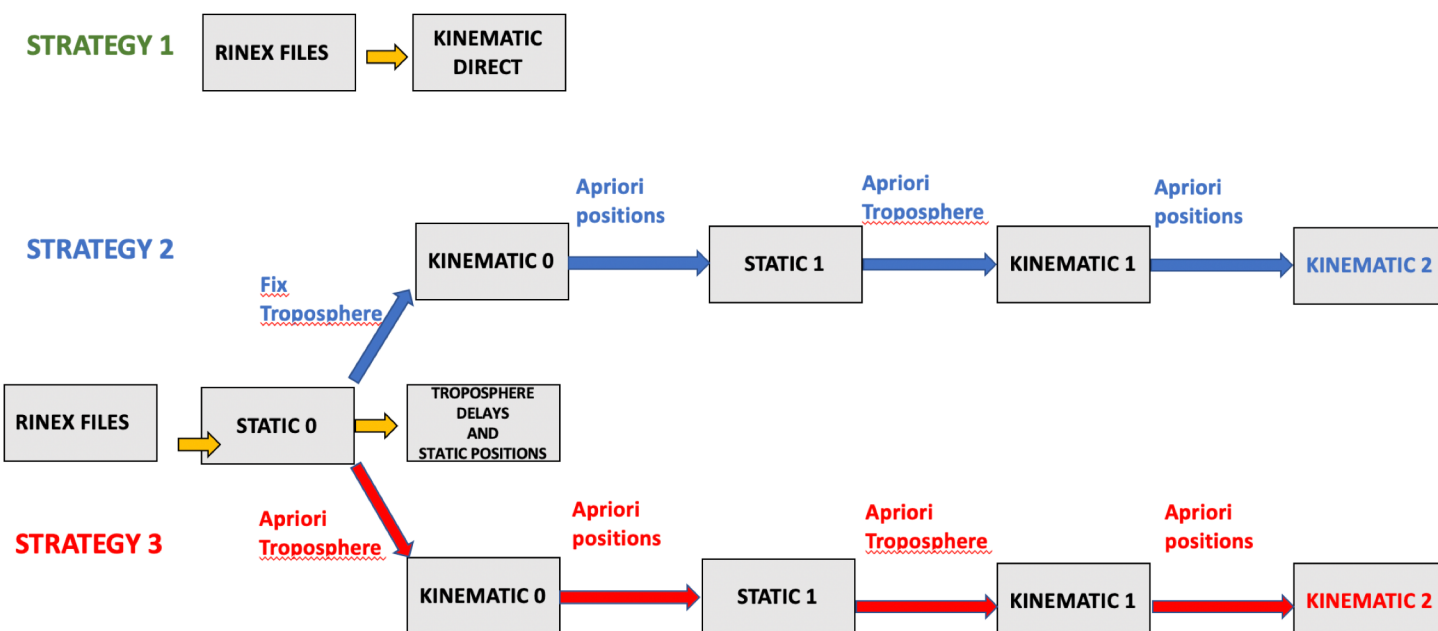
GPS PPP processing:

- We used the Precise Point Positioning strategy (single-receiver) and the JPL solutions for satellite clock estimates and final orbits.
- We obtained high-rate position time series with the gd2e module of GipsyX-OASIS 1.2 software (JPL).

Corrections	Models
Higher order ionospheric terms	IRI model
Ocean loading effects	FES2014b
Troposphere delays	VMF1 mapping function



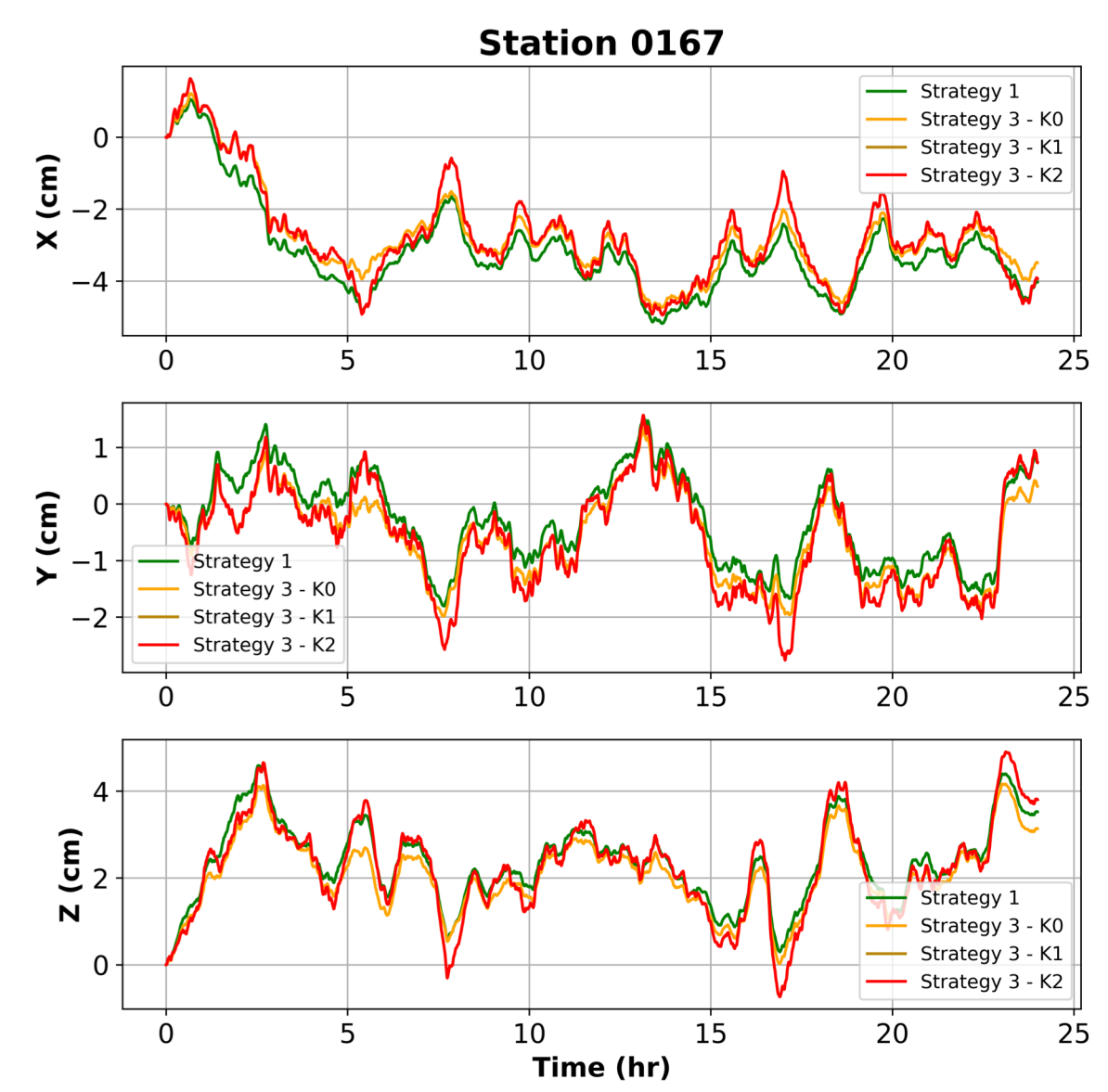
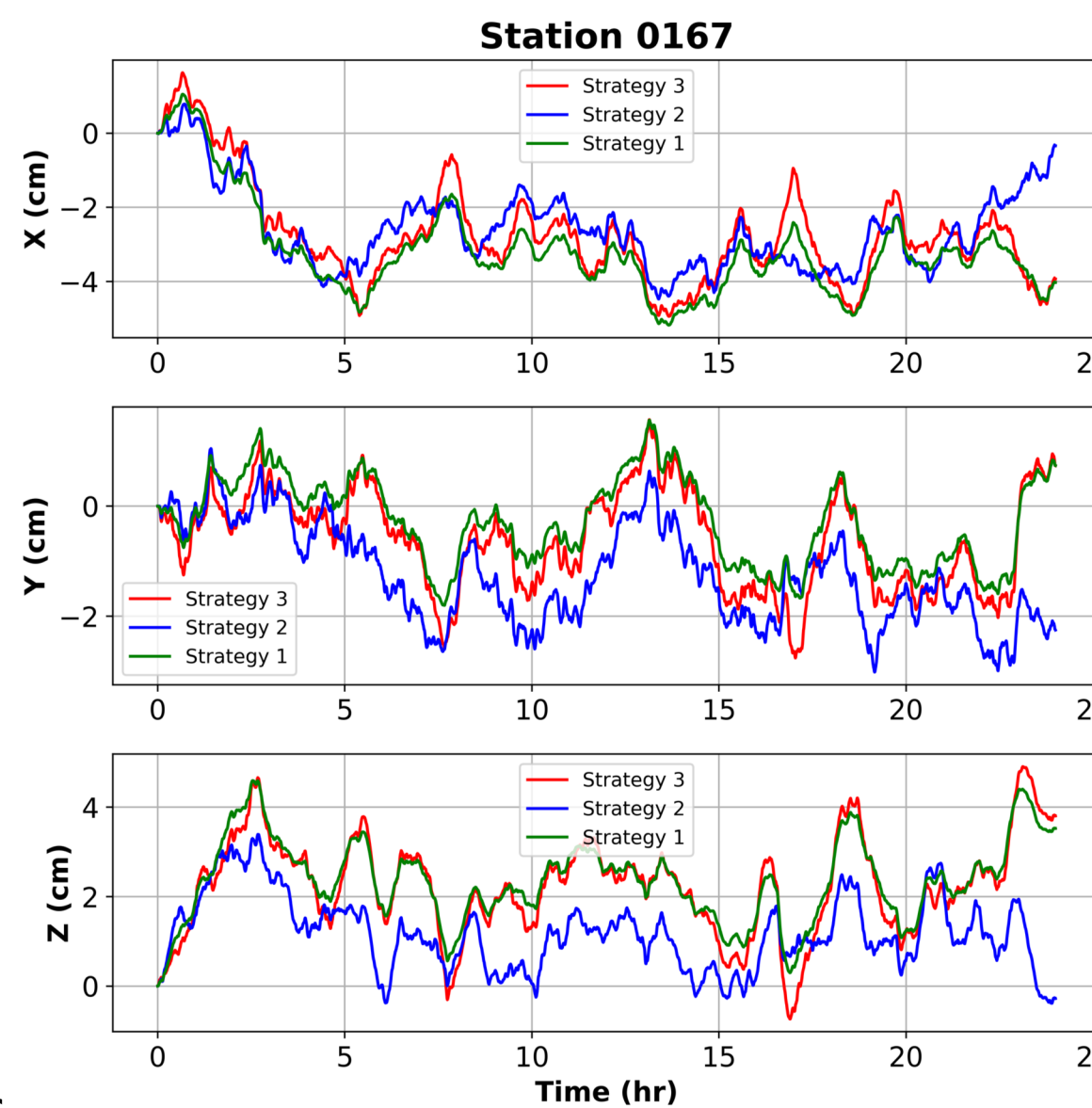
I - Troposphere Strategies:



At each epoch, positions and troposphere delays are **inverted** at the same time.

How to invert the parameters?

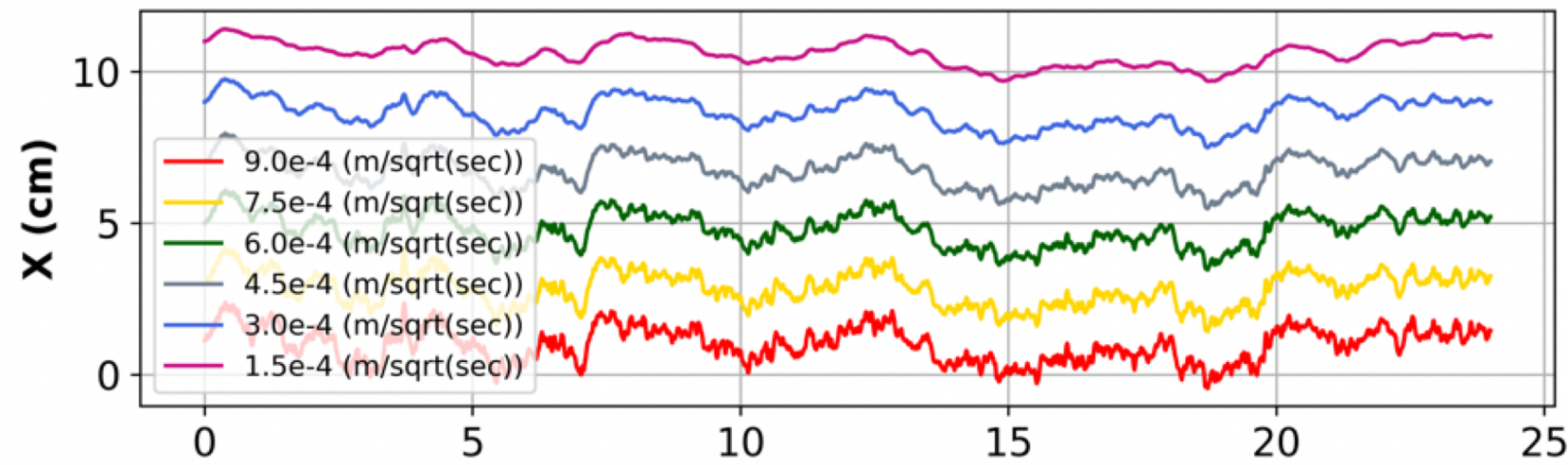
- No instructions (**Strategy 1**).
- Instructions as a priori informations on troposphere as fixed value (**Strategy 2**) or as a priori (**Strategy 3**) with a stochastic approach.
- Instructions as a priori information on positions (**all the strategies**)



II - Kalman Filter and Randomwalk:

- The Kalman filter predicts displacement.
- Randomwalk parameter value controls the smoothing of the solution.

Station 0910

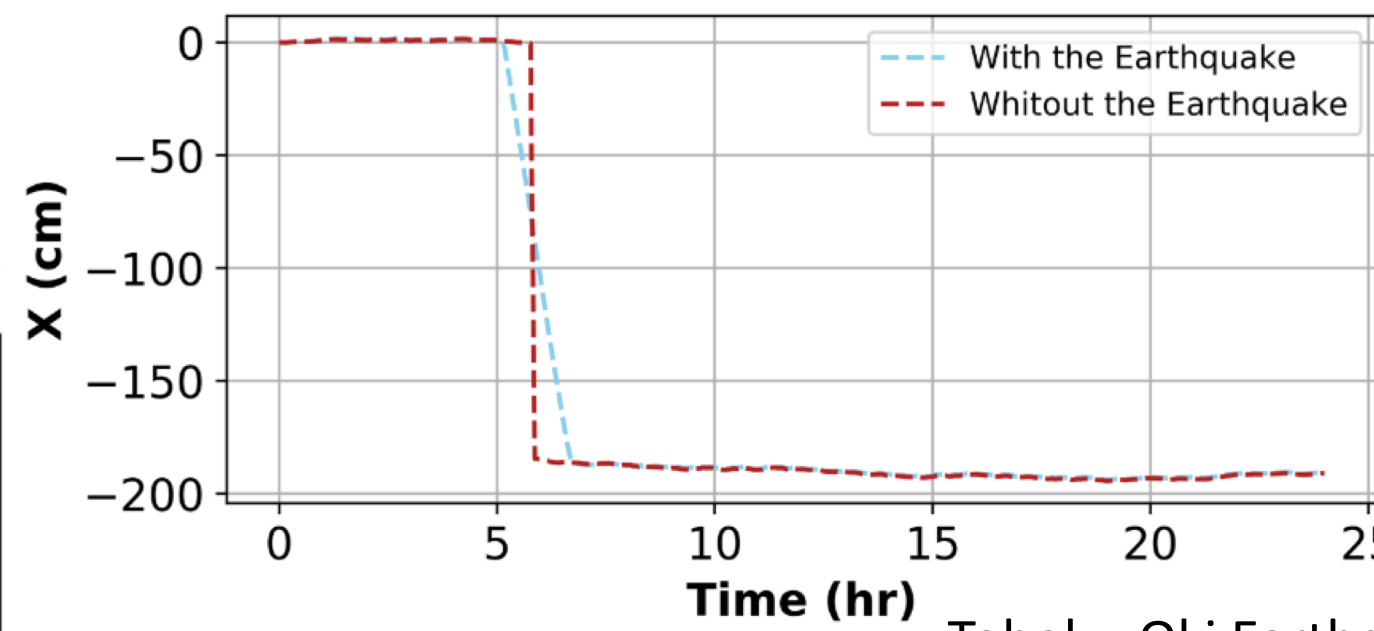


- There is a direct effect between the expected displacement at each epoch and the randomwalk value.

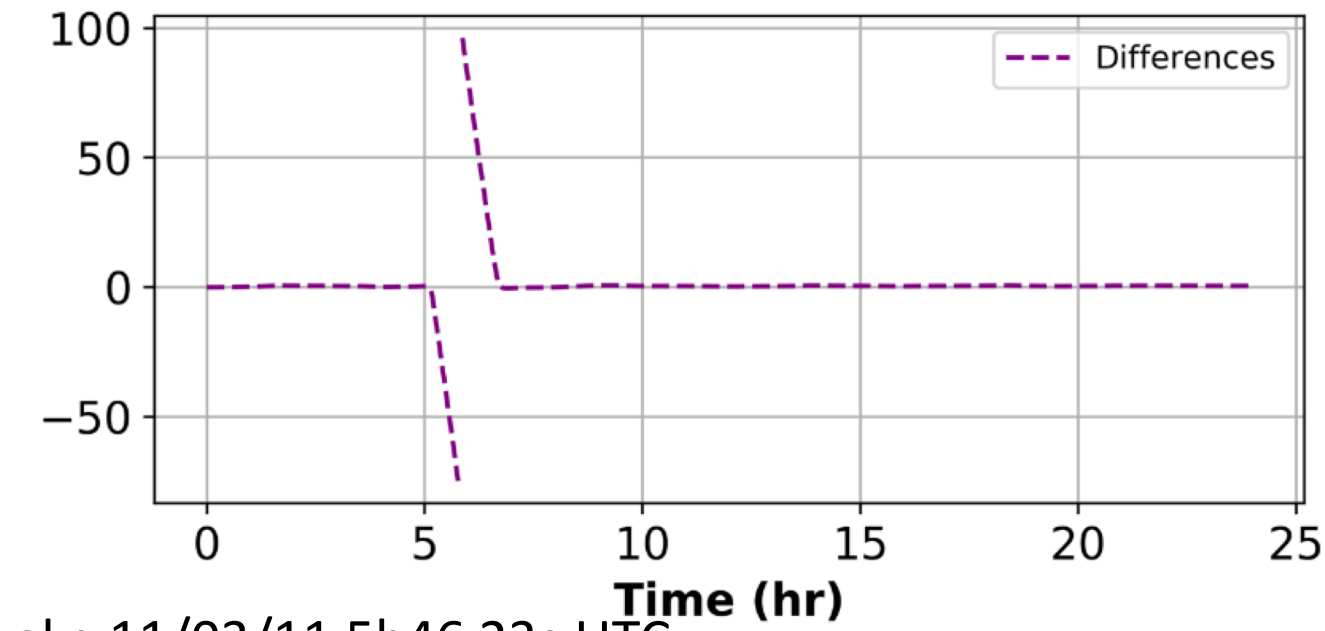
- We used 3.0×10^{-4} m/ $\sqrt{s}$ as randomwalk value.

II - Influence of co-seismic offset:

Station 0910



Station 0910

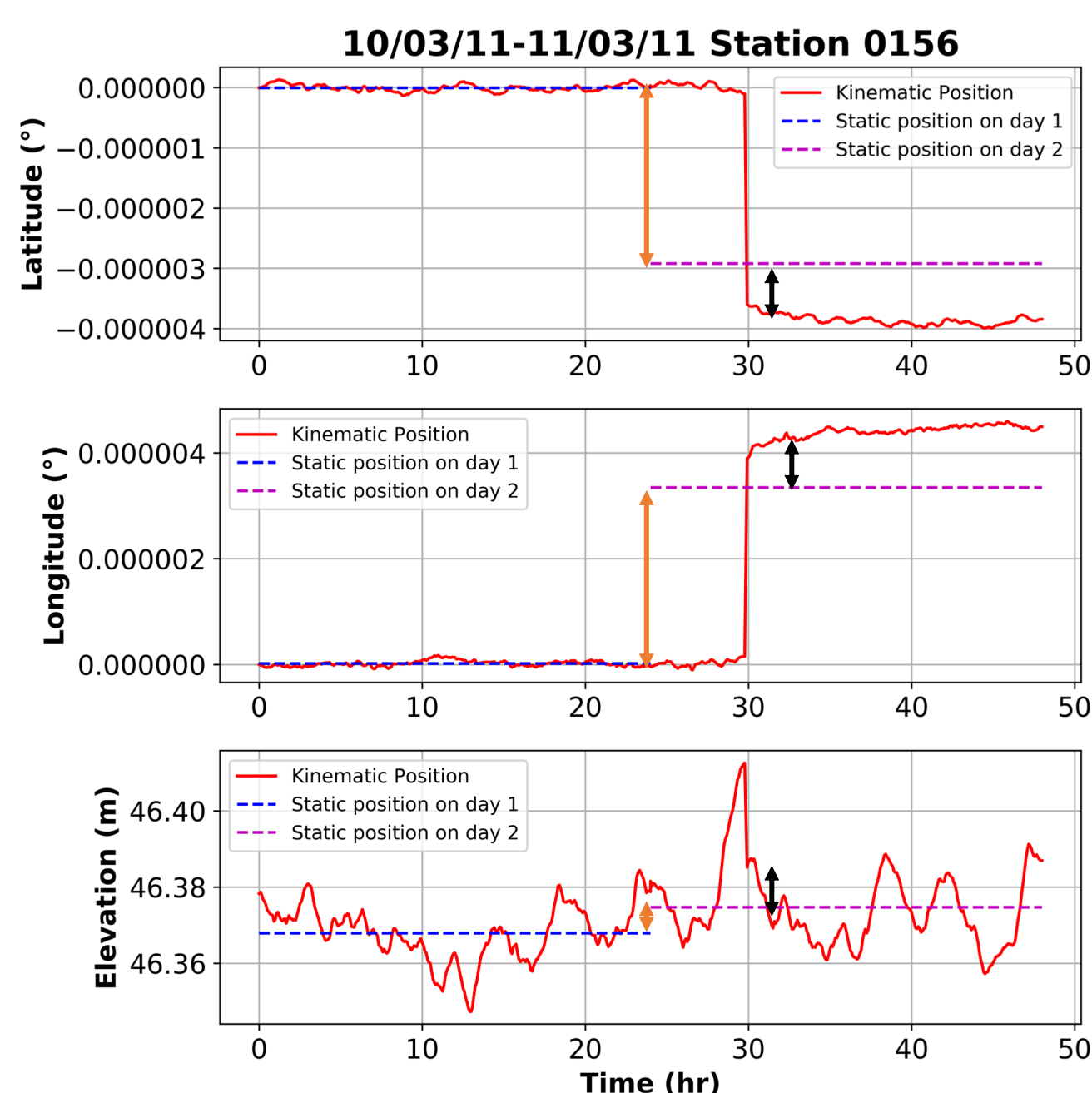


Tohoku-Oki Earthquake 11/03/11 5h46 23s UTC

- The co-seismic offset induces strong displacements in the observations.
- The chosen strategy is to remove the co-seismic observation.
- There is a gap of 5 minutes between the early pre- and post-seismic observations.

On-going work:

- To process data on days before the earthquake without seismic signal to create a sidereal filter to correct the multipath effect on each station.
- Some displacement observations on the early post-seismic.
- And maybe early pre-seismic?
- Magnitude afterslip vs Omori distribution.
- Look at the early post-seismic displacement pattern of the Tohoku-Oki foreshock (09/03/11 M_w 7.2).
- Interactions between aseismic and seismic slip.



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