THE CLASSIFICATION ON THE MIXING TYPES OF SALINITY INTRUSION IN THE TIDAL ESTUARY

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Several efforts have been made for the classification of the mixing types on the tidal estuary because of its importance for the estimation of mass transport such as salt, sediment or pollutant concentration etc. Two classification systems have been used widely. One is the method which uses two-parameter scheme proposed by Hansen and Ratray(1966), and the other is the method which uses estuarine Richardson number R_E proposed by Fischer(1972). We have sometimes difficulty for the application to the field because these techniques require the velocity data. The purpose of this paper is to propose new methods which use newly introduced non-dimensional bulk flow parameters easily defined at many rivers. This study also proposes a flow diagram for prediction of the local mixing types.

In order to estimate the stratification, index β (the ratio of average surface layer salinity concentration (moving average for 25 hours) to the bottom value) was introduced. For the classification of local mixing type, two parameters were proposed. One is α which estimates mixing force by tide. The other is Densimetric Froude number F_{ds} which estimates buoyant force of density intrusion from the sea.

Fig. 1 shows proposed concept to classify the local mixing types in estuaries. The curves indicate the lines of constant value of F_{ds}, relatively. One of the features of this figure is that the value of β becomes larger (larger β means stronger mixing) with increasing value of α (due to the occurrence of stronger tidal current). This means tidal current accelerate mixing between the upper layer (fresh water) and the lower layer (salt water). The other feature is that the value of β becomes smaller (small β means stratification) with increasing value of F_{ds} (the reason of this phenomenon was discussed in the paper).

To verify the proposed concept, the data of Nagara estuary (Gifu prefecture, Japan) was used (the sample of time series of data was shown in Fig.2). Comparison between the proposed conception (as shown in Fig.1) and field data was conducted and it presents good agreements. Proposed diagram and flow parameters are considered useful not only for the classification of local mixing type but also to understand the physical characteristics in the tidal estuary.

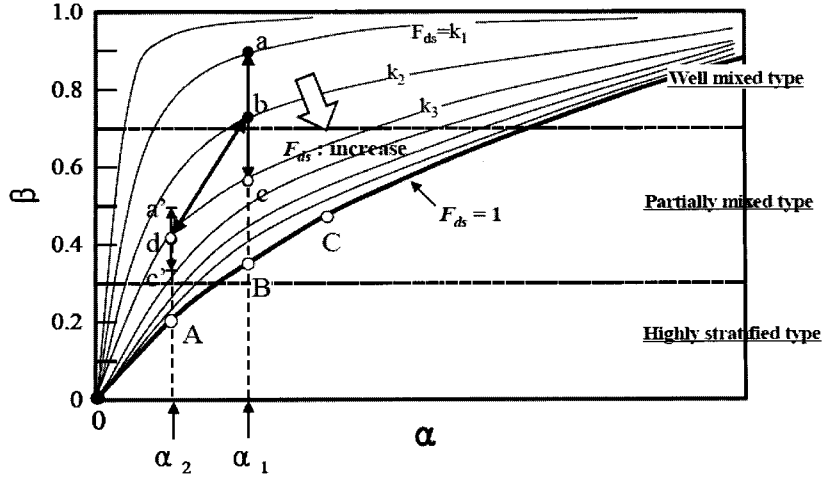

Fig. 1 flow diagram to classify estuaries

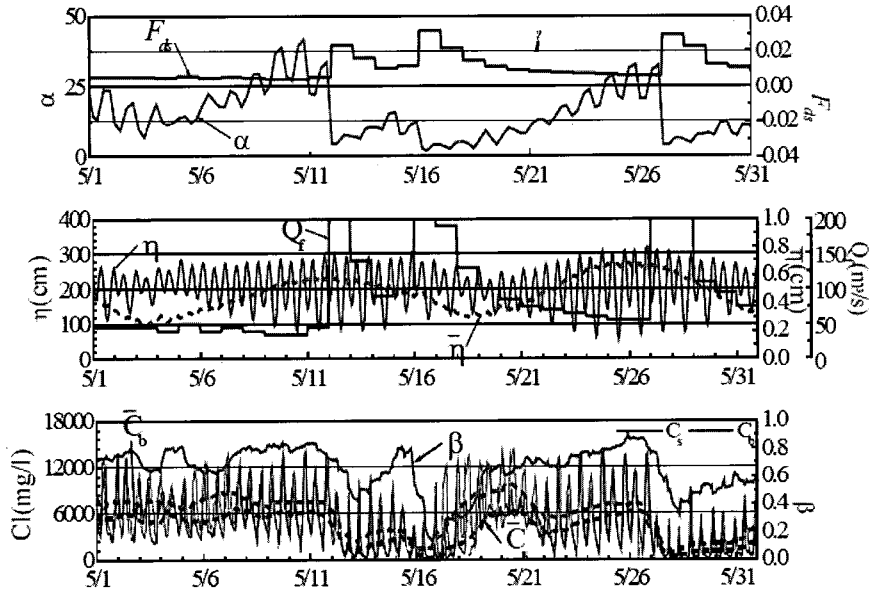

Fig. 2 rTime series of F_{ds}, α, η, Q_f *and* Cl (May, 1994) (η=water level, Q_f=flow rate of river, Cl=salinity)