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Error estimation of buoy, altimeter, and model significant wave height from triple collocation technique

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Ocean wave information is of major importance for a number of applications including climate studies, safety at sea, marine engineering (offshore and coastal), and coastal risk management. Depending on the scales and regions of interest, several data sources may be considered (e.g. in situ data, VOS observations, altimeter records, numerical wave model), each one with its pros and cons. In order to optimize the use of multiple source wave information (e.g. through assimilation scheme in NWP), the error characteristics of each measurement system need to be investigated and inter-compared. In this study, we use triple collocation technique to estimate the random error variances of significant wave height from in situ, altimeter and model data. The buoy dataset is a selection of ~100 in-situ measuring stations provided by the CMEMS In-Situ Thematic Assembly Center. The altimeter dataset is composed of the ESA Sea State CCI V1.1 L2P product. The model dataset is the result of WW3 Ifremer hindcast run forced with ERA5 winds using the recently updated T475 parameterization. In comparisons to previous studies using similar techniques, the large triple collocation dataset (~450 000 matchups in total) generated for this study provides some new insights on the error variability within in situ stations, satellite missions and upon sea state conditions. Moreover, the results of the triple collocation technique help developing improved calibration of the altimeter missions included in the ESA Sea State CCI V1.1 dataset.