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Toward the generation of EPOS-GNSS products

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Massive GNSS processing & evaluation of a statistical approach for the velocity field computation

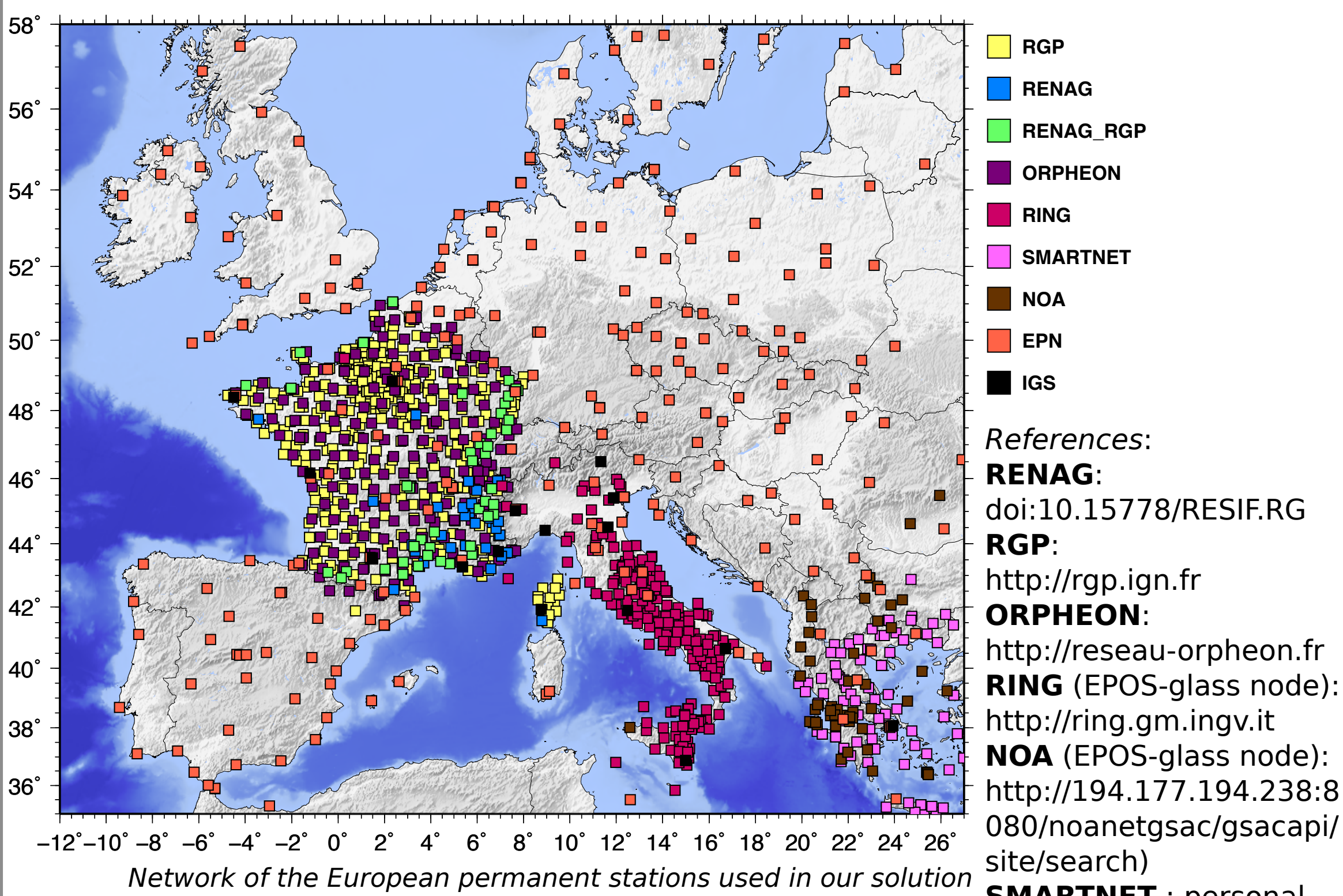
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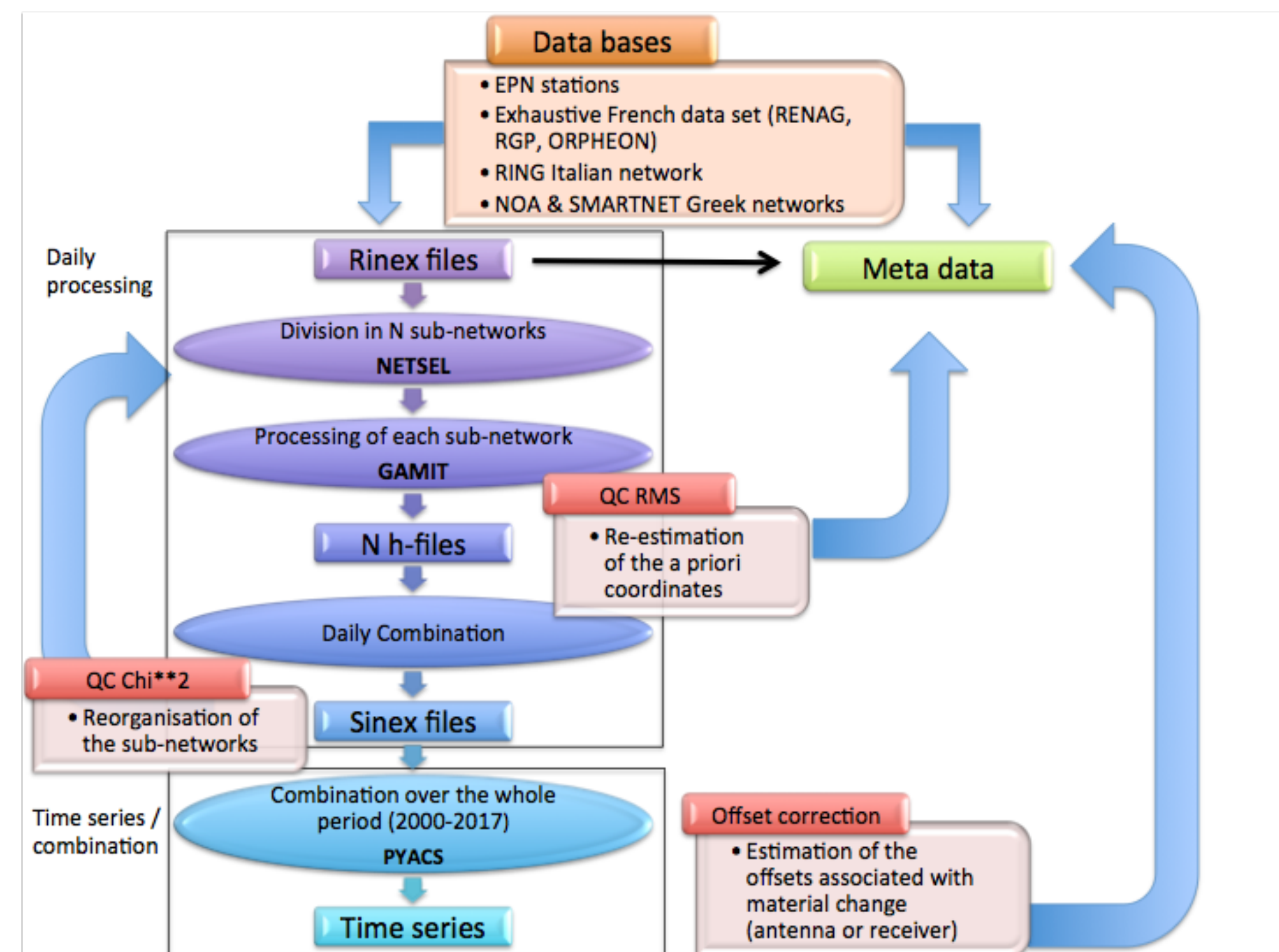
1. Massive data set & processing method

The GNSS solution presented here is the result of a **massive GNSS processing** based on a double difference method (using GAMIT / GLOBK software, Herring et al., 2010).

Our data set is composed of rinex files from more than **1500 permanent stations** over **18 years** (2000-2017 included).



This represents more than **4 millions of rinex files** being an amount of data of more than **2000G**. Such a processing justifies the use of a high performance computing platform (CIMENT hosted at

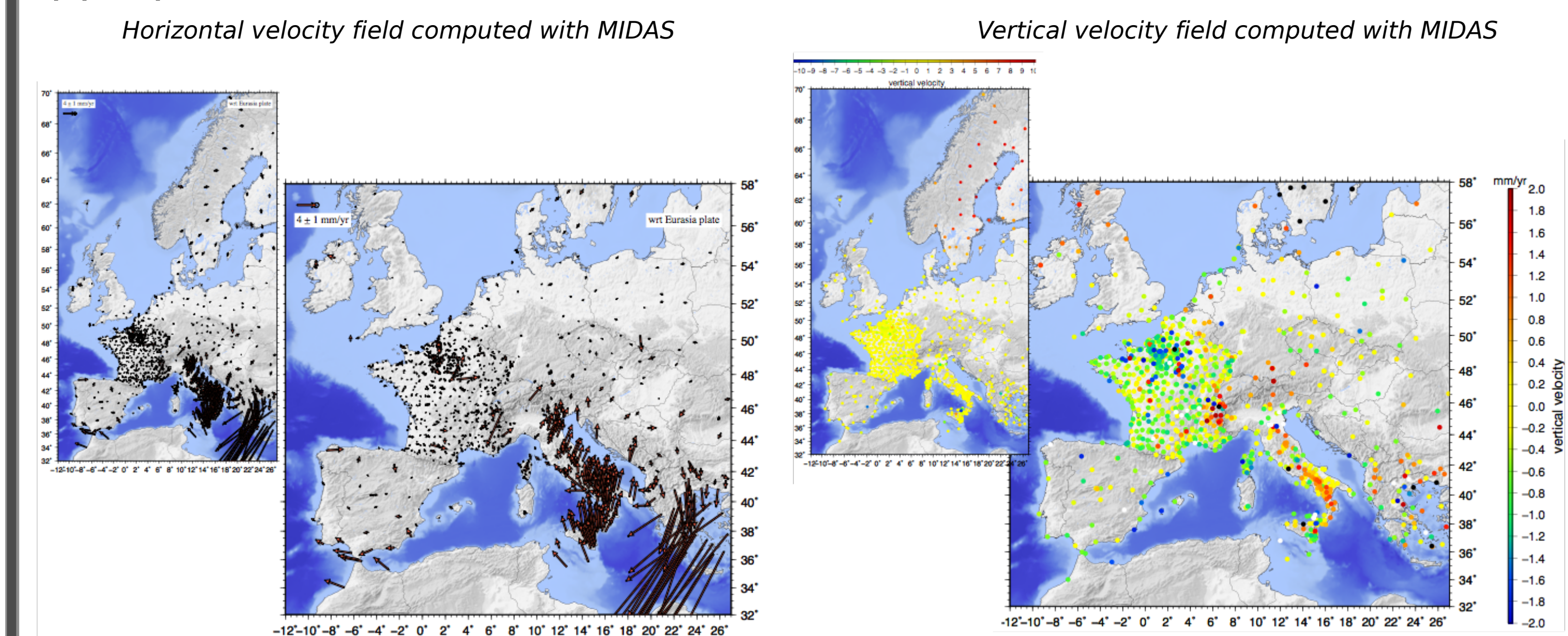


Processing chart from the data download to the position time series generation

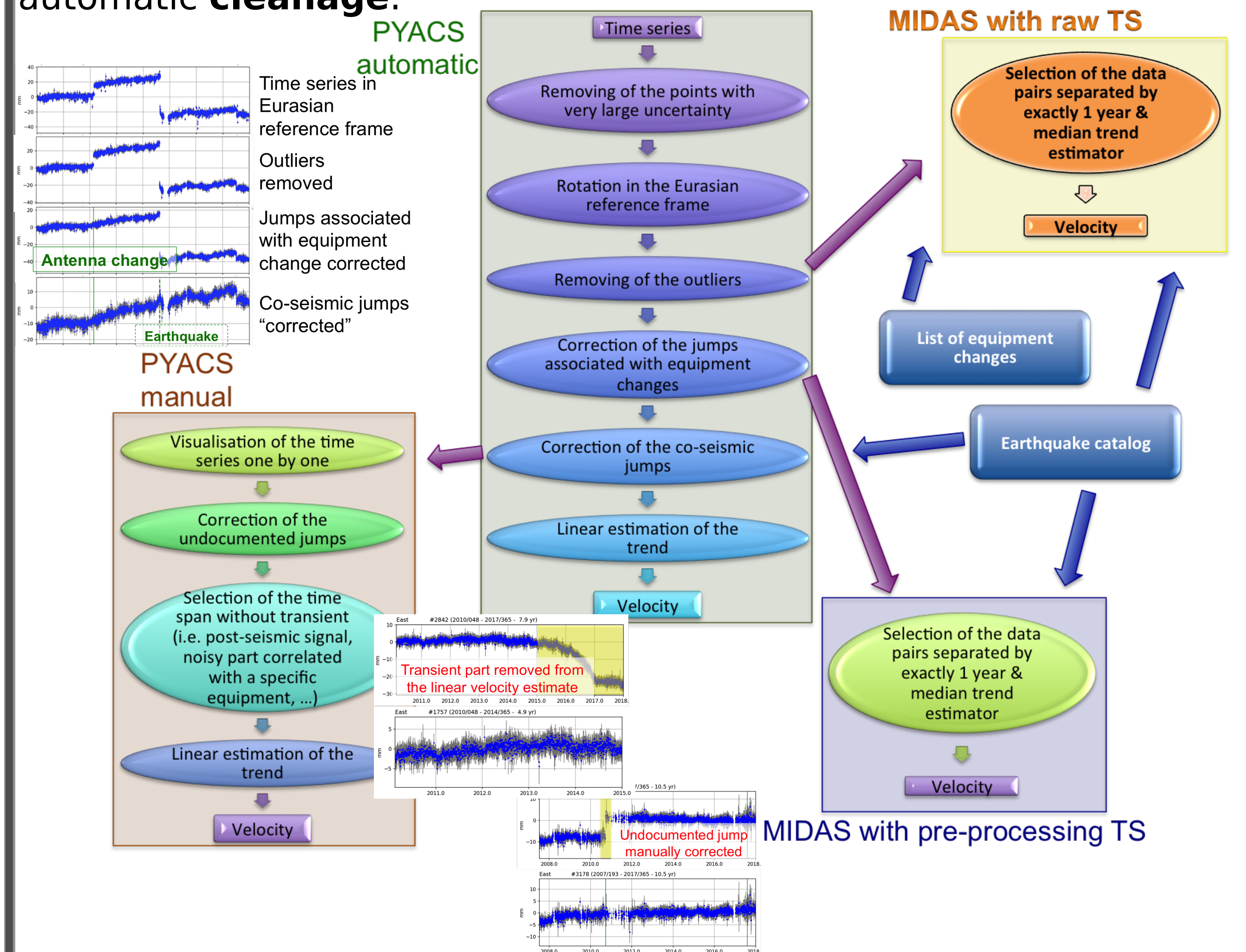
2. Approaches tested to evaluate the velocity field

The massive processing implementation requires innovative strategies in order to satisfy the **efficiency, robustness & automation** criteria for the computation of GNSS velocity field in a **"big data"** context.

MIDAS software appears to be a good, **fast** and the most appropriate method (Blewitt et al., 2016).

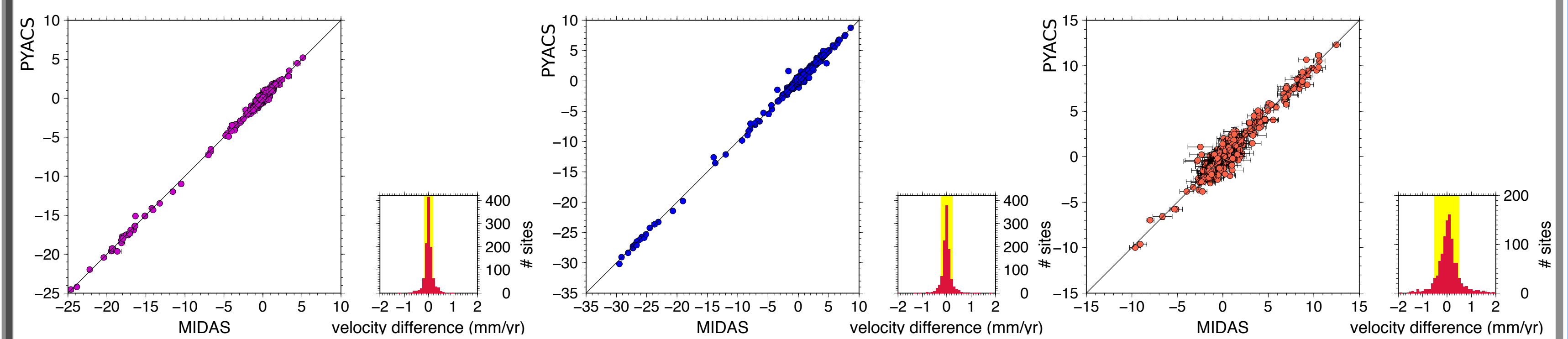


We obtained a "MIDAS velocity" for 1362 stations. In order to validate this "unusual" approach on our data set, we compared these velocities with the ones obtained using a more "traditional" approach (using PYACS, Socquet et al. in prep.) i.e. : estimation of a **linear trend** on position time series after an automatic or semi-automatic **cleanage**.

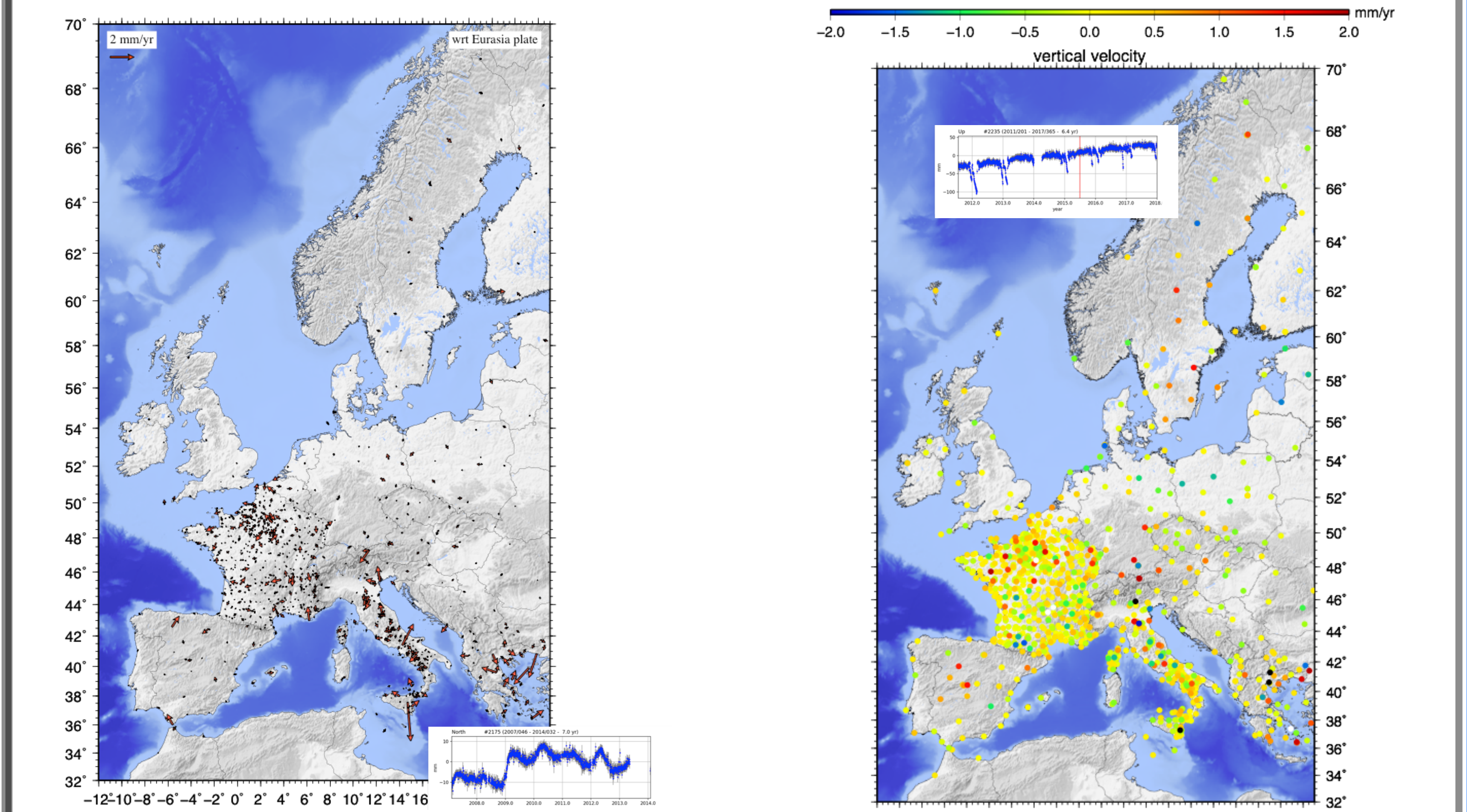


3. Comparison of the results in terms of velocity

We presented here the statistics associated with the comparison between the MIDAS evaluation and the linear regression of the time series after spending a lot of time in order to carefully visualize the time series data set and to correct them using human eyes and knowledge.



The standard deviations of the differences were 0.182, 0.240 and 0.509 mm/yr respectively for the east, north and vertical component.



Differences in terms of horizontal velocities between the statistical approach (MIDAS) and the linear regression (PYACS), with respect to the Eurasia fixe.

Differences in terms of vertical velocities between the statistical approach (MIDAS) and the linear regression (PYACS).

There were still 74 remaining stations with a difference > 0.5 mm/yr for the horizontal velocity and 21 stations with a difference > 1.5 mm/yr for the vertical velocity. However they are mainly located in active zones and are associated with area for which a constant velocity is meaningless, regardless the chosen method. Some differences in the vertical component were also associated with a high level of seasonal noise due to snow.

References:
 Herring, T. A., King, R. W. & McClusky, S. C. Reference Manual (GPS Analysis at MIT) Gamit-Globk Blog http://www.gpsg.mit.edu/~simon/gtk/GAMIT_Ref.pdf (2010)
 Blewitt, G., Kreemer, C., Hammond, W. C. & Gazeaux J., MIDAS robust trend estimator for accurate GPS station velocities without step detection, J. Geophys. Res. Solid Earth, 121, 2054-2068 (2016), doi:10.1002/2015JB012552
 Nocquet et al., in preparation PYACS, a framework (i.e. a set of tools and a way to think) to analyze and model geodetic data