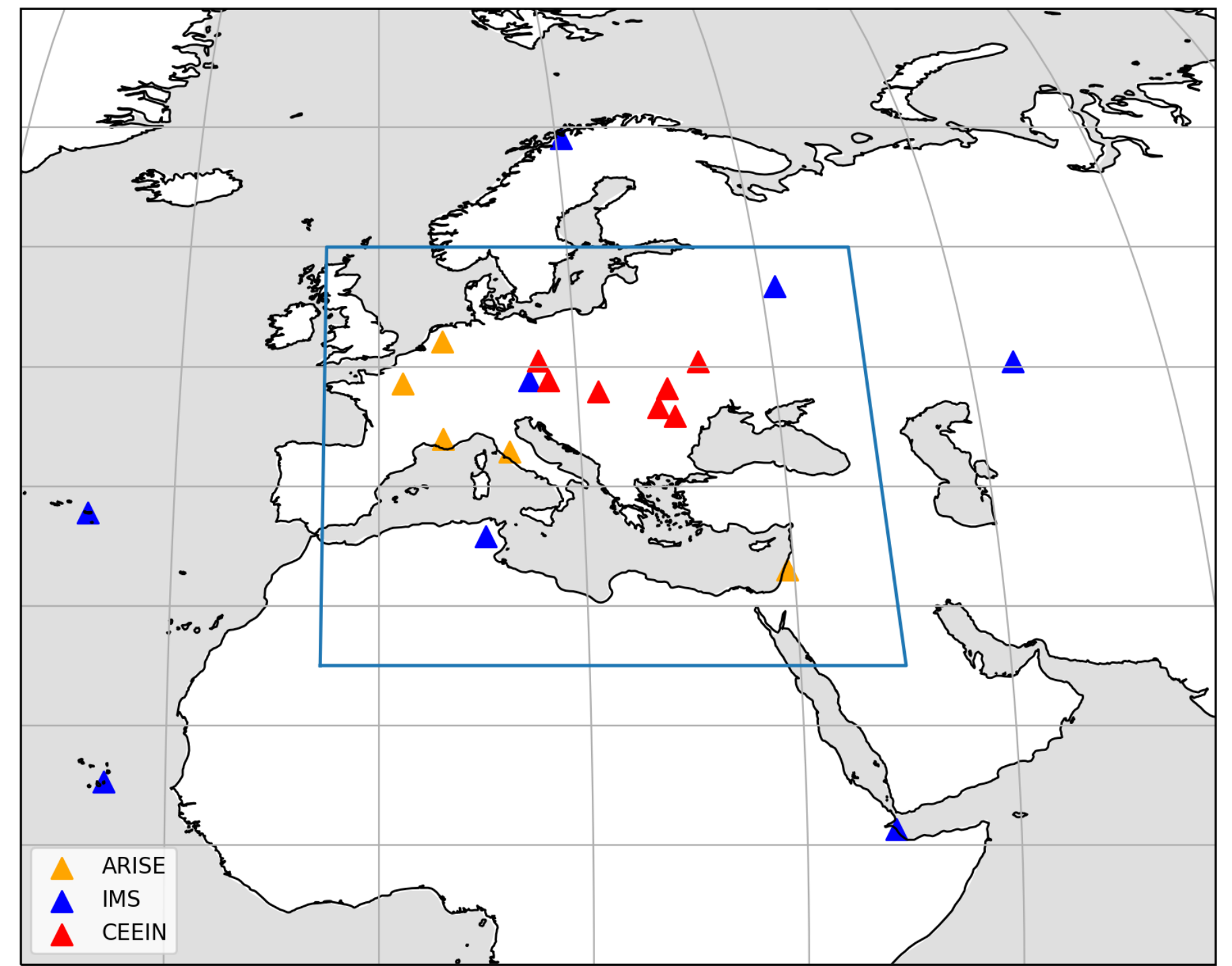




## Introduction

In the last two decades many infrasound arrays have been deployed worldwide. The core of the worldwide infrasound network is the IMS network, but several national arrays exist worldwide and in Europe. The Central European region had a very sparse network for long, however in the last years significant development has taken place in the region. Several new national infrasound arrays have been deployed recently in Romania, Hungary, Czechia, Austria and Ukraine, filling a large gap in the infrasound coverage of the region. In June 2018 a regional collaborative project has been established among Hungary, Romania, Czechia and Austria in order to share infrasound data and joint data analysis of regional sources. In May 2019 Ukraine also joined the network. Presently the Central and Eastern European Infrasound Network (CEEIN) includes 9 infrasound arrays. The details of these arrays are shown below in the table. In this poster the authors investigate the added value of the CEEIN network to the European infrasound network, by modeling the detection capability of the network.

Country	Station code	Latitude (°N)	Longitude (°E)	Aperture (m)	No. of elements	Other
Hungary	PSZI	47.92	19.89	250	4	Co-located with broadband seismic station
Romania	IPLOR	45.85	26.64	2500	6	co-located with seismic array
Romania	BURARI	47.61	25.21	1200	4	co.located with seismic array
Romania	I67RO	46.67	23.12	900	4	PTS mobile temporary array co-located with NIEP seismometer
Czechia	PVCI	50.53	14.57	200	3	co-located with seismometer
Czechia	WBCI	50.25	12.44	~6000	4	co-located with seismometer
Austria	ZAMG	47.78	16.03	700	4	mobile array
Ukraine	KPUA	48.20	26.16	700	4	
Ukraine	MALIN	50.42	29.19	180	3	Co-located with PS45



Map of the infrasound arrays considered in the modeling. The blue rectangle marks the area which is shown on Figs 1-3.

## Simulation

To quantify the added value of the CEEIN network to the European infrasound network we used the method developed by Le Pichon et al. (2012) to model the detection capability of the network. The method is based on a frequency dependent attenuation relation to predict the smallest detectable amplitude, using and realistic atmospheric data based on ECMWF atmospheric models. For the simulation we used the average noise level measured at all the IMS stations. The simulation included the relevant IMS infrasound stations and other national infrasound stations, members of the ARISE project (see the map on the left).

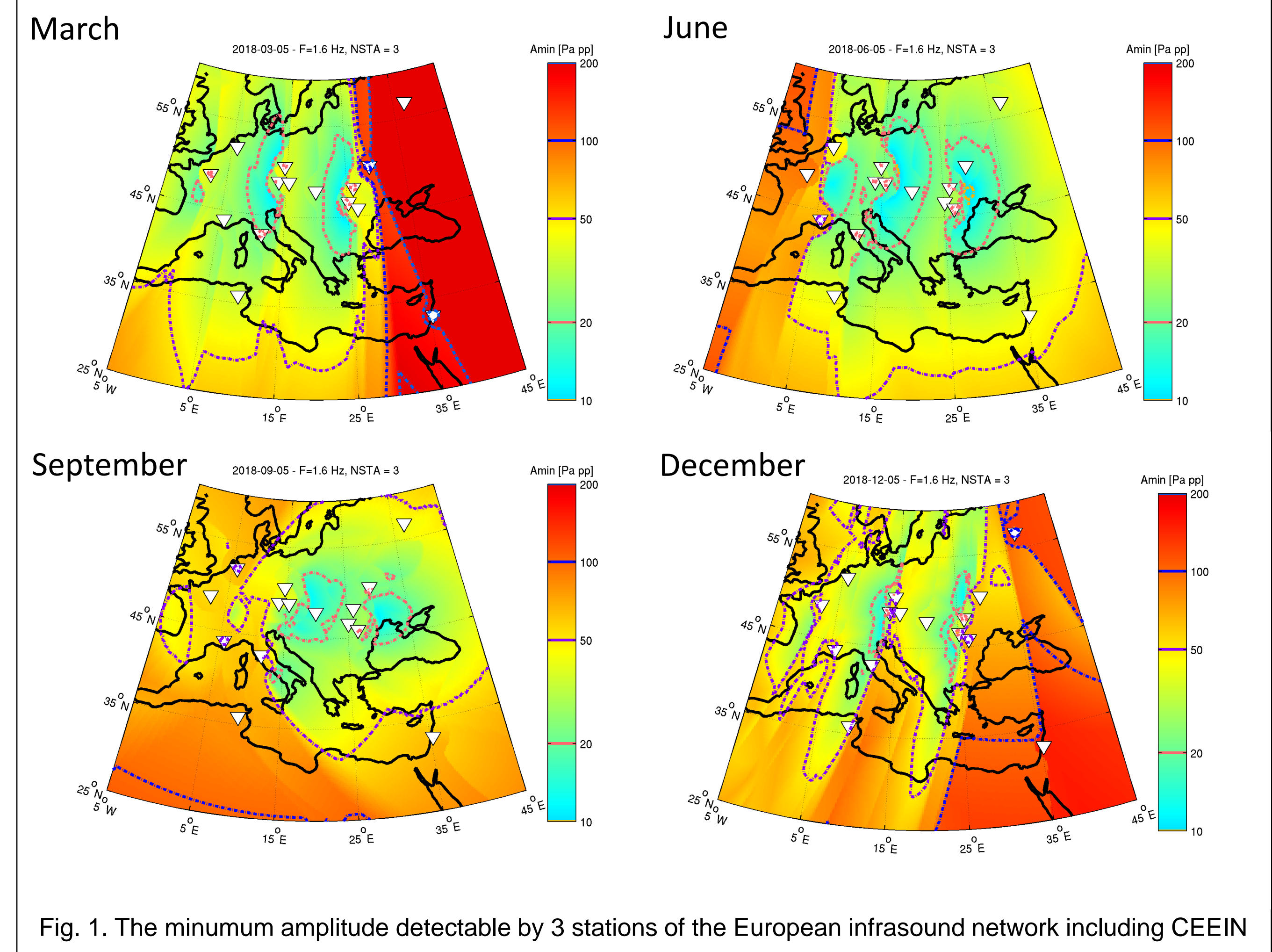


Fig. 1. The minimum amplitude detectable by 3 stations of the European infrasound network including CEEIN

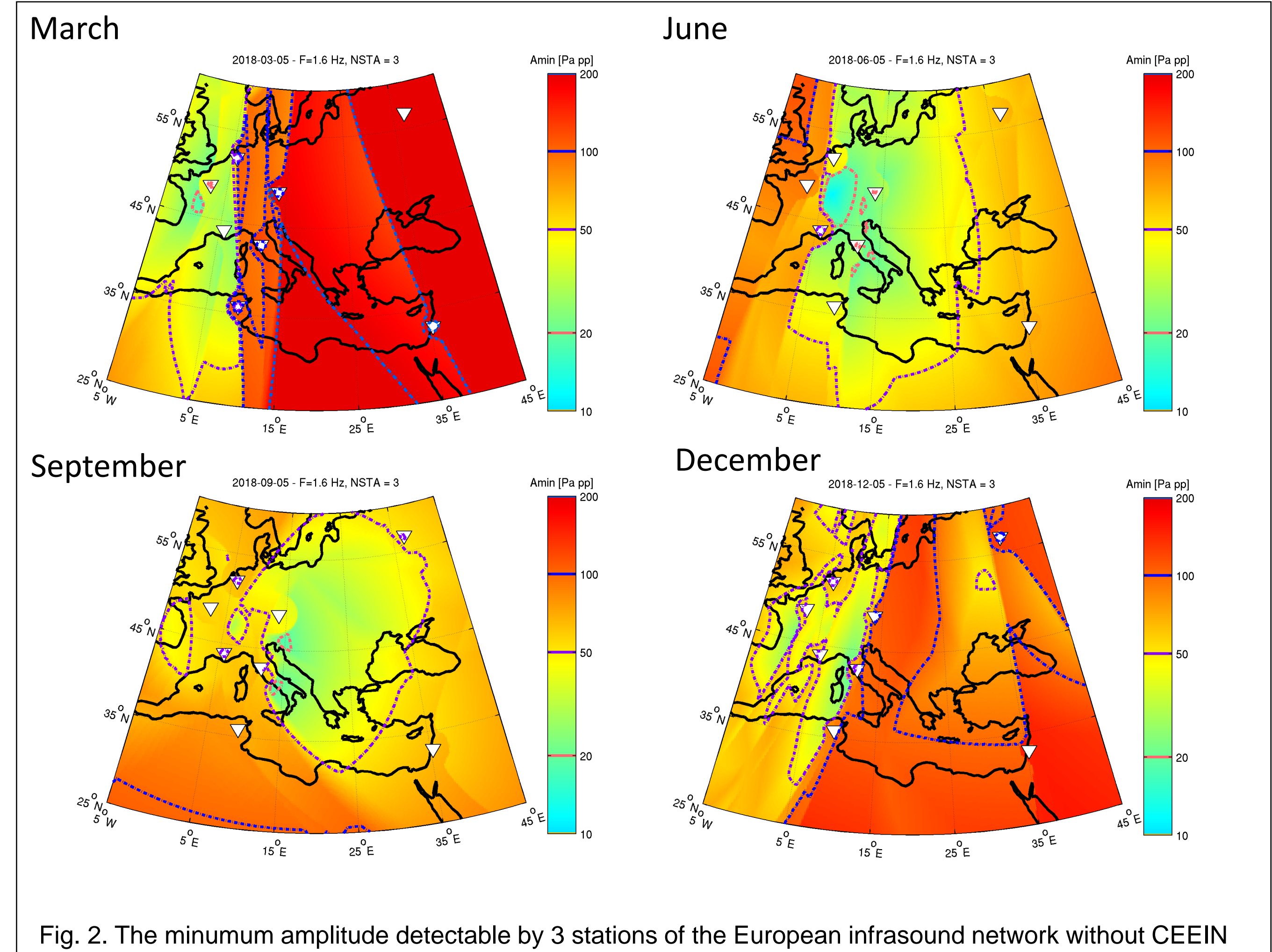


Fig. 2. The minimum amplitude detectable by 3 stations of the European infrasound network without CEEIN

Combining the  $A_p$  attenuation of a source of  $f$  frequency at  $(i,j)$  gridpoint detected at station  $k$ , with  $N$  background noise at the station and assuming that  $SNR=1$  is needed for detection the minimum detectable amplitude ( $A_{min}$ ) is given by

$$A_{min}[k,f](i,j) = \frac{N \cdot SNR}{A_p[k,f](i,j)}$$

The results of the simulation are shown in the following maps. The modeling was made for each day of the year 2018, using one average wind and temperature data for each day. Here we show one map for each season which represents sufficiently the typical trends.

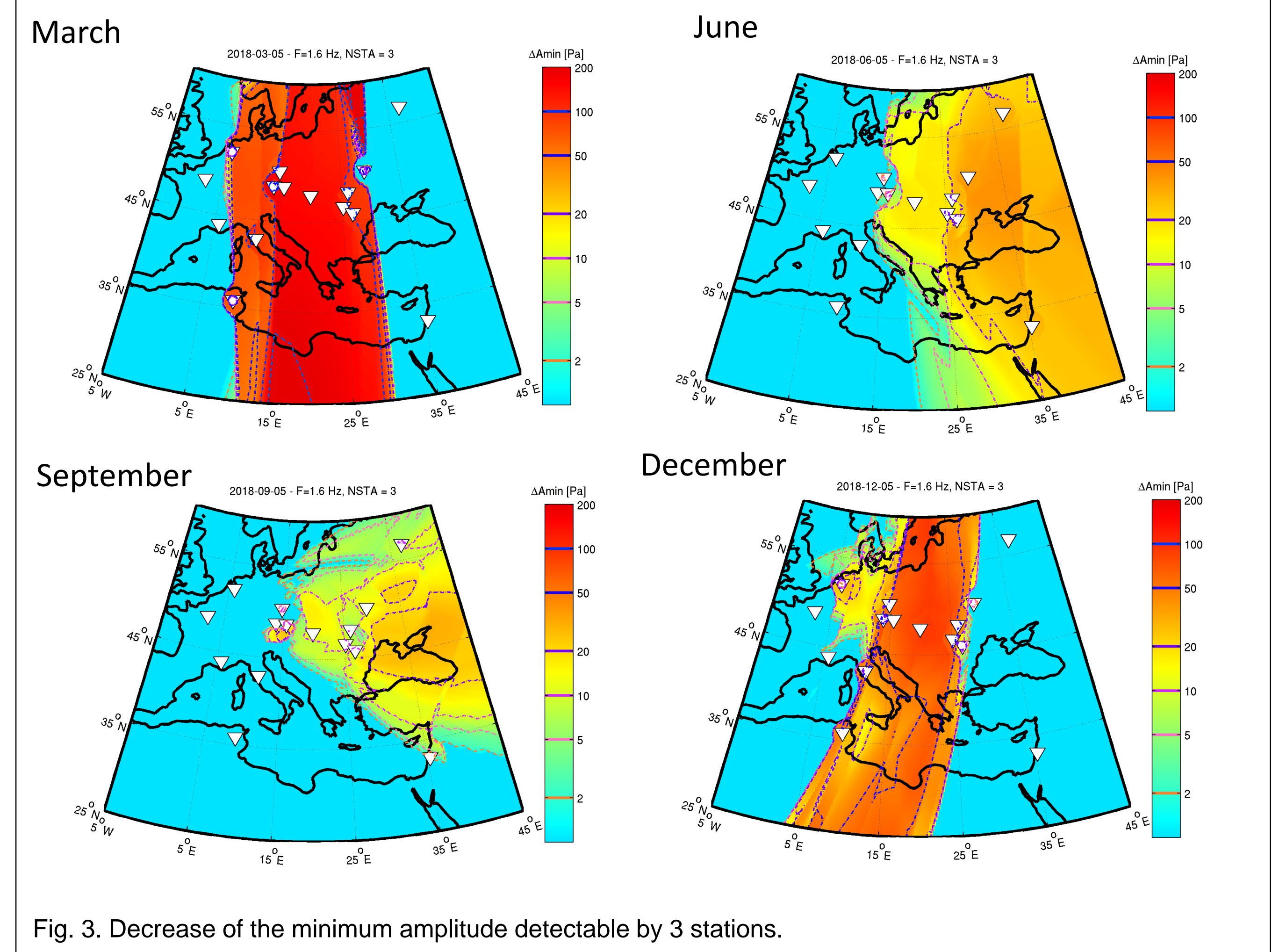


Fig. 3. Decrease of the minimum amplitude detectable by 3 stations.

The maps show the minimum amplitude detectable by 3 stations. In Fig. 1 the simulation was made considering the European network including CEEIN stations, and in Fig. 2 CEEIN stations were not included. Fig. 3 shows the difference of the first two: the decrease of detection thresholds by adding CEEIN stations to the network. Fig 4. shows the median decrease of detection thresholds for the studied region throughout 2018.

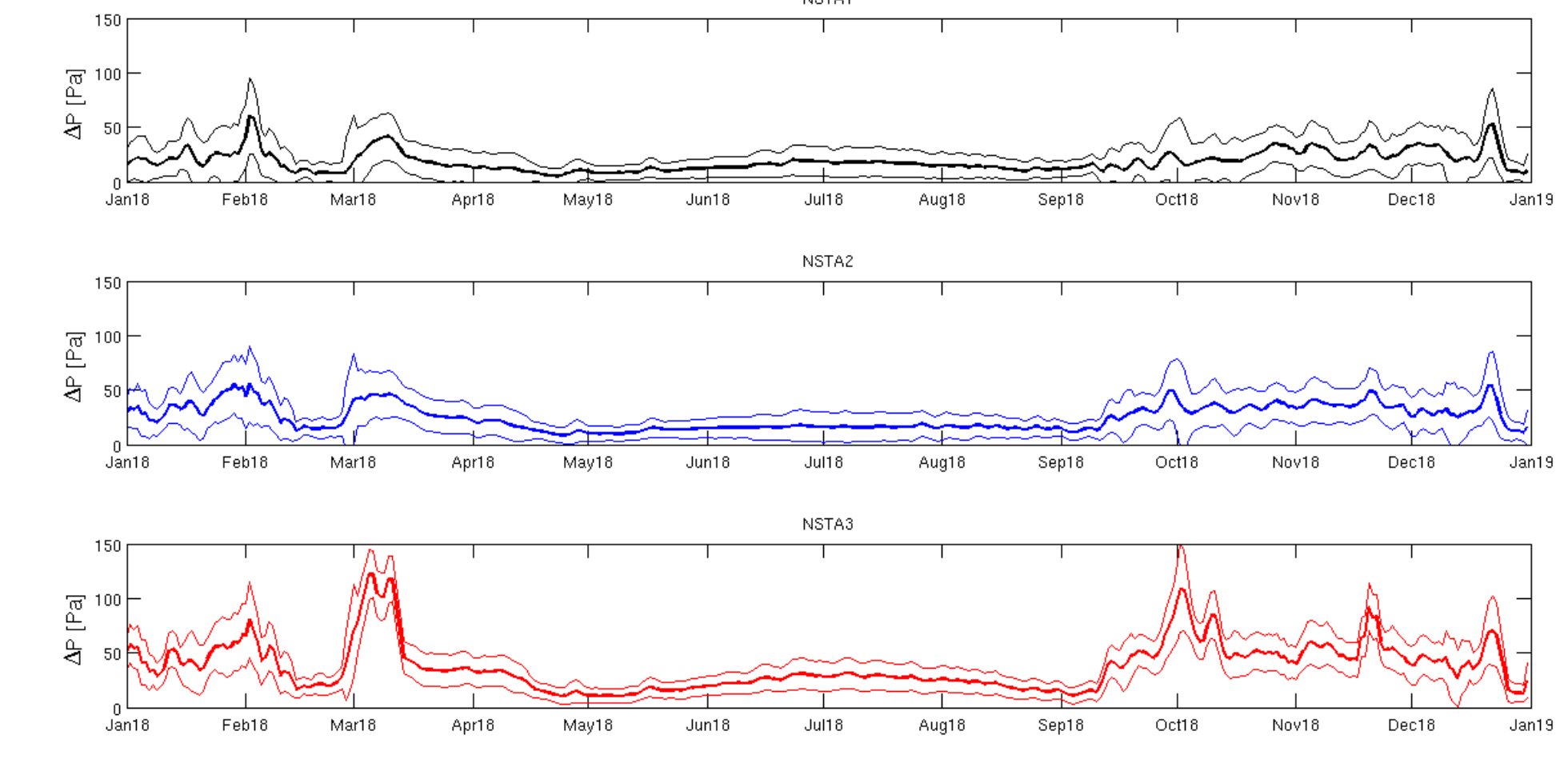


Fig.4. Median decrease of detection thresholds during 2018, for 1 (black), 2 (blue) and 3 (red) station coverage.

## Conclusion

The recently deployed CEEIN arrays significantly improve the detection capability of the European infrasound network. In average the minimum detectable amplitude in the region decreases by 37 Pa (considering 3 station coverage). The improvement is more significant during the winter time when stratospheric westerly winds inhibit the Western European stations' capability to detect sources in Eastern Europe.

## Reference

Le Pichon, A., L. Ceranna, and J. Vergoz (2012), Incorporating numerical modeling into estimates of the detection capability of the IMS infrasound network, *J. Geophys. Res.*, 117, D05121, doi:10.1029/2011JD016670.

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