

Influence of Different PBL Schemes on Secondary Eyewall Formation and Eyewall Replacement Cycle in Simulated Typhoon Sinlaku (2008)

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The effects of the different planetary boundary layer (PBL) processes on the secondary eyewall formation (SEF) and eyewall replacement cycle (ERC) in Typhoon Sinlaku (2008) are investigated by using the Weather Research and Forecasting Model (WRF) with six different PBL schemes. The SEF and ERC have been successfully simulated with all the six PBL schemes and the mechanism of the SEF and ERC proposed in our previous study has been reconfirmed: It is demonstrated that both the intensification of the storm and the inward-moving outer spiral rainband contribute to the SEF. After the SEF, the associated diabatic heating enhances the secondary eyewall further and transfer of the moist air from outer region to the primary eyewall is cut off by the secondary eyewall. In such a way the primary eyewall dies and an ERC completes.

It is found that some simulated features of the SEF and ERC, such as the time and location of the SEF and duration of the ERC, do vary from one simulation to another. In order to describe the feature of the SEF and ERC quantitatively, a concentric eyewall index (CEI) is defined and a threshold of the CEI is suggested to determine the onset of the secondary eyewall. The differences of the simulated SEF and ERC are discussed and some possible causes are suggested. In addition, based on the threshold of the CEI and the conservation law of the angular momentum a formula to predict the location of the SEF is also suggested and applied to all the six simulations. The success and failure of the formula are also discussed.

Key words: eye-wall replacement cycle, secondary eye-wall formation, PBL scheme, CEI