Li, T.-H., and Y. Wang, 2021: The role of boundary layer dynamics in tropical cyclone intensification. Part I: Sensitivity to surface drag coefficient. *J. Meteor. Soc. Japan*, **99**, https://doi.org/10.2151/jmsj.2021-027

Plain Language Summary: Most previous studies have found that the intensification rate of a tropical cyclone (TC) simulated in high resolution numerical models is often insensitive to surface drag coefficient (C_D) or surface friction. A new explanation to this finding has been provided in this study based on the hypothesis that although surface friction has dual opposite effects: negative direct frictional dissipation effect and indirect positive effect by strengthening and inwardly shifting eyewall updrafts/convection. We have demonstrated that the increased/reduced positive indirect effect of surface friction is roughly offset by the increased/reduced negative direct dissipation effect due to increased/reduced C_D. As result, the intensification rate of the simulated TC is insensitive to C_D (Figure 1). However, increased C_D can result in earlier onset of the intensification stage through increasing frictional moisture convergence and Ekman pumping and thus moistening of the inner-core column of the TC vortex, but would lead to a weaker storm in the mature stage.

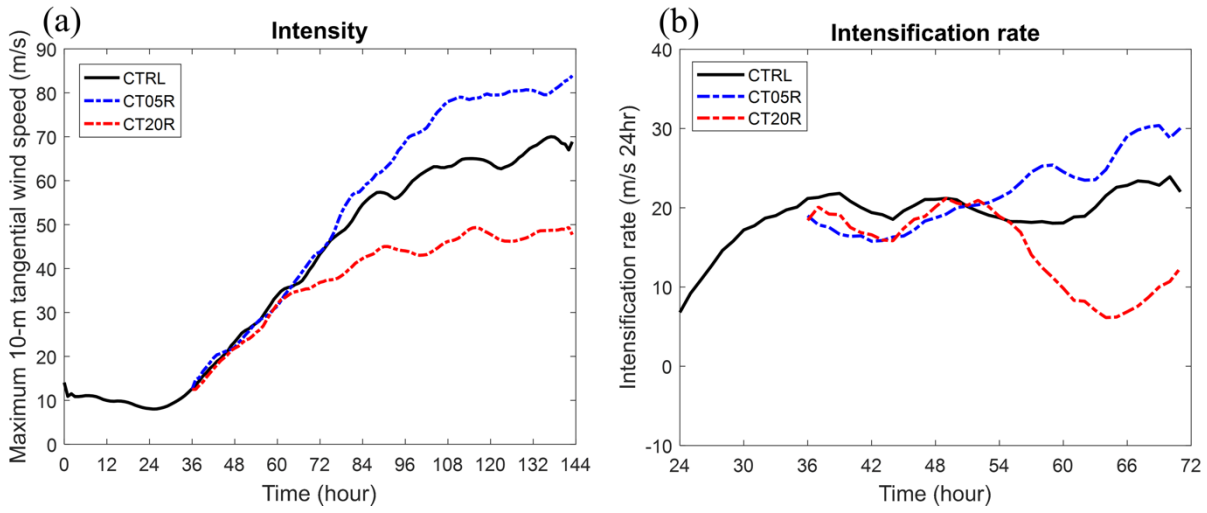

Figure 1. The time evolution of intensity and intensification rate of the simulated TC in three experiments: CTRL with the default C_D, CT05R with C_D reduced by half, and CT20R with C_D doubled. The halved and doubled C_D were activated after the initial 36-h model spinup.

- Although surface friction has a dissipation effect on kinetic energy of the TC system, it can strengthen and inwardly shift the eyewall updrafts and contributes positively to TC intensification.
- The increased/reduced dual (positive and negative) effects above due to increased/reduced C_D are nearly offset each other, leading to an insensitivity of the simulated TC intensification rate to C_D.
- Increased C_D can lead to increased frictional moisture convergence and Ekman pumping and thus moistening of the inner-core column of the TC vortex and earlier onset of the intensification stage, but would lead to a weaker storm in the mature stage.