The 10th International Conference on Coasts, Ports and Marine Structures (ICOPMAS 2012)
Tehran, Iran, 19-21 Nov. 2012

EVALUATION OF GENERATION AND DEVELOPMENT OF BED RIPPLES IN NAVIGATION CHANNELS (CASE STUDY OF SAJAFI PORT NAVIGATION CHANNEL AT ZOHRE RIVER)

Ali Karami Khaniki[1] , Hamideh Daghigh[2]

Key Words: ripple, estuary, tide, dredging.

Introduction

Shoaling due to sedimentation is one o the major problems in navigation channels. Tidal currents and currents due to breaking effects are main reasons of sedimentation and erosion in these channels. If tidal currents flow along the channels, usually we expect to have uniform sedimentation or erosion but the fact is something else, So that it is in the form of paired holes and hills, called “ripple”. In this paper, we studied generation and development of these ripples in bed of Sajafi port at Zohre River. For this purpose, used numerical modeling accompanied with theoretical studies. Results performed that distance and dimensions of ripples are related to wave length, current velocity and bed roughness. In this case, lots of researches have done by various people, recently. For instance we can mention to Cheng, H. Q., Kostaschuk, R. and Shi, Z. (2004); Leo C. van Rijn. (2007); FAN DaiDu (2012); Ourmie`res,Y., Chaplin, J. R. (2004); Villaret, C., Huybrechts, N. (2012).

Materials and methods

Sajafi port is located at the end of Zohre River in Hendijan zone. The port is on geographic position of 29° 59′ 55″-30° 14′ 25″ latitude and 49° 23′ 25″-49° 45′ 49″ East longitude. General position of area is shown in figure1. Topographic map of zone is provided in AutoCAD environment in scale of 1/2000 to 1/10000 in 1390 summer by measuring. Regard to nearness of synoptic station of Mahshahr port, we prepared 21 years (1987-2007) wind data statistics of this station from Iran Meteorological organization and area wind rose and wind analysis obtained. We used Mike21/3 Coupled Module of Mike21 software in order to evaluate waves and currents effects on generation and development of bed ripples in navigation channels. this module is a combination of hydrodynamic (HD), spectral waves (SW), sand transport (ST), mud transport (MT) and coast morphology (CAMS) modules. We run it for two distinct cases of topography for prior and after dredging under effects of waves, wind, river discharge and tide together. Results include current, sedimentation, erosion and bed topography changes for both situations.

[1] Assistant professor , Soil conservation and watershed management research institute, akk7239@yahoo.com
[2] PHD student, Keyhan Khak engineering company, hamidehdaghigh@yahoo.com

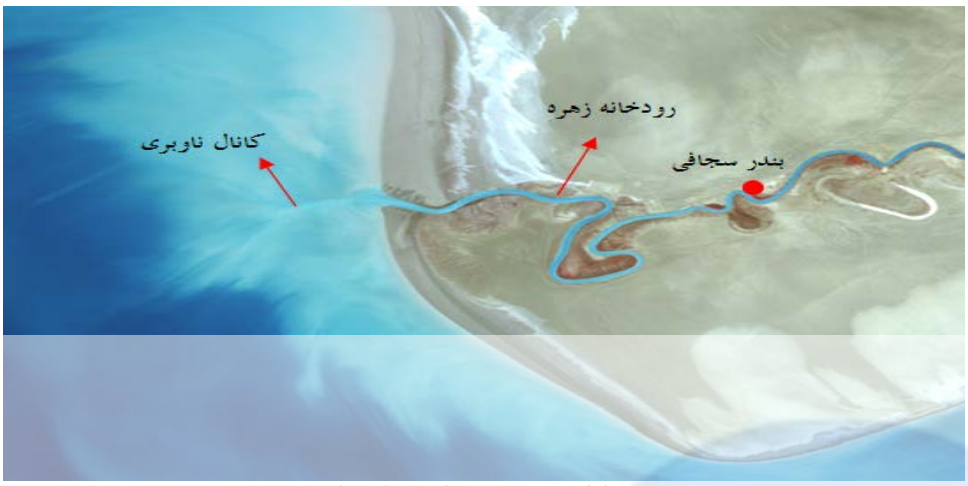

Fig. 1) Project area position.

Conclusion

Modeling perform that a strong current forms in dredging channel at tide time that has more velocity compare with other points in tide area. Evaluating of sediment transport discharge in different tidal points of Zohre River entrance shows that sediment transport causes bed level changes. Net amount of bed level changes in 78 hours duration include 6 tide period is shown in figure2. Bed level changes vary from 50 cm erosion to 70 cm sedimentation for different points in navigation channel. Formation of sedimentary ripples is considerable at channel so that we have holes with depth of about 50 cm in some points of channel and hills with height of 40-70 cm in about 10 cm distance in lower part. These sedimentary holes and hills are paired and a sedimentary hill forms in lower part o each hole (figures 2, 3). Development rate of these ripples, decrease by time and mean distance of them are about wave length of sea waves reaches to project area.

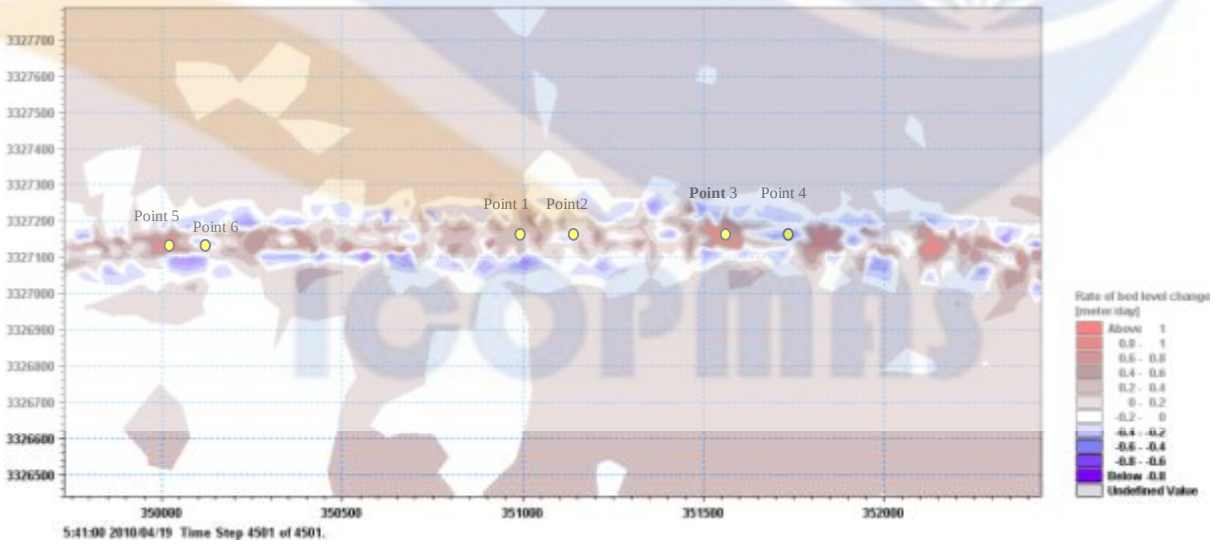

Fig. 2) Bed level changes in 78 hours (6 tide period)

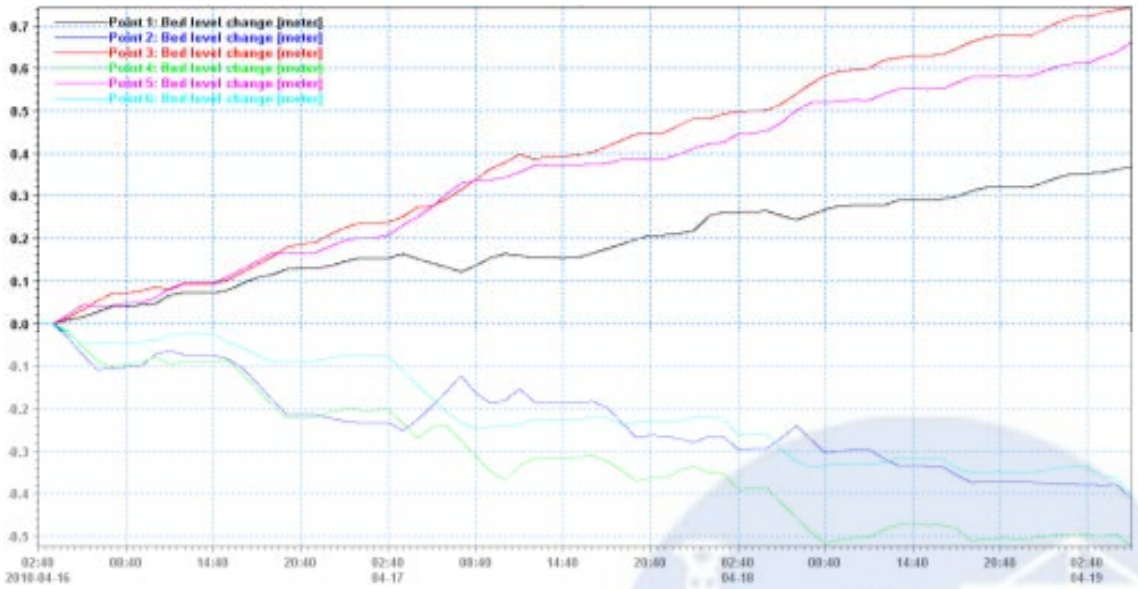

Fig. 3)Bed level changes in 78 hours in some points along the navigation channel (formation of ripples)

References

[1]- Leo C. van Rijn. (2007), Unified View of Sediment Transport by Currents and Waves. I: Initiation of Motion, Bed Roughness, and Bed-Load Transport .Journal of Hydraulic Engineering, Vol. 133, No. 6.

[2]- Villaret, C., Huybrechts, N., Davies, A.G. (2012), A large scale morphodynamic process-based model of the Gironde estuary. Jubilee Conference Proceedings, NCK-Days 2012.

[3] -Cheng, H. Q., Kostaschuk, R. and Shi, Z. (2004), Tidal Currents, Bed Sediments, and Bedforms at the South Branch and the South Channel of the Changjiang (Yangtze) Estuary, China: Implications for the Ripple-dune Transition. Estuaries, Vol. 27, No. 5, p. 861–866.

[4]- FAN DaiDu et, al. (2012), Sedimentation processes and sedimentary characteristics of tidal bores along the north bank of the Qiantang Estuary, Oceanology, Chinese science Bulletin.

[5]- Ourmie`res, Y., Chaplin, J. R. (2004), Visualizations of the disturbed-laminar wave-induced flow above a rippled bed. Experiments in Fluids 36 (2004) 908–918.