Geophysical Research Abstracts
Vol. 17, EGU2015-9122, 2015
EGU General Assembly 2015

Sand dunes development of Vistula River mouth during May 2014 flood

Aliaksandr Lisimenka, Stanisław Rudowski, Maciej Kałas, and Kazimierz Szefler
Maritime Institute in Gdansk, Dlugi Targ str. 41/42, 80-830 Gdansk, Poland (sasha@im.gda.pl)

The Vistula, Poland's primary river, is the largest river of the southern Baltic Sea and is one of the least regulated amongst large rivers in Europe. The Vistula has a vast delta with the main mouth in the form of an artificial cross-cut channel of about 3000 m length, 400 m width and up to 10 m depth. The comprehensive riverbed morphology in the area is characterized by the set of both 2D and 3D sandy bedforms of various orientations (Lisimenka et al., 2013). About 95% of total Vistula water, with the long-term average annual water discharge of 1081 m3/s, outflows into the Baltic Sea through this channel, which also plays a crucial role in sediment delivery processes into the Vistula External Delta, coast and neighbouring marine waters.
Results of bathymetry measurements which were carried out in the main Vistula river mouth during the 23-26 May 2014 flood are presented. Echosounding records were made using boat mounted high-resolution Reson Seabat 7101 multibeam echosounder system (MBES) operating at 240 kHz. The measurements set includes data from: (1) the central part of the river channel with a wide band width for the first and last days of the experiment; (2) the riverbed elevation along axis longitudinal profile obtained on a daily basis with a twice per day registration at the final stage of the rising limb of a flood wave. During the considered period of time, extremely high magnitudes of water level and water discharge values changed from 2590 m3/s up to 4110 m3/s were observed. Estimated based on positioning system data, water flow velocity amounted to about 2 m/s and exceeded a long-term average conditions in more than two times.
Based on bedform tracking tool proposed by Van der Mark and Blom (2007), the geometric variables of individual bedforms for each elevation profiles were extracted and histograms of the dune height and length were obtained. The results revealed significant changes in bedform geometry with a counterclockwise hysteresis effect as regards both the mean dune height and length. The mean dune height and length steadily increased from Δ=0.25 m and Λ=5 m at the start of the experiment up to Δ=0.92 m and Λ=19.2 m near the peak discharge respectively, becoming more higher Δ=1.0 m and more longer Λ=23.8 m at the beginning of the falling limb.
The instability of the channel riverbed, due to mainly floods and sea storm surges, makes proper management of the river mouth area very problematic and requiring hydrographic monitoring.

References

Lisimenka, A., Kałas, M. and Rudowski, S. (2013), Quantification of bedform roughness development in the Vistula River mouth using multibeam echosounder bathymetry data, In: Proc. of the 1st Underwater Acoustics International Conference and Exhibition, ed. J.S. Papadakis & L. Bjørnø, Corfu, Greece, 23-28 June 2013, 1421-1426.
Van der Mark, C. F., and A. Blom (2007), A new and widely applicable tool for determining the geometric properties of bedforms, CE&M Research Report 2007R-003/WEM-002 ISSN 1568-4652, University of Twente, Enschede, Netherlands.