[EJ] Evening Poster | S (Solid Earth Sciences) | S-GD Geodesy

[S-GD02]Geodesy General Contributions &Global Geodetic Observing System

convener:Koji Matsuo(Geospatial Information Authority of Japan), Yusuke Yokota(Japan Coast Guard, Hydrographic and oceanographic department), Takahiro Wakasugi(国土交通省国土地理院)

Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

In this session, general contributions from all areas of geodesy are welcomed. Topics of interest will include but not limited to recent advances in measurement techniques, reference frame realization, earth rotation or earth tide. In addition, this session also provides a forum for discussing GGOS (Global Geodetic Observing System) related observation programs, advancements of geodetic techniques, collaboration among various organizations in the world. Topics will include improvements of observing system and data analysis, participations in global programs, global reference frames and geodesy's contributions to society.

[SGD02-P08]A study to measure PWV and wave height over the ocean by kinematic PPP procedure with MADOCA Real-time Orbits

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Keywords:GNSS, Precipitable Water Vapor, Wave height

We installed two Global Navigation Satellite System (GNSS) antennas on a research vessel, the RYOFU MARU of the Japan Meteorological Agency, and conducted experimental observations to assess the GNSS derived precipitable water vapor (PWV) from October 19, 2016, to August 6, 2017. The RYOFU MARU is equipped with meteorological sensors, a radiosonde observation facility, and a microwave type wave height meter (WM-2 developed by Tsurumi-Seiki Co., Ltd.). WM-2 is an apparatus with an acceleration sensor and a microwave Doppler radar. The microwave Doppler radar measures the vessel’s relative height against the sea surface at the bow, while the acceleration sensor estimates the vertical motion at the bow. The RYOFU MARU logs the 2 Hz sampled bow height and observed wave height. The actual wave height is calculated by subtracting the vertical displacement at the bow from the observed bow height from the sea surface measured by the microwave Doppler radar. The significant wave height is calculated twice an hour using 20 min consecutive observations from 5–25 min and 35–55 min by averaging the wave height of the highest third of the actual wave heights.
One antenna was set on the mast (MAST) while another antenna was set on the upper deck (DECK). The GNSS analysis was conducted using the Precise Point Positioning procedure with a real-time GNSS orbit. A quality control (QC) procedure based on the amount of Zenith Tropospheric Delay (ZTD) time variation was proposed. After the QC was applied, the retrieved PWVs were compared to 77 radiosonde observations. The PWVs of MAST agreed with the radiosonde observations with a 1.7 mm root mean square (RMS) difference, a −0.7 mm bias, and 3.6% rejection rate, while that of DECK showed a 3.2 mm, −0.8 mm, and 15.7%. The larger RMS and higher rejection rate of DECK implies a stronger multi-path effect on the deck. We also, compared vertical antenna displacement with those obtained by WM-2 wave height meter. Because the location of the two instruments are different, phase of vertical displacement is different, but cycle were close each other.

The differences in the GNSS PWV versus radiosonde observations were compared to the atmospheric delay, the estimated altitude of the GNSS antenna, the vessel’s moving speed, the wind speed, and the wave height. The atmospheric delay and GNSS antenna altitude showed moderate correlation with the differences. The results suggest the kinematic PPP’s potential for not only practical water vapor monitoring but also wave height measurement over oceans worldwide. At the same time, from the growing negative biases with the PWV value and with estimated antenna altitude, it could be inferred that the difficulty grows in separating the signal delay from the vertical coordinate under high humidity conditions.