

Lake of Neuchatel: Effect of Increasing Storm Events on Littoral Transport and Coastal Structures

Authors : Charlotte Dreger, Erik Bollaert

Abstract : This paper presents two environmentally-friendly coastal structures realized on the Lake of Neuchâtel. Both structures reflect current environmental issues of concern on the lake and have been strongly affected by extreme meteorological conditions between their period of design and their actual operational period. The Lake of Neuchatel is one of the biggest Swiss lakes and measures around 38 km in length and 8.2 km in width, for a maximum water depth of 152 m. Its particular topographical alignment, situated in between the Swiss Plateau and the Jura mountains, combines strong winds and large fetch values, resulting in significant wave heights during storm events at both north-east and south-west lake extremities. In addition, due to flooding concerns, historically, lake levels have been lowered by several meters during the Jura correction works in the 19th and 20th century. Hence, during storm events, continuous erosion of the vulnerable molasse shorelines and sand banks generate frequent and abundant littoral transport from the center of the lake to its extremities. This phenomenon does not only cause disturbances of the ecosystem, but also generates numerous problems at natural or man-made infrastructures located along the shorelines, such as reed plants, harbor entrances, canals, etc. A first example is provided at the southwestern extremity, near the city of Yverdon, where an ensemble of 11 small islands, the Iles des Vernes, have been artificially created in view of enhancing biological conditions and food availability for bird species during their migration process, replacing at the same time two larger islands that were affected by lack of morphodynamics and general vegetalization of their surfaces. The article will present the concept and dimensioning of these islands based on 2D numerical modelling, as well as the realization and follow-up campaigns. In particular, the influence of several major storm events that occurred immediately after the works will be pointed out. Second, a sediment retention dike is discussed at the northeastern extremity, at the entrance of the Canal de la Broye into the lake. This canal is heavily used for navigation and suffers from frequent and significant sedimentation at its outlet. The new coastal structure has been designed to minimize sediment deposits around the exutory of the canal into the lake, by retaining the littoral transport during storm events. The article will describe the basic assumptions used to design the dike, as well as the construction works and follow-up campaigns. Especially the huge influence of changing meteorological conditions on the littoral transport of the Lake of Neuchatel since project design ten years ago will be pointed out. Not only the intensity and frequency of storm events are increasing, but also the main wind directions alter, affecting in this way the efficiency of the coastal structure in retaining the sediments.

Keywords : meteorological evolution, sediment transport, lake of Neuchatel, numerical modelling, environmental measures

Conference Title : ICCEA 2022 : International Conference on Coastal Engineering and Applications

Conference Location : Berlin, Germany

Conference Dates : July 21-22, 2022