

# The transfer operator approach: Limitations, ambiguities, and potential remedies

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Eddies, mesoscale masses of coherent rotating fluid volume, are considered to have a substantial impact on the the transport of heat, nutrition and oxygen in the ocean. Since coherent sets in time-dependent flows are of Lagrangian nature by definition, localizing the boundaries of eddies requires Lagrangian tools. In this respect, the use of transfer operators has proven to be a promising approach: Approximating a given, possibly time-dependent flow, as a probabilistic Markov process on a grid, this method yields coherent sets as eigenvectors related to the process' transfer operator. However, testing this approach on time-invariant Hamiltonian systems reveals ambiguities of the resulting set and limitations concerning the detection of separatrices. In our study, we aim to overcome these ambiguities and limitations by use of physical arguments.