

ROYAL METEOROLOGICAL SOCIETY: AUSTRALIAN BRANCH MEETING

10 August 1978

Synoptic Systems as Mechanisms of Meridional Eddy Transport

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The importance of eddy transfer processes in the global heat and momentum budgets has been recognised for a number of years. The need to parameterise such eddy fluxes in climate models has led to a renewal of interest in baroclinic instability theory. Analysis of linear (developing) waves produces reasonable agreement with the observed latitudinal structure of heat and momentum fluxes. However, Dr Tucker (Chief, CSIRO Division of Atmospheric Physics) presented synoptic arguments and numerical model results to show that the structure and indeed the character of heat and (particularly) momentum fluxes shows considerable variation over the life cycle of a synoptic disturbance.

Atmospheric eddies are observed to develop preferentially at low latitudes and to migrate towards the poles before decaying. The speaker posed the question: is it possible to explain the observed latitudinal structure of eddy fluxes purely as a function of age of synoptic systems? The cloud vortex classification structure of Stretten and Troup was used to express the population density in each latitude band of vortices in the developing, mature, and decaying stages (southern hemisphere, both equinoctial and summer seasons). Data on the latitudinal structure of transient eddy fluxes (integrated up to 100 mb) in the southern hemisphere were obtained from an ANMRC general circulation model, and were shown to be in reasonable agreement with available observational data.

Assuming a constant flux index for each eddy in a given stage of development Dr Tucker then presented results obtained by finding the best fit to the flux data. This technique was shown to fit the heat flux data rather well. In order to explain the momentum flux structure it was found necessary to add a fourth index independent of the transient eddies. This was interpreted as representing the contribution of transient long waves and in the first instance was taken to be independent of latitude. Thus it was found that developing and mature systems transport westerly momentum poleward; for decaying systems the transfer is equatorward. This age dependence is in accord with numerical model results; from Dr Tucker's viewpoint, then, the observed equatorward momentum flux at high latitudes results from the dominance of decaying vortices in such regions. It was therefore suggested that linear baroclinic wave theory is inadequate to provide information on the transfer properties of mature and decaying systems.

The speaker went on to infer the properties of the energy cycle of the transient eddies. He also speculated on how certain refinements to his analysis might improve agreement with observations. There followed considerable discussion. A particular point was the relatively large magnitude of the fourth (constant) flux index and some members of the audience expressed reservations about the validity of the results in view of the inclusion of this large residual parameter.

Forty members were present.

R.A.P.

