

EARLY WARNING SIGNAL FOR FLOODS USING PERSISTENT HOMOLOGY

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Flooding is an environmental hazard that occurs almost everywhere around the world and it contributes to a high number of deaths and loss of properties. Analysis of streamflow data can give us important climatic information for flooding events. Persistent homology (PH), a tool in topological data analysis (TDA) provides a new way to look at the information in a data set using a qualitative approach. PH uses topology to extract qualitative information from noisy data sets at various scale of the data by giving information on topological features that exist in the data set. In this paper, we present a new approach for streamflow data analysis by using PH. An analysis was conducted at the Guillemard Bridge Station, Kelantan River, Malaysia. The topological features extracted are summarize in a topological summary known as the persistence landscape. By analysing the persistence landscape, we get a signal that can be use for an early warning signal for floods. The result shows that this signal exhibit critical slowing down when approaching flood events. Increase in variance and power spectrum are the indicators for this critical slowing down. As a conclusion, this study suggests that the information on topological features of streamflow data can be used as a basis for an early warning signal for floods.

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