Geophysical Research Abstracts
Vol. 17, EGU2015-1250, 2015
EGU General Assembly 2015

Comparison in Schemes for Simulating Depositional Growth of Ice Crystal between Theoretical and Laboratory Data

Guoqing Zhai (1) and Xiaofan Li (2)

(1) Department of Earth Sciences, Zhejiang University, Hangzhou, China (zhaigq@zju.edu.cn), (2) Department of Earth Sciences, Zhejiang University, Hangzhou, China (xiaofanli@zju.edu.cn)

The Bergeron-Findeisen process has been simulated using the parameterization scheme for the depositional growth of ice crystal with the temperature-dependent theoretically predicted parameters in the past decades. Recently, Westbrook and Heymsfield (2011) calculated these parameters using the laboratory data from Takahashi and Fukuta (1988) and Takahashi et al. (1991) and found significant differences between the two parameter sets. There are two schemes that parameterize the depositional growth of ice crystal: Hsie et al. (1980), Krueger et al. (1995) and Zeng et al. (2008). In this study, we conducted three pairs of sensitivity experiments using three parameterization schemes and the two parameter sets. The pre-summer torrential rainfall event is chosen as the simulated rainfall case in this study. The analysis of root-mean-squared difference and correlation coefficient between the simulation and observation of surface rain rate shows that the experiment with the Krueger scheme and the Takahashi laboratory-derived parameters produces the best rain-rate simulation. The mean simulated rain rates are higher than the mean observational rain rate. The calculations of 5-day and model domain mean rain rates reveal that the three schemes with Takahashi laboratory-derived parameters tend to reduce the mean rain rate. The Krueger scheme together with the Takahashi laboratory-derived parameters generate the closest mean rain rate to the mean observational rain rate. The decrease in the mean rain rate caused by the Takahashi laboratory-derived parameters in the experiment with the Krueger scheme is associated with the reductions in the mean net condensation and the mean hydrometeor loss. These reductions correspond to the suppressed mean infrared radiative cooling due to the enhanced cloud ice and snow in the upper troposphere.