Indian J. Met. Hydrol. Geophys. (1978), **29**, 1 & 2, 273

551·553·21 : 551·511

*On the role of the Asian monsoon in the angular momentum and kinetic energy balances of the tropics**

ABRAHAM H. OORT and PAUL H. CHAN†

Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, Princeton, New Jersey, U.S.A.

ABSTRACT

The balance conditions of angular momentum and time-mean kinetic energy and their annual variations are studied for the northern hemisphere tropical belt. The belt is divided into two roughly equal-sized parts, the monsoon and the extramonsoon regions. The data used consist of all available daily rawinsonde reports from the world aerological network for the two 5-year periods 1958-63 and 1968-73.

In winter, the trade winds in the monsoon and extramonsoon regions are both sources of relative westerly angular momentum for the middle latitude circulation. However, it is found that the angular momentum gained in the extramonsoon region of the tropics (26 Hadley) is mostly destroyed by a net southward flow of mass in that region (on the order of 30 cm sec^{-1}), and becomes regenerated in the monsoon region by a net northward flow of mass there. This excess of angular momentum together with the angular momentum picked up locally in the monsoon region (17 Hadley) is almost all exported across its northern boundary (35 Hadley). It is further found that in winter the tropics are also an important source of mean kinetic energy for middle latitudes. Again almost all export of kinetic energy was found to take place across the northern boundary of the monsoon sector. Most of this energy must be generated through the pressure gradient term inside the monsoon region itself (about 4 watt m^{-2}), the transformation from transient eddy kinetic energy being very small. The proper evaluation of the zonal pressure gradient appears to be the main stumbling block in the present study, preventing us from estimating the generation and thereby, as a residual, the frictional dissipation in the two regions.

In summer, the extramonsoon region remains a source of angular momentum (20 Hadley), but the monsoon region with its surface westerlies acts as a sink (—18 Hadley), leading to a sharp reduction (and even a midsummer reversal) of the export into middle latitudes. Also the export of mean kinetic energy almost vanishes in summer, except for a small southward transfer across the equator. Probably most of the summer generation and dissipation of mean kinetic energy in the tropics (about 1 watt m^{-2}) occur in the monsoon sector itself without appreciable exchange with other regions. The calculations for two 5-year periods give very similar estimates and thereby show the reliability of the results.

*Full paper published in *J. Pur. appl. Geophys.*, **115**, p. 1167.

†Geophysical Fluid Dynamics Program, Princeton University.