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Geometrical alignment between SGS stress and its production rate<sup>1</sup> CHENNING TONG, XINGSHI WANG, Clemson University — The conditional SGS stress and conditional SGS stress production rate evolve the joint probability density function of the resolvable-scale velocity. We examine the orientations of the eigenvectors of the SGS stress and the SGS stress production rate using data obtained in the atmospheric boundary layer. The results show that the pdf of the relative angles between the eigenvectors of these are concentrated in three regions representing three alignment modes: (a) Their corresponding eigenvectors are in near perfect alignment; (b) The eigenvectors for their largest eigenvalues are aligned; (c) The eigenvectors for the intermediate production and the smallest SGS stress eigenvalues are aligned. The overall alignment is better than that between the SGS stress and the resolved strain rate. The production of SGS energy is largest in (a) and is smallest in (c). The probability for mode (a) is larger for positive vertical velocity whereas that for (c) is larger for negative vertical velocity. Consequently, the two tensors are better aligned when the vertical velocity is positive. These three regions correspond to three modes of alignment between the SGS stress and the resolvable strain rate. The results are important for understanding the SGS dynamics and for SGS modeling involving the SGS stress production.

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