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Left-hand rule for Synoptic eddy and Low-frequency Flow Interaction

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Abstract

In this study, scale interaction between synoptic eddies and low-frequency flow is investigated. It is demonstrated that there is a general rule, name as "Left-Hand Rule", to reveal a role of synoptic eddy feedback onto low-frequency flow. This rule indicates that low-frequency anomalies systematically stir and deform the transient eddies in such a way that net anomalies in the eddy-vorticity fluxes are directed preferentially about 90 degrees towards their left-hand side, thus this eddy positive feedback plays a role in maintaining and prolonging low-frequency flow under the stormy atmosphere. As well as the eddy-vorticity flux, we demonstrate here that the eddy-temperature and moisture fluxes are also preferentially about 90 degrees toward the left-hand side of the low-frequency flow in the northern hemisphere. The temperature fluxes and their vertical structure play a role in constructing equivalent barotropic structure of the low frequency flow. The moisture fluxes play a role in enhancing low-frequency flow by providing eddy-induced convective instability. Finally, we show that the potential vorticity flux by synoptic eddies also follow the Left-hand rule, indicating that the eddy vorticity and temperature fluxes play a role in enhancing low-frequency flow.