

Abstract:

Cyclone Gonu is the strongest tropical cyclone that attacked the Arabian Peninsula and Sultanate of Oman. The resulting vast damage has raised a big concern about the safety of dams and other large hydraulic structures. This concern can be rephrased as: should the previously adapted design discharges (for large hydraulic structure) be raised due to Gonu event?

The main objective of this paper is to present the results of a study that analyzes the occurrence of Gonu in an area (wadi Al-Zyhimi in Sultanate of Oman) not hit by it and also for which no ground rainfall data is available for the Gonu event.

The study presents first a statistical analysis of Gonu's storm data recorded at the ground rainfall stations that lie within the attacked area. The hourly pattern of Gonu's storm is identified and a comparison with some world and global maximum events is presented. The study also compares the ground measurements with the TRMM radar data. The assessment of the available data indicates the existence of significant discrepancies between the ground rain gauge records and the TRMM satellite based data.

The spatial variability of the recorded ground rain data was also investigated over a selected wadi (wadi Hayfadah) within the attacked area. This analysis indicates that the ground raingauge stations probably represent only local points and should not be used to represent the areal rainfall field.

The study also discusses how to rescale the rainfall data for the un-attacked areas (in the shade of Gonu event) by making use of the storm properties within the attacked area. Two approaches are proposed and applied to estimate the expected maximum rainfall precipitation depth over the case study wadi Al-Zyhimi as a result of a storm similar to Gonu's event.

The first approach is based on a storm transfer protocol using the TRMM data and the Standardized Variates Approach (SVA) to calculate the scale factors.

The second proposed approach is based on the recorded data and it comprises a linear regression analysis between the maximum recorded data at ground stations and the root square of the gauge elevation (in meter) to gauge distance (in meter) ratio. The first approach gives a maximum rainfall of 130 mm whereas the second approach produces 165 mm. It is interesting to note that the results of both approaches are lower than the expected value of PMP at wadi Al-Zyhimi.