Microscale ocean disturbance that affects the GPS-A seafloor geodesy

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Seafloor geodetic observations accomplished several monumental works in the fields of seismology and geodesy. Many seafloor geodetic works were performed using the GPS-Acoustic ranging combination technique (GPS-A) [e.g., Gagnon et al., 2005, Nature; Sato et al., 2011, Science; Kido et al., 2011, GRL; Yokota et al., 2016, Nature]. In this technique, we observe using vessels (or buoys) on the sea around the seafloor acoustic mirror-type transponders set within the range of 1 - 3 km. Seafloor absolute positions were determined using this acoustic data, the attitude data and the GPS data on the vessels. Although the GPS-A technique achieved establishment of the stable and sophisticated seafloor observation network, an observation precision (1 σ = 2 - 3 cm: horizontal) remains lower than other geodetic observation techniques.
The observation precision is affected by ocean disturbances strongly. We have reduced this effect using analytical approaches in this decade (Figure). In that process, spatial and temporal changes of undersea sound speed structures (SSS) were approximated as fields modelled using high-order temporal functions [Fujita et al., 2006, EPS]. In the recent study, we found out a possibility that spatial biases of the SSS were also able to be modelled by using the similar method. These methods could make contributions to upgrade the precision of the GPS-A data. In this presentation, we' d like to review our current analysis flow and discuss effects of these analytical approaches.
Additionally, we remark the SSS modelled in our analysis. Although it was just noise for us, it is able to be considered as an important parameter visualizing an ocean event. The obtained SSS has very small spatial and temporal scales, a km-scale and an hour-scale, and is difficult to be acquired in other observations. Therefore the GPS-A may have possibility to open a new window to see a microscale ocean event.

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