The Central and Eastern European Infrasound Network

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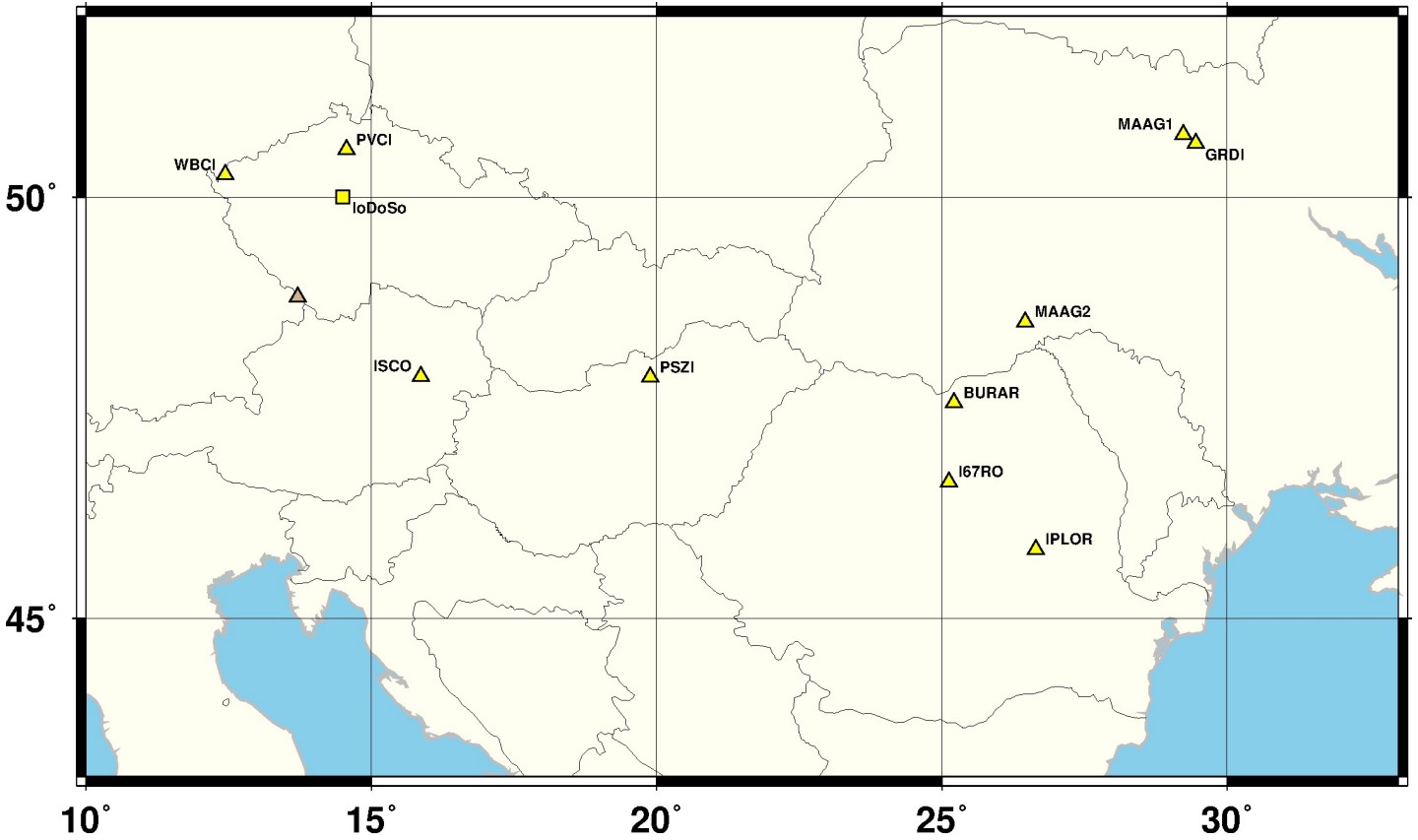
A brief history of CEEIN

- Infrasound is one of the key monitoring technologies of the CTBT
- CEEIN was established in 2018 as part of the ARISE2 network extension program (http://arise-project.eu)
- Collaboration between research institutes in Central and Eastern Europe (www.ceein.eu)
  - Zentralanstalt für Meteorologie and Geodynamik (ZAMG), Austria
  - Institute of Atmospheric Physics of the Czech Academy of Sciences (CAS IAP), Czechia
  - Research Centre for Astronomy and Earth Sciences of the Eötvös Loránd Research Network (ELKH CSFK), Hungary
  - National Institute for Earth Physics (NIEP), Romania
  - The Main Centre of Special Monitoring National Center for Control and Testing of Space Facilities, State Agency of Ukraine joined in 2019

Objectives

- Real-time data exchange between participants
- Collaboration in scientific research focusing on
  - infrasound propagation in local and regional distances
  - identification of infrasound sources
  - seismo-acoustic studies
  - discrimination between natural and anthropogenic events
- Publication of the Central and Eastern European Infrasound Bulletin
  - the first CEEIN bulletin is available at www.ceein.eu
  - contribution to the European Infrasound Bulletin

CEEIN stations



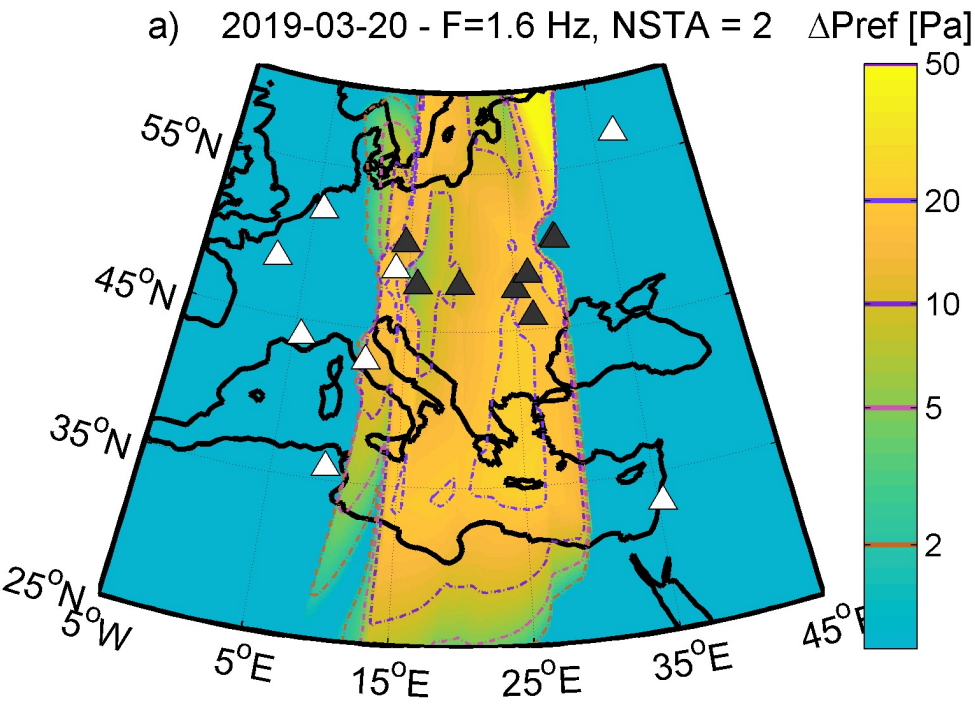
PSZI is operated by the Institute of Earth Physics and Space Science, ELKH since 2020/04/01

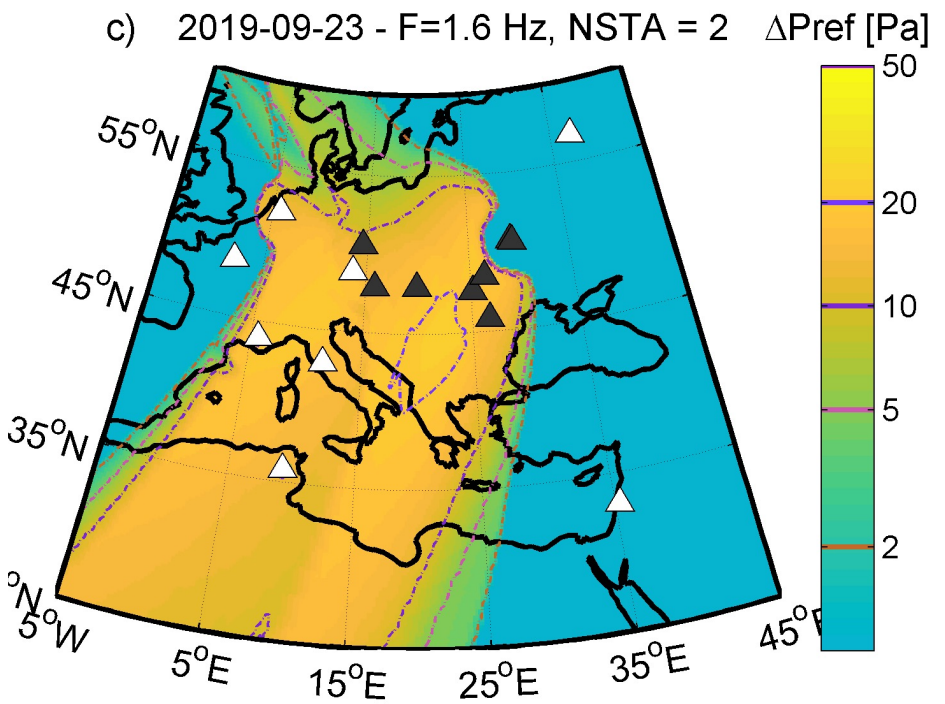
I67RO was deployed by NIEP in collaboration with CTBTO between 2016 and 2018 and no longer operational

Data Availability

- BURAR and IPLOR infrasound waveforms are archived at the NIEP EIDA node, http://www.infp.ro/index.php?i=eida
- PSZI infrasound waveforms are archived at the GEOFON EIDA node, https://geofon.gfz-potsdam.de/doi/network/HN
- Archiving the rest of CEEIN infrasound data at the NIEP EIDA node is planned in the near future

Detection capability with and without CEEIN

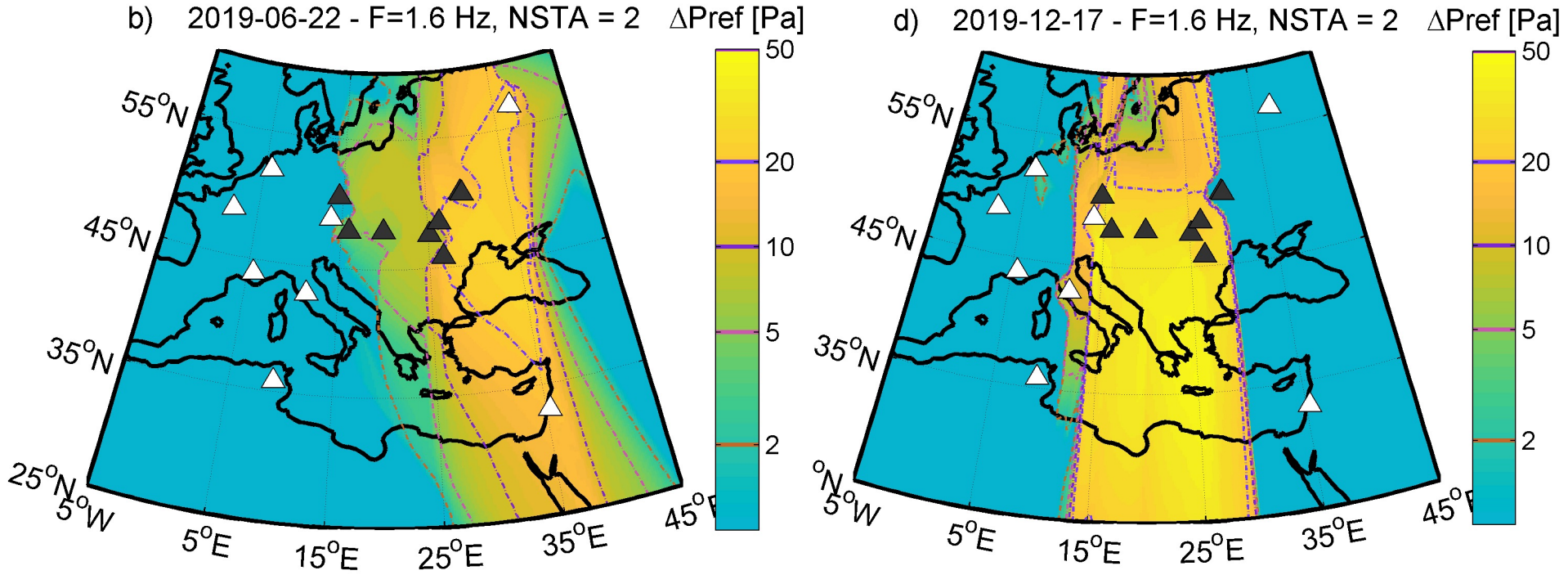




Difference between the detection thresholds of the infrasound network in Europe with and without the CEEIN stations.

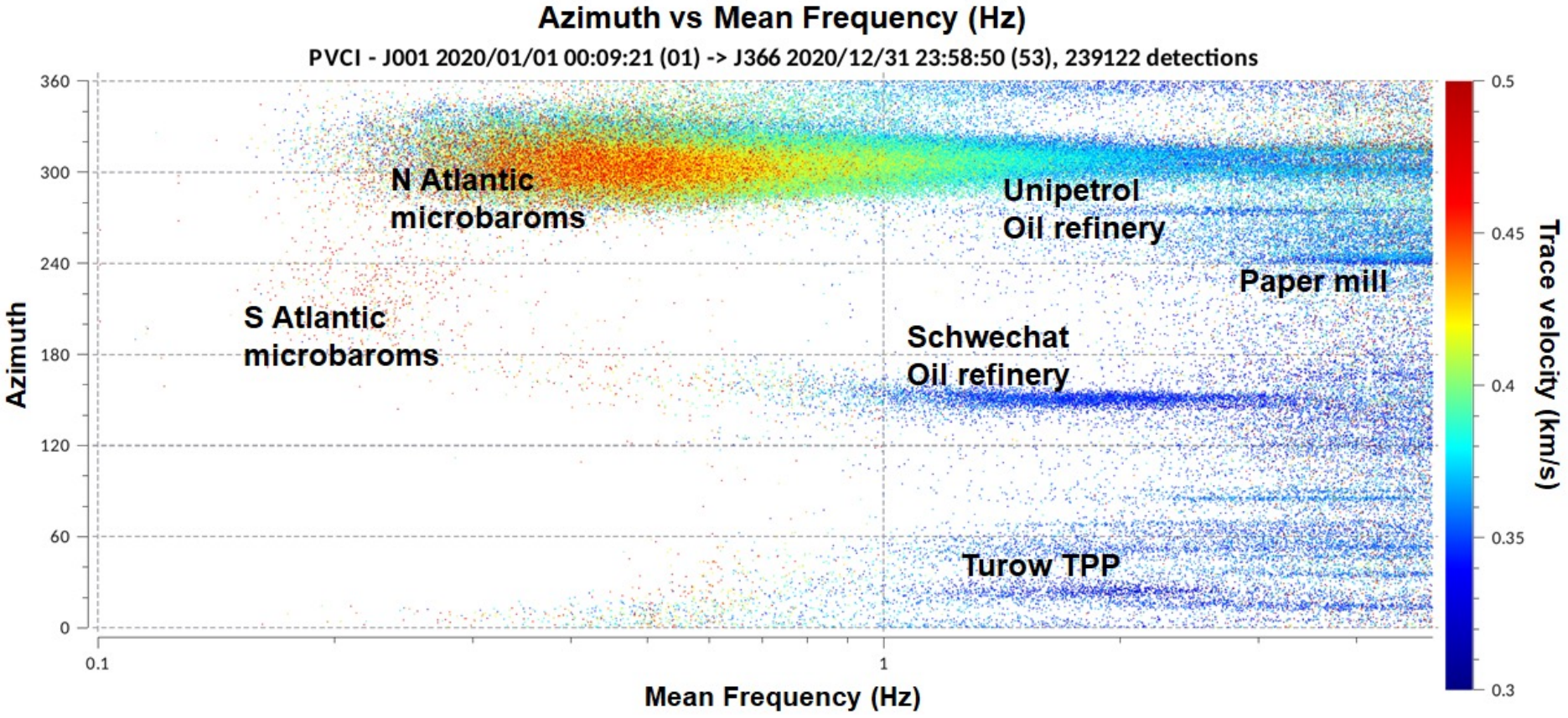
During the equinoxes local stations become important as the stratospheric waveguide gets weak due to the seasonal reversal of zonal stratospheric winds.

Detection capability with and without CEEIN

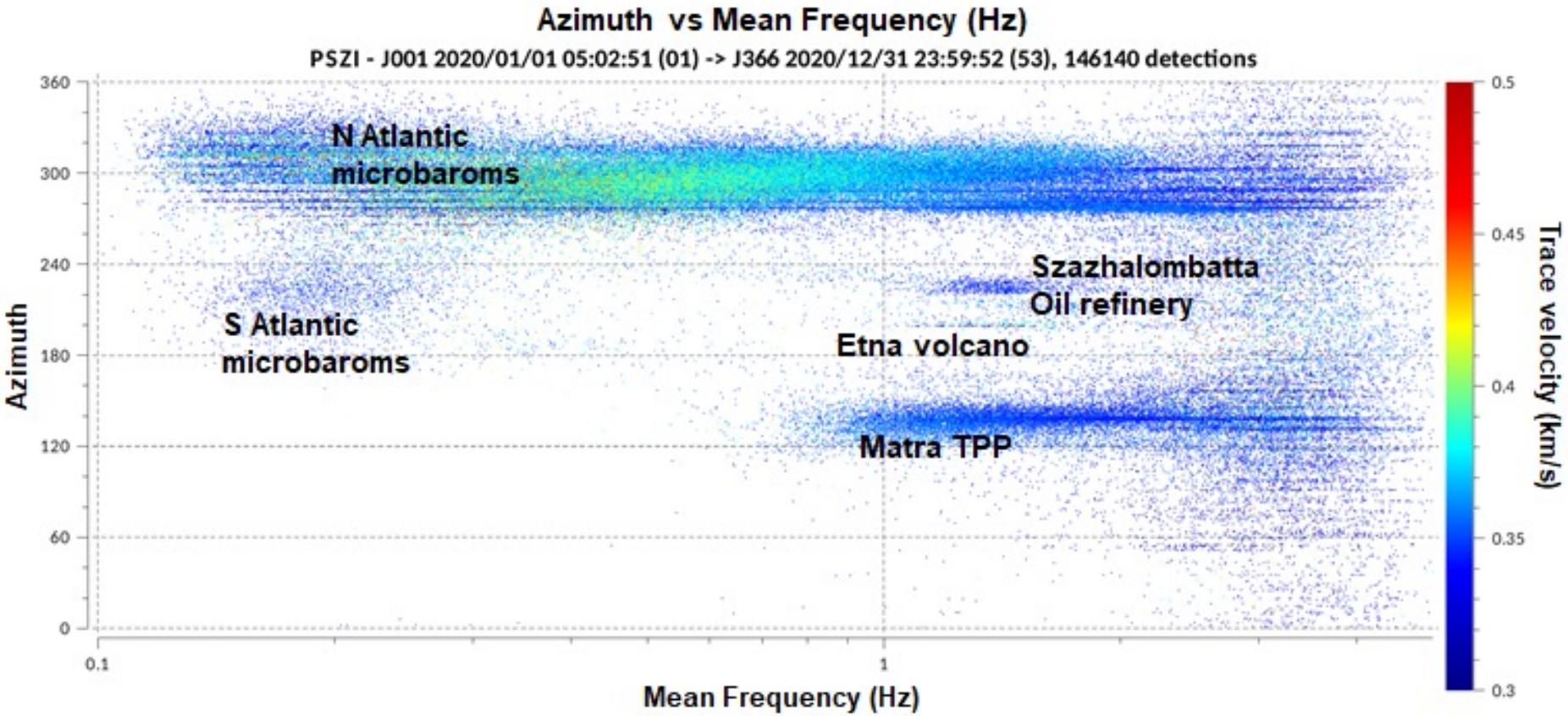


Difference between the detection thresholds in Europe with and without the CEEIN stations.
During the summer (easterly winds) improvements for the Black Sea and Easter Mediterranean.
During the winter (westerly stratospheric winds) large increase in detection capability in Central Europe.

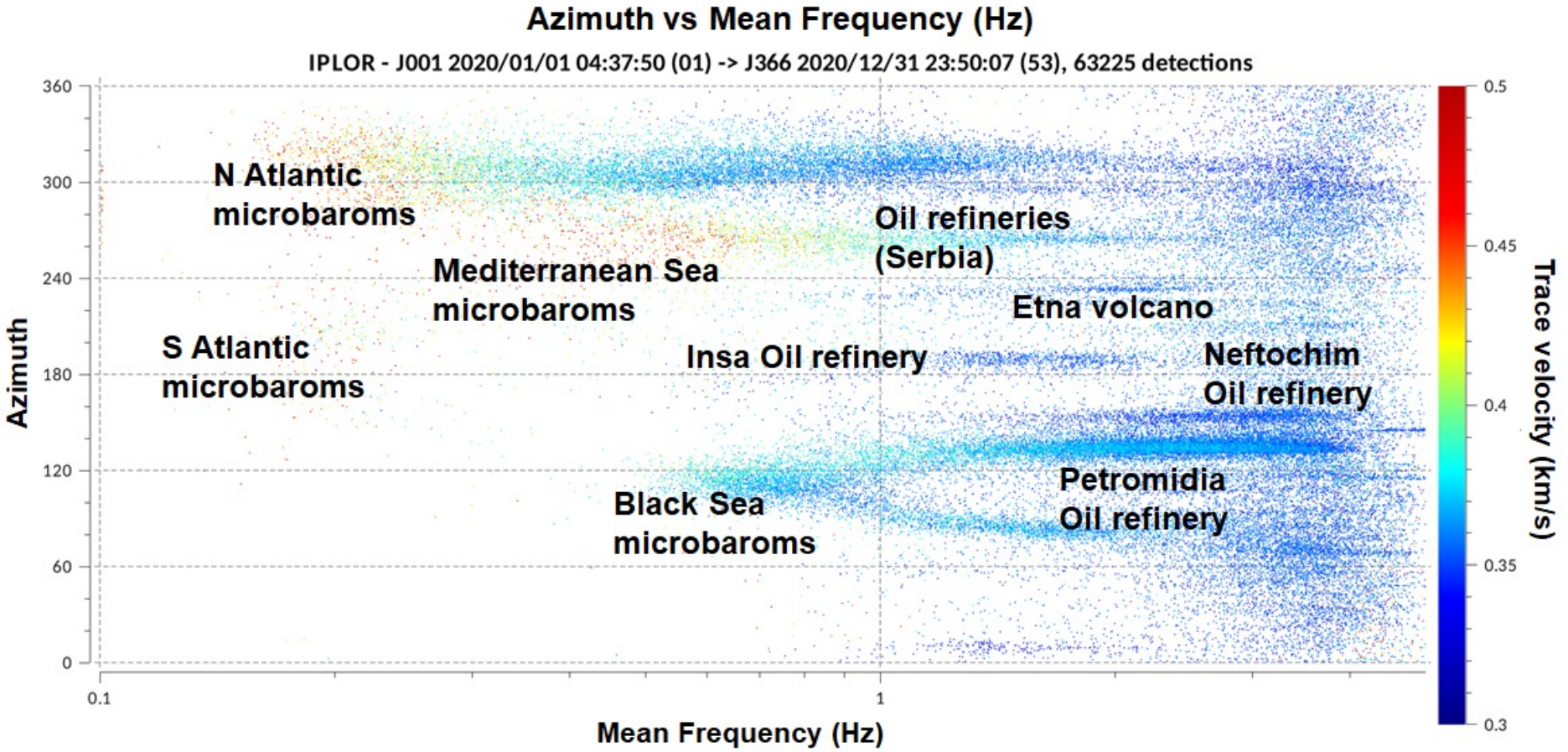
Coherent noise sources, PVCI



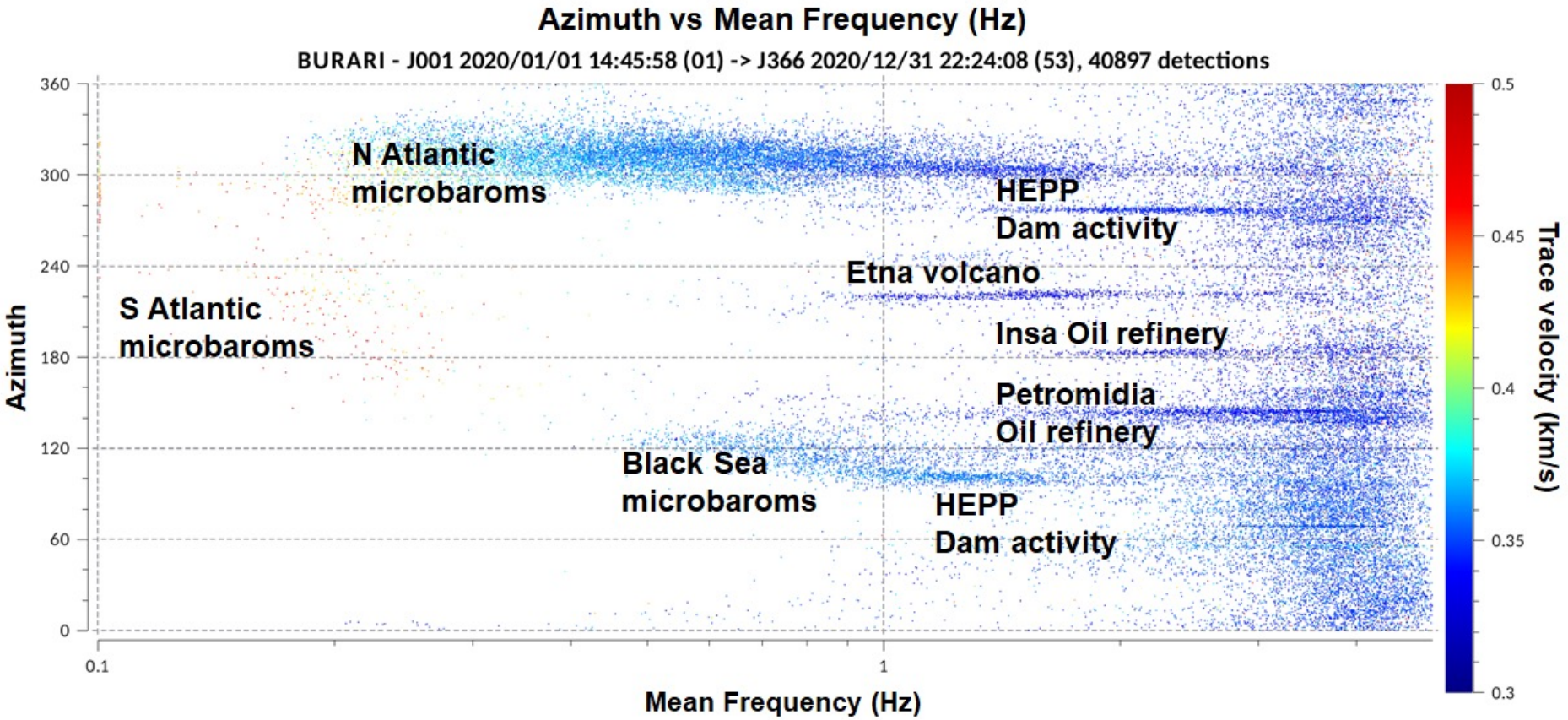
Coherent noise sources, PSZI



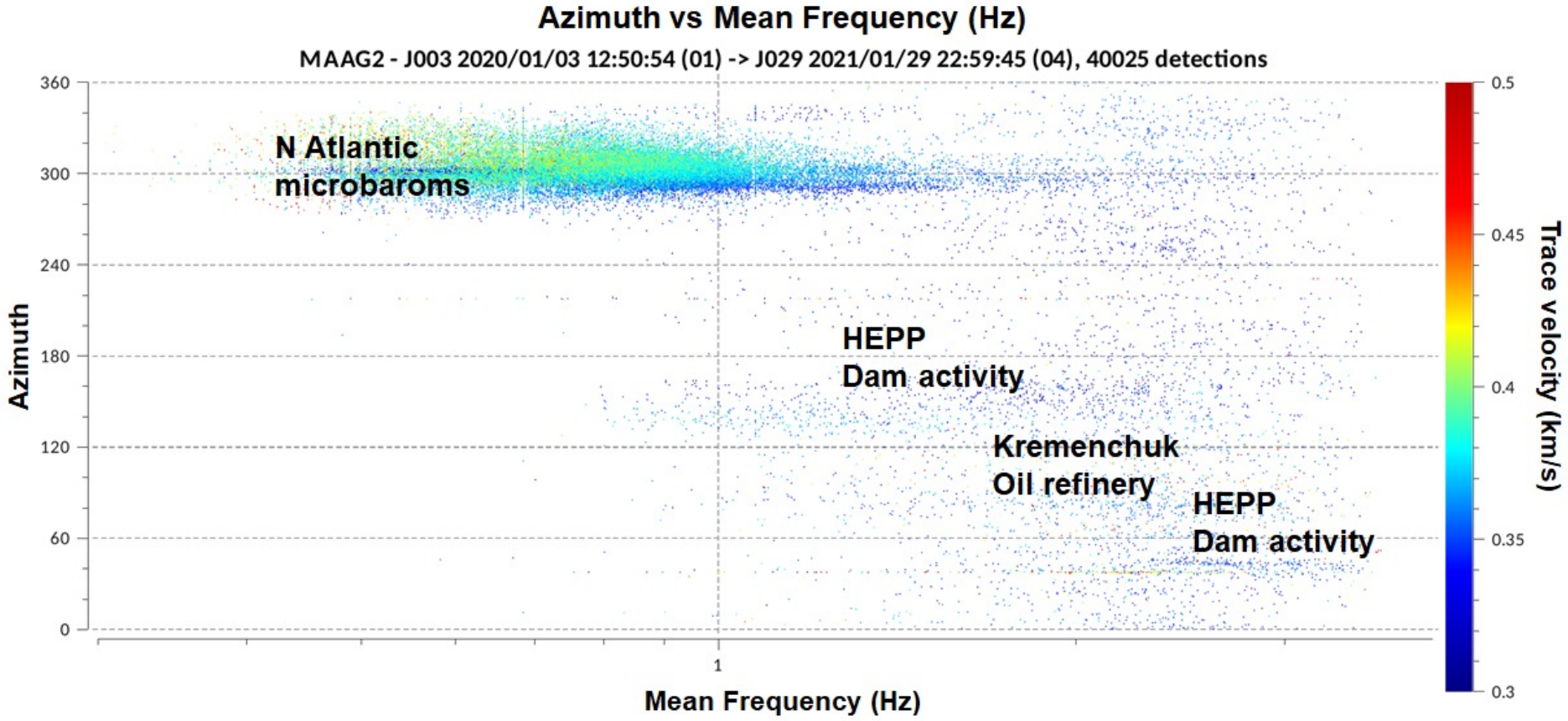
Coherent noise sources, IPLOR



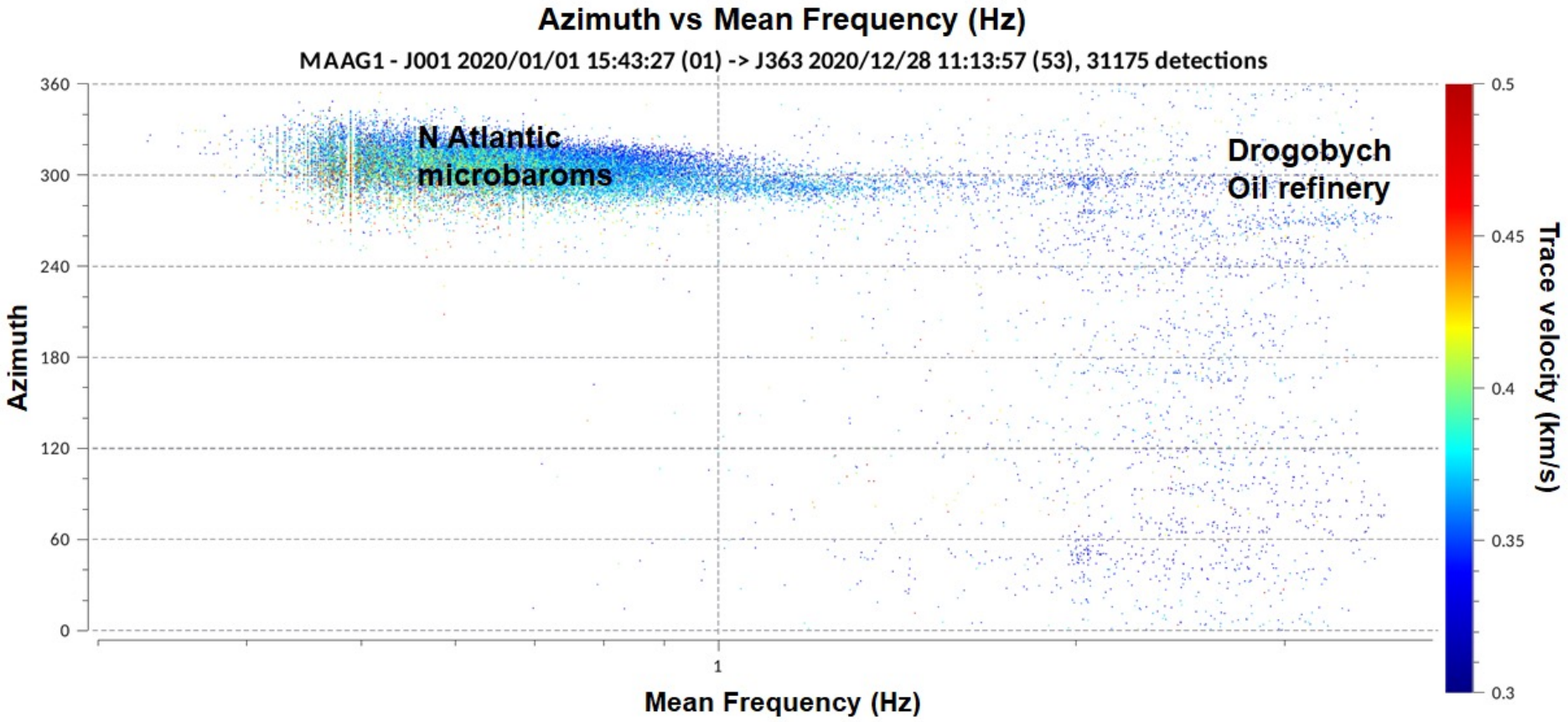
Coherent noise sources, BURAR



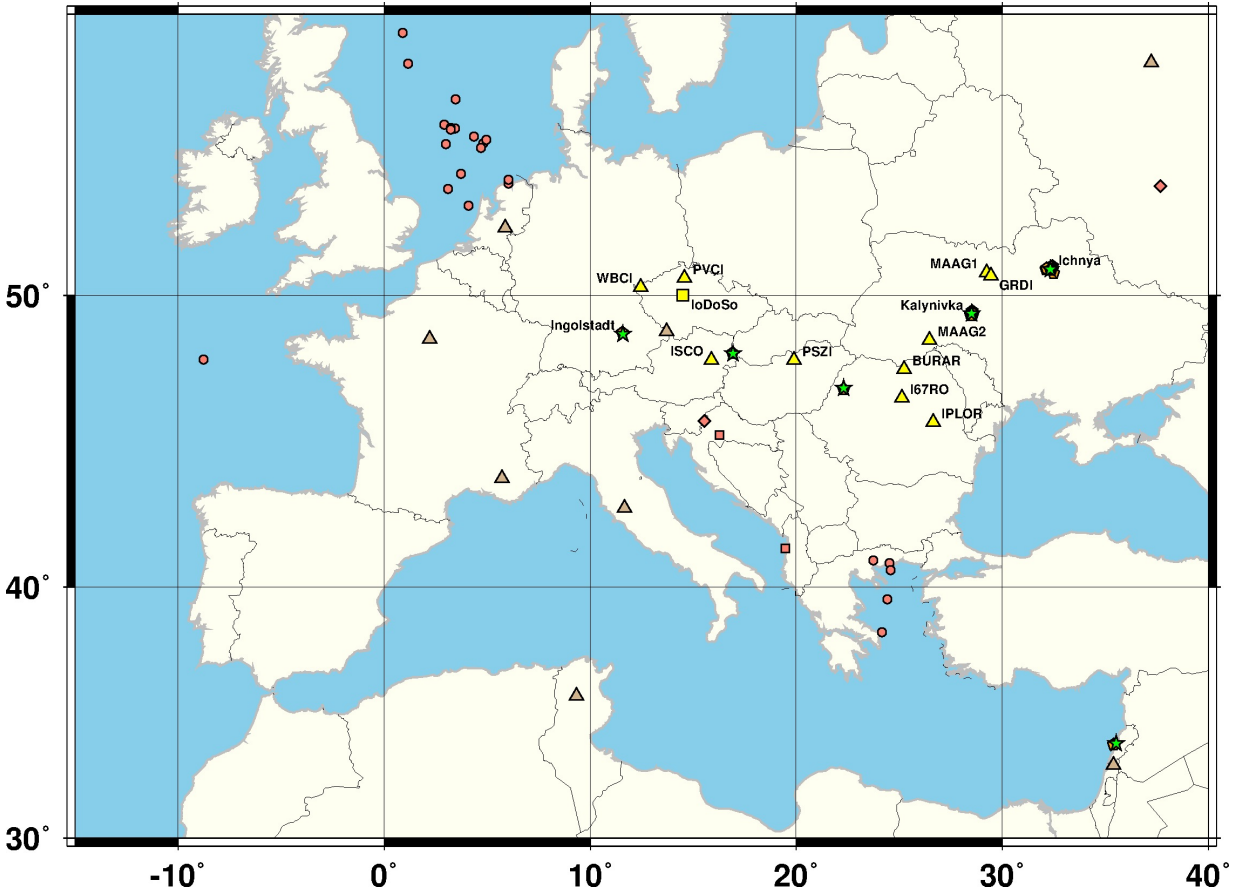
Coherent noise sources, MAAG2



Coherent noise sources, MAAG1



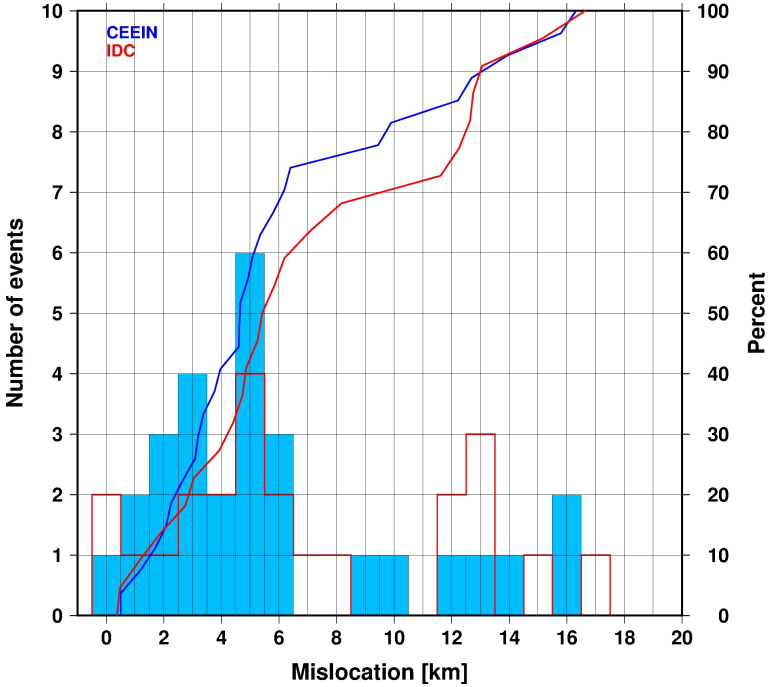
CEEIN bulletin (2017-2020)



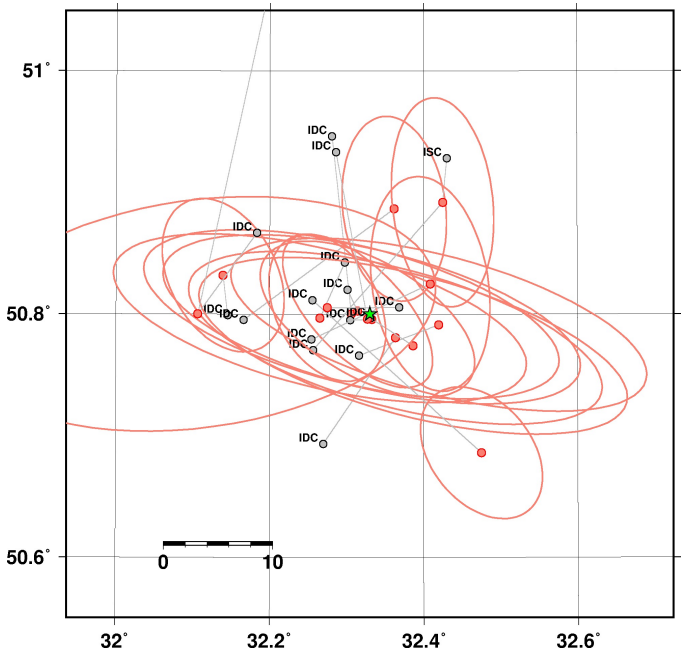
- Contains 147 events recorded by at least two CEEIN arrays and located with iLoc
- Includes explosions, quarry blasts, bolides, supersonic flights, earthquakes
- Ground truth events are identified

Ground Truth events

- CEEIN stations improve the location accuracy and reduce the location uncertainty of the ground truth explosions.



Distribution of mislocation of GT events in the IDC and CEEIN bulletins



Ammunition storage explosions in Ichnya, Ukraine, 2018/10/09

Summary

- CEEIN stations complement the European infrasound network
  - only two IMS stations, I26DE and I43RU cover the region
- Improved detection capability all-year round, at least by 20 Pa
  - Better coverage of the Eastern Mediterranean and the Black Sea during the summer months
  - Enhanced detection capability in Central and Eastern Europe in winter months
- CEEIN stations record not only the North and South Atlantic microbaroms but also those from the Black Sea and the Mediterranean
- CEEIN bulletin contributes infrasound and seismo-acoustic events, including GT information to the European infrasound bulletin
- BURAR, IPLOR and PSZI waveforms are open access through EIDA nodes
- We encourage infrasound station operators to archive infrasound waveforms at EIDA nodes