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Panel Discussion of Vertical Winds

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Are vertical winds affected by vertically stratified horizontal winds?

To infer U_z from measured gradients of $\mathbf{U}_{hor}$, Burnside et al., (J. Geophys. Res., 86, 5532, 1981) derived the expression

$$U_z = (\nabla_{hor} \bullet \mathbf{U}_{hor}) H \ , \ \text{with} \ H = H_n \ .$$

Simultaneous measurements of U_z and $(\nabla_{hor} \bullet \mathbf{U}_{hor})$ by R. Crickmore (Ann. Geophysicae, 11, 728, 1993) show that

$$H \cong 5H$$

with data from many nights of observation at Halley in Antarctica.

Does a vertically stratified $\mathbf{U}_{hor}$ that increases with height affect U_z significantly? Combining

$$\mathbf{U}_{hor} = \mathbf{U} \exp(-z / H_U) \ \text{ and}$$

$$\rho = \rho_0 \exp(-z / H_n)$$

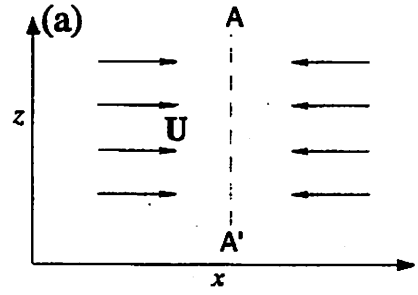
give a momentum density

$$\rho \mathbf{U}_{hor} = \rho_0 \mathbf{U} \exp(-z / H) \ , \ \text{where} \ H = \frac{H_n H_U}{H_n + H_U} \ .$$

A new derivation of an expression for U_z preserves the form of the equation above but with the new value for H. That is,

$$U_z = (\nabla_{hor} \bullet \mathbf{U}_{hor}) H \ , \ \text{with} \ H = \frac{H_n H_U}{H_n + H_U} \ .$$

$$H_U = -1.2 H_n . \ \text{gives} \ H = 5 H_n \ .$$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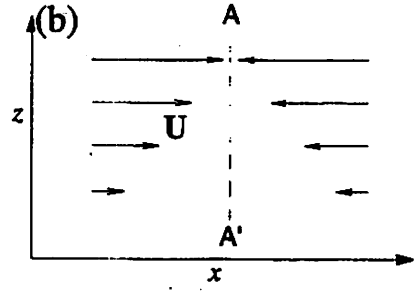
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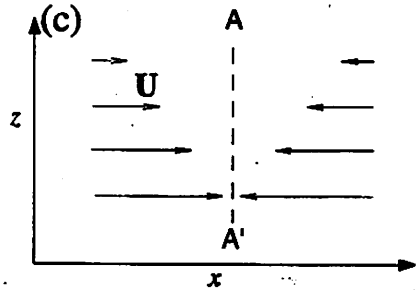
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