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Open cast mine explosion confirmation in South Africa with infrasound waves recorded at station I47

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INTRODUCTION AND MAIN RESULTS

This presentation demonstrates how, from April 2024 onward, open cast mine blasts, whose infrasound waves are recorded at station I47, South Africa, are analysed together with seismic events located by the national seismograph network. If the infrasound signals meet a certain acceptance criteria the originating events are confirmed as explosions. The distribution of confirmed explosions displays a seasonal trend. During May and June 2024 confirmed explosions mostly occurred to the west of I47 whereas during January and February 2025 they occurred mostly to the east.

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Introduction

Seismic events in South Africa are recorded by the national seismograph network and located with the SeisComp software. Seismic events include earthquakes, mining-related events associated with deep gold and platinum mining, and explosions that occur in opencast mines. Suspected explosions are identified through their geographical association with opencast mines and the time-of-day. From April 2024 onward, open cast mine blasts whose infrasound waves are recorded at station I47, South Africa, are analysed and if they meet a certain acceptance criteria, confirmed as explosions. (See figure below for position of IMS station I47).

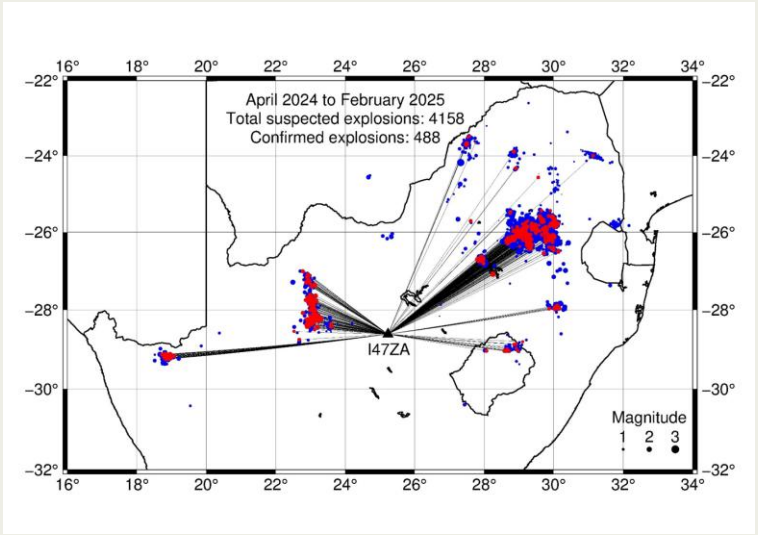
Map of southern Africa showing infrasound station I47 and other technology type stations and laboratories

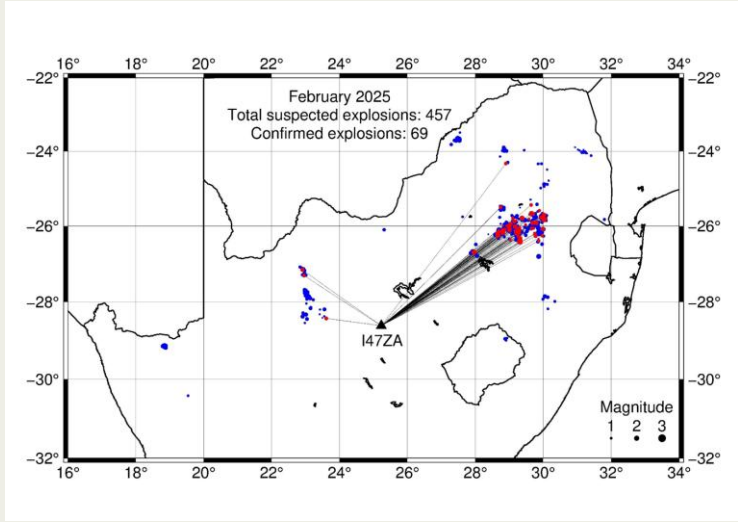
Method

The confirmation criteria for the analysed infrasound waves are: (1) the back azimuth from station to explosion epicentre is within 8 degrees, (2) predicted travel time is within 7 minutes assuming a constant velocity of 330 m/s, and (3) waves have an apparent velocity between 220 m/s to 440 m/s. Signal analysis is undertaken with the Infrapy infrasound analysis software.

Results and Conclusions

A total of 488 confirmed explosions (red dots) of 4158 suspected explosions (blue dots) occurred from April 2024 to February 2025 shown in the map. The distribution of confirmed explosions displays a seasonal trend. During May and June 2024 confirmed explosions mostly occurred to the west of I47 whereas during January and February 2025 they occurred mostly to the east. (See Figure below for confirmed explosions during February 2025). Our plans are to identify the various Infrasound arrivals that travelled through the Tropo-, Strato- and Thermosphere, relate the seismic magnitude of explosions to events that were detected and then derive seasonal celerity models.





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