Waveform Analyses Presented at the "Common Exercise" during The East Asia Regional NDC Workshop 2014

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Technical representatives from 11 National Data Centers (NDCs) participated in the 3rd (2014) East Asia Regional NDC Workshop (EARNW) held July 29 – August 1, 2014, at Ulaanbaatar, Mongolia. The PTS selected an event with magnitude about m₄, 2.7 near the China-North Korea border for the workshop’s Common Exercise session. Seven teams presented seismic relocation results utilizing the standard Geiger inversion method. They only differed in the selection of seismic stations. Key observations included: (1) the location accuracy is highly dependent on the configuration of the selected seismic network; (2) very impressive location accuracy can be achieved (to within 1 kilometer) when local/regional data are included; hence sharing non-IMS local/regional data would be very helpful; and (3) the Wadati method gives an earlier origin time. The ROK NDC also attempted an end-to-end seismic analysis, covering the detection, location, discrimination, magnitude calculation, and yield estimation steps, plus an independent location based on infrasound data alone. The selection of a magnitude-yield formula for this geographic region is not quite settled yet. The need for validated region-specific magnitude-scaling formulae is recognized, thus opening up opportunities for further cooperation among the NDCs.

The workshop participants used the following six basic questions to guide their analysis called for by the Common Exercise to the extent they could. Most EARNW participants focused on the location alone due to the small size (m₄ ~ 2.7) of the selected event. A handful of NDCs carried out seismic discrimination and one even tried yield estimation.

- Did we see it? (Detection)
- Where was it? (Location)
- Was it an explosion? (Discrimination)
- Was it nuclear? (Characterization)
- How big was it? (Yield estimation)
- Who did it? (Attribution)

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- NDCs using IMS data alone obtained single-event locations very consistent with the REB result, 11-15 kilometers from the Ground Truth spot. While this demonstrates good consistency, it also illustrates the challenges and limitations in locating small events with a network of relatively sparse stations. Additional data from seismographs at much closer distances prove to be very helpful when advanced analytical tools (such as relative location techniques) are not readily applicable.
- ROK NDC attempted an end-to-end analysis, exploiting a combination of seismic data: IMS, open (IRIS), national, and joint stations. The resulting location is indeed very impressive – within 800 meters to the suspected open pit (GT), similar to that based on the precious IRIS/NECESSArray data.
- ROK NDC also proactively employed infrasound technology.
- The EARNW facilitated further cooperation among participating NDCs after the workshop. By combining the IMS, open (MDJ and NECESSArray), and national data kindly provided by ROK NDC, Japanese NDC’s refined location fell right on the pit of the North Korean cooper mine next to the Yalu River.