DesignRainfall

Design rainfall depths for South Africa – in-browser app • Hydrogeological Repository

What it does

DesignRainfall gives the rainfall depth expected at a location for a chosen storm duration and return period – the design storm that a flood peak, a stormwater system or a spillway is sized against. It covers all of South Africa on a 1′×1′ latitude and longitude lattice of about 421 000 points, at **23 durations from 5 minutes to 7 days** and **seven return periods from 2 to 200 years**, each with confidence limits.

It reimplements the procedures of JC Smithers and RE Schulze, developed under Water Research Commission project K5/1060 and published as WRC Report 1060/1/03, *Design Rainfall and Flood Estimation in South Africa.* The original was a Windows desktop program requiring a Java runtime from 2002; this is the same calculation on the same data, in a browser.

Everything runs in your browser

No installation and no server-side calculation. The grid is downloaded once (4.3 MB) and every estimate is computed on your own machine, so a query returns in well under a millisecond and nothing about the site you are designing is transmitted anywhere.

What you get

Output	Detail
Depth table	Rainfall depth in mm for every selected duration and return period, with lower and upper confidence limits.
Depth–duration–frequency curves	Depth against duration on log–log axes, one curve per return period – the conventional presentation. Sub-daily and multi-day durations are plotted separately.
Growth curve	How depth grows with return period at one duration, with the confidence band around it.
Block query	Every grid point within a radius of 0 to 5 minutes, so the spatial variation across a catchment can be seen rather than assumed.
Station comparison	The nearest gauges and the design rainfall published for the station itself, as a sanity check on the gridded figure.
Exports	CSV in long form (one row per point, duration and return period), the original program’s fixed-width text layout, chart PNGs, and a printable report.

How the estimate is built

Design rainfall at a grid point is the mean of the annual maximum series for the duration, $L_1(d)$, multiplied by a regionalised growth factor for the return period. Three separate regionalisations key the three lookup steps, and the values that applied at your point are reported on screen.

Step	Source	Keyed on
Grid point	1′×1′ lattice, 421 027 points	Latitude and longitude
Mean 1-day maximum	L_1 stored at the grid point	–
24 hours from 1 day	Median 24h:1day ratio	Short-duration cluster (1–15)

Step	Source	Keyed on
L_1 for 5 min – 24 h	Short-duration regressions	Short-duration cluster (1–15)
L_1 for 2 – 7 days	Daily regressions	Daily region (1–7)
Growth factors, 2 – 200 yr	Regional growth curves	Growth-curve cluster (1–78)

Only six of the 23 durations have a standard error tabulated at the grid point; the rest are interpolated log–log between the pair that brackets them. Confidence limits are that standard error carried through the growth curve.

24 hours and 1 day are not the same thing. The 24-hour depth is always the larger, and both are correct: 24 hours is the maximum over any continuous window, while 1 day is the maximum over a fixed calendar day as a daily rain gauge records it, so a storm straddling midnight is split between two readings. They come from different regressions and are reported as separate rows. Use the 24-hour value for a design storm; use the daily values when comparing against daily rainfall records.

How a run works

Step	What happens
1. Location	Click the map, type coordinates in decimal degrees, degrees and minutes, or minutes, or search the 3 946 weather stations by number or name.
2. Area	A radius in minutes around the point, giving every grid point in the square.
3. Durations & Return Periods	Which rows and columns appear in the results, charts and exports.
4. Curves	Depth–duration–frequency curves and the growth curve, with confidence bands.
5. Results	The depth table, and the spread across the block if one is set.
6. Stations	The nearest gauges and their published at-station values.
7. Report	A standalone report of the query, ready to print or save as PDF.
8. Export	CSV, or the original program's text format.

Limitations worth knowing

- The grid has no values outside South Africa, and none over the sea or in a few unmodelled areas inland – about 44% of the map rectangle. The extent is shaded so a point without an answer can be seen before it is clicked.
- A grid point is roughly 1.9 km by 1.6 km. For a small catchment the estimate is a point value, not an areal one: an areal reduction factor still has to be applied before it becomes a catchment design storm.
- Confidence limits describe how well the regional method is constrained at that point – they are the standard error of the estimate carried through the growth curve. They are not the year-to-year variability of the rainfall, and they do not cover the risk of the method being wrong.
- Published at-station values in step 6 are fitted to that gauge's own record and are a different quantity from the gridded estimate. They are a cross-check, not a substitute, and they cover 1 to 7 days only.
- Return periods stop at 200 years. The underlying growth curves extend to 1 000 years but the original program does not report beyond 200, and neither does this.
- The dataset is the 2003 release. Check whether a later revision supersedes it before using these figures for design.

Checked against the original program, value for value. The 2003 software was driven directly to produce reference output at 1 964 grid points chosen to cover every combination of the three cluster systems present in the dataset, plus the extremes of each input. All 971 796 individual values – depth, lower limit and upper limit, across every duration and return period – are identical.

Credit

The method and the dataset are the work of **JC Smithers** and **RE Schulze** (University of Natal, now the University of KwaZulu-Natal), funded by the Water Research Commission under project K5/1060 and by the University of Natal Research Fund. The original desktop software was written by MJ Gorven. This app is a reimplementation of their published procedures and claims no authorship of the method or the data.

Beta. DesignRainfall is published for evaluation and feedback. The calculation matches the original program exactly, but check any figure you rely on against the published tables before using it in a design.