



X CONFERÊNCIA NACIONAL DE CARTOGRAFIA E GEODESIA
INFORMAÇÃO GEOESPACIAL PARA OS OBJETIVOS DE DESENVOLVIMENTO SUSTENTÁVEL
INSTITUTO POLITÉCNICO DA GUARDA
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Uma investigação do ruído e da estabilidade das estações GNSS da ReNEP

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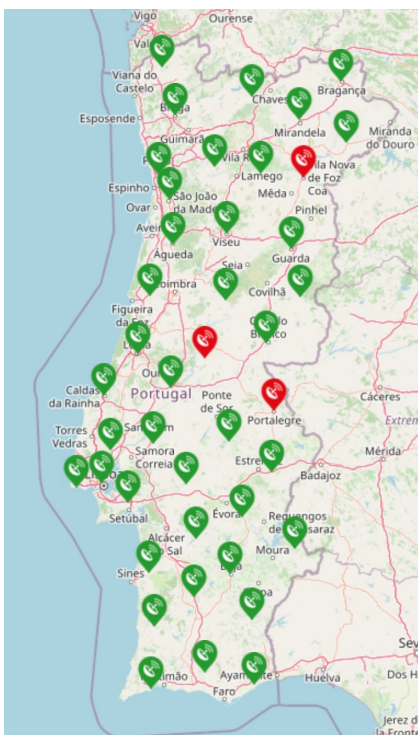
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ORDEM
DOS
ENGENHEIROS

ReNEP



A Rede Nacional de Estações Permanentes GNSS (ReNEP) é um serviço público de geoposicionamento prestado pela Direção-Geral do Território (DGT) que facultam a determinação de coordenadas geográficas com precisão melhor que **10 cm**.

<https://rekep.dgterritorio.gov.pt/>

10-20 anos após a sua instalação, as estações mostraram algum movimento?



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Method

- Daily solutions in IGS14 calculated by Nevada Geodetic Laboratory (PPP, GIPSY-X). [<http://geodesy.unr.edu/>]
- Daily solutions in IGS14 calculated by ISTERre (Double differencing, GAMIT/GLOBK). [<https://www.isterre.fr/>]
- MetaData: M3G - Metadata Management and Distribution System for Multiple GNSS Networks [<https://gnss-metadata.eu/>]
- Only time series with more than 3 years of data are analysed.

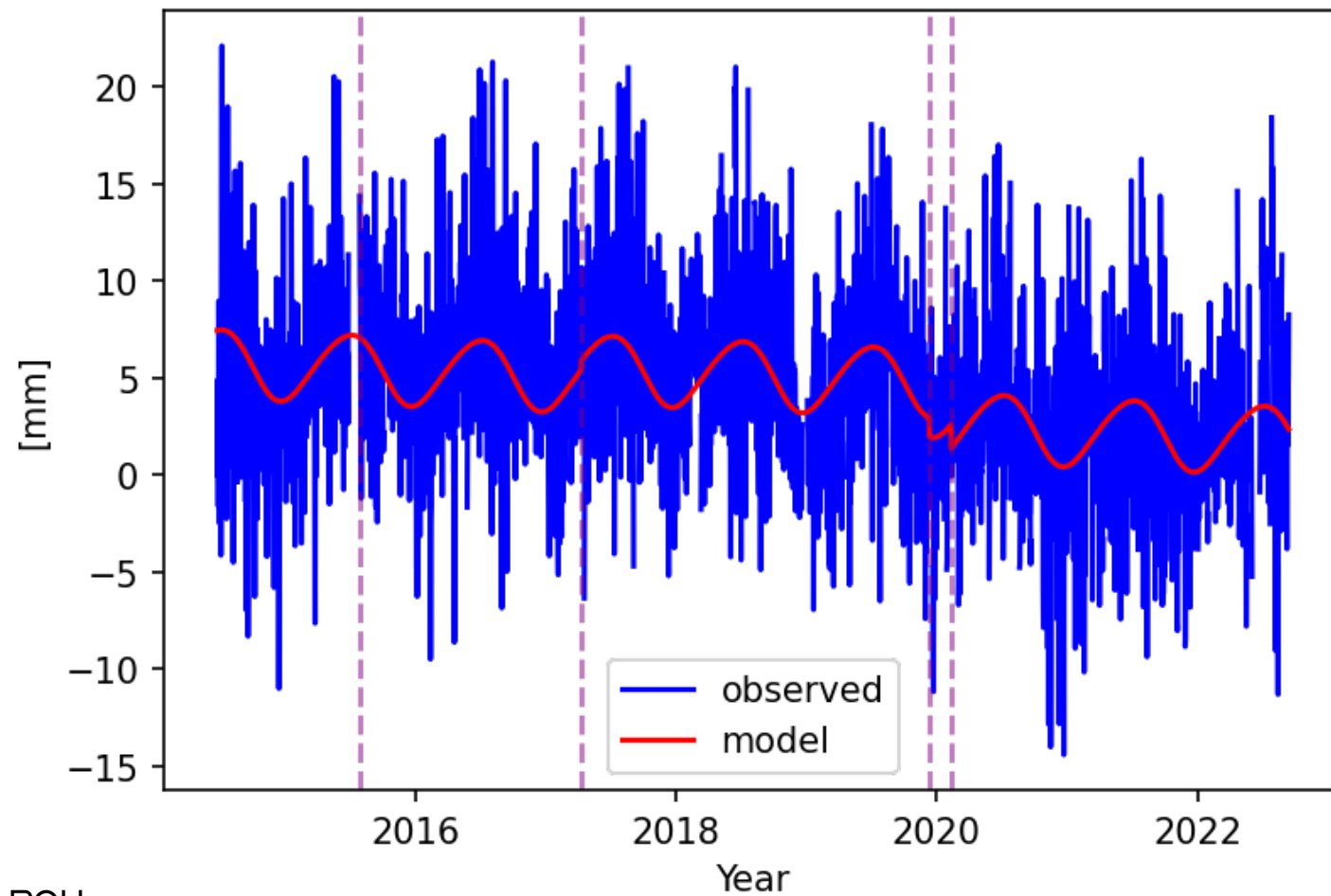


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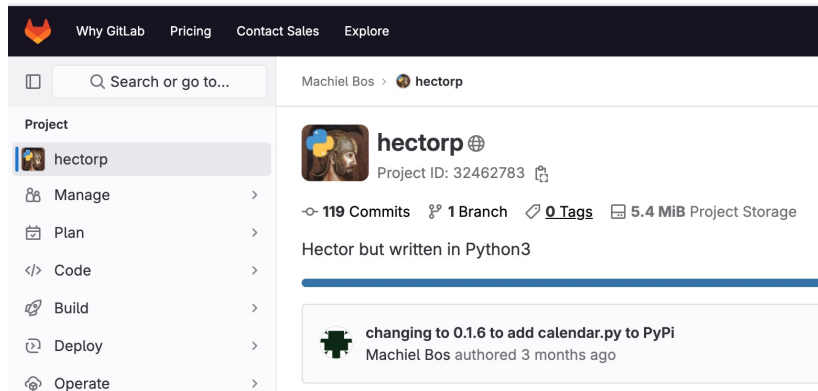
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ARRD vert

ARRUDA DOS VINHOS



<https://gitlab.com/machielsimonbos/hectorp>



Linear trend (velocity), annual, semi-annual signal estimated with HectorP

<https://teromovigo.com/product/hector/>

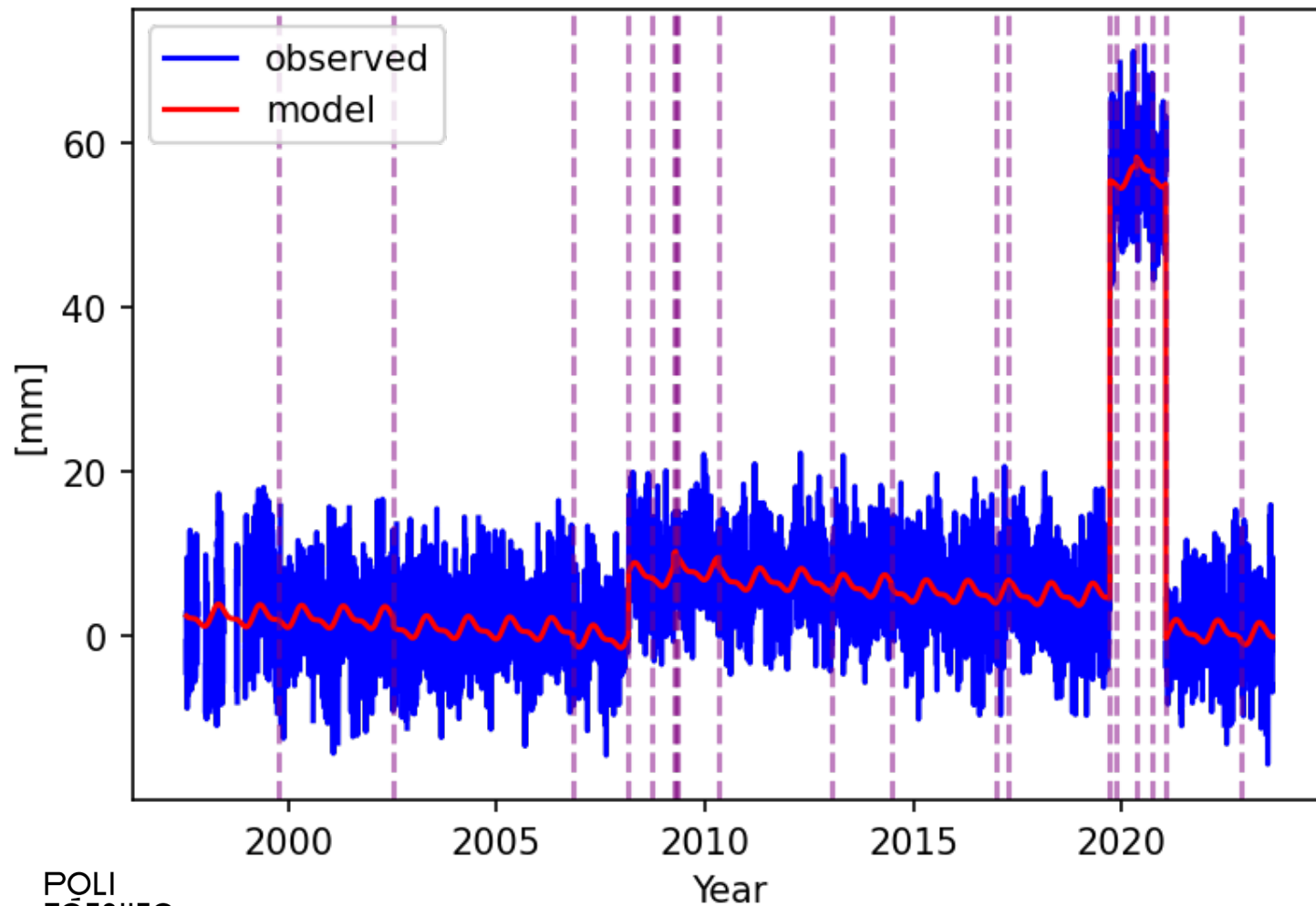
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- hector_2.0_Ubuntu18.04.tar.bz2 (Ubuntu 18.04 LTS)
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- hector_2.1_Ubuntu20.04.tar.bz2 (Ubuntu 20.04 LTS)
- hector_2.1_Ubuntu21.04.tar.bz2 (Ubuntu 21.04)
- hector_2.1_Ubuntu22.04.tar.bz2 (Ubuntu 22.04 LTS)
- source code hector-2.0
- source code hector-2.1
- Python3 scripts hector-2.0
- Python3 scripts hector-2.1
- examples
- manual hector-2.0
- manual hector-2.1

OPEN SOURCE!

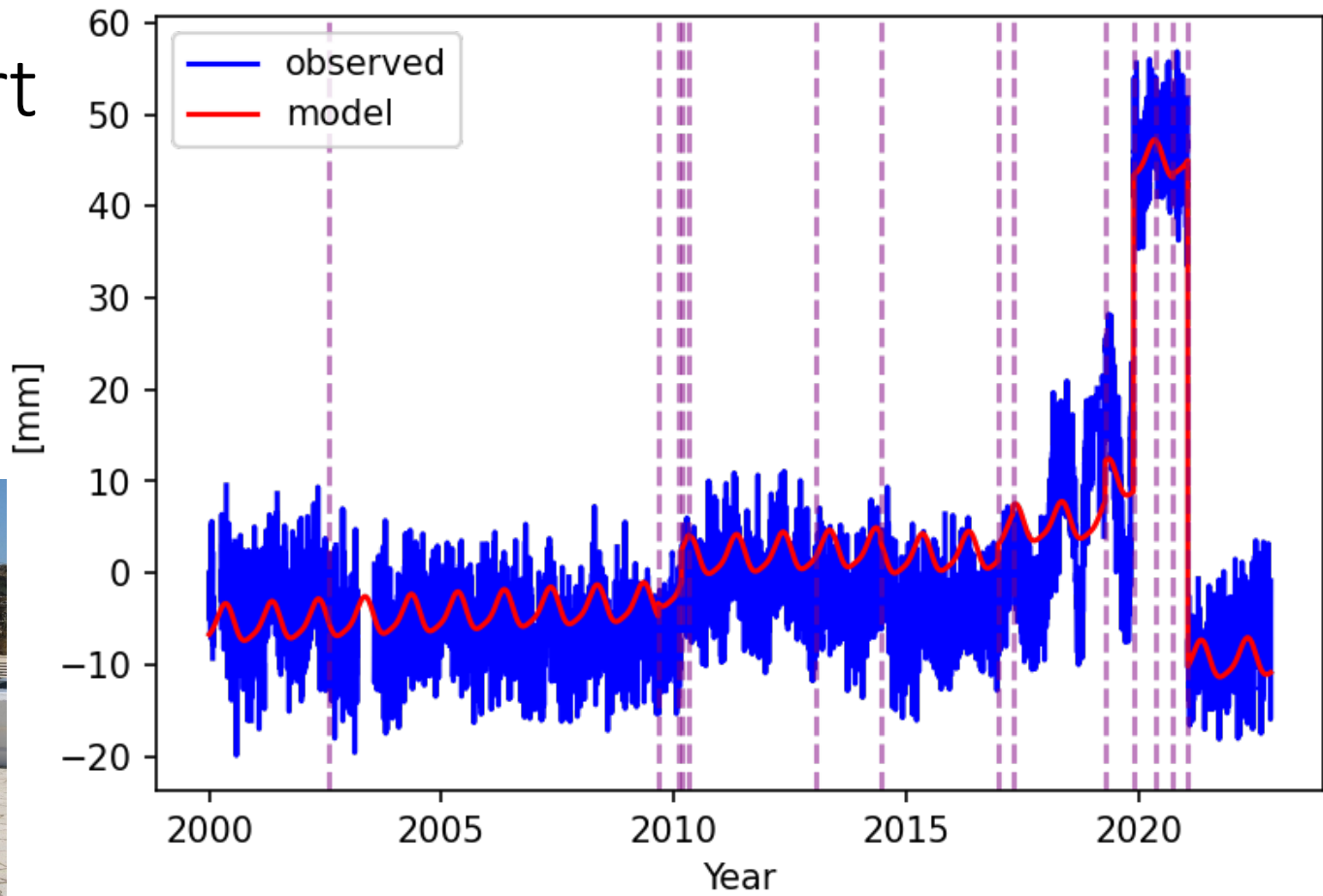


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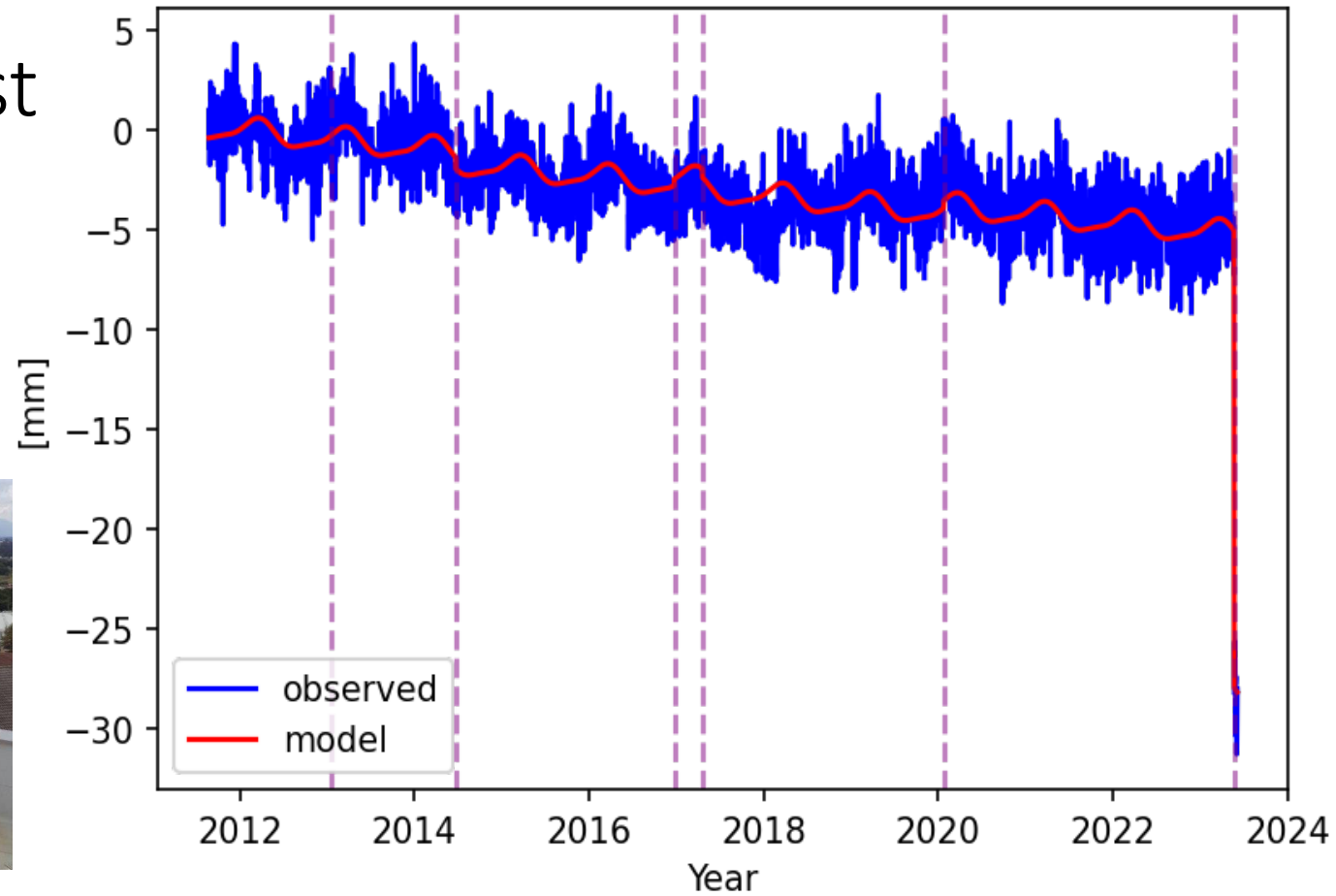
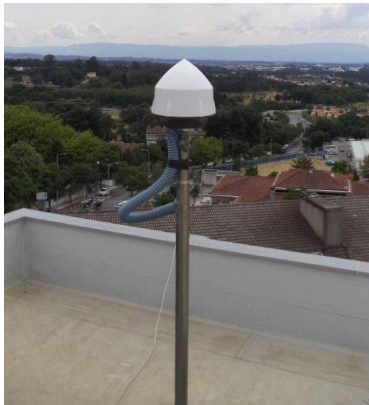
CASC vert

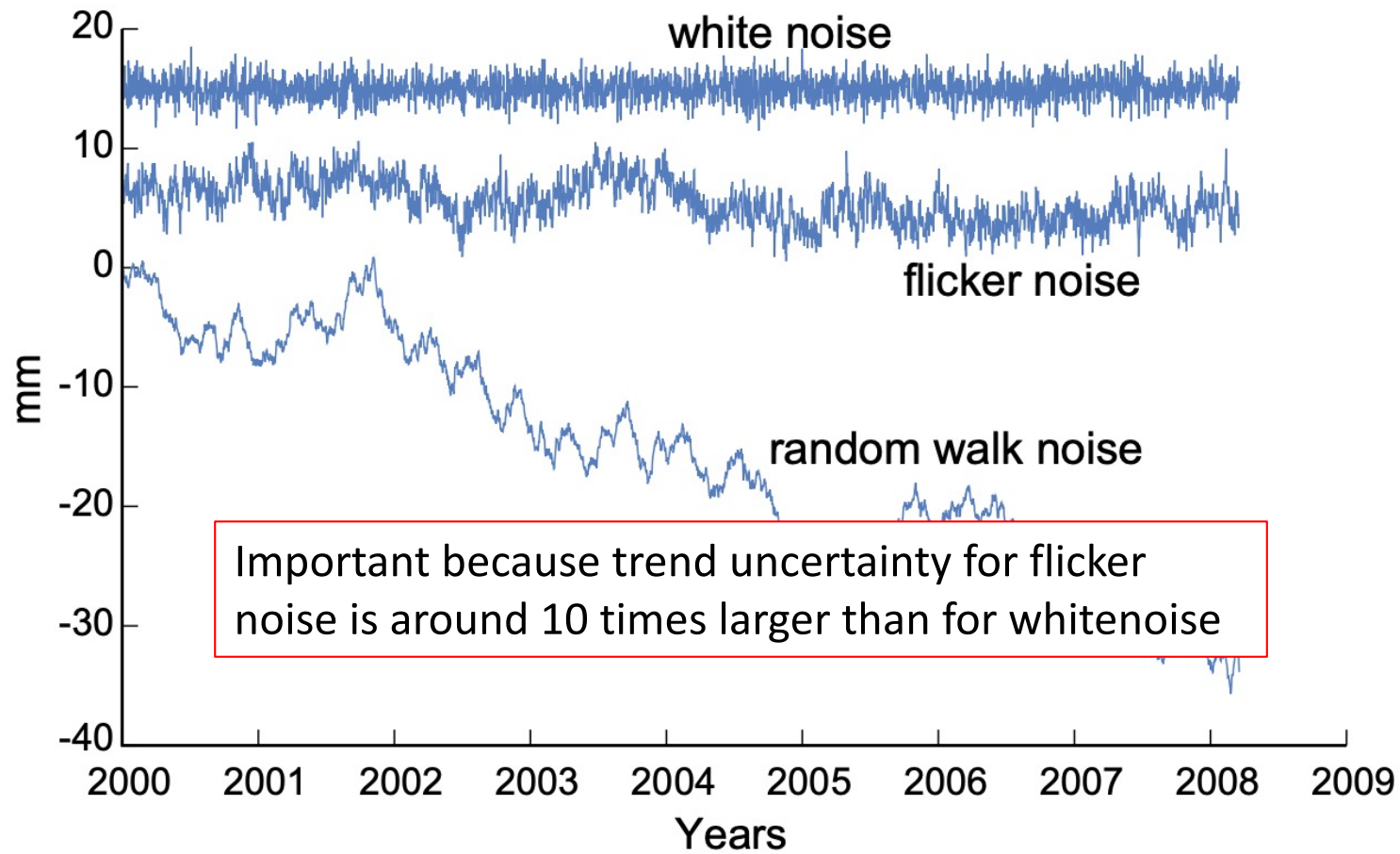


LAGO vert



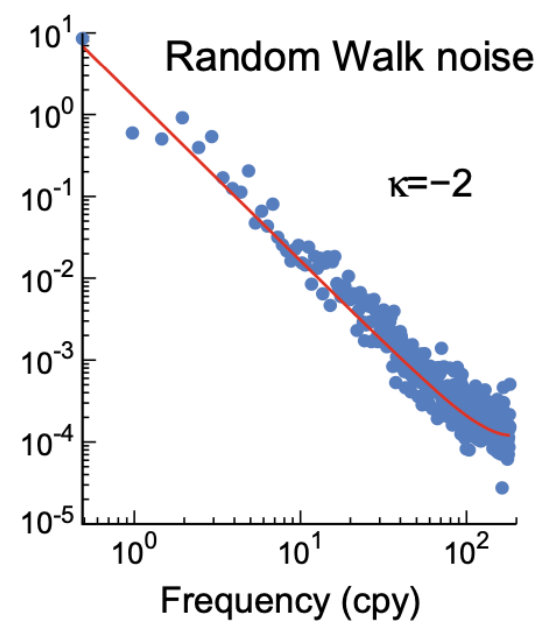
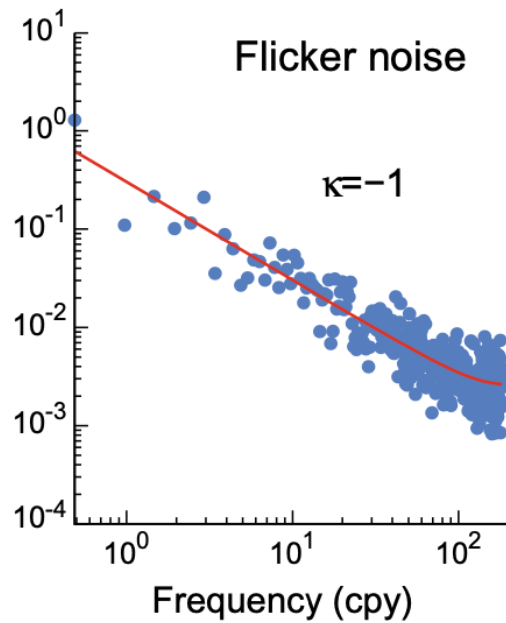
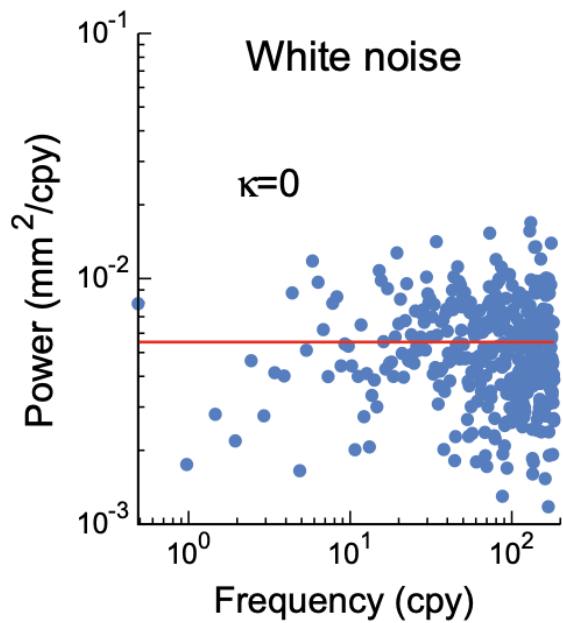
VSEU east





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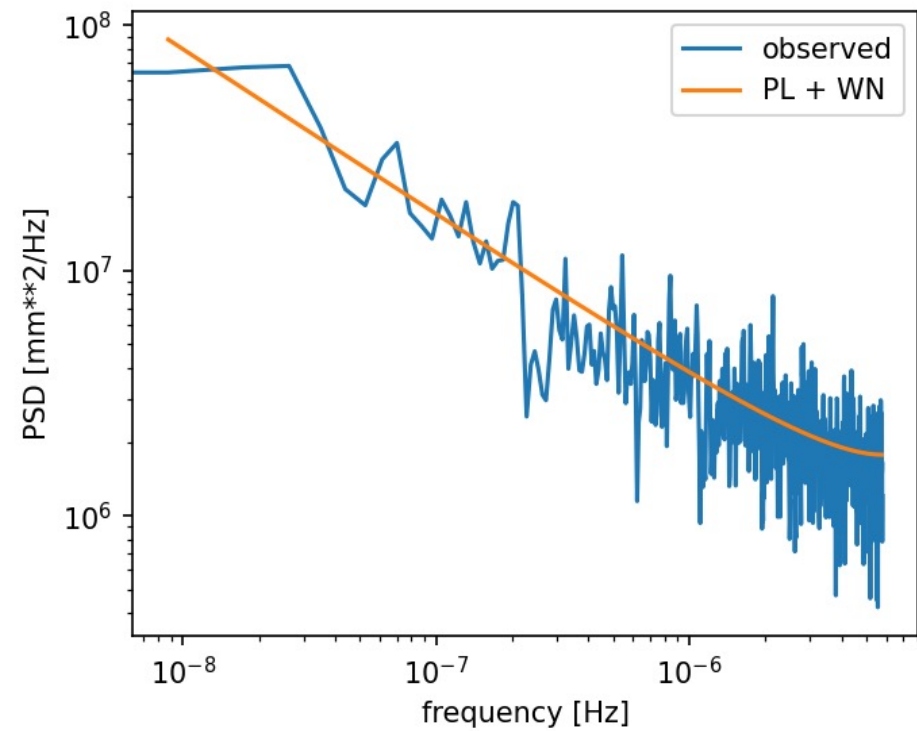
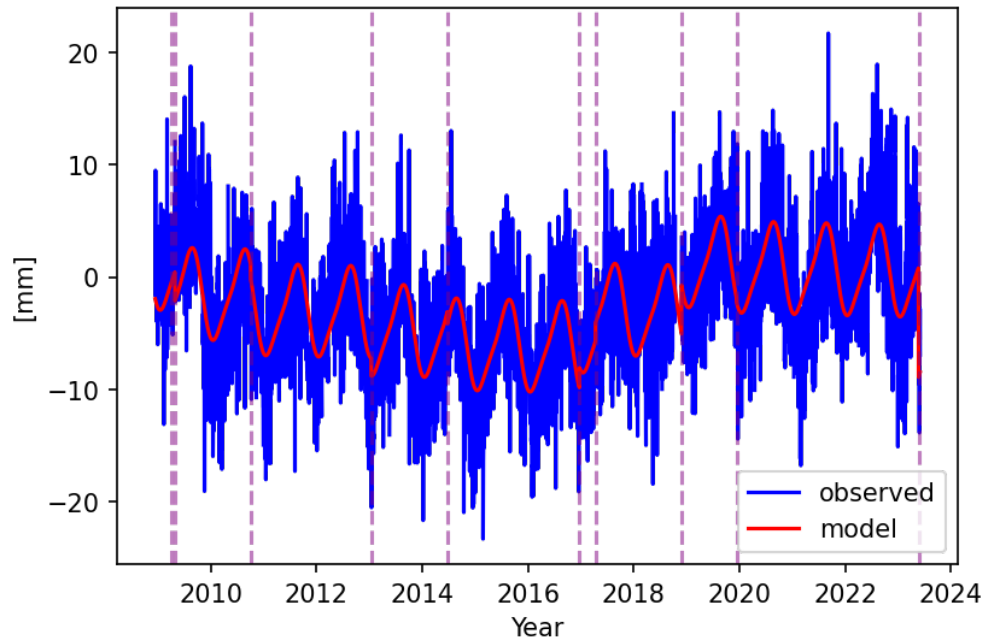
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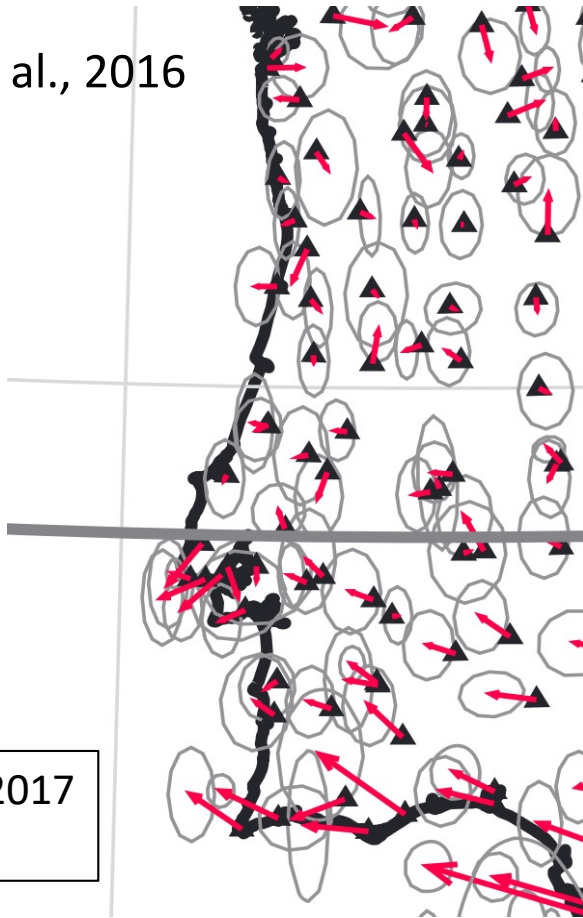
Noise properties



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Neres et al., 2016



Mendes 2017
No figure

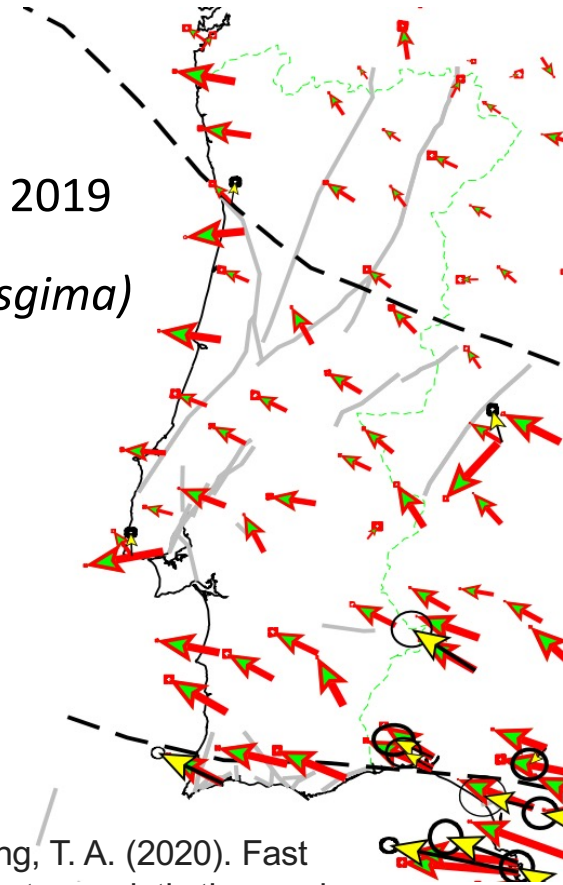


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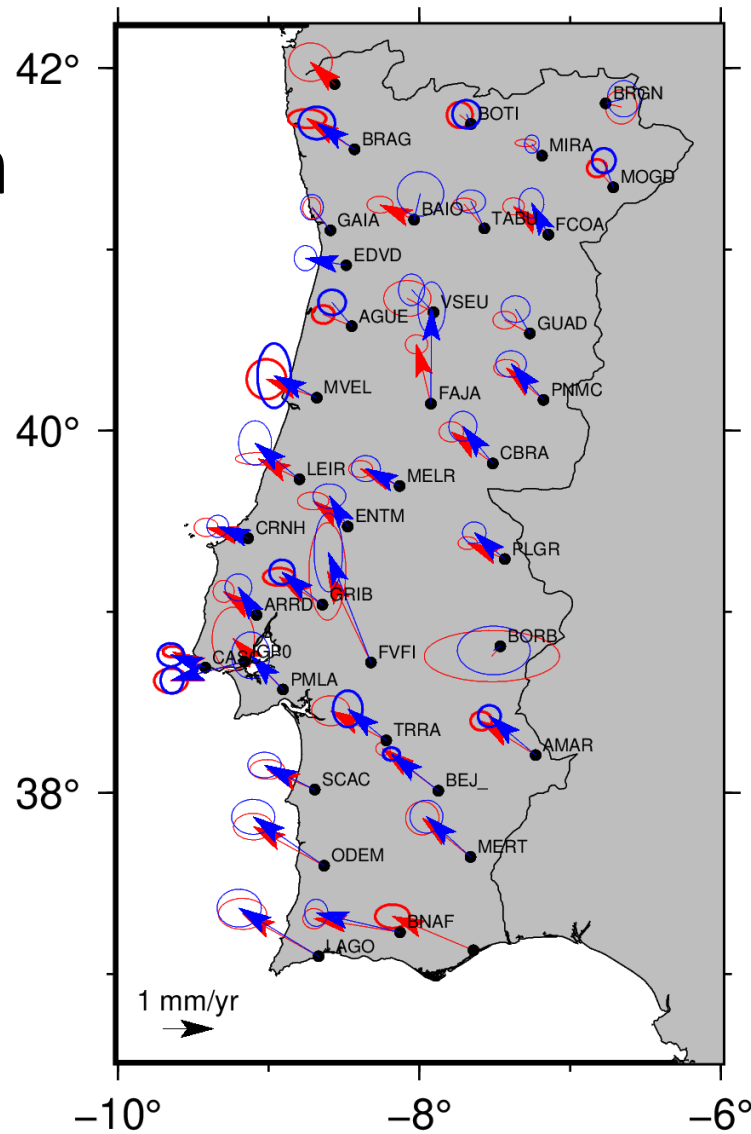
Khazaradze et al., 2019

Errors GAMIT (1 sigma)



Floyd, M. A., & Herring, T. A. (2020). Fast statistical approaches to geodetic time series analysis. *Geodetic Time Series Analysis in Earth Sciences*, 157-183.

Horizontal motion



ISterre

Nevada
Geodetic
Laboratory

2-sigma

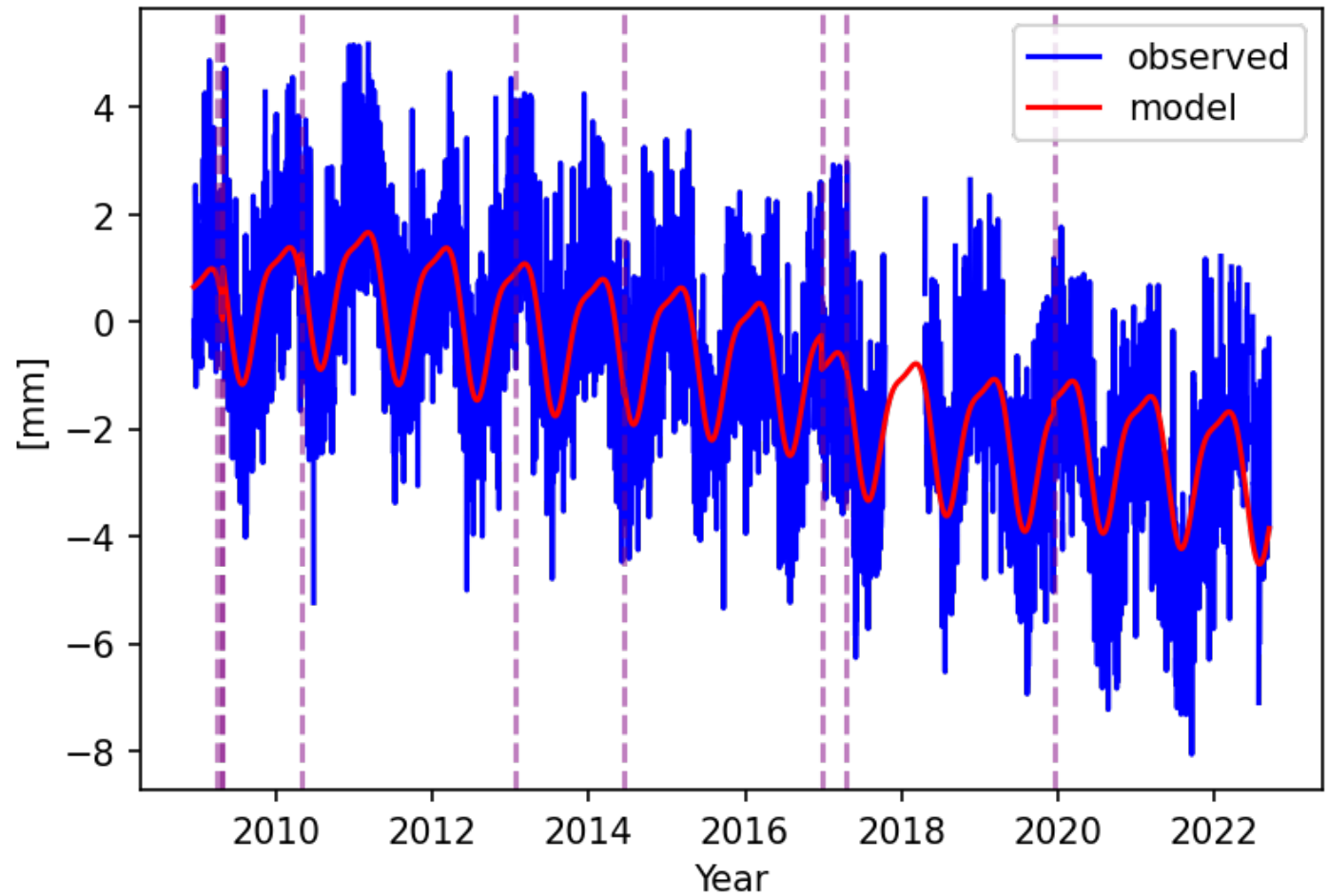


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FAJA east



FAJA->FAJ1

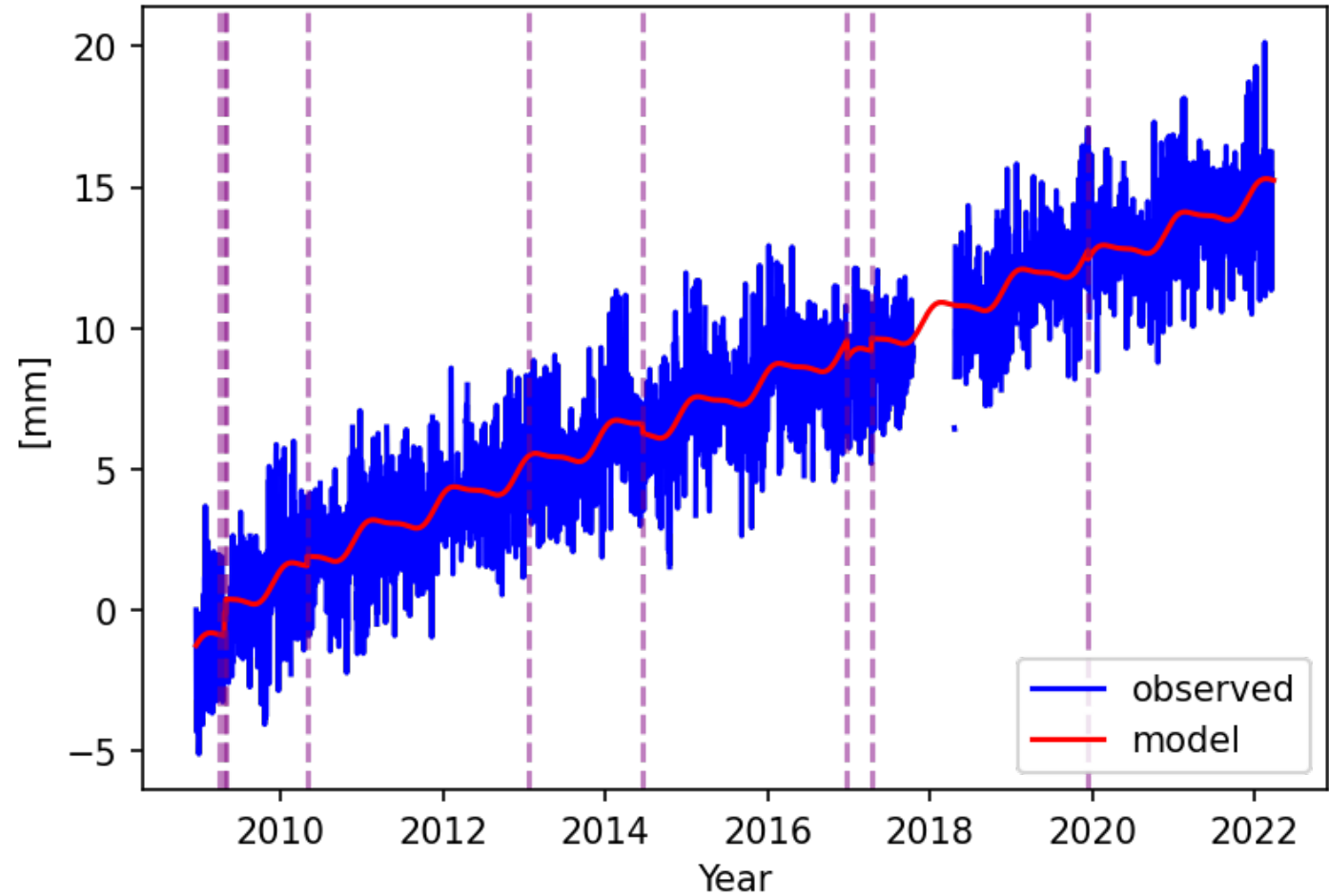


FAJA north

Fajão

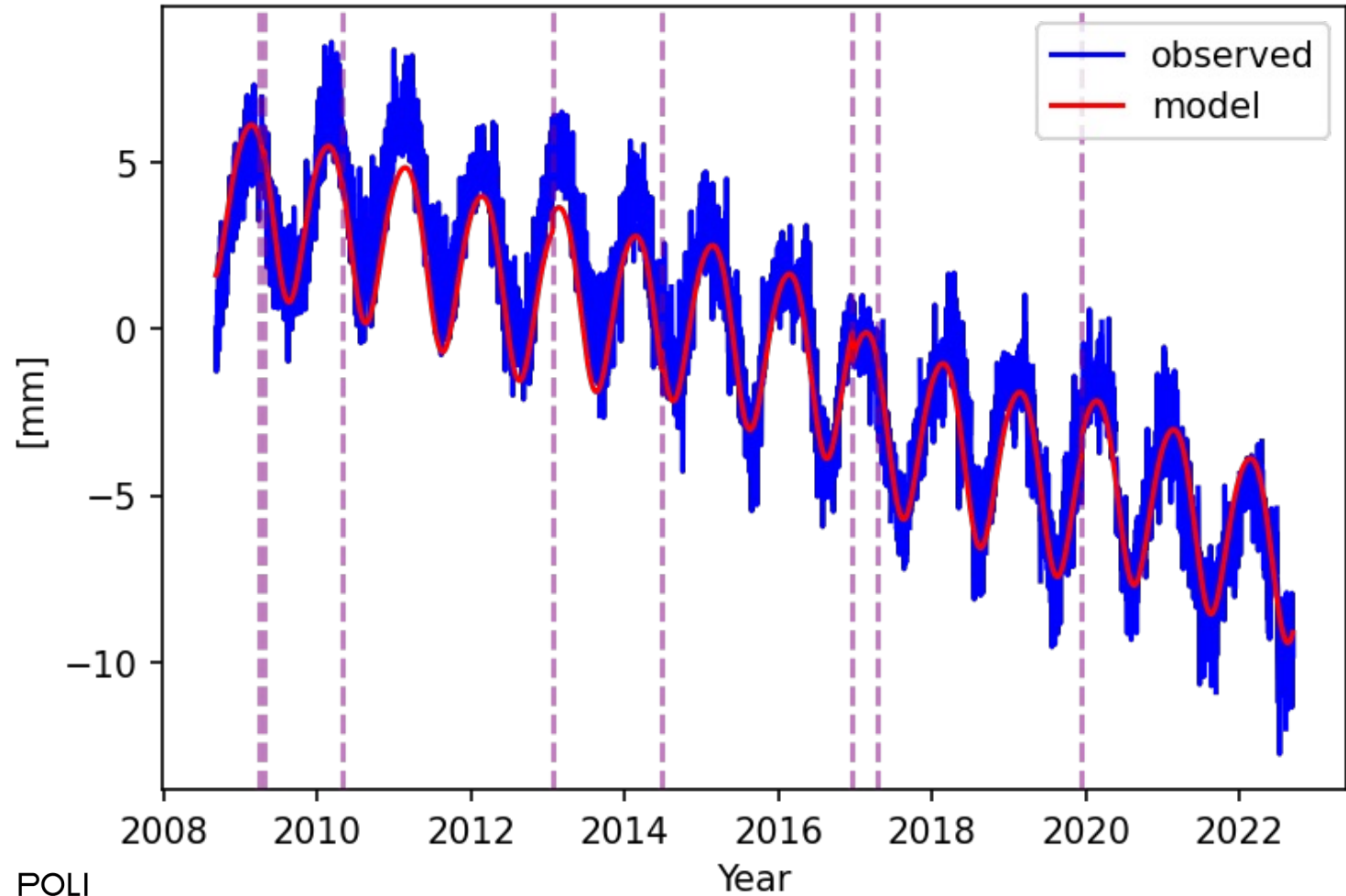


FAJA->FAJ1

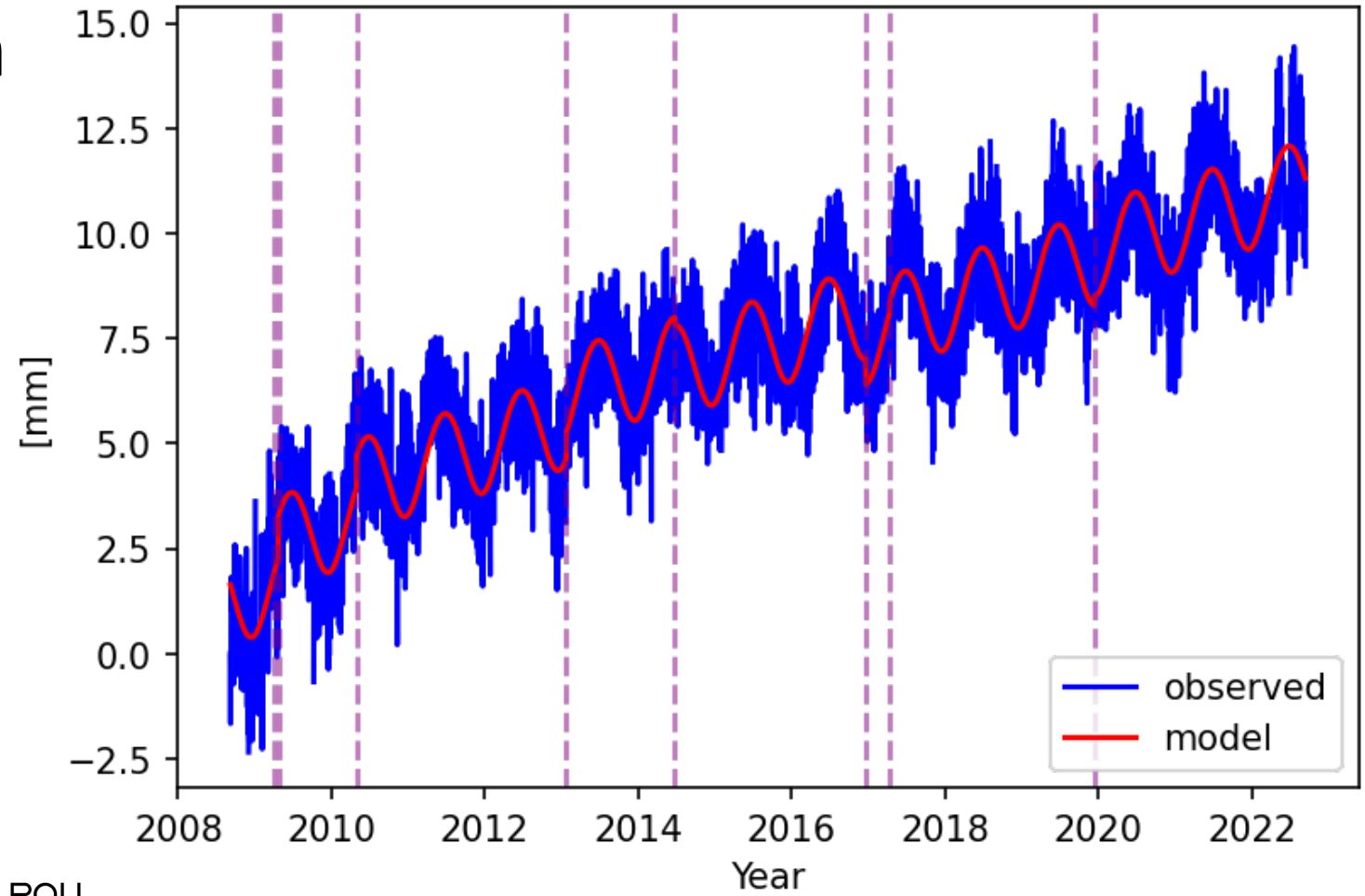


GRIB east

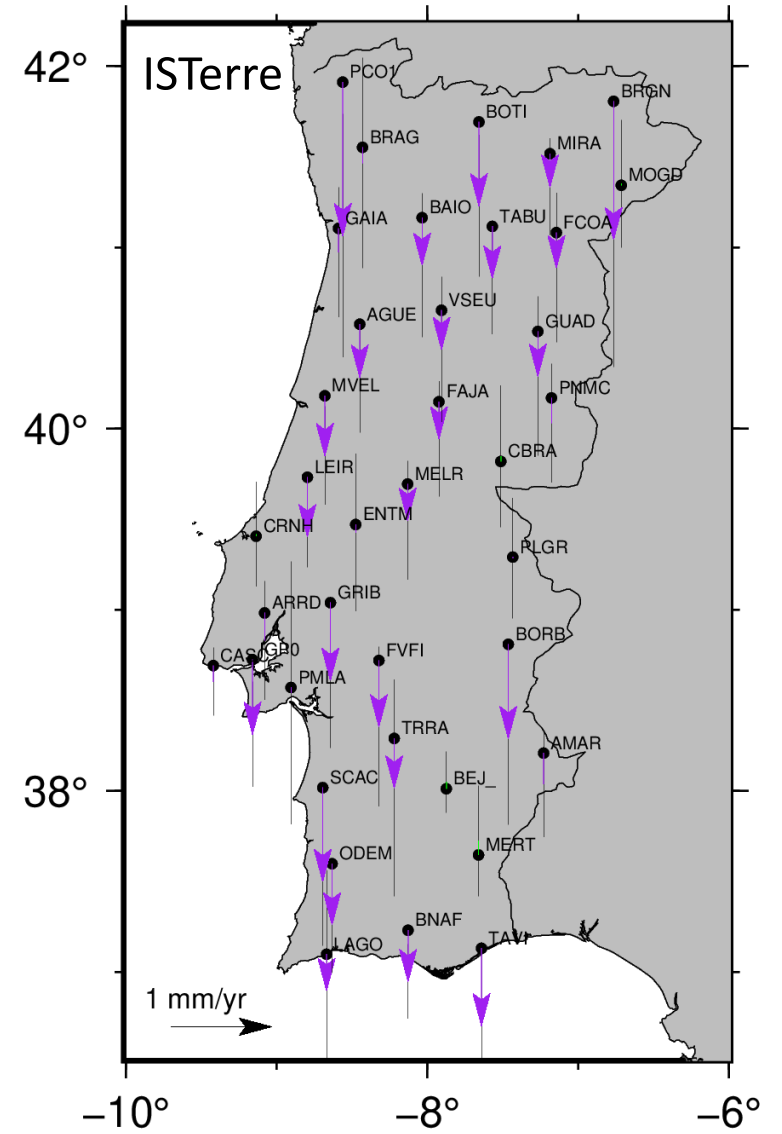
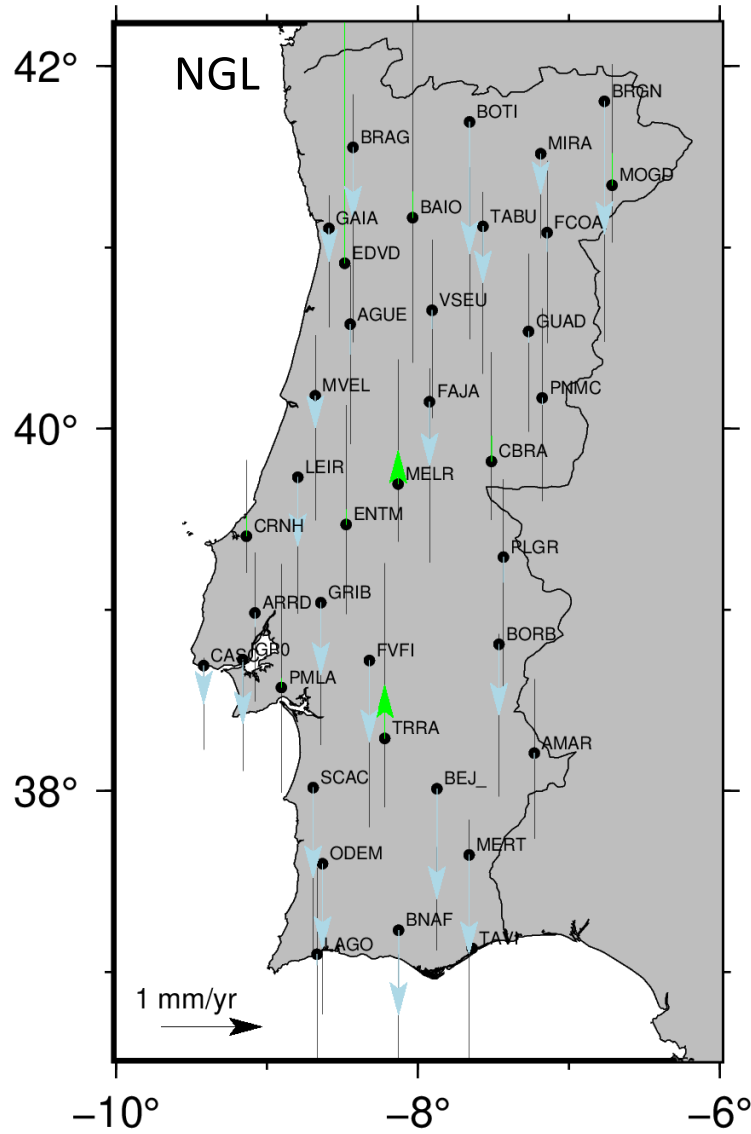
GLORIA RIBATEJO



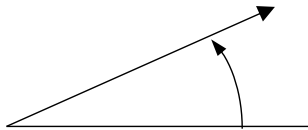
GRIB North



Ver motion

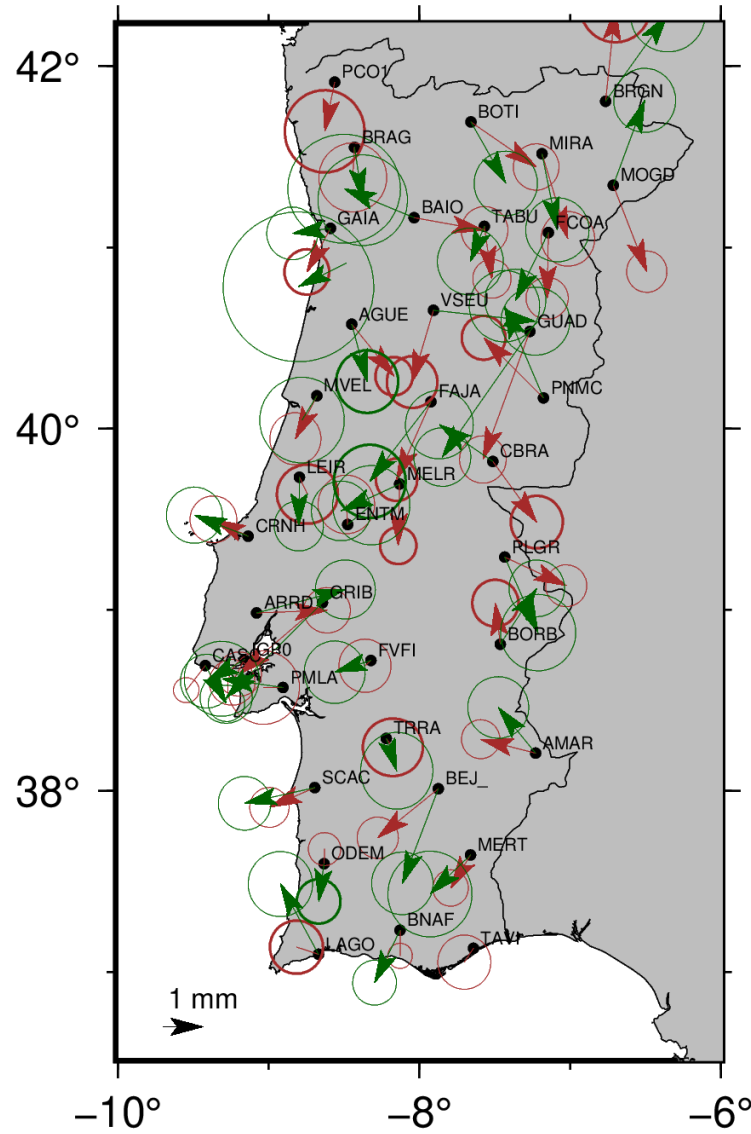


Annual signal
vert



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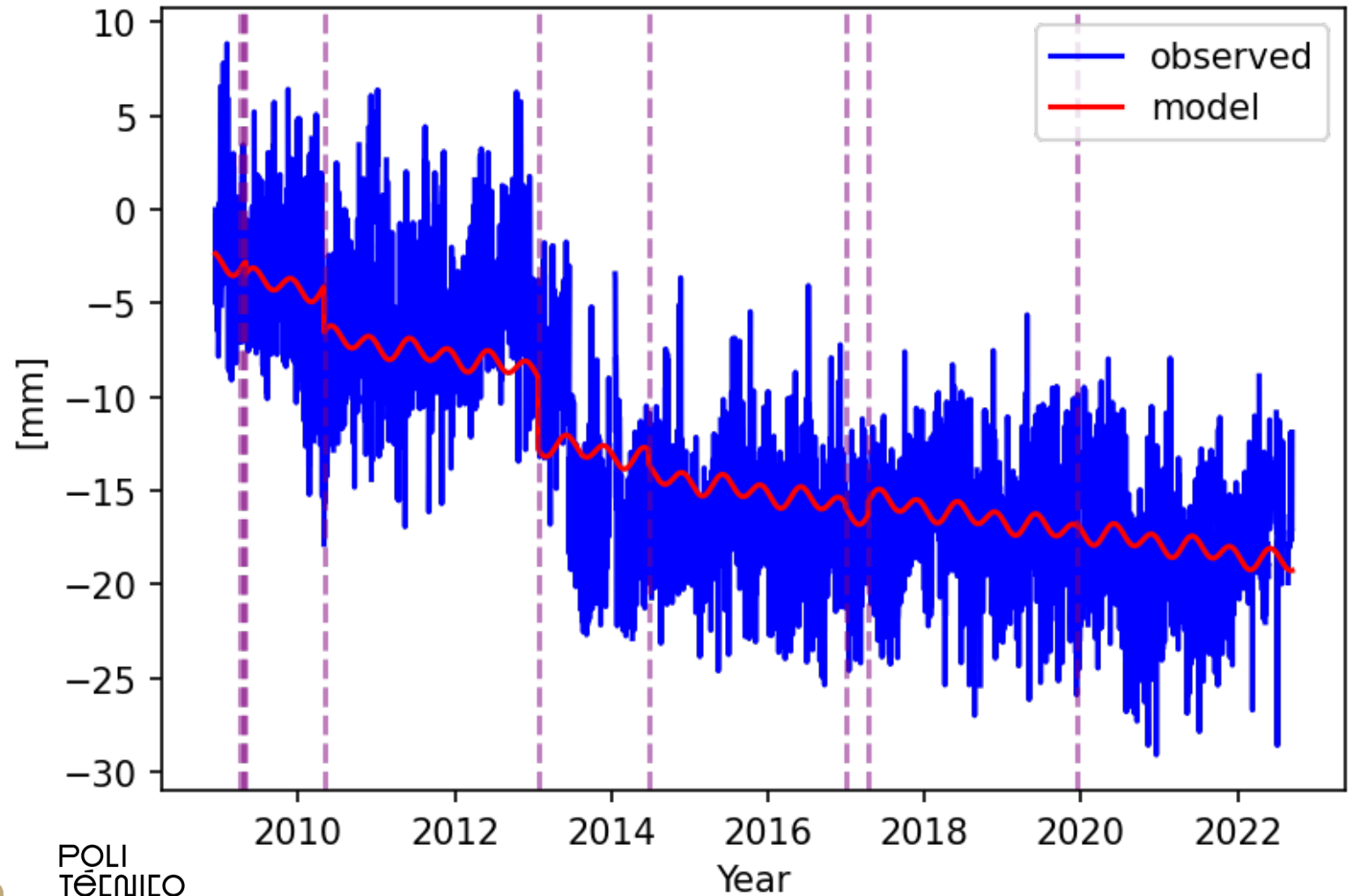


ISerre

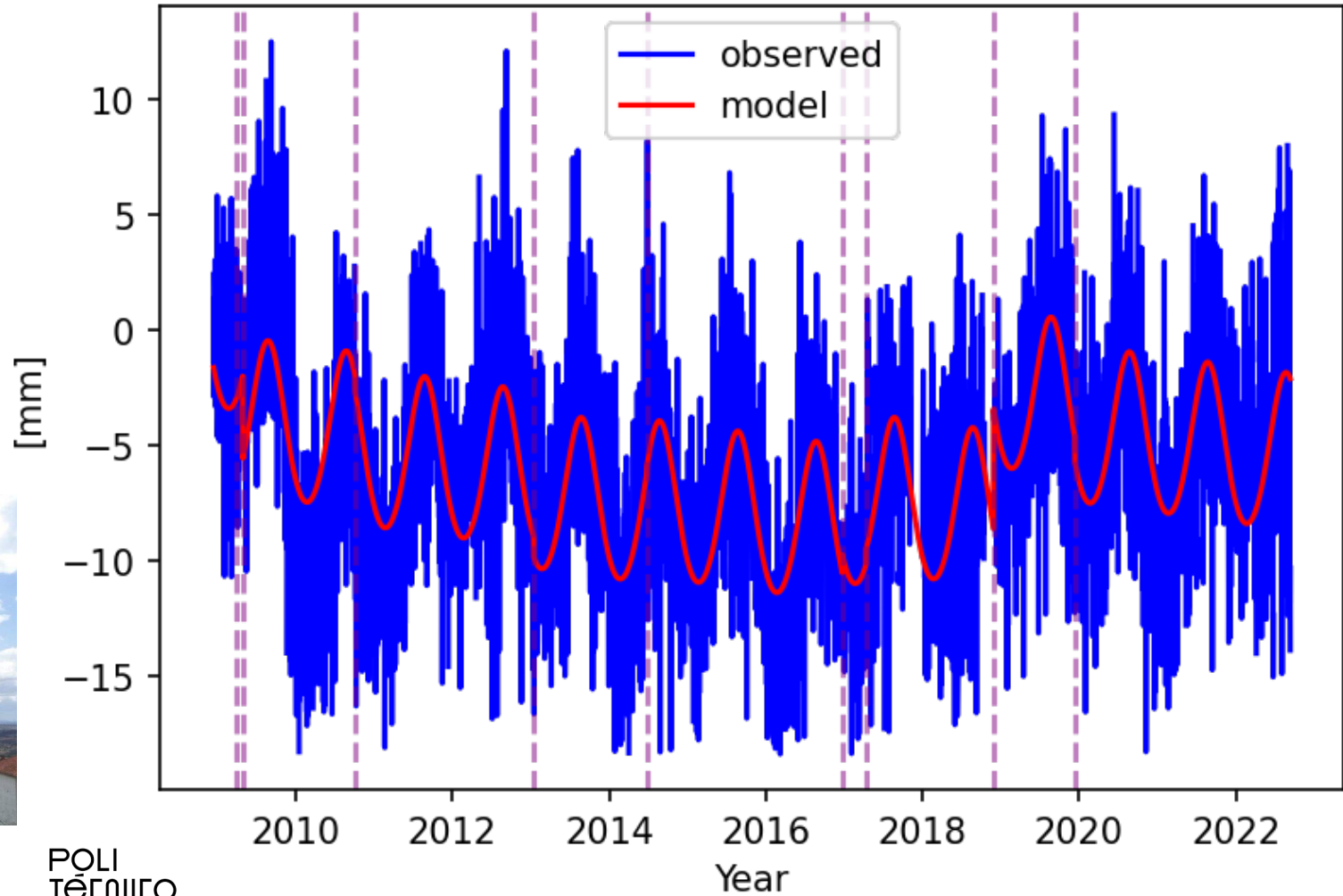
Nevada
Geodetic
Laboratory

FVFI up

FOROS DE VALE FIGUEIRA

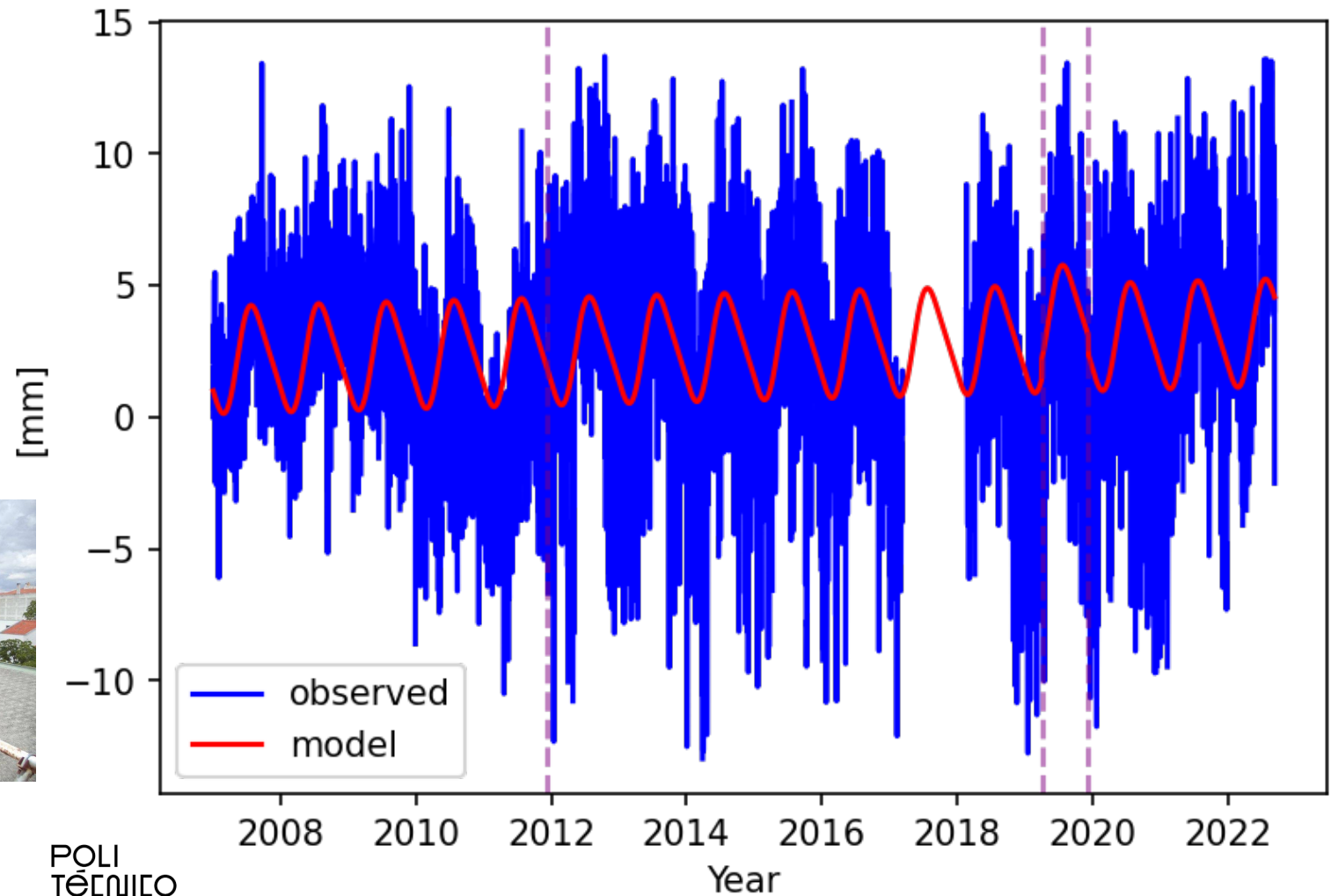


GUAD up



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BEJ_up



Conclusions

- Estimated velocities for NGL and ISTerre are not significantly different
- All ReNEP time series demonstrate power-law +white noise
- Tectonic behaviour of continental Portugal is becoming very clear (south of Portugal moving away from Europe)
- Vertical annual mostly smaller than 2mm, exception GUAD and BEJ_
- **10 cm accuracy is always guaranteed at all ReNEP stations.**



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Obrigado pela atenção

Agradecemos à Direção-Geral
do Território a disponibilização
dos dados para esta
investigação.

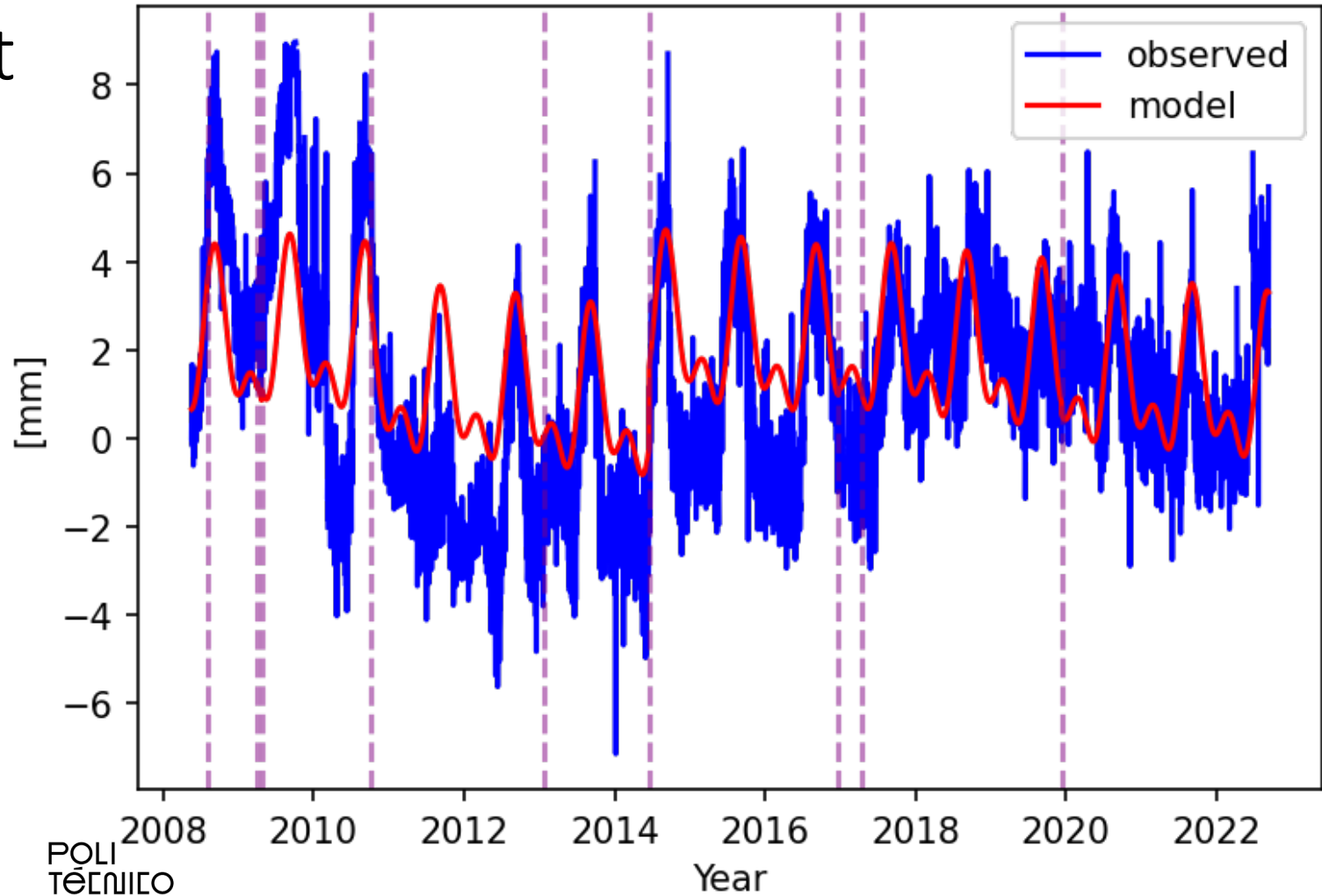


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BORB east



BOTI east



boticas

BOTI->BOT1

