Probability Estimation of Radar Analytical Rainfall Products based on L-Moments method in the field of Sediment Disaster Area

Sabo Department

The Sabo Department is conducting research aimed at identifying statistical trends in rainfall indicators, which serve as fundamental data for the provision of sediment disaster warning information. Our study's objective is to disseminate highly reliable warnings for sediment disasters, particularly when there is an imminent risk of rainfall-induced sediment disasters.

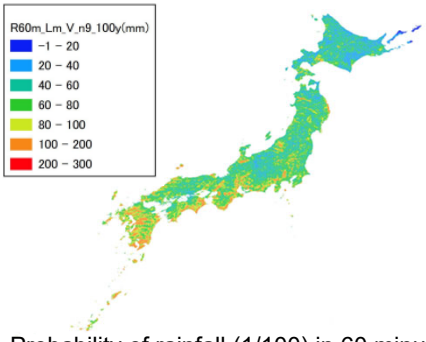
Social background and challenges

The sediment disaster warning information system is in operation to determine the risk level of sediment disasters based on rainfall indicators. Its objective is to alert individuals to the imminent threat of rainfall-induced sediment disasters and encourage timely evacuation. The analytical rainfall data employed in the sediment disaster warning information has the advantage of comprehensive national coverage. However, it suffers the drawback that the sample size is limited because the calculation method is improved drastically every ten years, making the data unsuitable for statistical processing. This has raised concerns about the reliability of the sediment disaster warning information system, given its reliance on analytical rainfall data for decision-making.

Detail of Research

Calculation of probable rainfall using the L-moments method

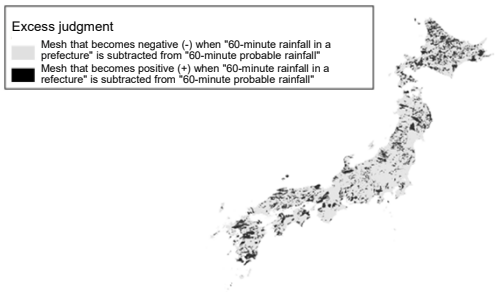
In a frequency analysis aimed at establishing the probability of rainfall for a recurrence interval, such as once in 100 years (1/100) or once in 50 years, an appropriate probability distribution type is chosen based on the accumulation of observational data spanning several decades. In recent years, the quality of analytical rainfall data used in sediment disaster warning information has been consistent since 2006 when the mesh size was standardized to 1 km, the update interval was set to 30 minutes, and data have been accumulated accordingly. Therefore, we employed a statistical method, specifically the L-moments method, to assess reliable rainfall probability and probability distribution models for the analytical rainfall data. This method is capable of mitigating the impacts of data variability and bias.



Probability of rainfall (1/100) in 60 minutes obtained using L-moments method

Can probable rainfall be applied to design rainfall?

Design rainfall intensity is employed in the planning and design of erosion control facilities, aiming to mitigate the risk of sediment disasters. The existing design rainfall intensity fails to account for shifts in rainfall patterns, such as the rise in short-duration intense rainfall, attributable to recent climate change. Hence, achieving more efficient and effective planning and design of erosion control facilities is possible by incorporating reliable rainfall probability. Currently, there is still some variation in the reliability of estimating rainfall probability using this method. However, as more analytical rainfall data accumulate and a certain level of reliability is assured in the future, it will become possible to verify the target maintenance level of erosion control facilities in specific regions using analytical rainfall-based probability values.



Mesh whose probable rainfall obtained by the L-moments method exceeds the design rainfall intensity (1/100, 60-minute rainfall)

Use of reliable rainfall indicators enhances the effectiveness of both structural and non-structural measures in controlling sediment disasters.

☞Relevant articles

- NILIM Reference No. 1222: Probability Estimation of Radar Analytical Rainfall Products based on L-Moments method in the field of Sediment Disaster Area