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Development on a method for automatically detection and location of very low frequency earthquakes in Japan

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We have examined results of automatic detection and location of very low frequency earthquakes (VLFEs) in Ryukyu, southern Japan. In this system, three component seismograms recorded at the NIED F-net were analyzed by using waveform-correlation and back-projection techniques after processing a band-pass filter (0.02 to 0.05 Hz). Here we used known 6 VLFEs and 17 regular interplate earthquakes near the trench axis as template events. Time series of cross-correlation function (CC) at each station was calculated from continuous waveform data and triggered seismograms of template events. Assuming surface wave propagation, CCs are back-propagated onto possible origin times and horizontal locations. We obtained epicenters of VLFE candidates by performing a grid search in time and space domains to maximize the averaged CCs from all stations under the condition of high signal to noise ratios that was defined as amplitude ratios between two time windows before and after the surface wave arrivals from the VLFE candidates. We applied this method to the F-net data on November 29, 2014, when VLFEs occurred in Ryukyu, where only six stations are available for the analysis. Small number of stations easily causes errors in our detection and location of VLFEs probably due to aliasing in space domain. As the results of analysis, most of the VLFEs were detected and located off Ishigakijima Island. These epicenter locations are consistent with surface wave arrival from the VLFE candidates. However, some events were located between Okinawa Island and Miyakojima Island. This suggests that the present method needs additional development considering arrival times.

Keywords: very low frequency earthquake, automatic detection, automatic location