IMPROVEMENT OF GT CATEGORIZATION OF SOVIET PNEs
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1. Abstract

From the 1960s through the late 1980s, the Soviet Union conducted 122 Peaceful Nuclear Explosions across its territory. These PNEs are very important to the seismological community as Ground Truth (GT) events. The PNE locations are widely distributed, thus GT-1 locations, meaning that the true location is known to within 1 km or better, are used as calibration events for developing seismic velocity models, model validation, seismic discrimination, etc. The monitoring research community generally utilizes PNE locations from Sultanov et al. (1999) as known or verified GT, though in reality there are errors and some PNEs are indicated as poorly located. We have determined or validated GT-1 locations for more than 60 of the Soviet PNEs. Some PNE locations published as GT-1 or better are found to have larger errors, the greatest of which exceeds 15 km. Our locations were determined using an integrated approach encompassing published literature, internet searches, analysis of satellite imagery and regional seismic data. In addition, several PNE sites in Ukraine and Kazakhstan were visited allowing GPS coordinates to be obtained in the field.

2. Introduction

Peaceful Nuclear Explosions (PNEs) were conducted by both the Soviet Union and the United States. The parameters of the Soviet Union PNE program have been extensively summarized by Sultanov et al. (1999). Sultanov et al. (1999) is a great work that has been valuable to the monitoring research community over the past decades. However, as many PNE locations continue to rely on seismically derived locations, Sultanov et al. (1999) advocated future studies incorporating GPS locations and other research tools as they became available to improve or verify locations. We have been able to determine GT-2 values for 18 of the seismically located events, and to validate or correct the 50 PNE locations thought to be GT-1. Some PNEs classified as GT-1 or better were found to have larger errors. Locations were determined using an integrated approach encompassing published open literature, analysis of satellite imagery and regional seismic data. Figure 1 displays all 122 PNE sites, and plots the revised and confirmed locations. Table 1 is a comprehensive list of PNEs following the Sultanov et al. (1999) parameters along with our revised coordinates and differences. Section 3 summarizes our work for selected PNEs or PNE sequences.

3.1 Kama-1 – 8 July, 1974

At the Kama-1 site, waste from the Salat oil refinery was injected in 1983-1993, reportedly 30 km west of Stetinak at 53.860° N 55.20E (Novik, 2000). Noma and Cochrane (1998) gives coordinates of 53.864° N 55.10E. Melnikov (1994) places it 20 km west of Salatol. Sultanov et al. (1999) lists seismically determined coordinates as 53.797° N 55.19E.

3.2 Lira Sequence – 10 July, 1983 and 21 July, 1984

The Lira sequence of PNEs consisted of two sets of three explosions, for a total of six, near the Karagachkent oil and gas complex in western Kazakhstan. All six explosions took place within salt domes to create storage tanks for gas condensates. The Sultanov et al. (1999) locations all correspond closely to circular fenced structures visible in satellite imagery (Figures 3A and 3B) and are also consistent to a location map in Agerov et al. (2008). A ground level photo of the Lira-2 site is posted in Google Earth by i testim.harisson (Figure 3C).

3.3 Magistral! – 25 June, 1970

Dubasov et al. (2005) give explicit coordinates and a Cesium contamination sketch for Magistral!, which formed a groundwater proof cavity. The well coordinates are given as 52.3577° N 55.723° E, and lie within a circular disturbed area in image Bing Maps (Figure 4A). These coordinates are in a field to the southwest of a complex labeled “Gazpromysoy Bolokhov” (R, Gas Socobing Agricultural Institute State Farm) the PNE has been published in other Russian papers.

3.4 Conclusions

The explosions of the Soviet PNE program represent a large dataset of GT events that are useful to the nuclear explosion monitoring community as well as seismologists in general. This project has verified or established GT-1 locations for 68 or 122 Soviet PNEs. We anticipate expanding this project to verify U.S. PNE sites for use by the global seismological community. We also welcome any collaboration in this project to verify either U.S. or additional Soviet PNE locations.

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6. References


