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Linear forcing for numerical generation of anisotropic turbulence field

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Summary: A new numerical method to generate anisotropic turbulence field in the large eddy simulation was proposed. Based on the assumption that the mean shear is the only external force to maintain the structural equilibrium of the small-scale turbulence,appropriate forcing component is estimated from the energy balance under the conditions of arbitrary energy dissipation rate and stratification. Removing nonlinear operation from the forcing process enables the stability and accuracy of the calculation. The energy dissipation rate, which can also be estimated by the turbulence model, had the error of at most 7 %, compared with the set value. Several calculations under the conditions of fixed stratification and different dissipation, the both of which are representative in the mixed layer of the open ocean were conducted. It was found that the Richardson number at the structural equilibrium increases with the decrease of energy dissipation rate, corresponding to the increase of the stability of stratified turbulence. The present method is applicable to the investigation of various phenomena in the small-scale stratified turbulence, such as turbulence diffusion of heat and mass in the ocean.