The 2021 floods in the Netherlands from a river engineering perspective

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Abstract

In July of 2021, large areas in the catchment of the Meuse River in Belgium, the Netherlands and Germany were affected by extreme rainfall and floods. In the Netherlands, measured peak discharges in the upstream part of the Meuse and regional tributaries were the highest ever recorded. This resulted in extreme water levels in the upstream reaches, but downstream of Roermond (about 80 km downstream of the border with Belgium) water levels were significantly lower than during previous flood events with similar discharge levels near the border with Belgium. The lower water levels resulted from the implementation of the large-scale room for the river program, in combination with very strong peak attenuation of the flood wave. Peak attenuation was especially high in the so-called Lake Meuse in the Netherlands, due to large storage areas in the floodplains. The floods in the Netherlands came in certain parts of the Meuse basin rather unexpected. The flood forecasts in the upstream part of the Meuse in the Netherlands depended heavily on rainfall forecasts and rainfall-runoff modelling and underestimated the peak water levels up to 36 hours before the flood actually peaked. Further downstream, the lead time increases and forecasts are based on discharge levels that are measured in upstream parts of the catchments. This results in more accurate estimates. The estimated probability of occurrence of the measured peak water level is around 1:100 per year for the Meuse at Borgharen (rkm 16) and decreases to 1:15 per year downstream near Gennep (rkm155). In the tributaries in Limburg the probabilities of occurrence of the measured water levels vary widely: at many locations along the rivers Geul, Geleenbeek and Roer, exceedance probabilities are estimated to be between 1:100 and 1:1000 per year. The floods have also resulted in unprecedented morphological changes. The armour layer in the riverbed of the 'Common Meuse', consisting of very coarse gravel, was mobilized and layers of fine sand quickly eroded. This resulted in multiple scour holes with depths of 3 to 15m. Riverbank erosion was observed and large quantities of sand were deposited on the river banks.

Keywords

Floods July 2021, Fact Finding, River Engineering, Peak Attenuation, Morphodynamics

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