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Dependency of Numerical Weather Prediction on the Vertical Resolution in Global Atmospheric Model

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High resolution for vertical layers has the capacity for providing an improved representation of significant weather prediction in global atmospheric model. Recent advances in available computation power support global simulations with quite fine vertical resolution atmospheric model. Thus, in this study, we address the impacts of changes in vertical resolution on simulated atmosphere structure and precipitation in a global atmospheric model. For the purpose, two experiments are performed; the control experiment employs the 64 hybrid sigma-pressure vertical levels and lowest model level height of 18m. The other was designed with increased vertical levels (91 layers) and smaller lowest model level height (10m) which is able to change the vertical structure of atmosphere and affect surface layer similarity. As decreasing vertical grid spacing and lowest model level height, the atmospheric temperature generally is reduced by enhanced vertical turbulent mixing, and atmospheric water vapor increases over the troposphere due to increased latent heat flux from the ocean to the atmosphere. This results in increase of cloud liquid water and decrease of cloud ice water and downward shortwave radiation at the surface. Besides, non-convective precipitation increases owing to enhancing large scale condensation rate, whereas convective precipitation decreases over the tropics. Furthermore, model performance is improved, especially temperature and specific humidity in the lower troposphere, throughout the systematic bias and root-mean-square error (RMSE) against GFS-FNL analysis data.