Improved satellite estimation of surface humidity using vertical water vapor profile information

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An accurate estimation of the air-sea fluxes is crucial for studies of the global climate system. Estimating surface flux using satellite remote sensing techniques is one possible answer to this challenge. Surface air specific humidity is one of essential climate variables and is also a key variable in the estimation of air-sea latent heat flux and evaporation from the ocean surface. Current remote sensing techniques are problematic and a major source of errors for flux and evaporation. Here, we propose a new method to estimate surface humidity using satellite microwave radiometer instruments (SSMI, SSMIS, AMSR-E, TMI, and AMSR2), based on a new finding about the relationship between multi-channel brightness temperatures measured by satellite microwave radiometers, surface humidity, and vertical moisture structure. Satellite estimations using the new method were compared with in situ observations to evaluate this method (Fig.1), confirming that it could significantly improve satellite estimations with high impact on satellite estimation of latent heat flux and evaporation. Finally, multi-satellite global air-sea latent heat flux was calculated over 1988-2015 as a part of the third-generation data set of Japanese Ocean Flux Data Set with Use of Remote-Sensing Observations (J-OFURO3). A general quality and improved features of the data set were investigated. J-OFURO3 data are of outstanding quality, facilitating a clearer understanding of more fine-scale ocean-atmosphere features and more long-term flux variation based on multiple satellite observations.

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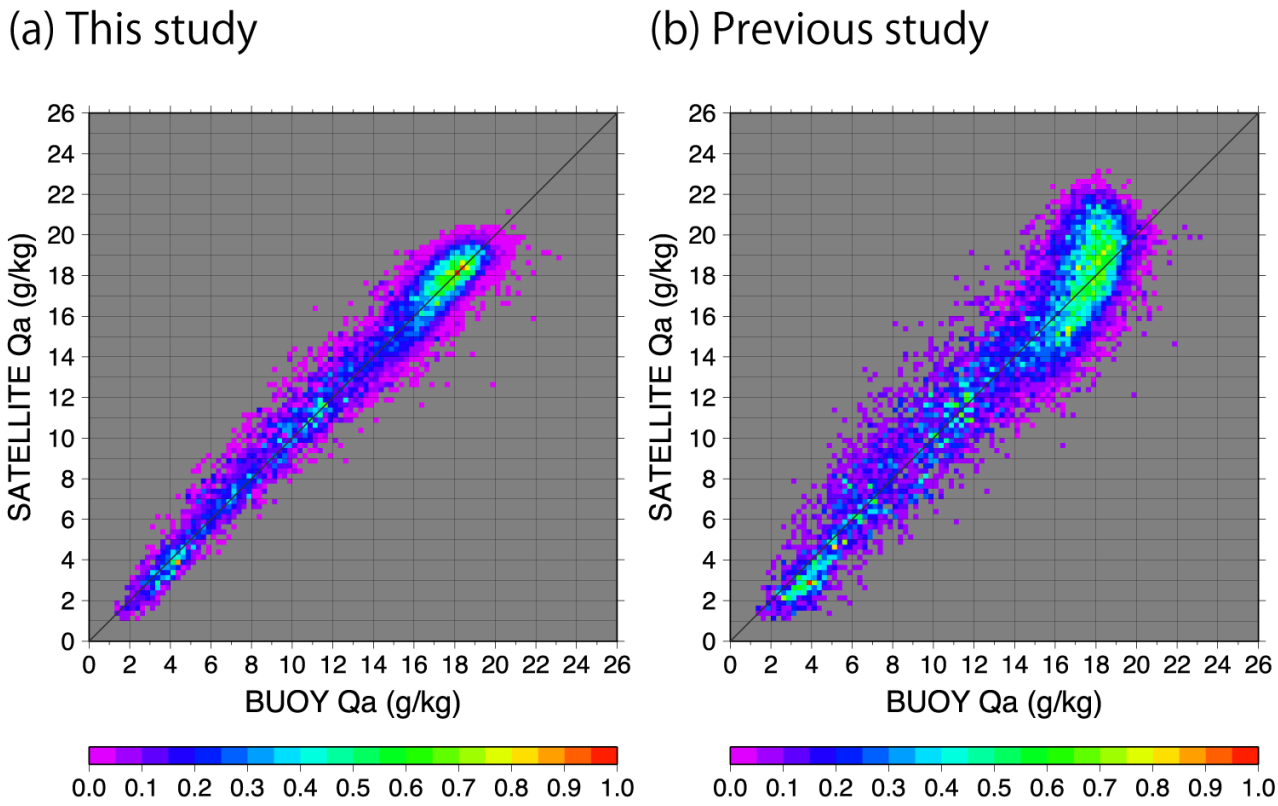

Scatter diagrams between in situ (buoy) and satellite esitimates of (a) this and (b) previous studies. Colors mean normalized data desnsity

