EGU21-7712
https://doi.org/10.5194/egusphere-egu21-7712
EGU General Assembly 2021

Effective Diahaline Diffusivities in Estuaries

Hans Burchard[1], Ulf Gräwe[1], Knut Klingbeil[1], Nicky Koganti[1], Xaver Lange[2], and Marvin Lorenz[1]
[1]Leibniz Institute for Baltic Sea Research, Physical Oceanography, Rostock, Germany (hans.burchard@io-warnemuende.de)
[2]Niels Bohr Institute, University of Copenhagen, Denmark

The present study aims to estimate effective diahaline turbulent salinity fluxes and diffusivities in numerical model simulations of estuarine scenarios. The underlying method is based on a quantification of salinity mixing per salinity class, which is shown to be twice the turbulent salinity transport across the respective isohaline. Using this relation, the recently derived universal law of estuarine mixing, predicting that average mixing per salinity class is twice the respective salinity times the river run off, can be directly derived. The turbulent salinity transport is accurately decomposed into physical (due to the turbulence closure) and numerical (due to truncation errors of the salinity advection scheme) contributions. The effective diahaline diffusivity representative for a salinity class and an estuarine region results as the ratio of the diahaline turbulent salinity transport and the respective (negative) salinity gradient, both integrated over the isohaline area in that region and averaged over a specified period. With this approach, the physical (or numerical) diffusivities are calculated as half of the product of physical (or numerical) mixing and the isohaline volume, divided by the square of the isohaline area. The method for accurately calculating physical and numerical diahaline diffusivities is tested and demonstrated for a three dimensional idealized exponential estuary. As a major product of this study, maps of the spatial distribution of the effective diahaline diffusivities are shown for the model estuary.