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Sensitivity Tests about Stability Function Change of the Local Scheme in Boundary Layer Parameterization of NWP model

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This is a sensitivity study about stability function which decides the K-profile of the local scheme in boundary layer scheme of NWP(Numerical Weather Prediction) models. Stability function is a factor to decide to K-Profile which consists of mixing length and vertical wind gradient. We conduct sensitivity experiments using the SCM(Single Column Model) and the global model. We apply the revised Louis-Tiedke-Geleyn(Viterbo et al., 1999) method(EXP2) stability function instead of the SHARP(Beare et al., 2004) and Long Tail(Beare et al., 2004) method(CTL) for stability conditions. For unstable conditions, the Troen-Mahrt (Troen and Mahrt 1986) method(EXP1) stability function is applied instead of Holtslag-Boville(Holtslag and Boville 1993) method(CTL). As a result of SCM experiments, EXP1 and EXP2 overestimate surface heat fluxes and underestimate temperature and specific humidity at 1.5m compared to CTL. In vertical temperature and specific humidity analysis results, the temperature is higher than CTL and the humidity is lower than CTL below the 850hPa. On the other hand, the temperature is lower and the humidity is higher than CTL over the 850hPa. In short, sensitivity tests indicate that air condition is drier at low layer and moister at upper layer than CTL case.
We analyze time series about variety boundary layer variables such as surface fluxes, temperature at 1.5m and wind stress for global model experiments. As a result, while sensitivity tests are similar to CTL during initial 5days among total prediction time and the variables have a difference compared to CTL case after initial 5 days. In vertical structure analysis about variables, vertical velocity have an effect temperature and humidity at low levels as vertical velocity of EXP1 and EXP2 is stronger than CTL at the low levels after initial 5 days.
Sensitivity tests show that variables such as temperature, specific humidity and vertical velocity overestimate at low levels including boundary layer. As a result, the low levels of sensitivity tests are more instability than low levels of the CTL case.