



Spatially-distributed IDF curves for Center-Southern Chile using IMERG

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The Intensity-Duration-Frequency (IDF) curves are crucial for urban drainage design and to mitigate the impact of extreme precipitation events and floods. However, many regions lack a high-density network of rain gauges to adequately characterise the spatial distribution of precipitation events. In this work we compute IDF curves for the South-Central Chilean region (26-56°S) using the latest version of the Integrated Multi-satellitE Retrievals for GPM (IMERGv06B) for 2001-2018, with a spatial resolution of 0.10° and half-hourly temporal frequency.

First, we evaluated the performance of IMERGv06B against 344 rain gauge stations at daily, monthly and annual temporal scales using a point-to-pixel approach. The modified Kling-Gupta efficiency (KGE') and its components (linear correlation, bias, and variability ratio) were selected as continuous indices of performance. Secondly, we fit maximum precipitation intensities from 14 long-term rain gauge stations to three probability density functions (Gumbel, Log-Pearson Type III, and GEV II) to evaluate: i) the impact of using 15-year rainfall time series in the computation of IDF curves instead of using the typical long-term periods (~ 30 years); and ii) to select the best distribution function for the study area. The Gumbel distribution was selected to obtain the maximum annual intensities for each grid-cell within the study area for 12 durations (0.5, 1, 2, 4, 6, 8, 10, 12, 18, 24, 48, and 72 h) and 6 return periods (T=2, 5, 10, 25, 50, and 100 years).

The application of the Wilcoxon Mann-Whitney test indicates that differences between IDF curves obtained from 15 years of records at the 14 long-term rain gauges and those derived from 25 years of record (or more) are not statistically significant, and therefore, 15 years of record are enough (although not optimal) to compute the IDF curves. Also, our results show that IMERGv06B is able to represent the spatial distribution of precipitation at daily, monthly and annual temporal scales over the study area. Moreover, the obtained precipitation intensities showed high spatial variability, mainly over the Near North (26.0-32.2°S) and the Far South (43.7-56.0°S). Additionally, the intensities from Central Chile (32.2-36.4°S) to the Near South (36.4-43.7°S) were systematically higher compared to the intensities described in older official governmental reports, suggesting an increase in precipitation intensities during recent decades.