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978-0-521-88886-8 - Estuaries: Dynamics, Mixing, Sedimentation and Morphology
David Prandle
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ESTUARIES

This volume provides researchers, students, practising engineers and managers access to state-of-the-art knowledge, practical formulae and new hypotheses for the dynamics, mixing, sediment regimes and morphological evolution in estuaries.

The objectives are to explain the underlying governing processes and synthesise these into descriptive formulae which can be used to guide the future development of any estuary. Each chapter focuses on different physical aspects of the estuarine system – identifying key research questions, outlining theoretical, modelling and observational approaches, and highlighting the essential quantitative results. This allows readers to compare and interpret different estuaries around the world, and develop monitoring and modelling strategies for short-term management issues and for longer-term problems, such as global climate change.

The book is written for researchers and students in physical oceanography and estuarine engineering, and serves as a valuable reference and source of ideas for professional research, engineering and management communities concerned with estuaries.

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Dynamics, Mixing, Sedimentation and Morphology

DAVID PRANDLE
University of Wales, UK

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Symbols

A	cross-sectional area
B	channel breadth
C	concentration in suspension
D	water depth
E	vertical eddy viscosity coefficient
E_X	tidal excursion length
F	linearised bed friction coefficient
	dimensionless friction term
H	total water depth $D + \varsigma$
I_F	sediment in-fill time
J	dimensionless bed friction parameter
K_z	vertical eddy diffusivity coefficient
L	estuary length
L_I	salinity intrusion length
L_M	resonant estuarine length
M_2	principal lunar semi-diurnal tidal constituent
M_4	M_6 over-tides of M_2
MS_4	MSf over-tides of M_2 and S_2
P	tidal period
Q	river flow
R_I	Richardson number
S_R	Strouhal number U^*P/D
S_c	Schmid number (K_z/E)
S_t	Stratification number
S_X	relative axial salinity gradient $1/\rho\ \partial\rho/\partial x$
S	dimensionless salinity gradient
SL	axial bed slope
SP	spacing between estuaries

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T_F	flushing time
U	axial current
U^*	tidal current amplitude

Residual current components:

U_0	river flow
U_s	density-induced
U_w	wind-induced
V	lateral current
W	vertical current
W_s	sediment fall velocity
X	axial dimension
Y	lateral axis
Z	vertical axis
c	wave celerity
d	particle diameter
f	bed friction coefficient ($\sim$0.0025)
g	gravitational constant
i	$(-1)^{1/2}$
	surface slope
k	wave number ($2\pi/\lambda$)
m	power of axial depth variations (x^m)
n	power of axial breadth variation (x^n)
s	salinity
t	time
t_{50}	half-life of sediment in suspension (α/0.693)
y	dimensionless distance from mouth
z	$= Z/D$
α	exponential deposition rate
	exponential breadth variation ($e^{\alpha x}$)
$\tan \alpha$	side slope gradient ($B/2D$)
β	exponential suspended sediment profile
	exponential depth variation ($e^{\beta x}$)
γ	sediment erosion coefficient
ε	efficiency of mixing
ς	surface elevation
ς^*	tidal elevation amplitude
θ	phase advance of ζ^* relative to U^*
λ	wavelength
ν	funnelling parameter $(n + 1)/(2 - m)$

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π	3.141592
ρ	density
σ	frequency
τ	stress
φ	latitude
φ_E	potential energy anomaly
ψ	ellipse direction
ω	tidal frequency ($P/2\pi$)
Ω	Coriolis parameter ($2\omega_s \sin\varphi$)

Superscripts

* tidal amplitude

– depth mean

Subscripts

0 residual

1D, 2D, 3D one-, two- and three-dimensional

Note: other notations are occasionally used locally for consistency with referenced publications. These are defined as they appear.

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