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Modelling momentum transport in climate simulations of boundary-layer winds with a higher order parameterization scheme

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Accurate modelling of sub-grid momentum flux is crucial for reliable climate simulations of the boundary-layer wind. While first-order momentum flux parametrizations often employed in leading climate models are crude, consisting in a downgradient diffusion scheme with a separate cumulus momentum transport scheme, higher-order turbulence parametrizations which directly prognose the momentum flux are more flexible and general, adhering more closely to the governing equations.

Here, we present the results of studying the sensitivity of the AM4-GFDL global climate simulations of the boundary-layer wind to a first-order, diagnostic, and a higher-order, prognostic, sub-grid momentum flux parametrization. Moreover, we demonstrate how the boundary-layer wind turning angle can be effectively used as a metric to evaluate the impact of changing the sub-grid momentum flux parametrization on the boundary-layer wind structure.