**The Korean Infrasound Bulletin:
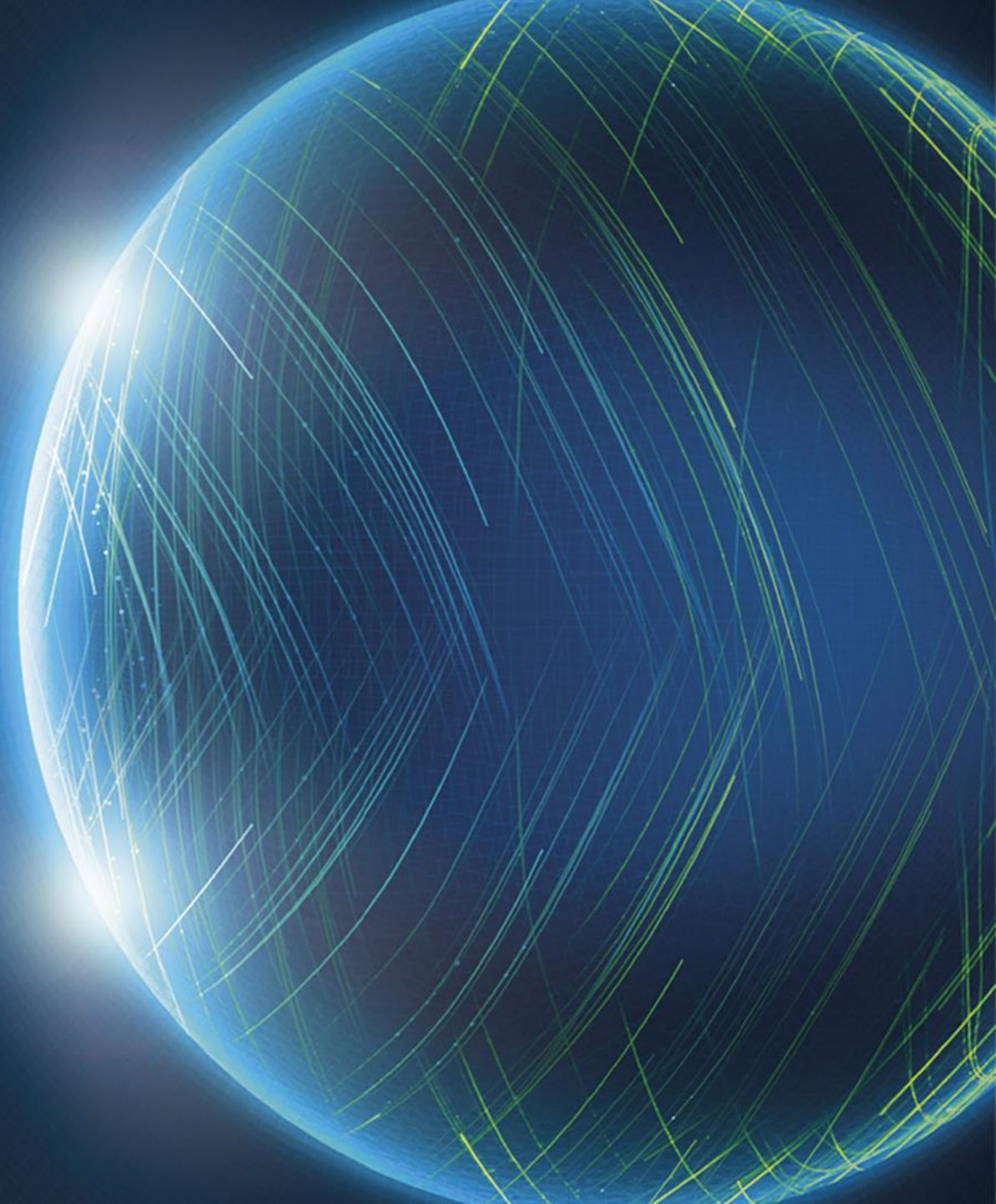Detection, Association, and Event Location**

Junghyun Park[1]*, Stephen Arrowsmith[1], Il-Young Che[2],
Chris Hayward[1], and Brian Stump[1]
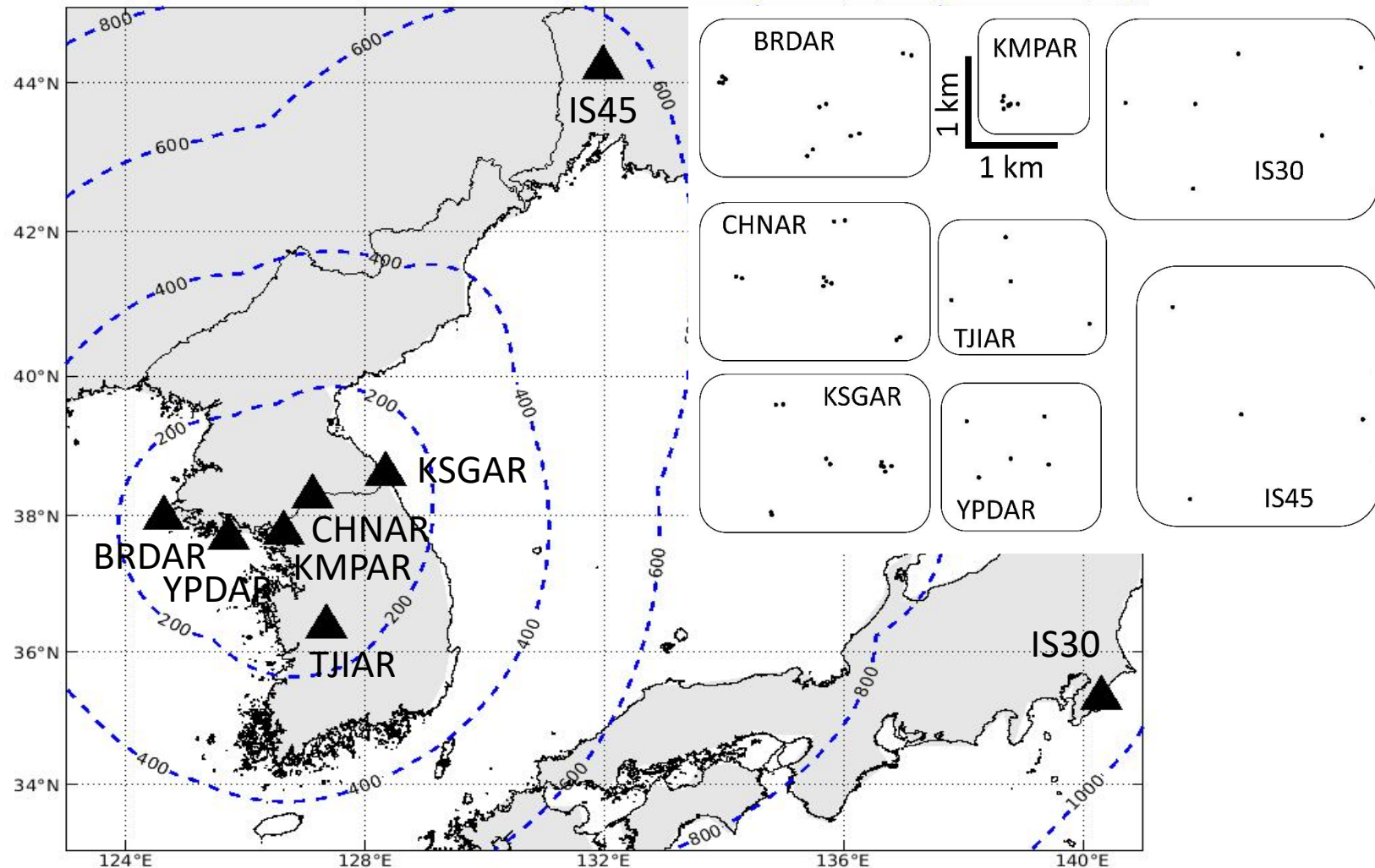1: Southern Methodist University
2: Korea Institute of Geoscience and Mineral Resources
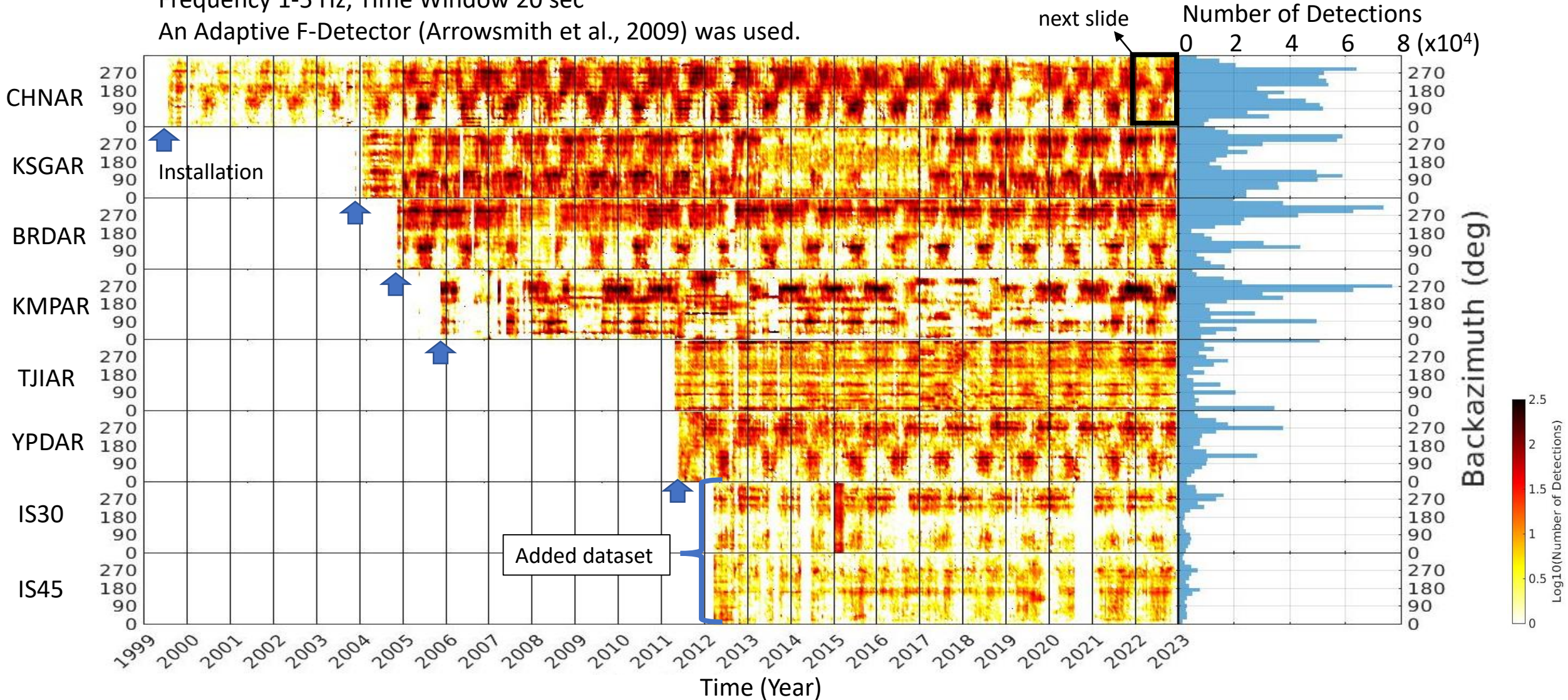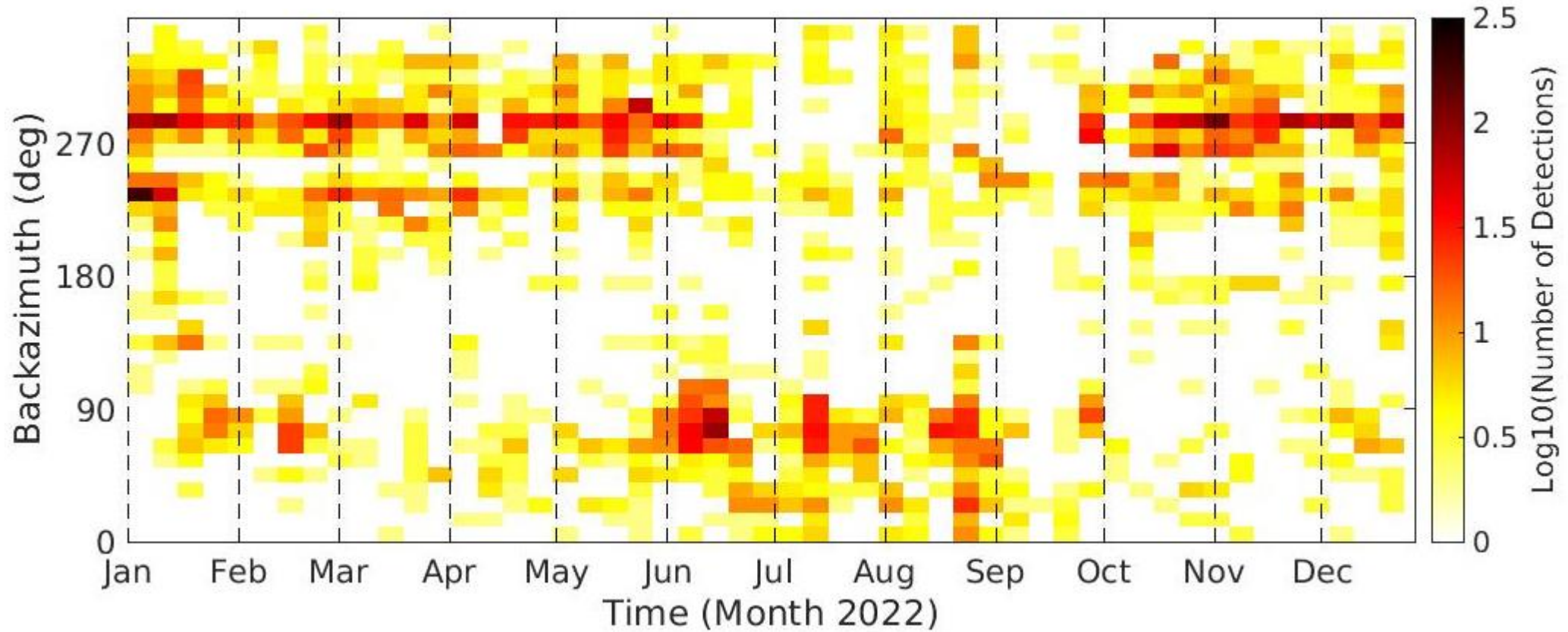
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20 June 2023

- Regional scale network
  - 6 infrasound arrays by SMU and KIGAM
  - 2 IMS infrasound stations

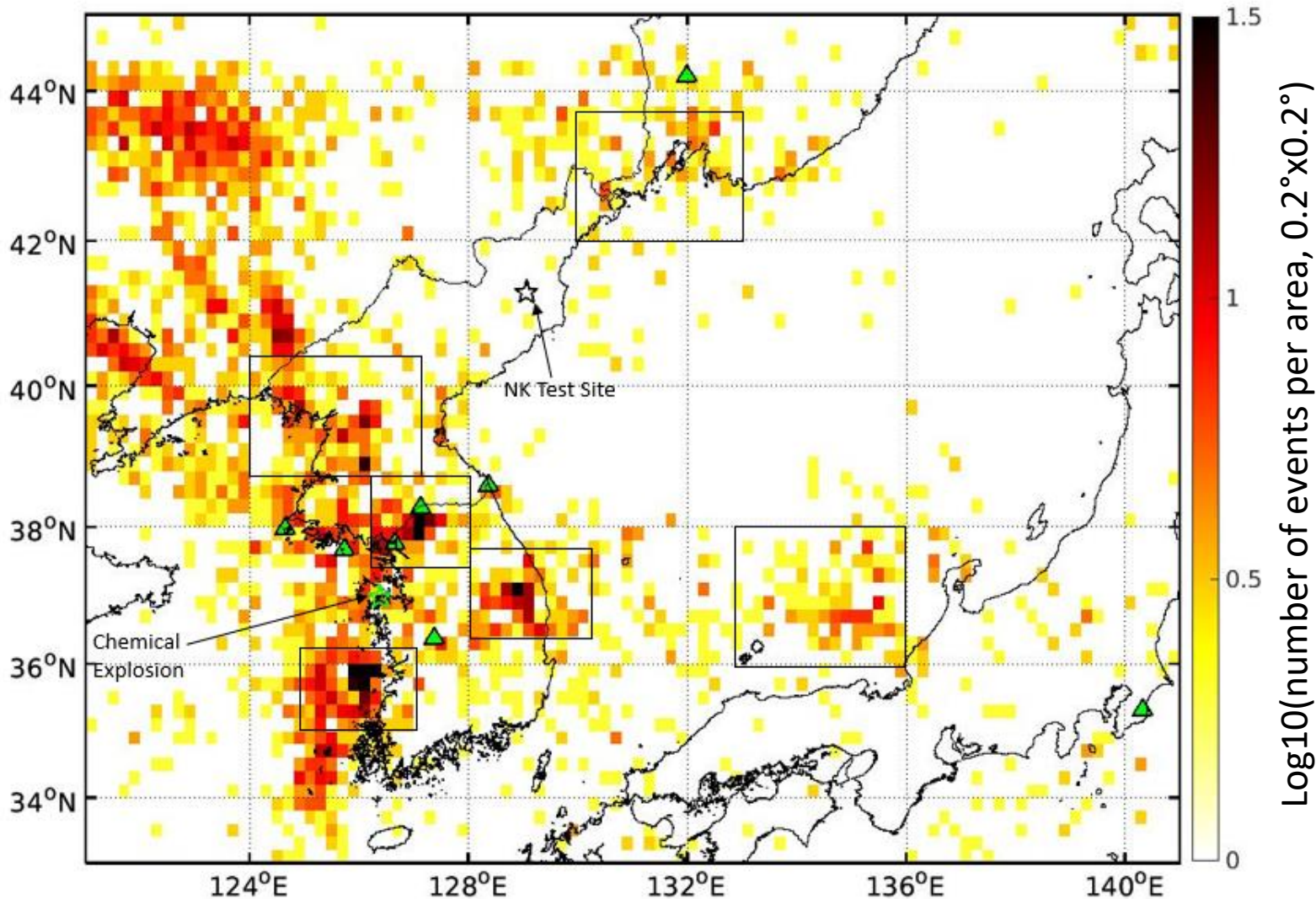- Produce infrasound event bulletin for 1999-2022

Frequency 1-5 Hz, Time Window 20 sec
An Adaptive F-Detector (Arrowsmith et al., 2009) was used.

*Temporal variations are related to seasonal variations in the atmosphere.*

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**Infrasound Hotspots**
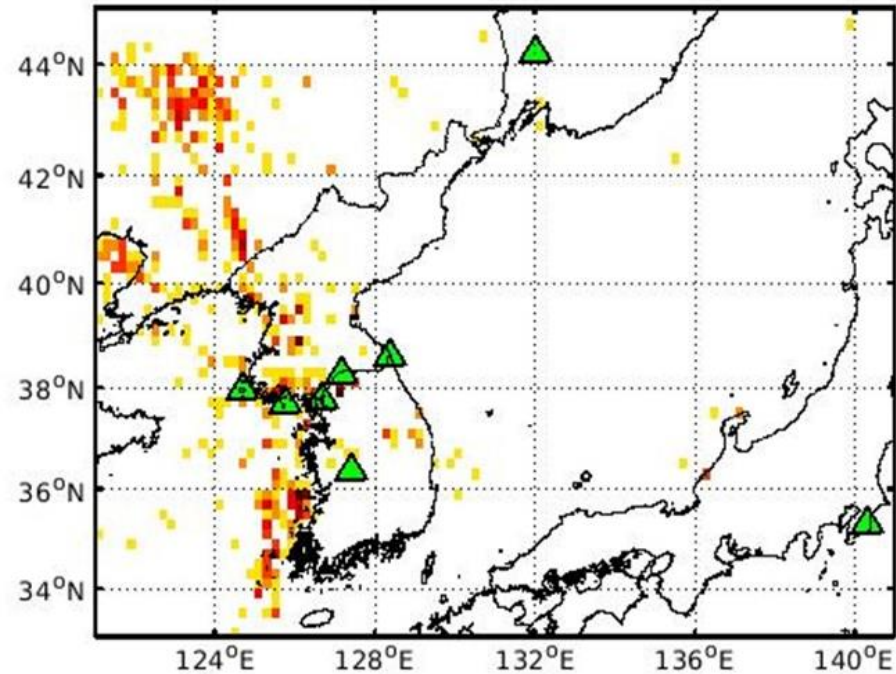
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- Bayesian Infrasonic Source Location (Modrak et al., 2010) was used.

- A total of 36,815 infrasound event locations for 24 years.

- Documents NK underground nuclear explosions and accidental chemical explosion.

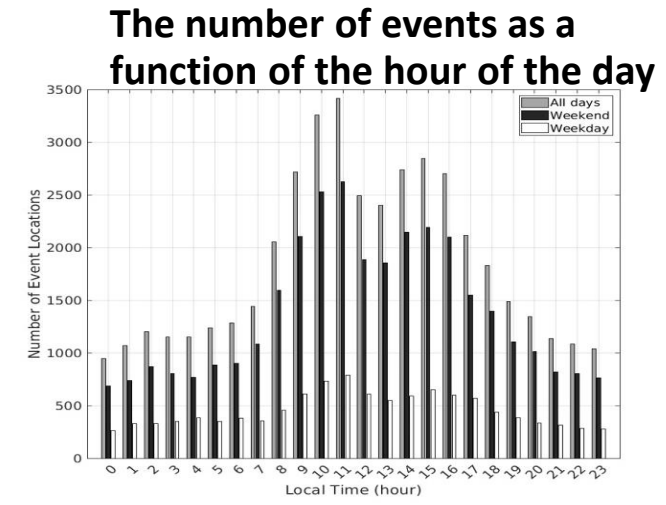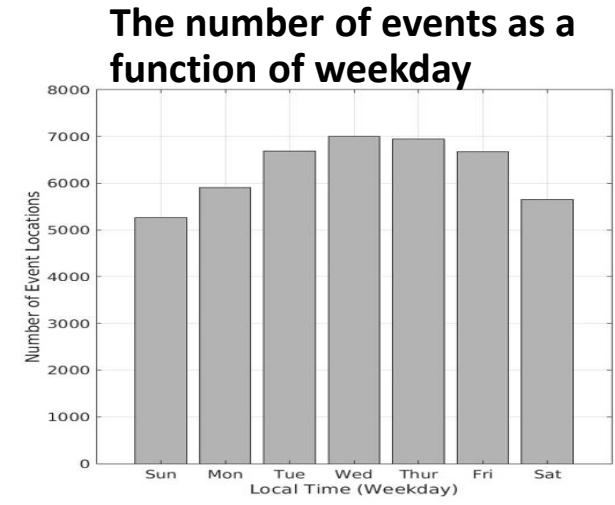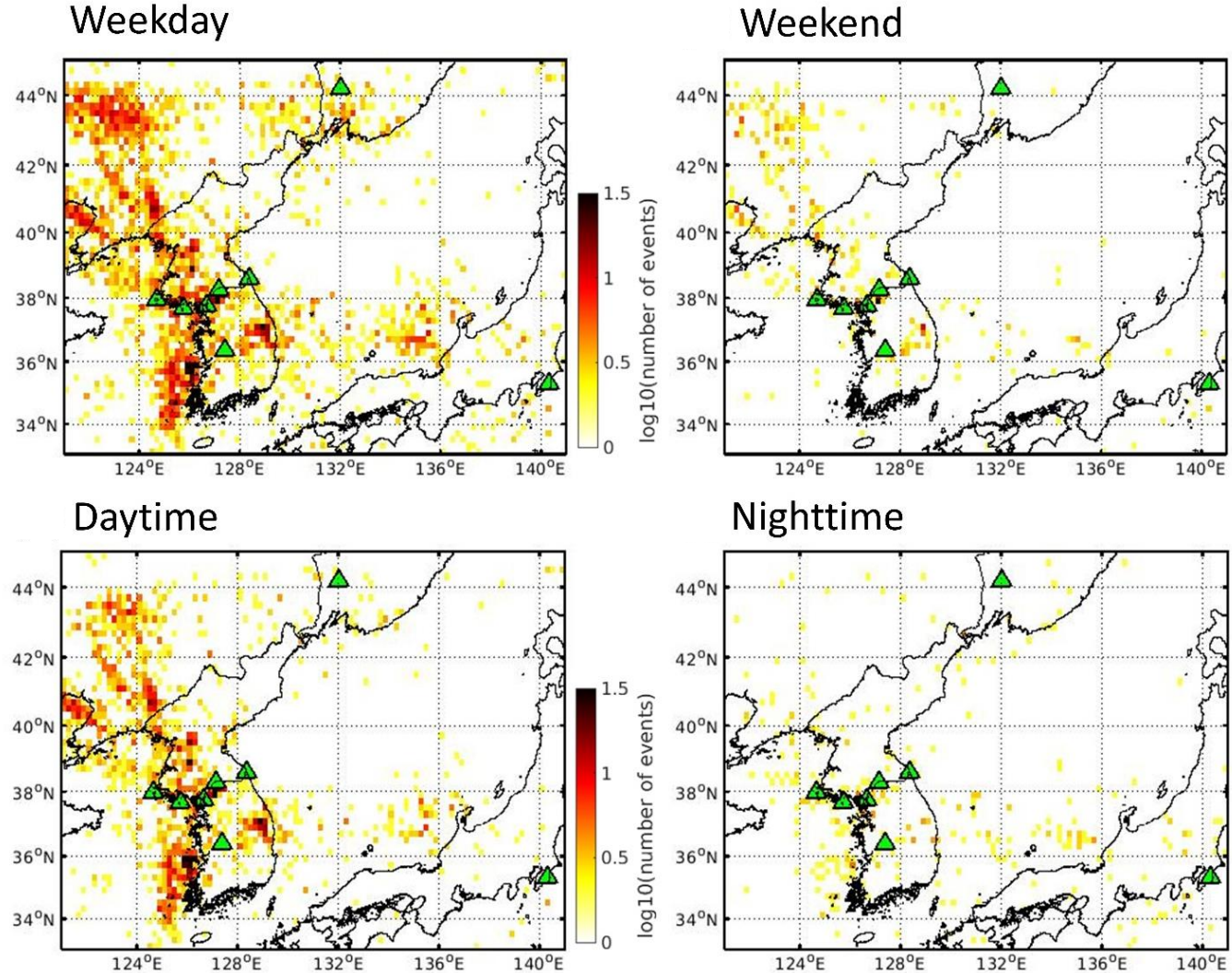- Repeated sources are related to human-activity sites.
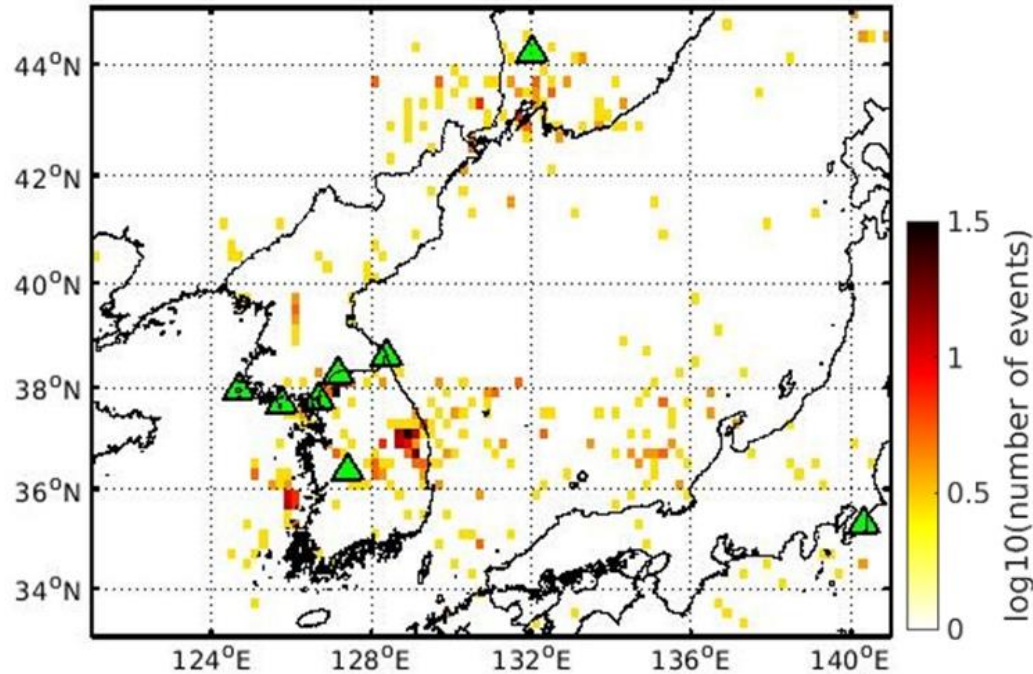
Summer / Winter

*Most detections during the summer are from the southeast,*
*while those during the winter are from the northwest and west.*

Weekday

Weekend

The number of events as a function of weekday

Daytime

Nighttime

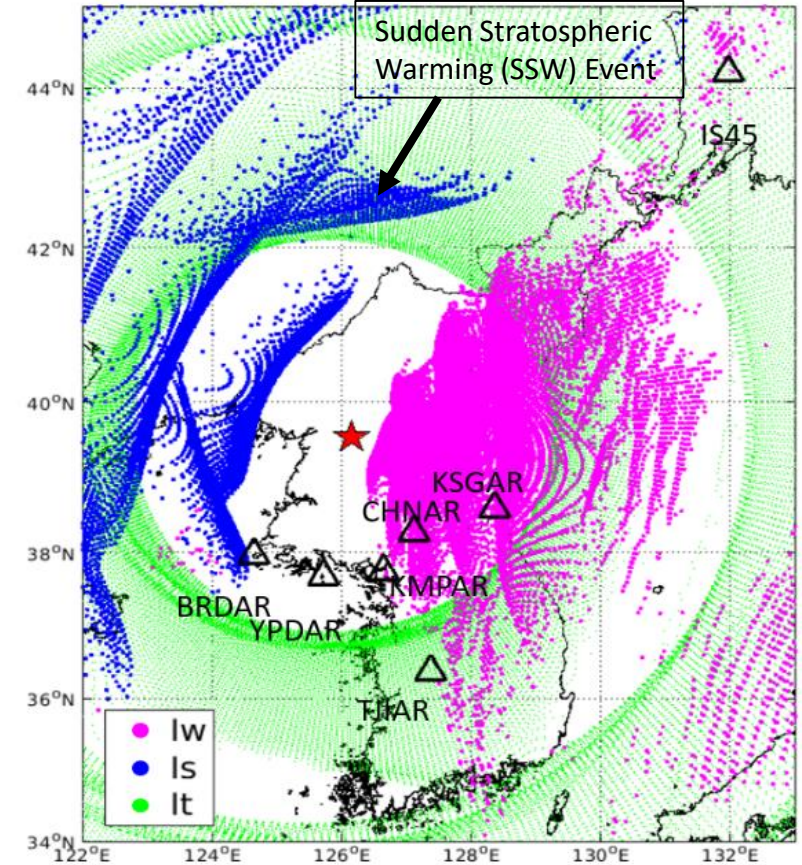The number of events as a function of the hour of the day

*A clear indication of dominant anthropogenic origin for infrasound events*

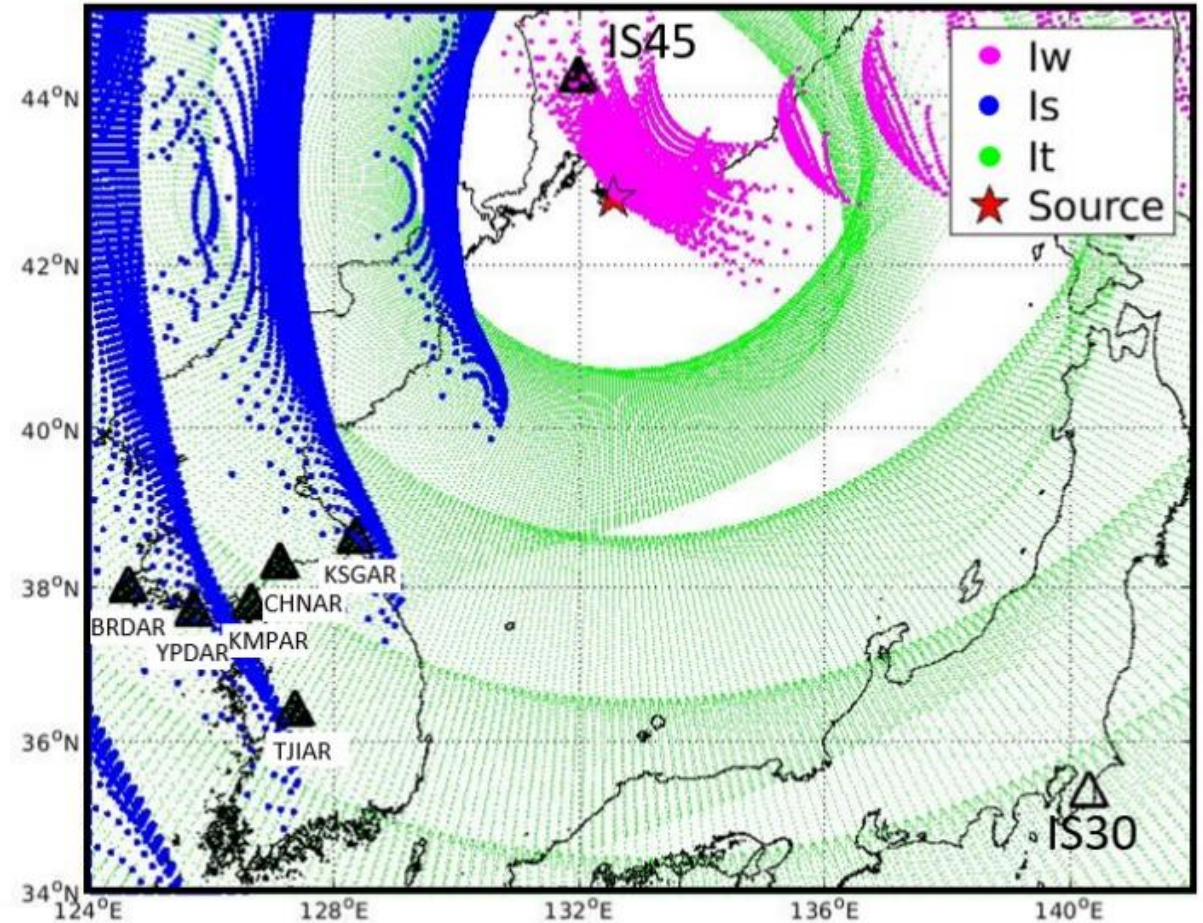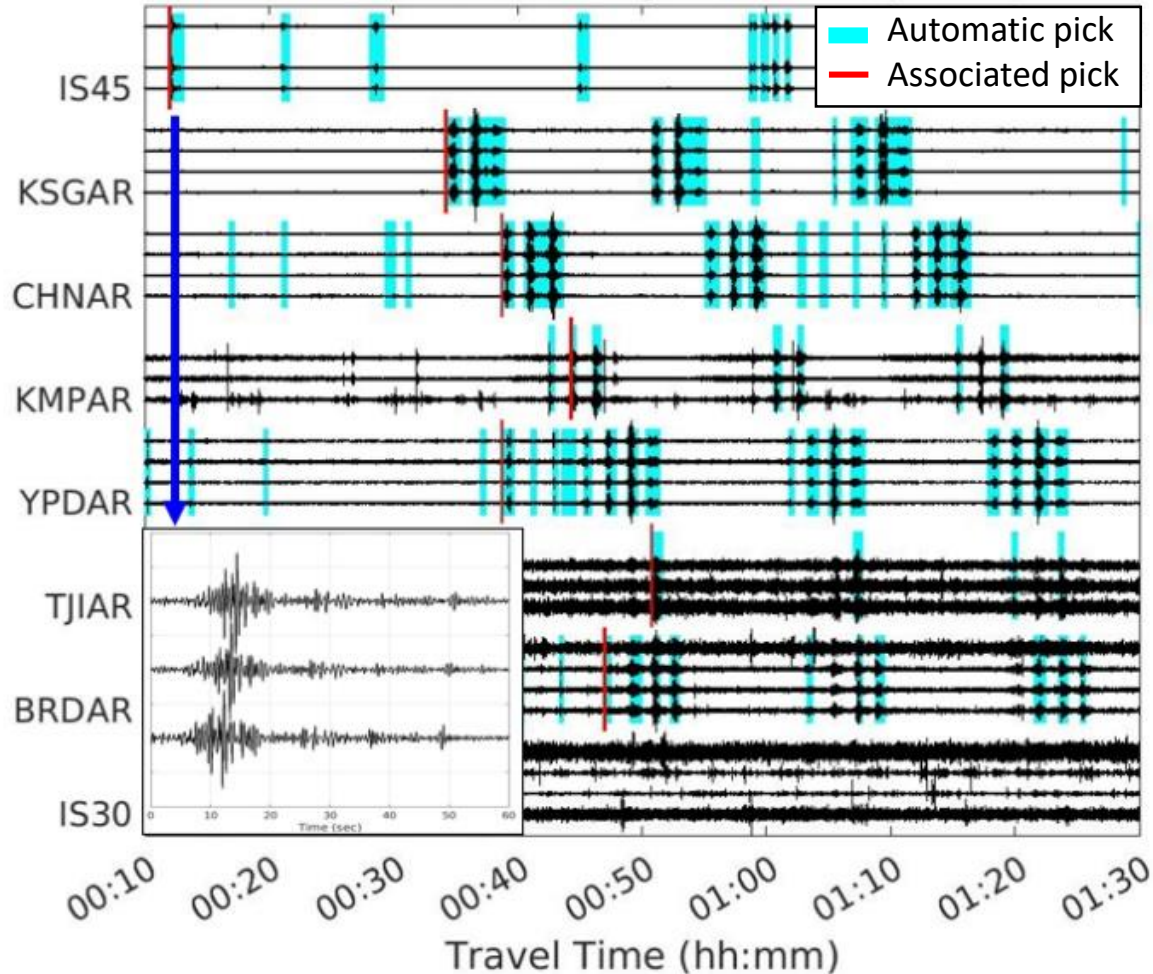Seismic arrivals at the collocated seismometer
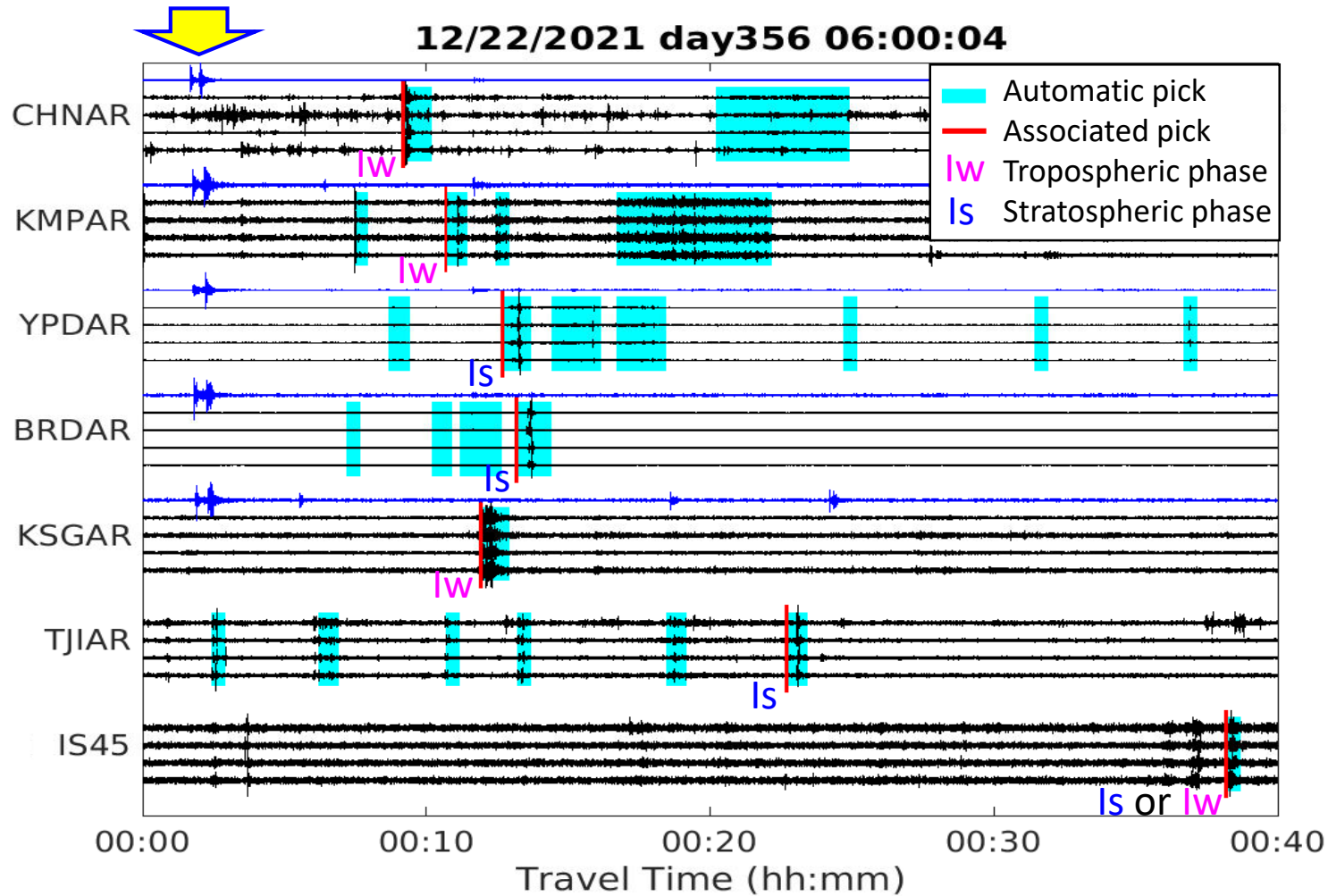
Ray Tracing (InfraGA/GeoAC, Blom and Waxler, 2012)
using G2S atmospheric specifications (Drob et al., 2013)



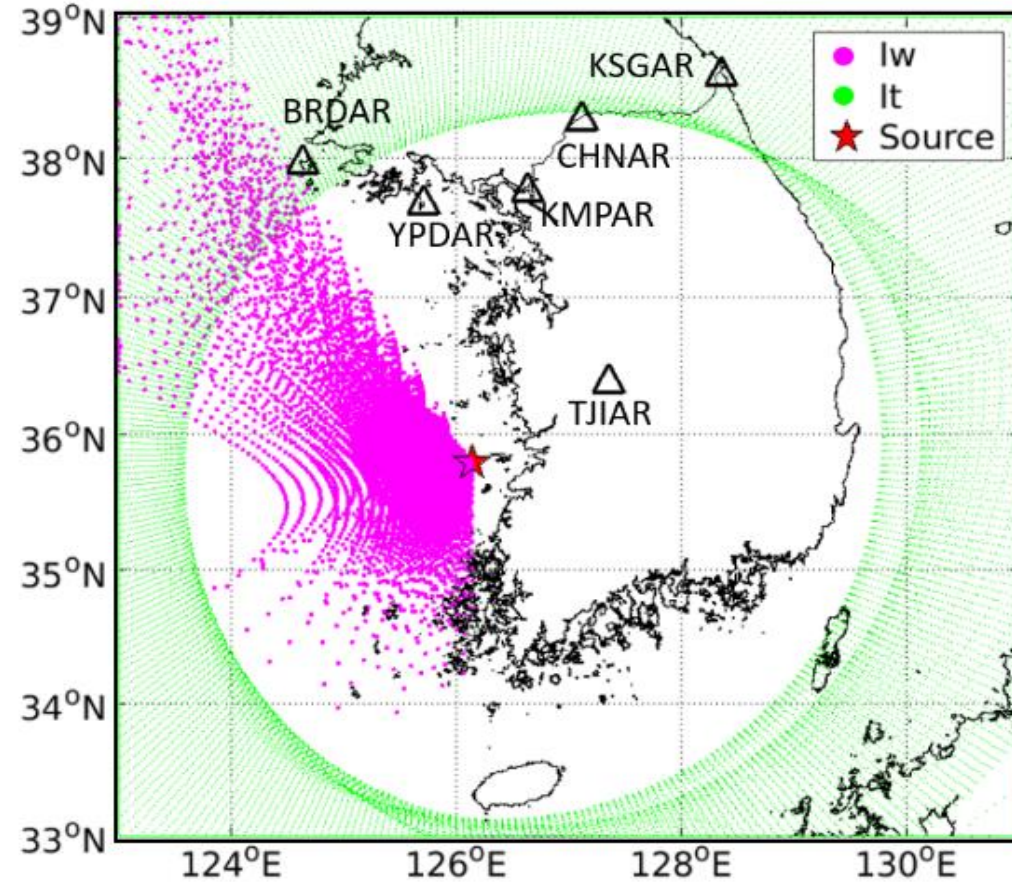*Ray tracing prediction using the G2S model explains infrasound observations.*

*Ray tracing prediction using the G2S model explains infrasound observations.*

**Infrasound Event in South Korea**

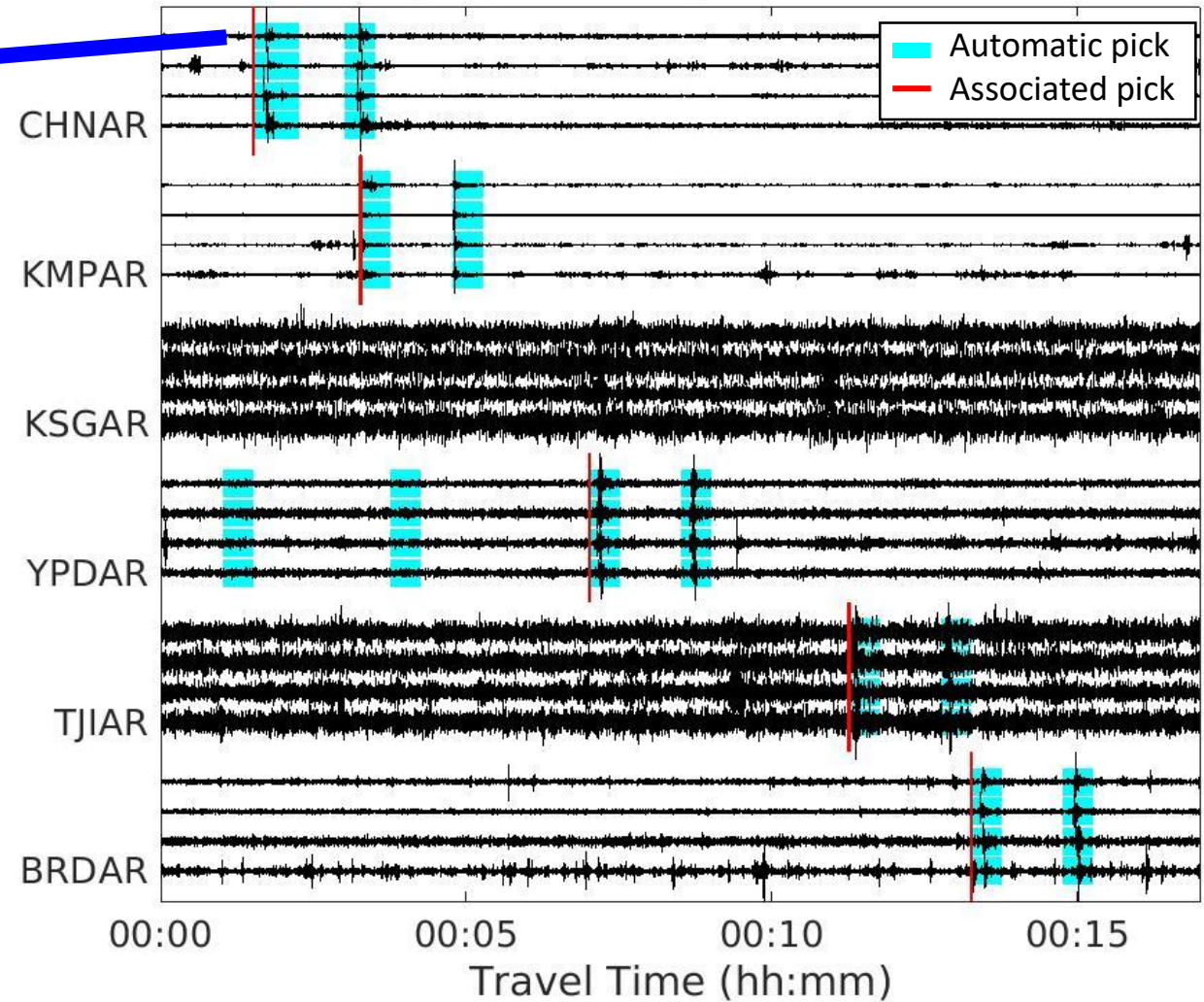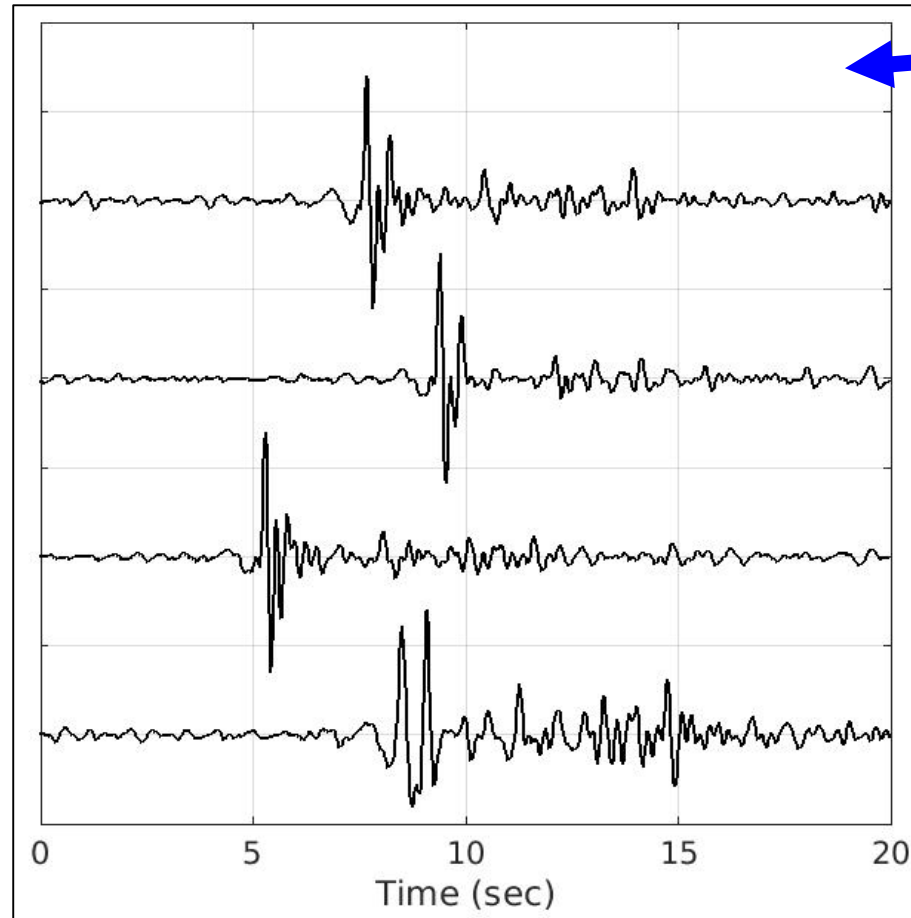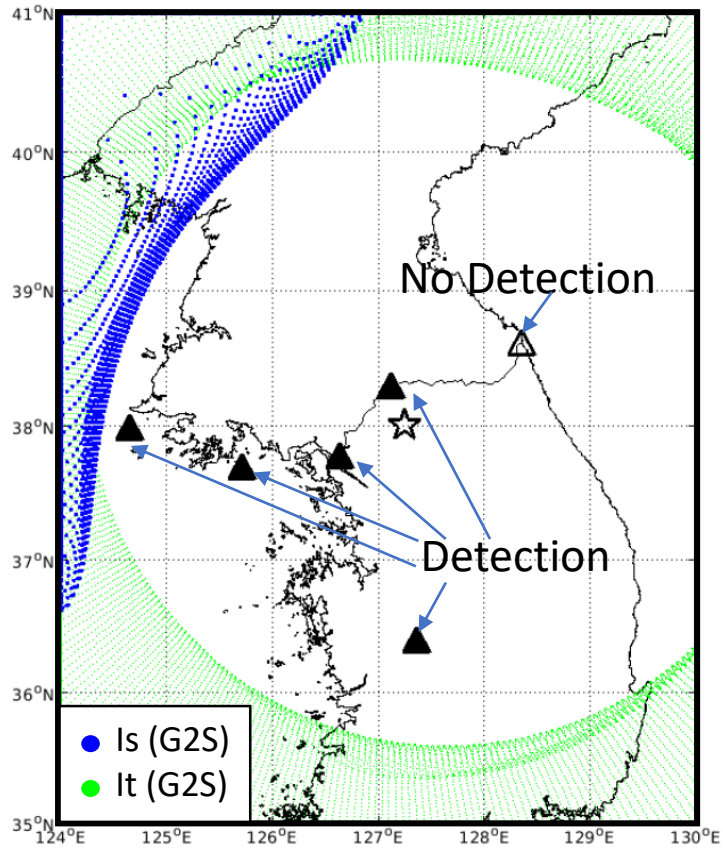*Ray tracing failed to predict the observations during September.*
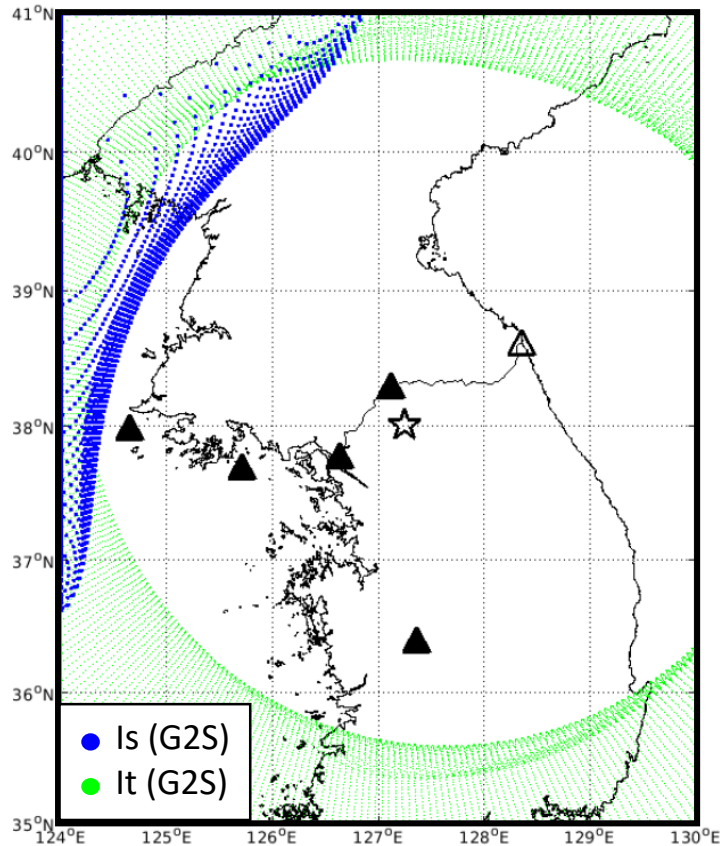
No seismic arrivals observed

05/24/2015 day144 03:12:14

Ray Tracing
using G2S model



No Detection

Detection

- Is (G2S)
- It (G2S)

*Ray tracing failed to predict the observations.*
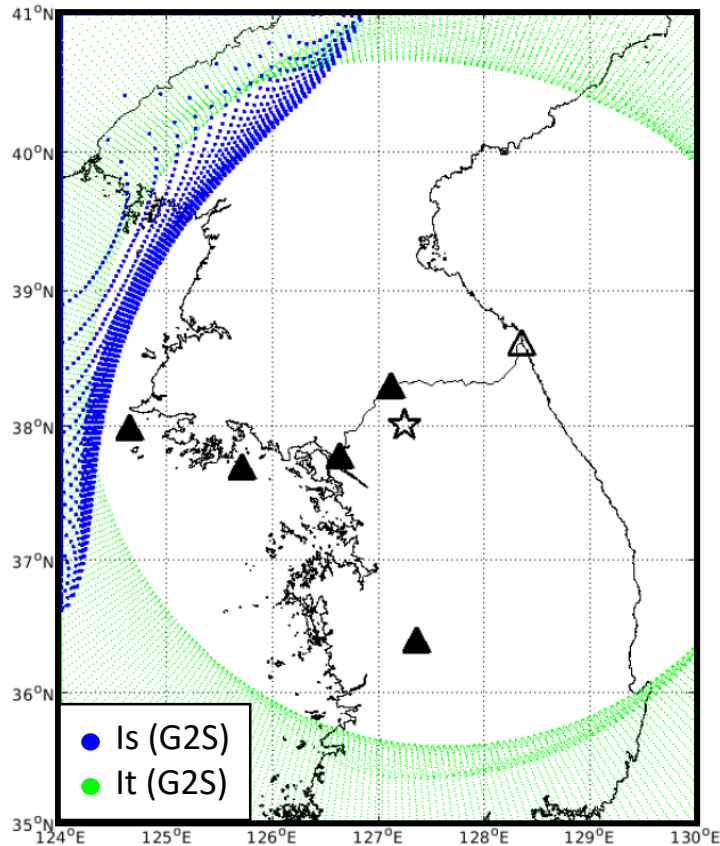
Ray Tracing
using G2S model
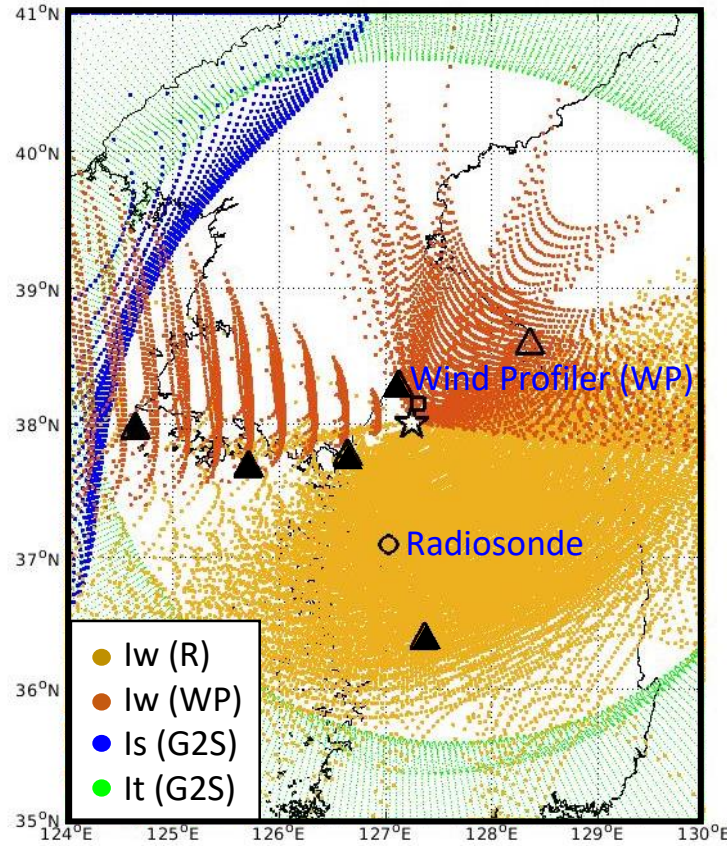
Ray Tracing
using G2S + local weather model
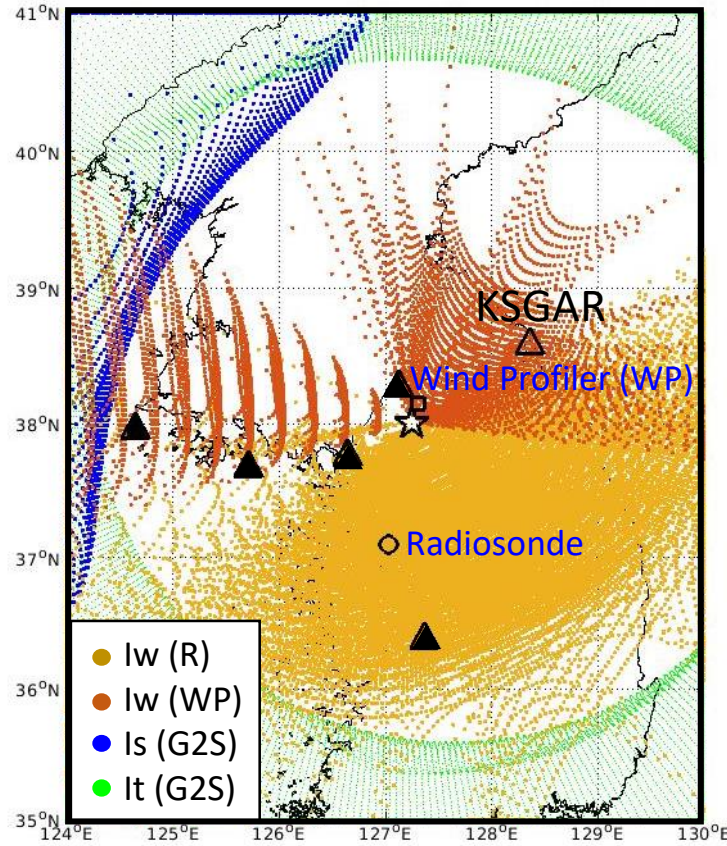


*Ray tracing using the local weather model supports the observations except at KSGAR.*

Wind Profiler data from Korea Meteorological Administration.
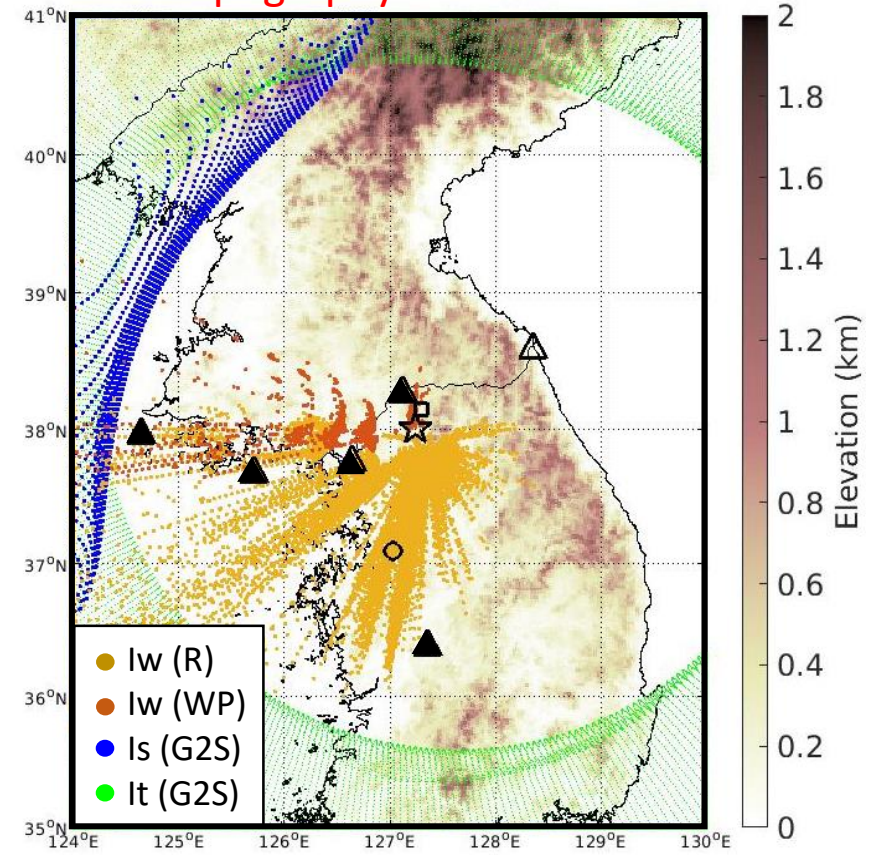Radiosonde data from the University of Wyoming.

Ray Tracing
using G2S model

Ray Tracing
using G2S + local weather model

Ray Tracing
using G2S + local weather model
with topography



*Utilizing local weather data + topography in ray tracing is important in local infrasound propagation.*
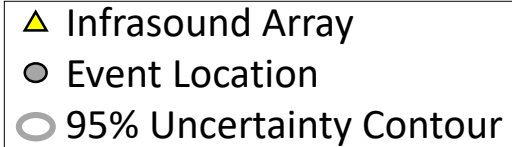
✓We produced a Korean infrasound bulletin over 24 years using data from 6 regional infrasound arrays in South Korea and 2 IMS infrasound stations.

✓Spatiotemporal trends in detections and locations were observed.

✓Infrasound events are mostly related to human activities.

✓The predictions using the G2S model generally agree with the observations, not in September and not for local distance.

✓Local weather data and topography are helpful for tropospheric propagation interpretation.
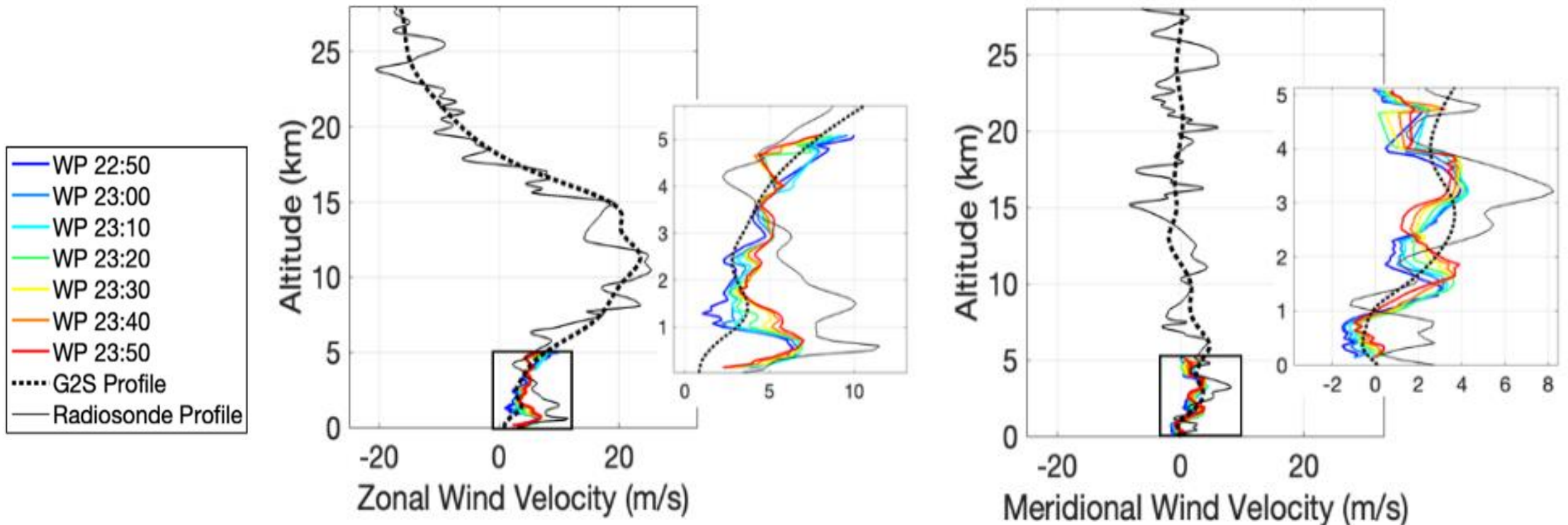
# Number of Detections
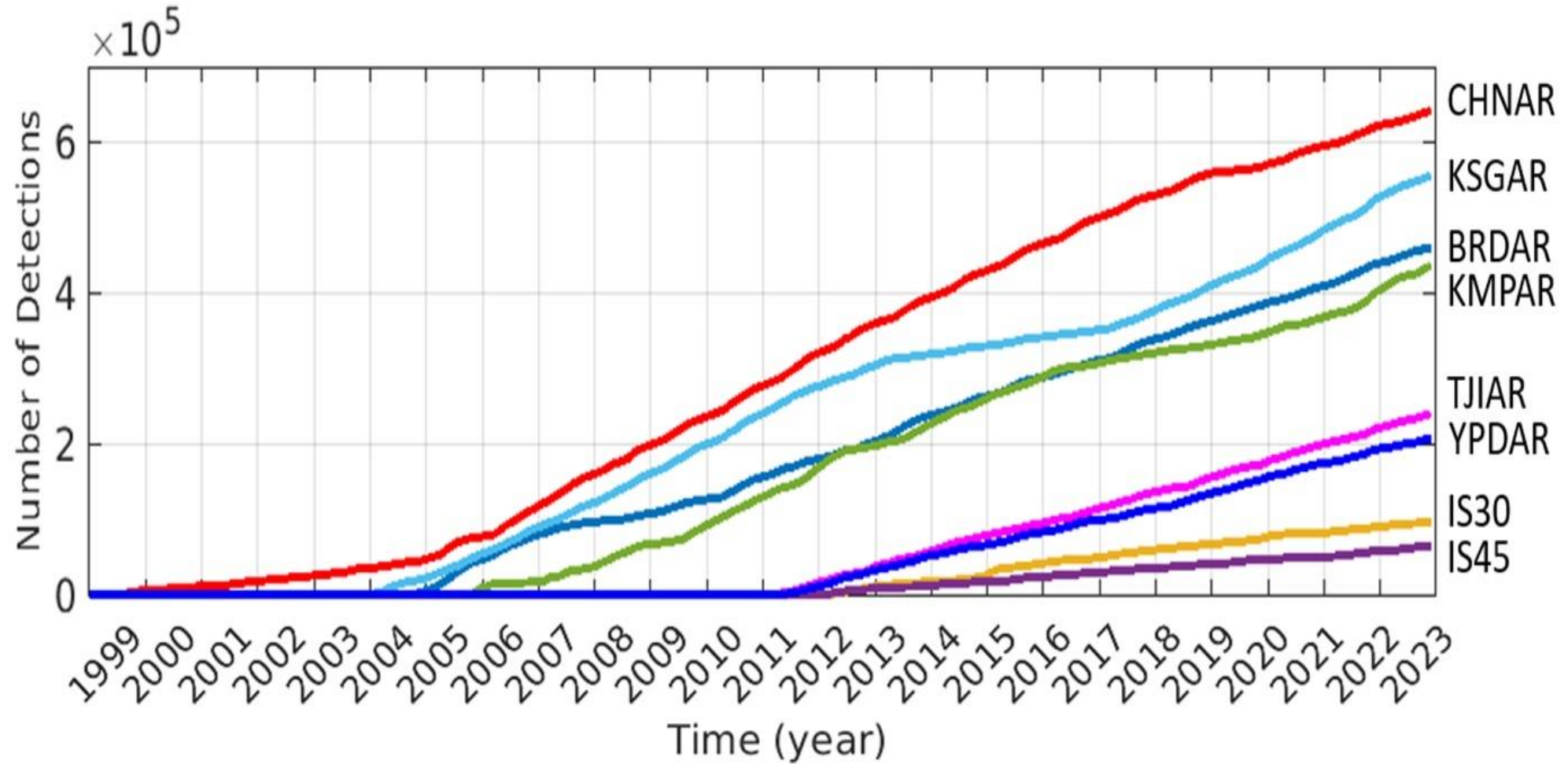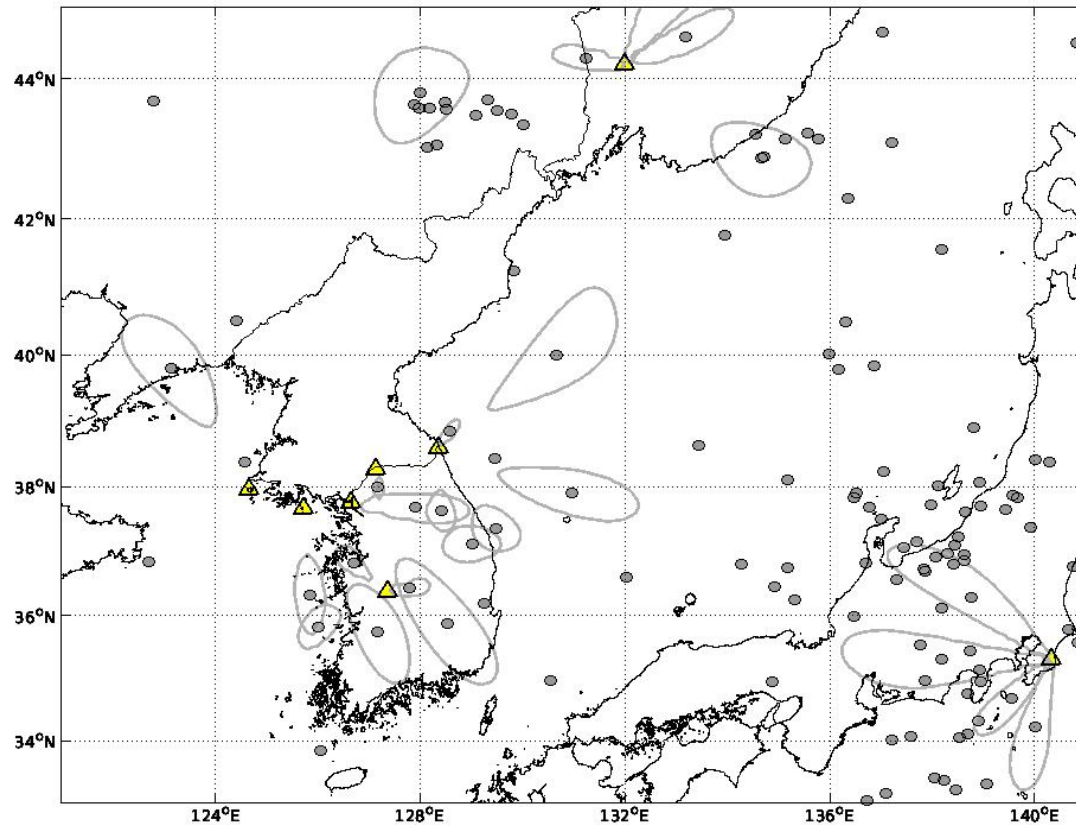
- SMU continues to process data from the eight infrasound arrays to produce a monthly catalog.

△ Infrasound Array
● Event Location
◯ 95% Uncertainty Contour

# G2S Profile vs. Radiosonde (R) and Wind Profiler (WP) data

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*Small-scale variations of both R and WP data are not included in the G2S profile, while the large variations in all profiles are similar*