

## Kuroshio detected from the GNSS-A oceanography

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The GNSS technique can determine an absolute position using the radio-wave ranging between a satellite and an onshore receiver. Because the radio-wave passes the ionosphere and the atmosphere, the GNSS was applied for ionospheric research and meteorology (GNSS meteorology). In this way, a geodetic observation technique can be used to analyze the path region.

The GNSS-Acoustic ranging combination (GNSS-A) seafloor geodetic observations accomplished several monumental works in the fields of seismology and geodesy [e.g., Gagnon et al., 2005, Nature; Sato et al., 2011, Science; Kido et al., 2011, GRL; Yokota et al., 2016, Nature; Tomita et al., 2017, SciAdv]. In this technique, we observe seafloor stations using vessels. The seafloor acoustic mirror-type transponders are set as seafloor stations within the range of 1 –3 km. Seafloor absolute positions are determined using this acoustic data, the attitude data and the GNSS data on the vessels. Because the acoustic wave passes the ocean field, this method not only determines the seafloor absolute positions but also can extract the ocean field condition as similar with the GNSS meteorology.

However, different modelling method from the GNSS is necessary for extracting the ocean disturbance from the GNSS-A. It is because there is a difference between conditions of sky and ocean as shown in Figure. Difference in characteristics is the altitude and thickness of the unstable layer. In the GNSS-A, it is necessary to change the modelling depending on how vessel/buoy moves. Taking these differences into account, adequate modelling for our observation system was developed and applied to real datasets. When compared using the JCOPE2 model [Miyazawa et al., 2009, JO], the extracted parameters are consistent with a steady state of the Kuroshio. The developed method would also be used for upgrading the GNSS-A seafloor geodetic observation accuracy.

In order to compare with real ocean fields, we conducted XBT continuous observation. Real observation was carried out in offshore of Bungo channel on December 2017. At this time, the Kuroshio were flowing strongly while turning from the south to the east as similar as the average field. In this presentation, we discuss this observation result with our analysis results.

Acknowledgements: We thank the Geospatial Information Authority of Japan (GSI) for high-rate GNSS data for kinematic GNSS analysis, and for daily coordinates of the sites on the GSI website. JCOPE2 data is provided by JAMSTEC's JCOPE website. We also thank R. Zhang for lecturing and advising us about JCOPE2 data.

Keywords: GNSS-A, GNSS-A oceanography, Oceanography, Seafloor geodetic observation, Acoustic ranging

