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# A novel way to present flood hazards using 3D-printing with transparent layers of return period isolines

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## Abstract

*This paper examines the 3D printed results of a floodplain analysis usually used for hydrological studies to calculate the probabilities in high water stage features. The analysis was performed using probability distributions, including Pearson type III distribution, Log-Pearson type III distribution, Gaussian (normal) distribution, Gumbel distribution, and Log-normal distribution. The maximum theoretical stages of best fitting distribution for different return periods were mapped to the Vardar and Boshava rivers in the Tikvesh Valley. Data to create the model were extracted from digital elevation models of the Vardar river target area. The extracted 3D surface model was covered with a map showing all the flooded areas in the relevant territory for different return periods as transparent layers. The data were converted into a physical model (relief map) using 3D printing methods for visualisation.*

## Zusammenfassung

Dieser Artikel untersucht das Ergebnis des 3D-Ausdrucks einer Naturgefahrenabschätzung, wie sie typischerweise in Flussebenen im Rahmen hydrologischer Studien durchgeführt werden, um die Wahrscheinlichkeit von Hochwasserständen abzuschätzen. Die Analyse des Hochwasserrisikos wurde anhand verschiedener bei der Abschätzung von Naturereignissen gebräuchlicher Häufigkeitsverteilungen durchgeführt: der Pearson Typ III Verteilung, der Log-Pearson Typ III Verteilung, der Normal- oder Gaußverteilung, der Gumbel-Verteilung und der Logarithmischen Normalverteilung. Die maximalen theoretischen Pegelstände der jeweiligen besten Häufigkeitsverteilungen für ausgewählte Wiederkehrintervalle wurden für die Flüsse Vardar und Boshava im Tikvesh-Tal (Nordmazedonien) berechnet und kartografisch dargestellt. Als topografische Grundlage wurde das digitale Geländemodell des Vardar Einzugsgebiets verwendet. Die daraus berechnete dreidimensionale Modelloberfläche für jedes Wiederkehrintervall wurde in eine Karte umgewandelt, welche die durch Überschwemmung gefährdeten Gebiete mit transparenten Flächen überlagert. Schliesslich wurden die Ebenen in ein physikalisches Modell (ein topografisches Relief) eingepasst und mittels 3D-Druck zur Veranschaulichung hergestellt.

**Keywords** 3D printing, modelling, floodplain, Vardar river, GIS

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# Hazards Way A Novel

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**Hazards Way A Novel:**

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