Evaluation of a tensor eddy-diffusivity model for the terra incognita using DNS data

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As the resolution of numerical weather prediction (NWP) models continues to increase it is becoming critically important to re-examine the appropriateness of existing sub-grid parametrizations. Similarly, except at the highest resolutions, details of the sub-filter model in large-eddy simulations (LES) of the atmospheric boundary layer can affect results significantly. There is therefore a clear need for better parametrizations of turbulence for both LES and NWP applications. A new approach proposed by Wyngaard (2004) generalises the scalar eddy diffusivity in the standard Smagorinsky sub-filter model to a tensor by considering the effect of extra production terms in the sub-filter scale conservation equations that are usually neglected. The importance of these extra terms is diagnosed by direct computation using a direct numerical simulation (DNS) dataset and the resulting model for the sub-filter scale fluxes is then evaluated. Results are compared with Wyngaard's own computations using observational data.