Higher Vertical Resolution for Select Physical Processes in the Energy Exascale Earth System Model (E3SM)

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Coarse vertical resolution in the current global climate models may be a significant cause of low cloud bias because planetary boundary layer parameterizations, including higher-order turbulence closure (HOC), cannot resolve sharp temperature and moisture gradients often found at the top of subtropical stratocumulus layers. The aim of this work is to implement a new computational method, the Framework for Improvement by Vertical Enhancement (FIVE) into the Energy Exascale Earth System Model (E3SM). Three physics schemes are interfaced to vertically enhanced physics (VEP), which allows for these schemes to be computed on a higher vertical resolution grid compared to rest of the E3SM model. In this study, we use VEP for turbulence, microphysics, and radiation parameterizations and demonstrate better representation of subtropical boundary layer clouds while limiting additional computational cost from the increased number of levels.