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# Typhoon-induced Wind and Wave Simulation in Suo-nada Bay

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## ABSTRACT

This study examined the method to input typhoon bogus in meteorological objective analysis dataset provided from JMA or NCEP, simulate the meteorological field by using the Mesoscale Model MM5 with the data assimilation of the typhoon intensity and track, and simulate waves by using the third generation wave prediction model WAM. The simulation introduced much more precise sea surface wind and wave prediction in Suo-nada Bay, Japan surrounded with high mountains for several typhoons than the previous simulation with conventional simulation with an empirical two-dimensional typhoon model and the MASCON model.

KEY WORDS: meteorological objective analysis dataset ; Mesoscale Model MM5 ; typhoon bogus ; data assimilation ; the third generation wave model WAM ; typhoon model ; inner bay

## INTRODUCTION

In Japan, Typhoon No.9918, Bart, in 1999 made landfall to Kyushu Island of Japan, and many coastal structures and peoples were damaged by waves and storm surge induced by Bart. When we have to examine the coastal disaster induced by waves, it is very important to understand wave conditions at that time. In such a case, an observed wave data is very useful for clarifying the cause of the wave disaster. However, we can not exactly obtain the observed wave data for some reasons. For that case, we simulate wave field by numerical wave model with sea surface wind data to obtain wave information about high wave condition.

It's well known that estimation accuracy of wave simulation greatly depends on accuracy of sea surface wind field. The wind field of typhoon is very locally compact and strong, and typhoon moves very fast under the influence of interaction between typhoon and surrounding meteorological field, for example jet stream and synoptic meteorological field. Therefore, we have to estimate typhoon intensity and position, i.e. typhoon track, with high accuracy in order to estimate wave field with high accuracy. Obviously, we also have to estimate synoptic meteorological field included the typhoon with high accuracy because typhoon track is generally decided by synoptic meteorological field around typhoon.

In practical use, sea surface wind field is estimated with an empirical two-dimensional typhoon model (Myers, V. A. and Malkin, W., 1961; Fujita, 1952, and so no). The wind field estimated with the two-dimensional typhoon model is sometimes adjusted with the MASCOM model (Sasaki, 1958, 1970a, 1970b; Sherman, 1978) in order to consider the effect of surrounding terrain to wind field, especially in inner bay surrounded with high mountains. The MASCON model is mathematical method by continuous equation based on variation method. We have used an empirical two-dimensional typhoon model and the MASCON model to estimate the wind field in inner bay in practical use for long time.

The two-dimensional typhoon model is very simple and useful model based on central pressure and radius of maximum wind speed of typhoon. But the estimation accuracy of the wind field by typhoon model is not occasionally so high because the typhoon model is not based on meteorology, and does not consider surrounding meteorological field except the typhoon and effect of terrain. In consequence, there are some cases that the estimation accuracy of wave simulation with wind field estimated by typhoon model is not occasionally high, especially in inner bay.

In this research, we examined estimation accuracy on numerical model of sea surface wind and wave fields during typhoon in inner bay. We simulated wind field by the Mesoscale Model MM5 with typhoon bogus and data assimilation by using meteorological objective analysis dataset, RANAL, provided from Japan Meteorological Agency (JMA), then wave field was simulated by the third generation wave model WAM. For comparison with MM5 result, we also simulated wind field by a typhoon model and the MASCOM model. The typhoon model has been used in practical use for long time to calculate wind field needed