LETTER TO THE EDITOR

Dear Sir:

The paper by Welander (1966) points out that in a rotating gas with a radial temperature or momentum gradient there is a zonal component of diffusion at right angles to the gradient; i.e. along the isolines of temperature or momentum, such as to keep the highest value of the quantity to the right when facing the direction of the flux. It is especially interesting to note that molecular diffusion results in a zonal flux which is much smaller than that down the gradient, while in the case of a turbulent fluid these two components can be of equal magnitude.

These conclusions have some resemblance to the results of a statistical study I made of the eddy flux of vorticity at 700-mb over North America during February 1950 (Clapp, 1956). In that case the flux was due to even larger eddies, represented by synoptic-scale transient cyclones and anticyclones. A component of flux was directed along the isolines of mean-monthly absolute vorticity; this parallel flux being much larger than the cross-gradient component. This result is perhaps not too surprising if it is permissible to extend the molecular-diffusion theory to include the effect of the even larger macro-scales of turbulence. What may be rather unexpected is the finding that the flux to the right of the vorticity gradient averaged out to be almost the same magnitude as that to the left. Furthermore, the small residual vector flux had a minor component directed toward higher mean vorticity values and its major component to the *left* of the vorticity gradient.

Perhaps it is not possible to draw an analogy with molecular diffusion, because transport by macro-scale transient eddies is not homogeneous in any respect. Furthermore, vorticity has a shearing part as well as rotation, and monthly-mean flow is not zonal but may be in any direction. Nevertheless, it would be of great value if either a theoretical or a statistical approach could provide a clue to a rational theory of macro-scale turbulence.

Sincerely yours,

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REFERENCES

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Welander, P. 1966. Note on the effect of rotation on diffusion processes. *Tellus 18*, 63–66.