Plain Language Summary: We studied the optimum analysis settings for precipitable water vapor (PWV) retrieval at sea using a ship-based Global Navigation Satellite System (GNSS). Based on the results of comparison of GNSS-derived PWV with the Meso-scale Analysis of the Japan Meteorological Agency (JMA), a new setting combination was selected. The use of the new setting combination improved the agreement between the GNSS-derived PWV and other observations.
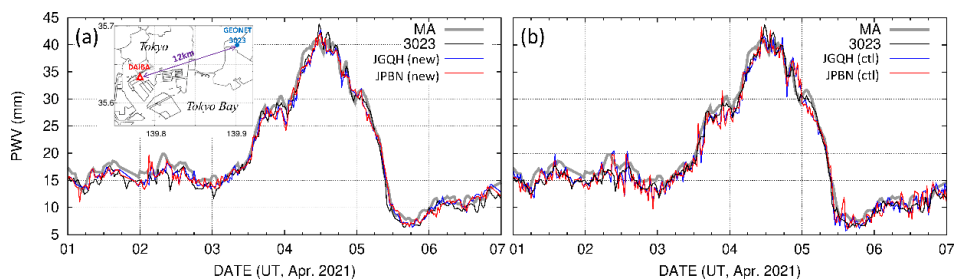

Figure 1. The PWV time sequence for April 1–April 6, 2021. Gray thick line: MA. Black line: 3023 (fixed GNSS station). Blue line: Ryofu Maru (JGQH); Red line: Keifu Maru (JPBN). The time sequences of JGQH and JPBN in (a) are obtained by the new settings described in this study, while those in (b), written as CTL, are obtained by those of Shoji et al. (2017) (https://doi.org/10.1186/s40623-017-0740-1).
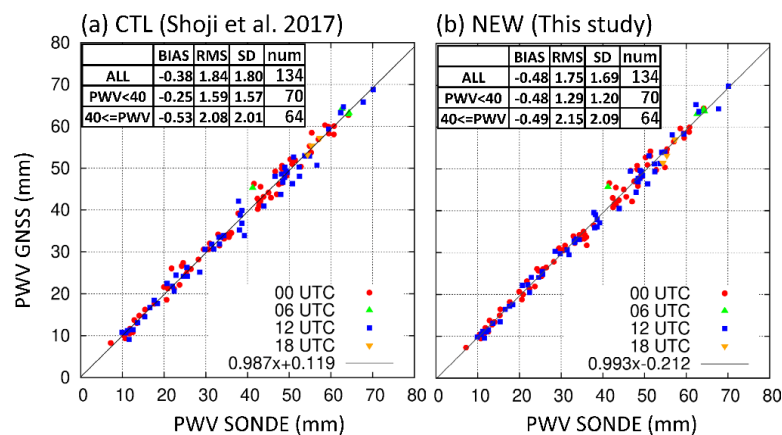

Figure 2. PWV comparison results obtained from Ryofu Maru observations in 2019 and 2020. In (a), the GNSS-derived PWV is retrieved using the procedure of Shoji et al. (2017) (https://doi.org/10.1186/s40623-017-0740-1), while the GNSS-derived PWV is retrieved by using our new settings, as shown in (b).

Highlights:

- The use of the new setting combination improved the agreement between the GNSS-derived PWV and other observations.
- It is found that the biases in the GNSS-derived PWV are closely related to the biases in the vertical coordinate solutions in the GNSS positioning.
- An operational system for real-time analysis of maritime PWV using GNSS receivers installed on two JMA research vessels is presented in the Appendix.