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[Volume 9, Issue 4 \(July 1979\)](#)

Journal of Physical Oceanography

Article: pp. 847–855 | [Abstract](#) | [PDF \(598K\)](#)

Conservation Calculations in Natural Coordinates (with an Example from the Baltic)

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(Manuscript received May 30, 1977, in final form October 12, 1978)

DOI: 10.1175/1520-0485(1979)009<0847:CCINCA>2.0.CO;2

ABSTRACT

Conservation expressions for a fluid property ϕ_i^* (e.g., salt, heat) and mass are derived for a semi-enclosed, stratified region as functions of a concentration ϕ_j (e.g., salinity, temperature) and time. A method is developed for calculating the mean active and diffusive cross-isosurface transports of ϕ_i^* , $\bar{A}d(\phi_j)$ and $\bar{F}(\phi_j)$ from time-averaged “local” fluxes at points on a vertical control plane at the opening of the region. This is a particularly useful form for using automatic recording instrument data. As an example of this type of calculation, cross-isohaline advective and diffusive salt transports were calculated from recording current meter and synoptic profiling measurements in a small coastal canyon in the northwest Baltic proper. Certain requirements for the use of this method are discussed in the light of the steps taken and assumptions made in the example.

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