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Potential Vorticity Conservation and Homogenization : Unifying Concepts for Self-Consistent Models of Drift Wave Turbulence P.H. DIAMOND, O.D. GURCAN, University of California, San Diego, T.S. HAHM, P.P.P.L., P.K. KAW, I.P.R., India — We identify a local, exact inviscid invariant of the 3D Hasegawa-Wakatani system, including dynamics (i.e. instability). This invariant is the total potential vorticity (PV). Consideration of PV dynamics facilitates a unified picture of several themes frequently encountered in the modelling of turbulence and transport. Most interesting, however, is the observation that in the absence of sources and sinks, conservation of the mean PV flux forces the sum of the particle flux and vorticity flux to be constant. Thus, recall that the vorticity flux is simply the gradient of the Reynolds stress, the constancy of PV flux implies that a jump in the flow shear amplification across a layer in which the density flux drops. This suggests that the density flux is 'inverted' to a vorticity flux and shear amplification. We also discuss generalizations of mixing length theory, upper bounds on driven sheared flow, and extensions to more complex models.

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