CONSIDERATION OF STORM SURGE CAUSED BY HURRICANE IRMA BASED ON STOC-WRF COUPLING MODEL

Taro Arikawa, Chuo University, arikawa.38d@g.chuo-u.ac.jp
Katsumi Seki, Chuo University, seki-k.15e@g.chuo-u.ac.jp
Takuto Haga, Chuo University, a13.jjnp@g.chuo-u.ac.jp
Kazuhiro Fujiwara, Chuo University, a14.xr7a@g.chuo-u.ac.jp

INTRODUCTION
Hurricane Irma occurred in the Atlantic Ocean in 2017. It has developed to Category 5, the maximum wind speed is about 82.7 [m/s], minimum central pressure is about 914 [hPa]. Because there is concern that the risk of storm surge due to global warming is increasing, it is important to predict storm surge for prevention of the disasters. For that purpose, it is important to construct a method that can predict local area phenomena. Therefore, in this study, to achieve that purpose, a methodology of downscaling the mesoscale data is developed by using the STOC-ML and WRF, and the applicability is verified to the storm surge due to Irma. In addition, wave set up is also estimated using SWAN and the characteristics of Irma is considered.

METHODOLOGY
In order to calculate storm surge using storm surge simulator, STOC-ML developed by Tomita et al. (2005). In this study, the meteorological data was prepared by interpolating the calculated data of WRF, which developed by Skamarock et al. (2008). Specifically, using the NCEP FNL (Final) data as initial and boundary condition, which are on 0.25-degree by 0.25-degree grids, were interpolated in time space using the WRF. Also, the third generation wave prediction model, SWAN developed by Ris et al. (1999), was applied by using this interpolation data. Figure 1 shows the method for applying the meteorological data calculated by WRF to STOC-ML and SWAN.

NUMERICAL RESULTS
Figure 2 shows time series of minimum central pressure and maximum sustained winds. They are good agreement with NOAA's data. Figure 3 and 4 show calculated distribution of storm tide and significant wave height.

CONCLUSION
The calculated storm surge which input weather condition is interpolated by WRF is compared with the observation storm tide. The result is the appropriate and also wave setup effect was considered.

ACKNOWLEDGMENTS
The authors would like to thank Mr. Y. Chida in Port and Airport Research Institute for providing insightful comments about STOC-ML.

REFERENCES
Skamarock, W. C., Klemp, J.B., Dudhia, J., Gill, D. O., Barker, D. M., Duda, M. G., and Huang, X.-Y., Wang, W., and Powers, J. G. (2008): A Description of the Advanced Research WRF Version3, NCAR Technical Note, NCAR/TN-475+STR.
Tomita T. and Kakinuma T. (2005): Development of numerical simulator STOC for storm surge and tsunami considering three dimensionality of seawater flow and application to tsunami analysis [in Japanese]. Report of the Port and Airport Research Institute, PARI 44(2), 83-98, 2005-06.
Ris, R. C., N. Booij and L.H. Holthuijsen, (1999): A third-generation wave model for coastal regions, Part II, Verification, J. Geophys. Res. C4, 104, 7667-7681.

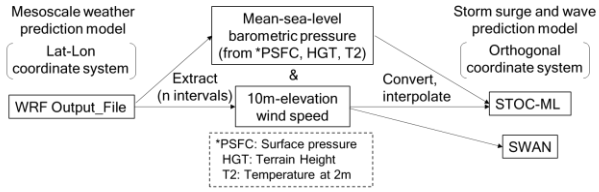

Figure 1 - Method for applying WRF to STOC-ML and SWAN

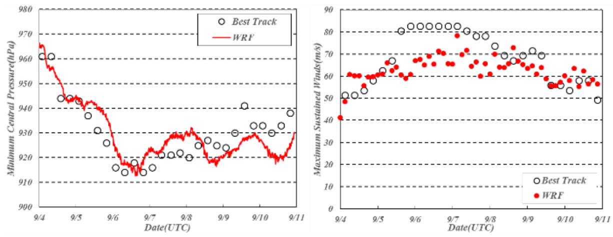

Figure 2 - Calculated minimum central pressure and maximum wind speed and Best Track

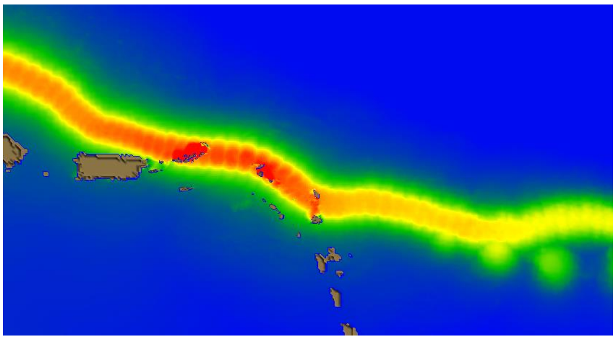
Figure 3 - Maximum storm tide distribution calculated by STOC-ML

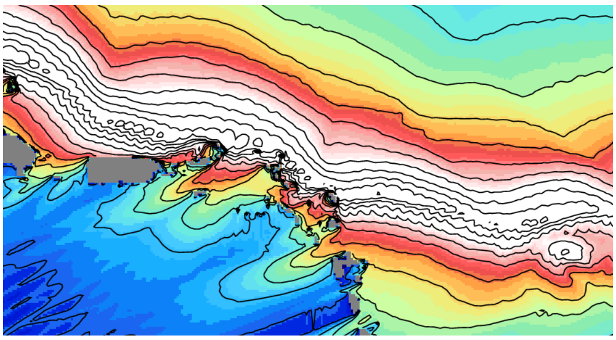
Figure 4 - Maximum significant wave height distribution calculated by SWAN