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Development of on-demand buoy system for crustal displacement observation and future plan

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Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Tohoku University and Japan Aerospace Exploration Agency (JAXA) has developed real-time observation system for tsunami and crustal movement using a buoy through twice sea trials since 2011. We already succeeded in mooring under the high speed sea current with over 5 knots, observation using a pressure gauge with tsunami mode, acoustic data transmission using double pulses, and data transmission from the buoy to a land station using satellite. We entered in new stage of the buoy system development for on-demand crustal displacement observation since 2014 as a part of strategy innovation program using accumulated know-how. This system measures the vertical and horizontal crustal displacements using above pressure gauge and six acoustic transponders in realtime and also make possible to measure via satellite transmission in on-demand. At this moment, we have some issues to be improved to implement this system. One is acoustic data transmission using double pulse between the seafloor unit and the wire-end station. There are error cases for identification of the double pulse due to reflection signals from the sea surface and sea bottom. And we have an issue about the accuracy for the acoustic transmission, and faced accuracy of the double pulse detection with over 1 msec. We try to reduce the accuracy to keep broad dynamic range, too. Second is data transmission between the wire-end station and the buoy station. We experienced stop of the data transmission there. As a result, we concluded that the reason is torsion of the wire rope there based on profile of the buoy position data. Considering damages by fishery activities, we decided to keep redundancy for data transmission by two methods using an electric line and pairs of electromagnetic modem. In addition, we also prepare precise point positioning systems for real-time calculation of the crustal displacement on the buoy station, which are MADOCA system developed by JAXA and starfire of commercial base. In this presentation, we introduce current stage of the development and the future view.

Keywords: Crustal displacement observation, Buoy, On-demand, real-time, Nankai Trough