Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Revisiting eddy diffusivity models in geophysical boundary layers

TOMAS CHOR, JAMES MCWILLIAMS, MARCELO CHAMECKI, University of California, Los Angeles — Eddy diffusivity models have proved invaluable when modeling turbulent fluxes in many situations. However, in atmospheric and oceanic boundary layers, large-scale motions (for example convective plumes and Langmuir circulations) do not conform to the usual assumptions necessary for their application. This has prompted the creation of several ad-hoc models, each designed to work under rather specific conditions, and each of them often failing to work well outside their intended operating area. In this work we present an alternative unifying solution that estimates the total eddy diffusivity without a priori assumptions about its shape or scaling. The approach is based on the fact that the eddy diffusivity should depend only on the flow, which we use as a basis for an optimization procedure that uses Large-Eddy simulation data. The result of our approach is that most of the fluxes are modelled with an eddy diffusivity, while the rest (which depends on specific sources of scalars and is attributed to large scale motions) is modelled as non-diffusive processes. We present an application of our proposed approach to the classic case of a convective boundary layer and show that we are able to predict the heat flux from quantities measured using passive tracers.

Tomas Chor
University of California, Los Angeles

Date submitted: 31 Jul 2019 Electronic form version 1.4