Monitoring of the Rainfall using Marine X-band radar

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Weather radars are operating at a higher site than the surrounding area in order to prevent the terrain from blocking the beam. This causes a quantitative error to the rainfall estimation near the surface, even though radar observations are useful over the sea where in situ observation is difficult. The marine radar has a shorter detecting radius than the weather radar, but can detect targets with higher spatial resolution. We modified a marine radar to estimate quantitative precipitation in order to fill the gap of the weather radar. The analogue-to-digital converter has been developed to extract the precipitation signal from the marine X-band radar. The terrain clutter and vessel included in the precipitation signal were removed by a clutter map. The attenuation of the precipitation signal due to the increase of beam volume were improved by applying the beam attenuation and volume correction factor depending on the distance. We have developed an algorithm to estimate the quantitative rainfall from the marine X-band radar signal based on the linear relationship between the rainfall measured by rain gauge on the ground and the marine X-band radar precipitation signal. This result was validated by comparison with the rainfall by rain gauge on the ground. The precipitation distribution over 5 mm hr^{-1} of the marine X-band radar was consistent with that of the weather radar and the movement of the precipitation echo can be monitored in real time on higher spatial and temporal resolution than the weather radar. This study suggests a new observation technique to complement the temporal and spatial gaps of weather radar and to forecast for the risk of severe weather over coastal region.

Keywords: marine X-band radar, rainfall, observation

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Weather radars are operating at a higher site than the surrounding area in order to prevent the terrain from blocking the beam. This causes a quantitative error to the rainfall estimation near the surface, even though radar observations are useful over the sea where in situ observation is difficult. Although the marine radar covers a shorter detecting radius than the weather radar, but it can detect targets with higher spatial resolution. We modified a marine radar to estimate a quantitative precipitation for the purpose of filling the gap of the weather radar. The analogue-to-digital converter has been developed to extract the precipitation signal from the marine X-band radar. The terrain clutter and vessel included in the precipitation signal were removed by a clutter map. The attenuation of the precipitation signal by the increase of beam volume was improved by the volume correction factor depending on the distance. We have developed an algorithm to estimate the quantitative rainfall from the marine X-band radar signal based on the linear relationship between the rainfall measured by rain gauge on the ground and the marine X-band radar precipitation signal. This result was validated by cross-checking with the rainfall from rain gauge on the ground. The precipitation distribution over 5 mm hr^{-1} of the marine X-band radar was consistent with that of the weather radar and the movement of the precipitation echo can be monitored in real time on higher spatial and temporal resolution than the weather radar. This study suggests a new observation technique to complement the temporal and spatial gaps of weather radar and to keep forecasting a risk of severe weather.

Keywords : marine radar, X-band radar, rainfall,

