Recent updates and new features in the InfraPy infrasound signal analysis software

Philip Blom, Jordan Bishop, Jeremy Webster, Christine Gammans
, Brady Spears, Jonathan MacCarthy, & Siobhan Niklasson

Los Alamos National Laboratory
National Security Earth Science Group

INTRODUCTION AND MAIN RESULTS

InfraPy is an open-source infrasound signal analysis software suite that includes detection, event building, localization, and yield estimation algorithms. The various algorithms in InfraPy have been part of seismoacoustic R&D at Los Alamos National Laboratory for more than a decade. Recent R&D includes implementation of a spectral density-based clustering detection method for single infrasound channels, a time-reversed ray-based localization algorithm, improvements to the InfraView GUI and command line interface, as well as updates to the data I/O to enable an automated analysis pipeline.

This research was funded by the National Nuclear Security Administration, Defense Nuclear Nonproliferation Research and Development (NNSA DNN R&D). This manuscript has been authored with number LA-UR-25-28853 by Triad National Security under Contract with the U.S. Department of Energy under contract no. 89233218CNA000001.

SnT 2025 CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE

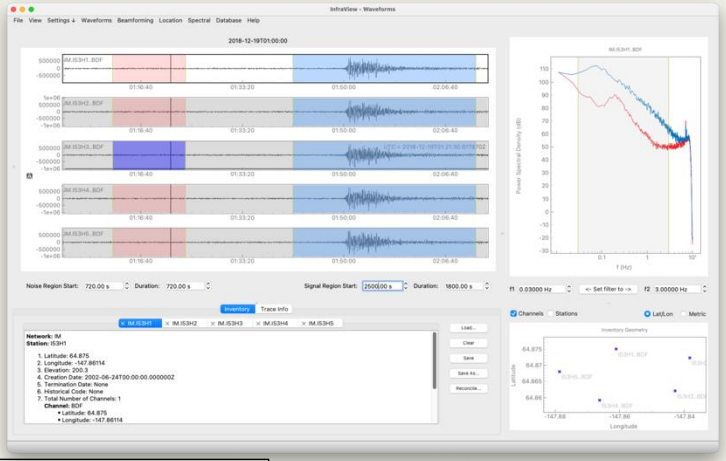
Recent updated and new features in the InfraPy signal analysis software

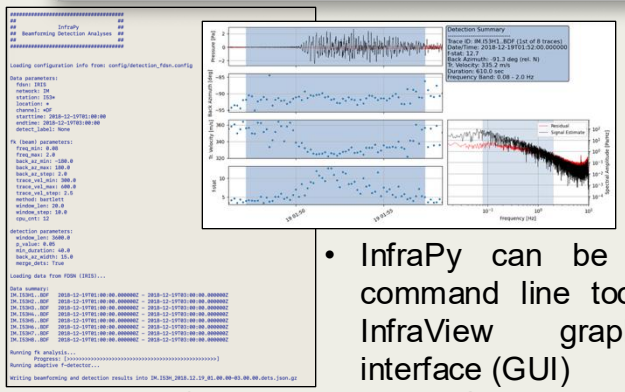
Blom, Bishop, Webster, Gammans, Spears, MacCarthy, & Niklasson

P3.5-253

Background

- InfraPy is an open-source suite of infrasound signal analysis tools developed and maintained by LANL infrasound SMEs
- Includes detection, event building, localization, and characterization (yield estimation) algorithms



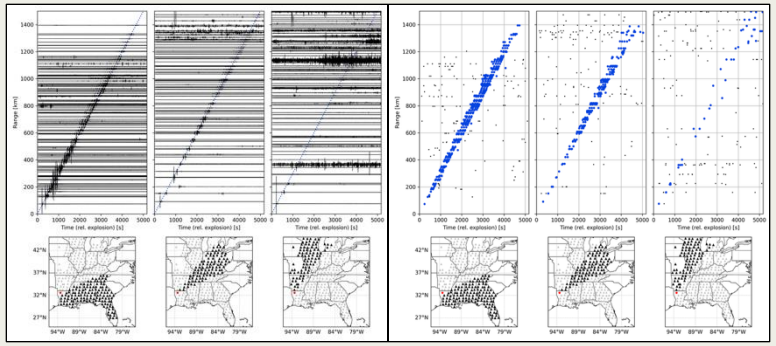


- InfraPy can be used as a command line tool or via the InfraView graphical user interface (GUI)

New Features

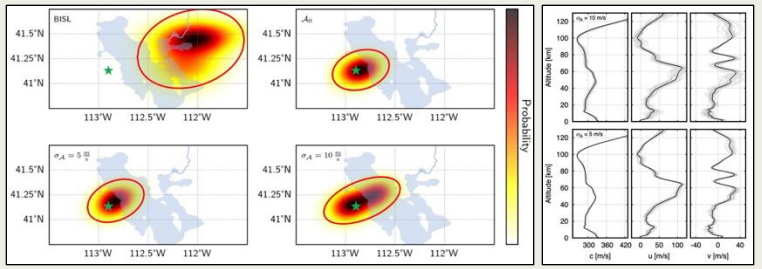
Spectral, Density-Based Clustering

- A spectrogram-based method has been developed using density-based clustering to identify signatures when coherence-based analysis isn't an option
- The method is being evaluated using signals on the USArray from the 2012 Camp Minden (below)



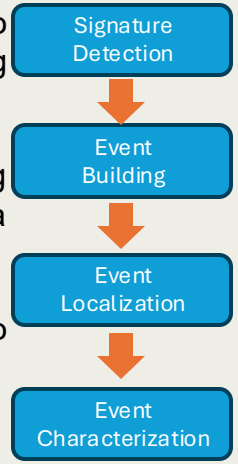
Time-Reversed Infrasonic Bayesian Localization

- A back-projection localization method was developed recently using infraGA ray tracing
- Uncertainty is quantified via atmosphere ensembles

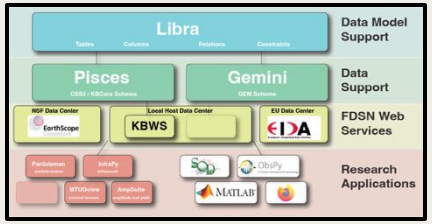


Interface and Data I/O Updates

- Config file I/O has been added to InfraView to enable parameter tuning that can be exported for CLI use
- Automated "pipeline" analysis is being developed along with updates to data I/O using JSON file for readability
- Detection information is written to enable downstream analyses



- InfraPy is part of the Python Geophysics Suite (PyGS)
- Automated methods will use Libra/Pisces for database interfacing



Software Availability

- InfraPy and other open-source software tools are available on GitHub

https://github.com/LANL-Seismoacoustics

Blom, P. S., Frazier, W. G., & Bishop, J. W. (2025). Localization of infrasonic sources via Bayesian back projection. *Geophysical Journal International, 240*(2), 1135-1146.

Blom, P.S., Bishop, J. W., Green, D. N., & Nippress, A. (2025) Evaluation of spectral density-based clustering as a means of detection for infrasound transients on single channels. *Geophysical Journal International, In Preparation*.

This research was funded by the National Nuclear Security Administration, Defense Nuclear Nonproliferation Research and Development (NNSA DNN R&D). This manuscript has been authored with number LA-UR-25-28853 by Triad National Security under Contract with the U.S. Department of Energy under contract no. 89233218CNA000001.

Los Alamos NATIONAL LABORATORY