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새만금지구의 퇴적과정에 관한 연구

A study of sedimentation processes in Seamangeum coastal area

申 文 燮[*] 柳 哲 雄[**] 김 익 중[***]

1.ABSTRACT

The purpose of this study is to find sedimentation patterns variation in Saemangeum coastal sea region. Water circulations are calculated diagnostically from the observed water temperature and salinity data and wind data and tidal residual current. Three dimensional movements of injected particles due to currents, turbulence and sinking velocity are tracked by the Euler-lagrange methoed.Calculated sedimentation patterns of riverine material are highly similar to the observed ones.

Key Words : Water circulations,Diagnostic,Water temperature, Salinity,Tidal residual current, Euler-lagrange methoed, Sedimentation

2.INTRODUCTION

The coastal region of Saemangeum(Kunsan) is located between 126°10′ E~126°50′ E and 35°35′ N ~36°05′ N at the western coast of the Korean Peninsula(Fig.1). There are many small islands including extensive areas of semi-diurnally flooded and dewatered tidal flats. The Saemangeum coastal region has a range of 5.6m spring tide and the maximum tidal current speed is about 1.41m/sec in ordinary spring tide. Most of the sediments deposited on the tidal flats were transported from the Mankyung River and the Dongjin River. The soil in this area consists of silty sand with the depth of 10m to 30m. The wind in the winter season is strong from the direction of northwest.

The 33km sea dike and 40,100ha reclamation area is being constructed in the Saemangeum area. Such large-scale coastal land reclamation works will certainly influence the marine environment and ecosystem in this area. The purpose of this study is to find sedimentation patterns variation in Saemangeum coastal sea region.

Three dimensional movements of injected particles due to currents,turbulence and sinking velocity are tracked by the Euler-lagrange methoed.

2. Tracking of the Soil

The *Euler−Lagrange* method is used to track the soil movement in the numerical model.

The position of a soil(X^{n+1}, Y^{n+1}, Z^{n+1}) at time $n+1$,which was at (X^n, Y^n, Z^n)at time n,can be calculated by the following equation utilizing the Taylor series(Yanagi et al.,1983).

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* 群山大學校 土木工學部
** 日本 愛媛大學校 土木海洋工學科
*** 도화Engineering

$$X^{n+1} = X^n + u'' \Delta t + (\nabla u'')u'' t^2 + R_x \qquad (1)$$

$$Y^{n+1} = Y^n + v'' \Delta t + (\nabla v'')v'' t^2 + R_y \qquad (2)$$

$$Z^{n+1} = Z^n + w_s \Delta t + R_z \qquad (3)$$

where, u'' and v'' denote the calculated velocity of residual current in x and y directions,respectively, before and after the construction of submerged breakwater in autumn. w_s means the sinking speed of soil and it is calculated from the Sotkes Law. R_x, R_y and R_z are the dispersion due to turbulence. R_x, R_y and R_z are given by the following equation.

$$R_x \text{ and } R_y = \gamma \ (2\Delta t(D_{ht} + D_{hw}))^{1/2}, R_z = \gamma \ (2\Delta t(D_{vt} + D_{vw}))^{1/2} \qquad (4)$$

where, γ is the normal random number.
The average value of γ is zero and its standard deviation is 1.0. The horizontal and vertical diffusivities due to tidal current D_{ht} and D_{vt} are given as follows on the basis of the mixing length theory,

$$D_{ht} = \frac{\beta}{2\pi} U_{amp}^2 \times T_{tide}, \ D_{vt} = 10^{-5} \times D_{ht} \qquad (5)$$

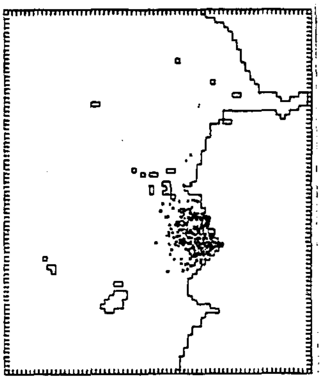
where, U_{amp} and T_{tide} denote the amplitude and the period of M_2 tidal current, respectively, β the parameter used to adjust the horizontal diffusivity locating in a reasonable range. Considering that the amplitude .of M_2 tidal current after the dike construction in the Saemangeum Bay is almost in the range of 6 and 20 cm/sec by the calculation of tidal current after the dike construction, parameter β is decided to be 0.06.

3.CONCULUSION

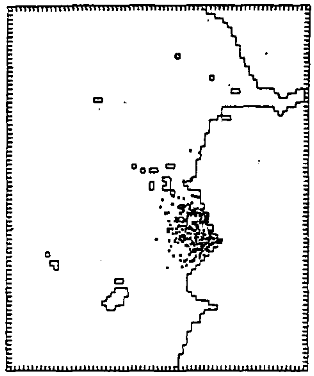
1.The calculated co-range and co-tidal charts of M_2 tide before the dike construction are similar to the observed ones.

2.Water temperature in autumn was the lowest at the mouths of the Mankyung River and the Dongjin River in the upper layer, But was nearly the same in the middle and lower layers. Salinity was the lowest at the northern area in the upper layer, but was uniform in the lower layer. Density was the lowest at the northern area in the upper layer, but was nearly uniform in the middle and lower layers.

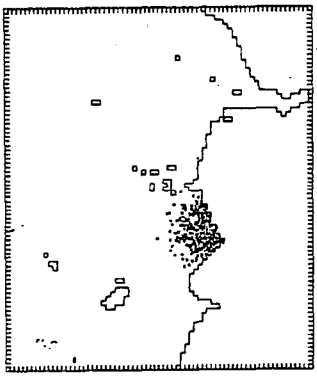
3.About half of released soil grain move a quite distance from the release point three day after the releasing.



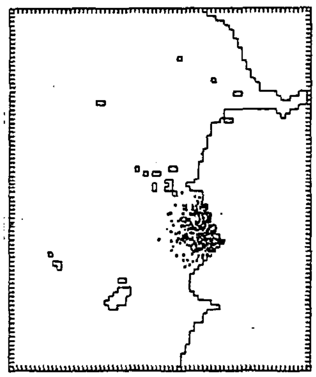
deposit(size of soil grain:60μm)



deposit(size of soil grain:80μm)

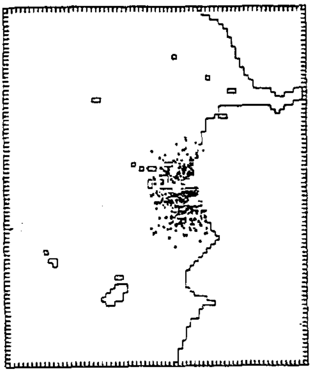


deposit(size of soil grain:200μm)

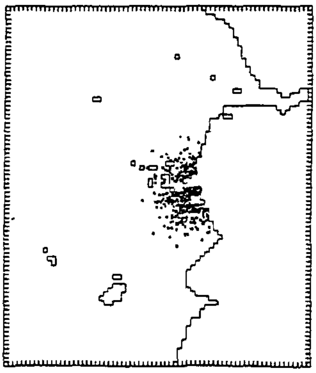


deposit(size of soil grain:400μm)

Fig.1.The distribution deposit of suspend sediment in the Shinsi drainage gate(calculation time : 72hr).



deposit(size of soil grain:60μm)



deposit(size of soil grain:80μm)

Fig.2.The distribution deposit of suspend sediment in the Garyeok drainage gate(calculation time : 72hr).

4.The dispersion range of soil grain for three day after releasing in the the Mankyung River indicates that the soil grain was dispersed within the range of Mal and Yon Island when specific gravity of soil grain is 60 μm. The soil grain moves a quite distance from the release point when size of soil grain is a small. These results indicate that size of soil grain and residual current is greatly influenced on the dispersion range of soil grain

4.REFERENCES

1.Yanagi T.,Okada Shin-Ichi and Tsukamoto K.:Numerical Simulation of dispersal patterns of red sea bream juveniles,Pagrus major,in Nyuzu Bay,Japan,Journal of Marine System,3(1992), 477-487.

2.Yanagi,T.,Okada S. and Tsukamoto K.:Numerical simulation of dispersal patterns of red sea bream juveniles, Pagrus major, in Nyuzu Bay,Japan,Journal of Marine System,3(1992), 477-487.

3.Hino,M.:Digital computer simulation of random phenomena,Trans of JSCE,No.123(1992), Nov. ,pp.33-43.

4.Yanagi T.,Tsukamoto H.,Inoue H. and Okaichi T.:Numerical Simulation of Drift Cards Dispersion,La mer,21(1983),218-224.