

FUZZY INFERENCE SYSTEM TO IDENTIFY DISASTER RISK LEVELS IN SRI LANKA

A.W.S.P. Karunarathne*, K. De Silva, and S.S.N. Perera

*Research and Development Center for Mathematical Modelling, Department of Mathematics,
Faculty of Science, University of Colombo, Sri Lanka.*

**sachinikarunarathne94@gmail.com*

Various uncontrollable factors influence natural disasters. Natural events, for instance, floods, occur during periods of extreme rainfall and can pose significant challenges and risks to Sri Lanka's agricultural sector. They threaten crop production and overall food security in the country. It is crucial to identify potential flood and drought threats related to rainfall to mitigate these risks. The Standardised Precipitation Index (SPI) is used to measure rainfall, but it alone cannot determine the risk levels for floods and droughts because it lacks clear definitions for prolonged periods and disaster thresholds. In this study, we have developed a fuzzy expert system that assesses the impact of rainfall fluctuations, as measured by the SPI, on the Disaster Risk Level (DRL) while considering uncertainty through fuzzy membership functions. This decision support system is a single-input, single-output model, with the SPI as the input variable and DRL as the output variable. Linguistic terms like Extremely Dry, Dry, Moderate, Wet, and Extremely Wet are used to describe SPI categories, while No Disaster, Disaster, and High Disaster are used for DRL. We calibrated this fuzzy expert rule-based system using historical records of floods and droughts in 1983, 2003, 2011, 2016, 2017, and 2020. The resulting fuzzy inference-based decision support system, which evaluates DRL based on SPI data, offers a practical and valuable solution for proactive disaster management and preparedness.

Keywords: Disaster risk level, Droughts, Floods, Fuzzy rule-based system, SPI.