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Tensor Inversion Analysis of DPRK6 Nuclear Events Using CTBTO/IMS Data

The global verification system under the Comprehensive Nuclear-Test-Ban Treaty (CTBT) is designed to detect all nuclear explosions on Earth, with seismic monitoring relying on the International Monitoring System (IMS) to identify explosion signals. This study applies Moment Tensor (MT) inversion analysis to assist States Parties through expert technical analysis (ETA) of IMS and additional datasets provided by the requesting State. MT inversion determines parameters such as total seismic moment, focal mechanism and source depth, with this analysis focusing on data from declared nuclear events in the Democratic People's Republic of Korea (DPRK), particularly the DPRK6 event on 2017/09/03. Two methodologies were applied: a time-domain regional moment tensor inversion (Dreger 2003) and a joint inversion combining regional waveforms and teleseismic first-motion polarities (Chi-Durán et al. 2024). Using four regional waveforms and 81 teleseismic polarities, and modeling with regional velocity models (Ford et al. 2010), the TDMT approach revealed a predominantly isotropic mechanism with a minor double-couple component, consistent with prior studies (e.g. Alvizuri and Tape 2018; Chiang et al. 2018). The joint inversion further improved the waveform fit, confirming isotropy as the dominant source characteristic. Ongoing efforts aim to incorporate teleseismic waveforms to refine the depth and other characteristics.

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