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Transport Induced by Mean-Eddy Interaction: II. Analysis of Transport Processes

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We present a framework for the analysis of transport processes resulting from the mean-eddy interaction in a flow. The framework is based on the {\bf T}ransport {\bf I}nduced by the {\bf M}ean-{\bf E}ddy {\bf I}nteraction (TIME) method presented in a companion paper \cite{ide_wiggins_pd06a}. The TIME method estimates the (Lagrangian) transport across stationary (Eulerian) boundaries defined by chosen streamlines of the mean flow. Our framework proceeds after first carrying out a sequence of preparatory steps that link the flow dynamics to the transport processes. This includes the construction of the so-called "instantaneous flux" as the Hovm\"{o}ller diagram. Transport processes are studied by linking the signals of the instantaneous flux field to the dynamical variability of the flow. This linkage also reveals how the variability of the flow contributes to the transport. The spatio-temporal analysis of the flux diagram can be used to assess the efficiency of the variability in transport processes. We apply the method to the double-gyre ocean circulation model in the situation where the Rossby-wave mode dominates the dynamic variability. The spatio-temporal analysis shows that the inter-gyre transport is controlled by the circulating eddy vortices in the fast eastward jet region, whereas the basin-scale Rossby waves have very little impact.

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