Scaling Relationships For Diffusive Boundary Layer Thickness And Diffusive Flux Based On In Situ Measurements In Coastal Seas

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In situ measurements of the diffusive boundary layer (DBL) and bottom boundary layer (BBL) under different dynamic and oxygen environments in three coastal seas are analyzed. Previous scaling methods for the DBL thickness (δ_{DBL}) are summarized. Three methods that lead to consistent dimensions at both sides of the derived relationships have all been rooted in the Batchelor length scale. The method representing the Batchelor length scale as a function of flow speed (U) is found to be the most appropriate for scaling δ_{DBL} when the law of wall applies. Diffusive flux is controlled by the dynamic-forced δ_{DBL} and the difference in oxygen concentration over the DBL (ΔC). Values of ΔC could be scaled using the oxygen concentration of the BBL (C_{BBL}) and the normalized benthic temperature. An effective method is developed for scaling the diffusive flux based on measurements of benthic temperature, salinity, U, C_{BBL}, and the estimation of bottom roughness. The scaling of δ_{DBL} based mainly on U and the scaling of diffusive flux well fit data from the three sites, despite their distinct differences in dynamic and oxygen environments.

Keywords: Diffusive Boundary Layer, Bottom Boundary Layer, Diffusive Flux, Sediment-water Interface

