

6. 短時間確率降雨強度

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6.1. 短時間雨量の確率解析

収集した4降雨観測所の時間雨量を用いて、中小河川改修の手引き（案）（平成11年9月）（以下、手引き案という）に基づく確率統計解析により観測所の年最大雨量の超過確率の算定を行い、超過確率（1/2、1/3、1/5、1/10、1/20、1/30、1/50、1/70、1/100、1/200）毎に短時間降雨強度式を作成した。

確率統計解析に用いた確率分布は、極値分布3手法（グンベル分布、一般化極値（GEV）分布、平方根指数型最大値（SQRT-ET）分布）とし、SLSCにより適合度評価を行う。この3手法で適合度がよくない場合には、他の分布に対する適合度評価を行う。選定された確率分布モデル（ $SLSC \leq 0.04$ のもの）のうち、jackknife法により推定誤差を算出した上で計画降雨量を判断した。

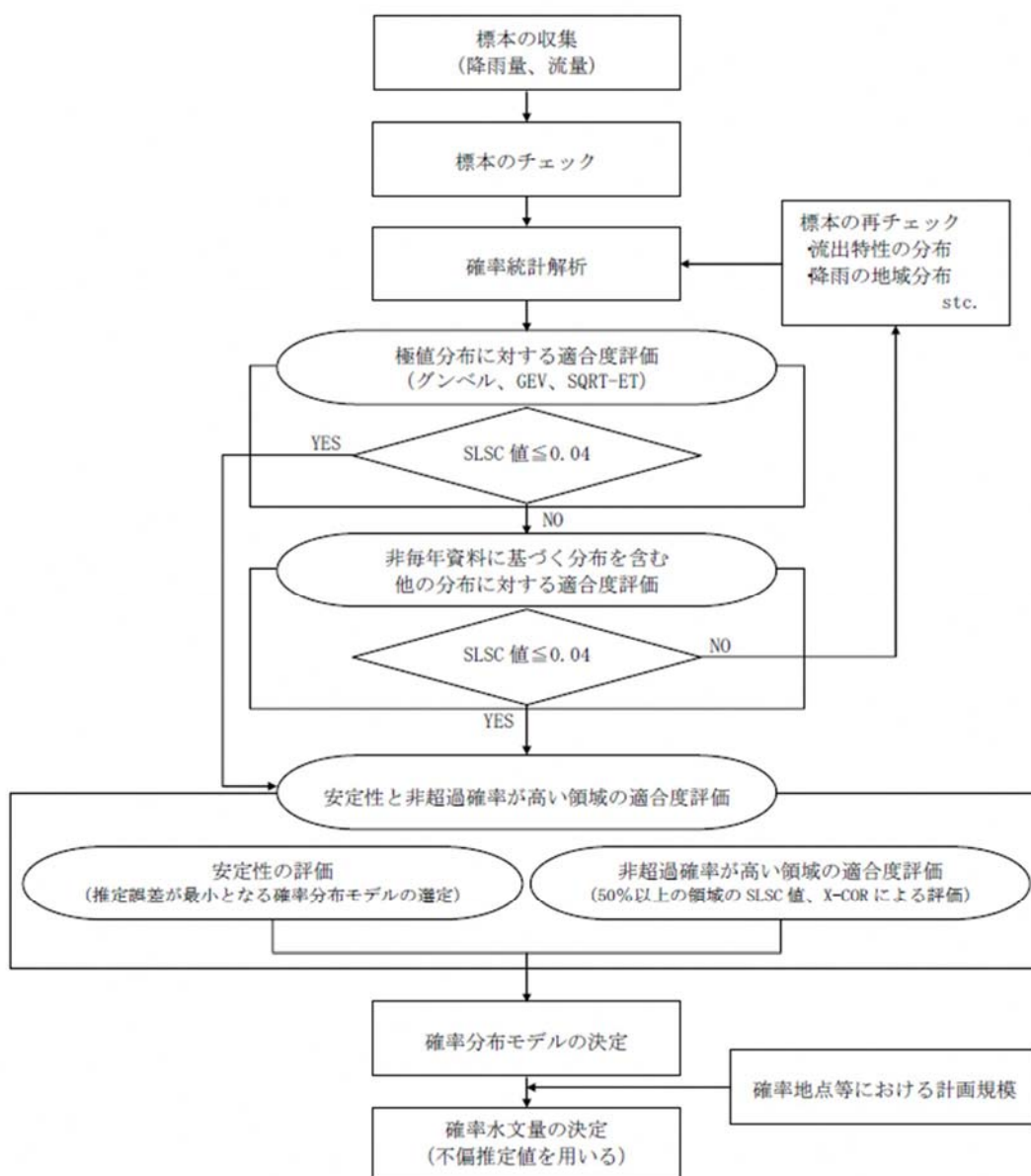


図 6.1-1 確率水文量算定フロー

6.2. 短時間降雨強度式の算定

(1) 降雨強度式算定に用いる確率分布モデル

降雨強度式算定に用いる確率分布モデルは、SLSC \leq 0.04 で Jackknife 推定誤差が最小となる **Gumbel 法**を使用する。

ただし、新庄観測所では、降雨継続時間 10 分から 60 分までは誤差最小となる Gumbel 法を採用するが、90 分から 180 分は第 1 位の雨量が突出して大きいため、Gumbel 法の適合が悪くなる。このため 90 分から 180 分は、高確率年で確率分布曲線が湾曲して適合度が良くなる GEV 法を採用した。

(2) 降雨強度式の型式

降雨強度式は、既往検討で採用されている以下の君島式とする。

$$r = \frac{a}{t^n + b}$$

君島式における n の最適値検索は、n を 0.10 から 0.99 まで 0.01 ピッチで変化させ、偏差 σ が最小となる n を最適値とした。偏差は以下の式により算定する。

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (r_{io} - r_i)^2}$$

σ : 偏差

N : 資料数

r_{io} : 入力する確率降雨強度 (mm/hr)

r_i : 降雨強度式による算定値 (mm/hr)

明治41年～令和2年（資料数：113 個）

山形

| 係数 | 確率年 | | | | | | | | | |
|----------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| n | 0.85 | 0.85 | 0.84 | 0.84 | 0.84 | 0.83 | 0.82 | 0.81 | 0.80 | 0.79 |
| a | 2869.8 | 2621.6 | 2371.5 | 2256.8 | 2086.2 | 1845.2 | 1536.6 | 1242.3 | 1016.7 | 825.90 |
| b | 10.7648 | 10.7890 | 10.0465 | 10.0514 | 10.1746 | 9.3648 | 8.7948 | 8.1924 | 7.6936 | 7.2060 |
| σ | 1.29 | 1.12 | 1.04 | 0.95 | 0.83 | 0.76 | 0.55 | 0.41 | 0.27 | 0.16 |

昭和32年～令和2年（資料数：64 個）

新庄

| 係数 | 確率年 | | | | | | | | | |
|----------|---------|--------|-------|--------|--------|--------|-------|---------|---------|--------|
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| n | 0.34 | 0.46 | 0.51 | 0.57 | 0.64 | 0.69 | 0.75 | 0.80 | 0.81 | 0.77 |
| a | 318.5 | 557 | 673.2 | 857.5 | 1083.1 | 1253.7 | 1386 | 1435.4 | 1260.5 | 867.2 |
| b | -0.0534 | 1.2182 | 1.964 | 3.2518 | 5.1439 | 6.8751 | 9.044 | 11.3608 | 11.3402 | 8.1279 |
| σ | 4.41 | 2.68 | 1.98 | 1.52 | 1.00 | 0.78 | 0.77 | 0.82 | 0.76 | 0.61 |

昭和12年～令和2年（資料数：84 個）

酒田

| 係数 | 確率年 | | | | | | | | | |
|----------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| n | 0.82 | 0.81 | 0.80 | 0.79 | 0.79 | 0.77 | 0.76 | 0.74 | 0.73 | 0.72 |
| a | 3906.3 | 3350.7 | 3006.3 | 2693.8 | 2463.1 | 2045.8 | 1661.8 | 1240.6 | 990.0 | 778.9 |
| b | 19.2296 | 17.3842 | 15.9306 | 14.4895 | 14.0347 | 11.7273 | 10.0304 | 7.7056 | 6.3341 | 4.9037 |
| σ | 1.61 | 1.40 | 1.33 | 1.26 | 1.11 | 1.01 | 0.82 | 0.60 | 0.47 | 0.34 |

昭和25年～令和2年（H.1～H.5年欠測）（資料数：66 個）

米沢

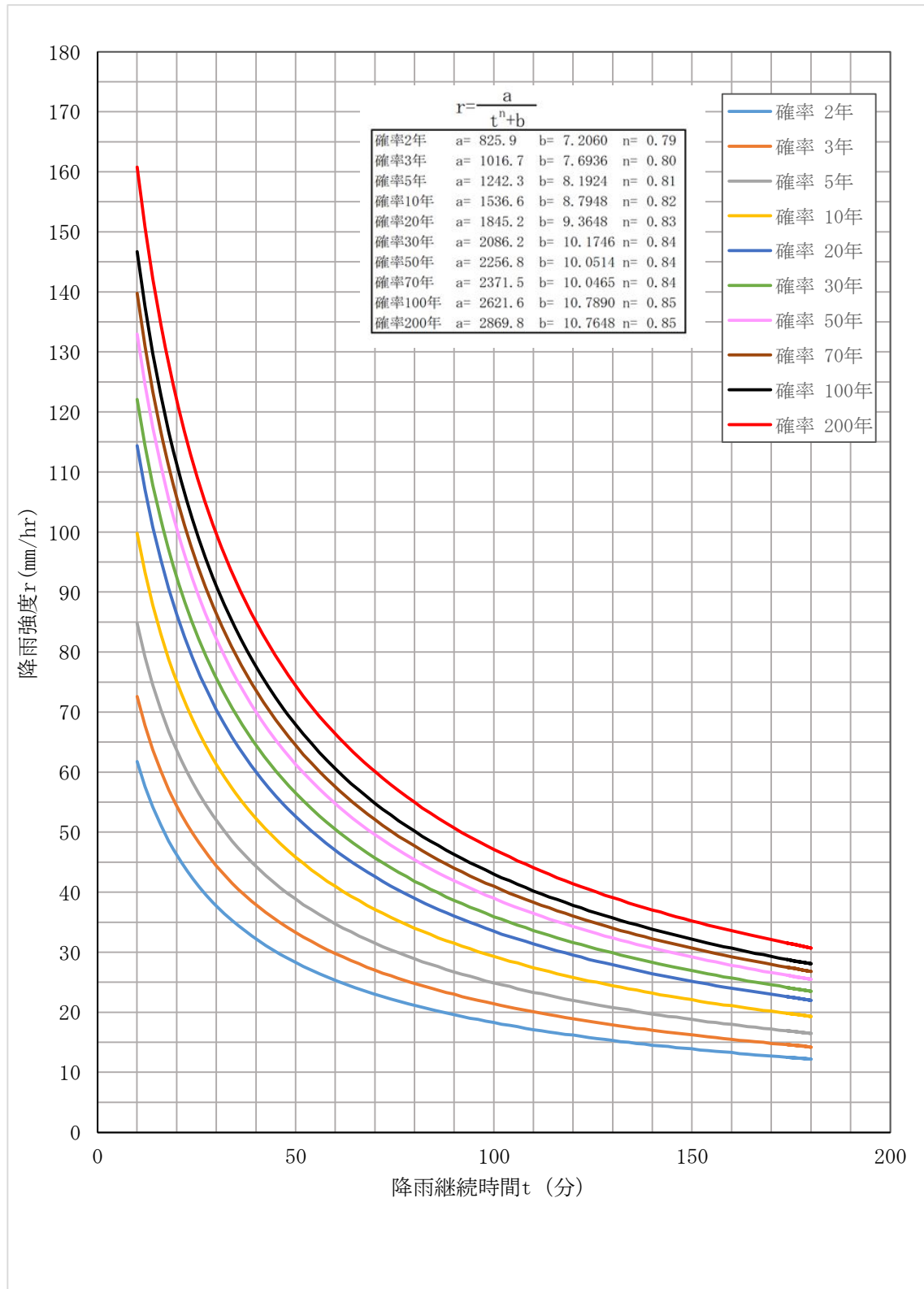
| 係数 | 確率年 | | | | | | | | | |
|----------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| n | 0.88 | 0.88 | 0.88 | 0.88 | 0.87 | 0.87 | 0.86 | 0.85 | 0.84 | 0.83 |
| a | 2934.3 | 2694.8 | 2572.3 | 2455.1 | 2165.4 | 2029.1 | 1704.0 | 1398.1 | 1162.4 | 963.4 |
| b | 12.0410 | 12.0558 | 12.1186 | 12.1456 | 11.3089 | 11.3230 | 10.5715 | 9.9049 | 9.3283 | 8.8018 |
| σ | 1.66 | 1.47 | 1.38 | 1.28 | 1.13 | 1.03 | 0.81 | 0.62 | 0.47 | 0.33 |

山形降雨強度表

明治41年～令和2年(資料数：113個)

| 降雨強度式の係数 $r=a/(t^n + b)$ (mm/hr) | | | | | | | | | | |
|----------------------------------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|
| n | 0.85 | 0.85 | 0.84 | 0.84 | 0.84 | 0.83 | 0.82 | 0.81 | 0.80 | 0.79 |
| a | 2869.8 | 2621.6 | 2371.5 | 2256.8 | 2086.2 | 1845.2 | 1536.6 | 1242.3 | 1016.7 | 825.90 |
| b | 10.7648 | 10.7890 | 10.0465 | 10.0514 | 10.1746 | 9.3648 | 8.7948 | 8.1924 | 7.6936 | 7.2060 |
| t (分) | 確率年 | | | | | | | | | |
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| 10 | 160.8 | 146.7 | 139.8 | 133.0 | 122.1 | 114.4 | 99.8 | 84.8 | 72.6 | 61.8 |
| 15 | 138.3 | 126.2 | 119.9 | 114.1 | 104.8 | 98.0 | 85.3 | 72.4 | 61.9 | 52.6 |
| 20 | 122.0 | 111.3 | 105.7 | 100.6 | 92.5 | 86.3 | 75.1 | 63.7 | 54.4 | 46.2 |
| 25 | 109.6 | 100.0 | 94.9 | 90.3 | 83.1 | 77.4 | 67.4 | 57.1 | 48.8 | 41.5 |
| 30 | 99.7 | 91.0 | 86.4 | 82.2 | 75.6 | 70.4 | 61.3 | 52.0 | 44.4 | 37.7 |
| 35 | 91.7 | 83.7 | 79.4 | 75.6 | 69.6 | 64.8 | 56.4 | 47.8 | 40.9 | 34.7 |
| 40 | 85.0 | 77.6 | 73.6 | 70.0 | 64.5 | 60.0 | 52.3 | 44.3 | 37.9 | 32.2 |
| 45 | 79.3 | 72.4 | 68.7 | 65.4 | 60.2 | 56.0 | 48.8 | 41.4 | 35.4 | 30.1 |
| 50 | 74.4 | 67.9 | 64.5 | 61.3 | 56.5 | 52.6 | 45.8 | 38.9 | 33.3 | 28.3 |
| 55 | 70.1 | 64.0 | 60.8 | 57.8 | 53.3 | 49.6 | 43.2 | 36.7 | 31.4 | 26.7 |
| 60 | 66.4 | 60.6 | 57.5 | 54.8 | 50.5 | 47.0 | 41.0 | 34.7 | 29.8 | 25.3 |
| 65 | 63.0 | 57.6 | 54.7 | 52.0 | 48.0 | 44.6 | 38.9 | 33.0 | 28.3 | 24.1 |
| 70 | 60.1 | 54.8 | 52.1 | 49.6 | 45.7 | 42.6 | 37.1 | 31.5 | 27.0 | 23.0 |
| 75 | 57.4 | 52.4 | 49.8 | 47.4 | 43.7 | 40.7 | 35.5 | 30.1 | 25.9 | 22.0 |
| 80 | 55.0 | 50.2 | 47.7 | 45.4 | 41.8 | 39.0 | 34.0 | 28.9 | 24.8 | 21.1 |
| 85 | 52.7 | 48.2 | 45.8 | 43.6 | 40.2 | 37.4 | 32.7 | 27.8 | 23.8 | 20.3 |
| 90 | 50.7 | 46.3 | 44.0 | 41.9 | 38.6 | 36.0 | 31.5 | 26.7 | 23.0 | 19.6 |
| 95 | 48.9 | 44.6 | 42.4 | 40.4 | 37.2 | 34.7 | 30.3 | 25.8 | 22.1 | 18.9 |
| 100 | 47.1 | 43.0 | 41.0 | 39.0 | 35.9 | 33.5 | 29.3 | 24.9 | 21.4 | 18.3 |
| 105 | 45.5 | 41.6 | 39.6 | 37.7 | 34.7 | 32.4 | 28.3 | 24.1 | 20.7 | 17.7 |
| 110 | 44.1 | 40.2 | 38.3 | 36.5 | 33.6 | 31.4 | 27.4 | 23.3 | 20.1 | 17.1 |
| 115 | 42.7 | 39.0 | 37.1 | 35.3 | 32.6 | 30.4 | 26.6 | 22.6 | 19.5 | 16.6 |
| 120 | 41.4 | 37.8 | 36.0 | 34.3 | 31.6 | 29.5 | 25.8 | 22.0 | 18.9 | 16.2 |
| 125 | 40.2 | 36.7 | 35.0 | 33.3 | 30.7 | 28.7 | 25.1 | 21.4 | 18.4 | 15.7 |
| 130 | 39.1 | 35.7 | 34.0 | 32.4 | 29.9 | 27.9 | 24.4 | 20.8 | 17.9 | 15.3 |
| 135 | 38.0 | 34.7 | 33.1 | 31.5 | 29.1 | 27.1 | 23.8 | 20.2 | 17.4 | 14.9 |
| 140 | 37.0 | 33.8 | 32.2 | 30.7 | 28.3 | 26.4 | 23.2 | 19.7 | 17.0 | 14.5 |
| 145 | 36.1 | 33.0 | 31.4 | 29.9 | 27.6 | 25.8 | 22.6 | 19.3 | 16.6 | 14.2 |
| 150 | 35.2 | 32.2 | 30.7 | 29.2 | 26.9 | 25.2 | 22.1 | 18.8 | 16.2 | 13.9 |
| 155 | 34.4 | 31.4 | 29.9 | 28.5 | 26.3 | 24.6 | 21.5 | 18.4 | 15.8 | 13.5 |
| 160 | 33.6 | 30.7 | 29.2 | 27.8 | 25.7 | 24.0 | 21.1 | 18.0 | 15.5 | 13.3 |
| 165 | 32.8 | 30.0 | 28.6 | 27.2 | 25.1 | 23.5 | 20.6 | 17.6 | 15.1 | 13.0 |
| 170 | 32.1 | 29.3 | 28.0 | 26.6 | 24.6 | 23.0 | 20.2 | 17.2 | 14.8 | 12.7 |
| 175 | 31.4 | 28.7 | 27.4 | 26.0 | 24.0 | 22.5 | 19.7 | 16.8 | 14.5 | 12.4 |
| 180 | 30.7 | 28.1 | 26.8 | 25.5 | 23.5 | 22.0 | 19.3 | 16.5 | 14.2 | 12.2 |

山形降雨強度曲線
(明治41年～令和2年(資料数:113個))

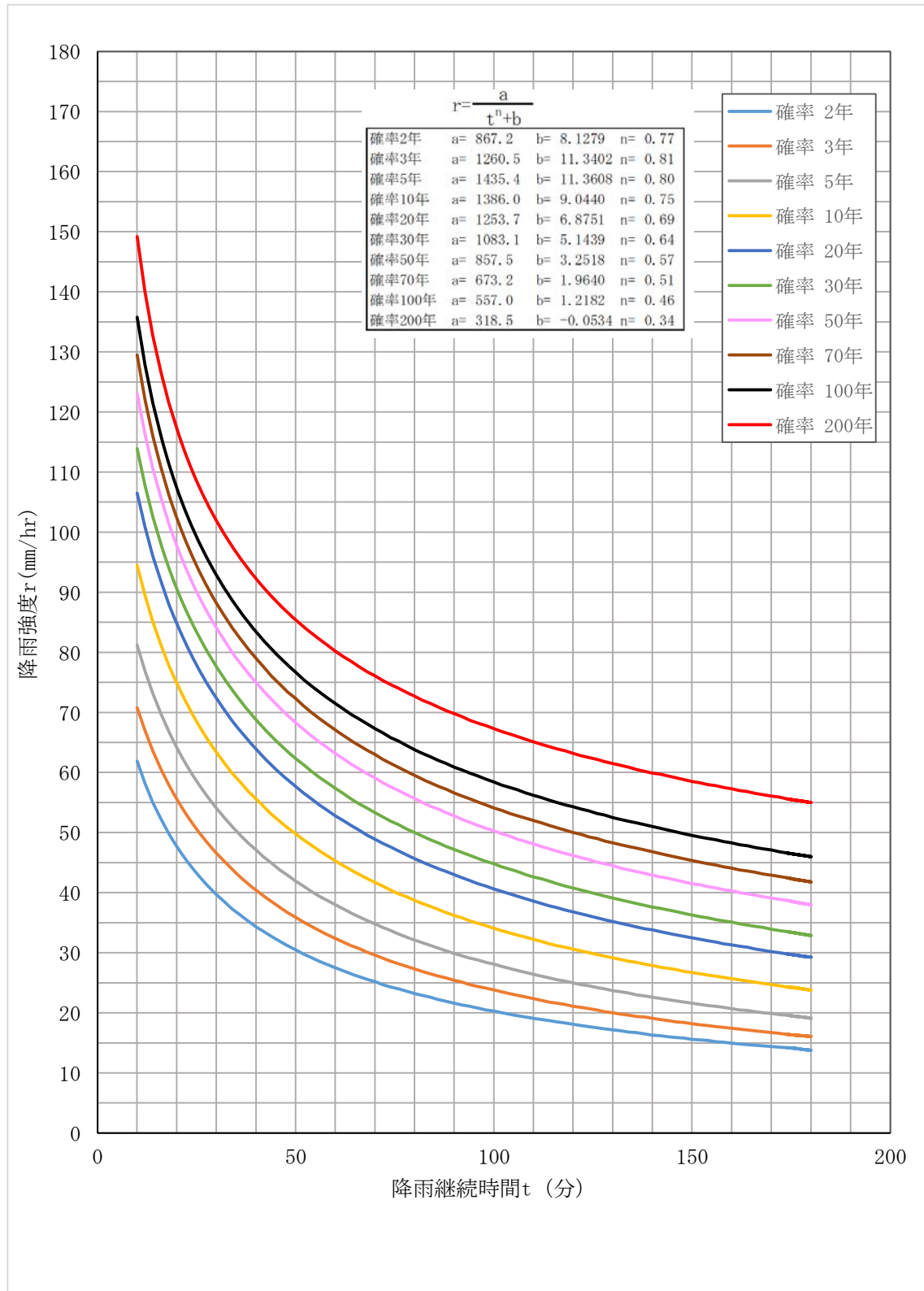


新庄降雨強度表

昭和32年～令和2年(資料数：64個)

| 降雨強度式の係数 $r=a/(t^n + b)$ (mm/hr) | | | | | | | | | | |
|----------------------------------|---------|--------|-------|--------|--------|--------|-------|---------|---------|--------|
| n | 0.34 | 0.46 | 0.51 | 0.57 | 0.64 | 0.69 | 0.75 | 0.80 | 0.81 | 0.77 |
| a | 318.5 | 557 | 673.2 | 857.5 | 1083.1 | 1253.7 | 1386 | 1435.4 | 1260.5 | 867.2 |
| b | -0.0534 | 1.2182 | 1.964 | 3.2518 | 5.1439 | 6.8751 | 9.044 | 11.3608 | 11.3402 | 8.1279 |
| t (分) | 確率年 | | | | | | | | | |
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| 10 | 149.2 | 135.8 | 129.5 | 123.1 | 113.9 | 106.5 | 94.5 | 81.2 | 70.8 | 61.9 |
| 15 | 129.6 | 118.7 | 113.3 | 108.1 | 100.3 | 93.9 | 83.2 | 71.5 | 62.1 | 53.6 |
| 20 | 117.3 | 107.4 | 102.4 | 97.8 | 90.7 | 84.8 | 74.9 | 64.2 | 55.6 | 47.7 |
| 25 | 108.6 | 99.2 | 94.5 | 90.1 | 83.4 | 77.9 | 68.5 | 58.6 | 50.6 | 43.2 |
| 30 | 101.9 | 92.9 | 88.2 | 84.1 | 77.6 | 72.4 | 63.4 | 54.1 | 46.6 | 39.7 |
| 35 | 96.6 | 87.7 | 83.2 | 79.1 | 72.8 | 67.8 | 59.1 | 50.3 | 43.2 | 36.8 |
| 40 | 92.3 | 83.4 | 79.0 | 75.0 | 68.8 | 63.9 | 55.6 | 47.1 | 40.4 | 34.3 |
| 45 | 88.6 | 79.8 | 75.4 | 71.4 | 65.3 | 60.6 | 52.5 | 44.3 | 38.0 | 32.3 |
| 50 | 85.4 | 76.7 | 72.3 | 68.3 | 62.3 | 57.7 | 49.8 | 41.9 | 35.9 | 30.5 |
| 55 | 82.7 | 73.9 | 69.5 | 65.6 | 59.7 | 55.1 | 47.4 | 39.8 | 34.0 | 28.9 |
| 60 | 80.2 | 71.5 | 67.1 | 63.2 | 57.4 | 52.8 | 45.3 | 38.0 | 32.4 | 27.5 |
| 65 | 78.0 | 69.3 | 64.9 | 61.0 | 55.2 | 50.8 | 43.4 | 36.3 | 30.9 | 26.3 |
| 70 | 76.1 | 67.3 | 63.0 | 59.1 | 53.3 | 48.9 | 41.7 | 34.8 | 29.6 | 25.2 |
| 75 | 74.3 | 65.5 | 61.2 | 57.3 | 51.6 | 47.2 | 40.1 | 33.4 | 28.4 | 24.1 |
| 80 | 72.7 | 63.8 | 59.5 | 55.7 | 50.0 | 45.7 | 38.7 | 32.1 | 27.3 | 23.2 |
| 85 | 71.2 | 62.3 | 58.0 | 54.2 | 48.5 | 44.3 | 37.4 | 31.0 | 26.3 | 22.4 |
| 90 | 69.8 | 60.9 | 56.6 | 52.8 | 47.2 | 43.0 | 36.2 | 29.9 | 25.4 | 21.6 |
| 95 | 68.5 | 59.6 | 55.3 | 51.5 | 45.9 | 41.7 | 35.1 | 29.0 | 24.6 | 20.9 |
| 100 | 67.3 | 58.4 | 54.1 | 50.3 | 44.8 | 40.6 | 34.1 | 28.1 | 23.8 | 20.3 |
| 105 | 66.2 | 57.3 | 53.0 | 49.2 | 43.7 | 39.6 | 33.1 | 27.2 | 23.0 | 19.7 |
| 110 | 65.1 | 56.2 | 52.0 | 48.1 | 42.6 | 38.6 | 32.2 | 26.4 | 22.4 | 19.1 |
| 115 | 64.1 | 55.2 | 51.0 | 47.1 | 41.7 | 37.7 | 31.4 | 25.7 | 21.7 | 18.6 |
| 120 | 63.2 | 54.3 | 50.0 | 46.2 | 40.8 | 36.8 | 30.6 | 25.0 | 21.1 | 18.1 |
| 125 | 62.3 | 53.4 | 49.1 | 45.3 | 39.9 | 36.0 | 29.9 | 24.3 | 20.6 | 17.6 |
| 130 | 61.5 | 52.5 | 48.3 | 44.5 | 39.1 | 35.2 | 29.2 | 23.7 | 20.0 | 17.2 |
| 135 | 60.7 | 51.7 | 47.5 | 43.7 | 38.4 | 34.5 | 28.5 | 23.2 | 19.5 | 16.7 |
| 140 | 59.9 | 51.0 | 46.8 | 42.9 | 37.6 | 33.8 | 27.9 | 22.6 | 19.1 | 16.3 |
| 145 | 59.2 | 50.2 | 46.0 | 42.2 | 36.9 | 33.1 | 27.3 | 22.1 | 18.6 | 16.0 |
| 150 | 58.5 | 49.5 | 45.4 | 41.5 | 36.3 | 32.5 | 26.7 | 21.6 | 18.2 | 15.6 |
| 155 | 57.9 | 48.9 | 44.7 | 40.9 | 35.7 | 31.9 | 26.2 | 21.1 | 17.8 | 15.3 |
| 160 | 57.3 | 48.3 | 44.1 | 40.3 | 35.1 | 31.3 | 25.7 | 20.7 | 17.4 | 15.0 |
| 165 | 56.7 | 47.6 | 43.5 | 39.7 | 34.5 | 30.8 | 25.2 | 20.3 | 17.1 | 14.7 |
| 170 | 56.1 | 47.1 | 42.9 | 39.1 | 33.9 | 30.2 | 24.7 | 19.9 | 16.7 | 14.4 |
| 175 | 55.5 | 46.5 | 42.4 | 38.6 | 33.4 | 29.7 | 24.2 | 19.5 | 16.4 | 14.1 |
| 180 | 55.0 | 46.0 | 41.8 | 38.0 | 32.9 | 29.3 | 23.8 | 19.1 | 16.1 | 13.8 |

新庄降雨強度曲線
 (昭和32年～令和2年(資料数:64個))

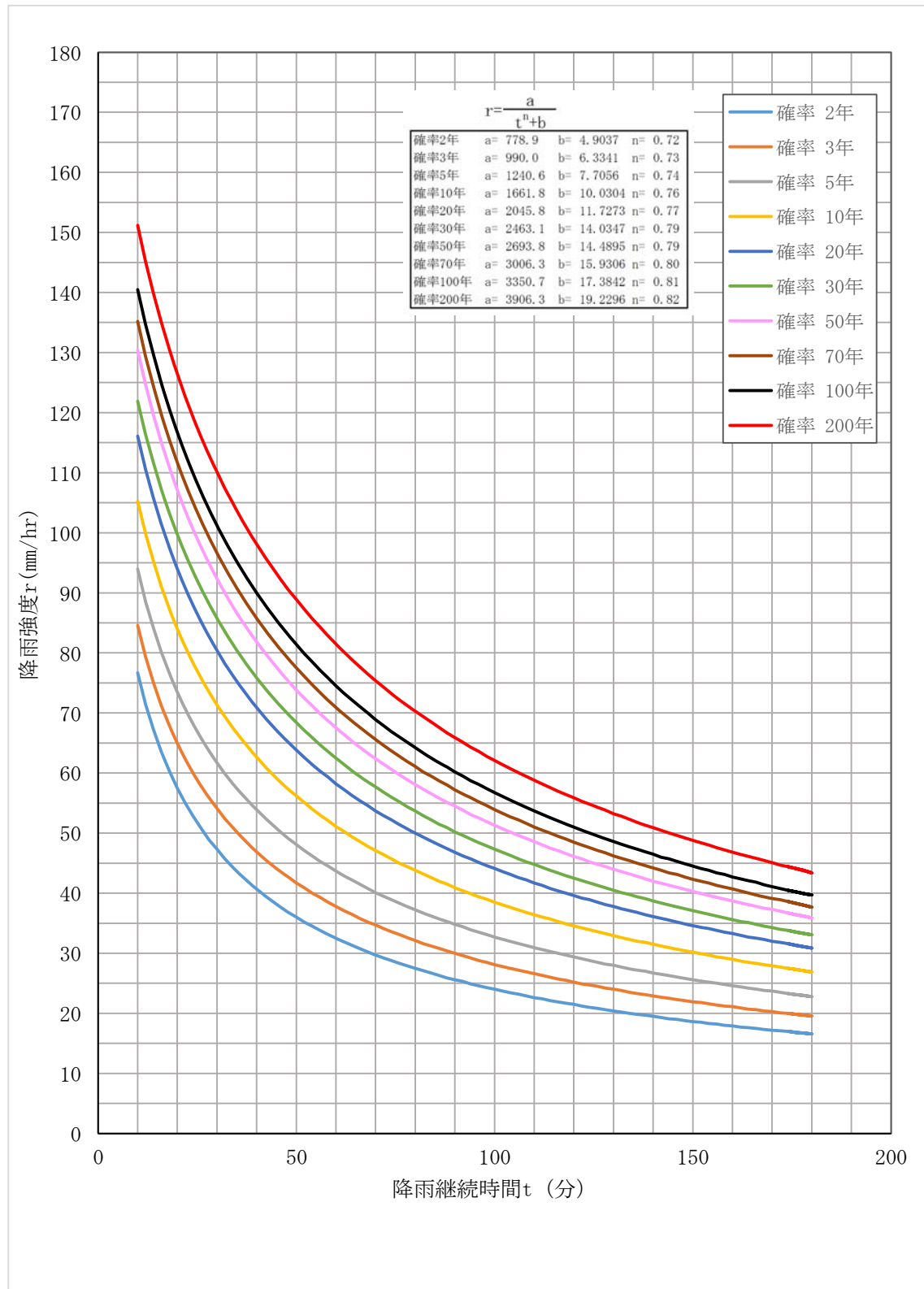


酒田降雨強度表

昭和12年～令和2年(資料数：84個)

| 降雨強度式の係数 $r=a/(t^n + b)$ (mm/hr) | | | | | | | | | | |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| n | 0.82 | 0.81 | 0.80 | 0.79 | 0.79 | 0.77 | 0.76 | 0.74 | 0.73 | 0.72 |
| a | 3906.3 | 3350.7 | 3006.3 | 2693.8 | 2463.1 | 2045.8 | 1661.8 | 1240.6 | 990.0 | 778.9 |
| b | 19.2296 | 17.3842 | 15.9306 | 14.4895 | 14.0347 | 11.7273 | 10.0304 | 7.7056 | 6.3341 | 4.9037 |
| t (分) | 確率年 | | | | | | | | | |
| | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| 10 | 151.2 | 140.5 | 135.2 | 130.4 | 121.9 | 116.1 | 105.3 | 94.0 | 84.6 | 76.7 |
| 15 | 137.3 | 127.2 | 121.9 | 117.2 | 109.3 | 103.5 | 93.0 | 82.0 | 73.0 | 65.3 |
| 20 | 126.4 | 116.7 | 111.7 | 107.1 | 99.7 | 94.0 | 84.0 | 73.5 | 65.0 | 57.5 |
| 25 | 117.5 | 108.3 | 103.4 | 99.0 | 92.1 | 86.5 | 77.0 | 66.9 | 58.9 | 51.7 |
| 30 | 110.1 | 101.2 | 96.6 | 92.3 | 85.8 | 80.4 | 71.3 | 61.7 | 54.1 | 47.3 |
| 35 | 103.7 | 95.2 | 90.8 | 86.7 | 80.4 | 75.3 | 66.6 | 57.5 | 50.2 | 43.7 |
| 40 | 98.1 | 90.0 | 85.8 | 81.8 | 75.9 | 70.9 | 62.6 | 53.9 | 46.9 | 40.7 |
| 45 | 93.2 | 85.4 | 81.4 | 77.6 | 71.9 | 67.1 | 59.2 | 50.8 | 44.1 | 38.2 |
| 50 | 88.9 | 81.4 | 77.5 | 73.8 | 68.4 | 63.8 | 56.2 | 48.1 | 41.7 | 36.0 |
| 55 | 85.0 | 77.8 | 74.0 | 70.5 | 65.3 | 60.9 | 53.5 | 45.8 | 39.6 | 34.1 |
| 60 | 81.5 | 74.5 | 70.9 | 67.5 | 62.5 | 58.2 | 51.1 | 43.7 | 37.8 | 32.5 |
| 65 | 78.3 | 71.6 | 68.1 | 64.8 | 59.9 | 55.9 | 49.0 | 41.8 | 36.1 | 31.0 |
| 70 | 75.4 | 68.9 | 65.6 | 62.4 | 57.7 | 53.7 | 47.1 | 40.1 | 34.7 | 29.7 |
| 75 | 72.7 | 66.5 | 63.2 | 60.2 | 55.6 | 51.8 | 45.4 | 38.6 | 33.3 | 28.5 |
| 80 | 70.3 | 64.2 | 61.1 | 58.1 | 53.7 | 50.0 | 43.8 | 37.2 | 32.1 | 27.5 |
| 85 | 68.0 | 62.1 | 59.1 | 56.2 | 51.9 | 48.3 | 42.3 | 36.0 | 31.0 | 26.5 |
| 90 | 65.9 | 60.2 | 57.2 | 54.5 | 50.2 | 46.8 | 40.9 | 34.8 | 30.0 | 25.6 |
| 95 | 64.0 | 58.4 | 55.5 | 52.8 | 48.7 | 45.4 | 39.7 | 33.7 | 29.0 | 24.8 |
| 100 | 62.1 | 56.7 | 53.9 | 51.3 | 47.3 | 44.1 | 38.5 | 32.7 | 28.1 | 24.0 |
| 105 | 60.4 | 55.2 | 52.4 | 49.9 | 46.0 | 42.9 | 37.4 | 31.8 | 27.3 | 23.3 |
| 110 | 58.8 | 53.7 | 51.0 | 48.6 | 44.8 | 41.7 | 36.4 | 30.9 | 26.6 | 22.6 |
| 115 | 57.3 | 52.3 | 49.7 | 47.3 | 43.6 | 40.6 | 35.5 | 30.1 | 25.9 | 22.0 |
| 120 | 55.9 | 51.0 | 48.5 | 46.1 | 42.5 | 39.6 | 34.6 | 29.4 | 25.2 | 21.5 |
| 125 | 54.5 | 49.8 | 47.3 | 45.0 | 41.5 | 38.7 | 33.7 | 28.6 | 24.6 | 20.9 |
| 130 | 53.2 | 48.6 | 46.2 | 44.0 | 40.5 | 37.8 | 32.9 | 28.0 | 24.0 | 20.4 |
| 135 | 52.0 | 47.5 | 45.2 | 43.0 | 39.6 | 36.9 | 32.2 | 27.3 | 23.4 | 19.9 |
| 140 | 50.9 | 46.5 | 44.2 | 42.0 | 38.7 | 36.1 | 31.5 | 26.7 | 22.9 | 19.5 |
| 145 | 49.8 | 45.5 | 43.2 | 41.1 | 37.9 | 35.3 | 30.8 | 26.1 | 22.4 | 19.0 |
| 150 | 48.8 | 44.5 | 42.3 | 40.3 | 37.1 | 34.6 | 30.2 | 25.6 | 21.9 | 18.6 |
| 155 | 47.8 | 43.6 | 41.5 | 39.5 | 36.3 | 33.9 | 29.6 | 25.1 | 21.5 | 18.3 |
| 160 | 46.8 | 42.7 | 40.7 | 38.7 | 35.6 | 33.3 | 29.0 | 24.6 | 21.1 | 17.9 |
| 165 | 45.9 | 41.9 | 39.9 | 38.0 | 34.9 | 32.6 | 28.4 | 24.1 | 20.7 | 17.5 |
| 170 | 45.1 | 41.1 | 39.1 | 37.3 | 34.3 | 32.0 | 27.9 | 23.7 | 20.3 | 17.2 |
| 175 | 44.2 | 40.4 | 38.4 | 36.6 | 33.7 | 31.4 | 27.4 | 23.2 | 19.9 | 16.9 |
| 180 | 43.4 | 39.7 | 37.7 | 35.9 | 33.1 | 30.9 | 26.9 | 22.8 | 19.6 | 16.6 |

酒田降雨強度曲線
(昭和12年～令和2年(資料数:84個))



米 沢 降 雨 強 度 表

昭和25年～令和2年（H.1～H.5年欠測）（資料数：66個）

| 降雨強度式の係数 $r=a/(t^n + b)$ (mm/hr) | | | | | | | | | | |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| n | 0.88 | 0.88 | 0.88 | 0.88 | 0.87 | 0.87 | 0.86 | 0.85 | 0.84 | 0.83 |
| a | 2934.3 | 2694.8 | 2572.3 | 2455.1 | 2165.4 | 2029.1 | 1704.0 | 1398.1 | 1162.4 | 963.4 |
| b | 12.0410 | 12.0558 | 12.1186 | 12.1456 | 11.3089 | 11.3230 | 10.5715 | 9.9049 | 9.3283 | 8.8018 |
| t | 確率年 | | | | | | | | | |
| (分) | 200 | 100 | 70 | 50 | 30 | 20 | 10 | 5 | 3 | 2 |
| 10 | 149.5 | 137.2 | 130.5 | 124.4 | 115.7 | 108.3 | 95.6 | 82.3 | 71.5 | 61.9 |
| 15 | 128.3 | 117.7 | 112.0 | 106.8 | 99.1 | 92.8 | 81.8 | 70.3 | 61.0 | 52.7 |
| 20 | 112.9 | 103.6 | 98.6 | 94.0 | 87.1 | 81.6 | 71.8 | 61.7 | 53.5 | 46.3 |
| 25 | 101.1 | 92.8 | 88.4 | 84.3 | 78.0 | 73.1 | 64.3 | 55.2 | 47.9 | 41.4 |
| 30 | 91.7 | 84.2 | 80.2 | 76.5 | 70.8 | 66.3 | 58.3 | 50.1 | 43.5 | 37.6 |
| 35 | 84.1 | 77.2 | 73.6 | 70.2 | 64.9 | 60.8 | 53.5 | 45.9 | 39.9 | 34.5 |
| 40 | 77.8 | 71.4 | 68.0 | 64.9 | 60.0 | 56.2 | 49.5 | 42.5 | 36.9 | 31.9 |
| 45 | 72.4 | 66.4 | 63.3 | 60.4 | 55.9 | 52.4 | 46.1 | 39.6 | 34.4 | 29.8 |
| 50 | 67.8 | 62.2 | 59.3 | 56.6 | 52.3 | 49.0 | 43.2 | 37.1 | 32.2 | 27.9 |
| 55 | 63.7 | 58.5 | 55.8 | 53.2 | 49.2 | 46.1 | 40.6 | 34.9 | 30.4 | 26.3 |
| 60 | 60.2 | 55.3 | 52.7 | 50.3 | 46.5 | 43.6 | 38.4 | 33.0 | 28.7 | 24.9 |
| 65 | 57.1 | 52.4 | 49.9 | 47.6 | 44.1 | 41.3 | 36.4 | 31.3 | 27.2 | 23.6 |
| 70 | 54.3 | 49.8 | 47.5 | 45.3 | 42.0 | 39.3 | 34.6 | 29.8 | 25.9 | 22.5 |
| 75 | 51.7 | 47.5 | 45.3 | 43.2 | 40.0 | 37.5 | 33.1 | 28.4 | 24.8 | 21.5 |
| 80 | 49.5 | 45.4 | 43.3 | 41.3 | 38.3 | 35.9 | 31.6 | 27.2 | 23.7 | 20.6 |
| 85 | 47.4 | 43.5 | 41.5 | 39.6 | 36.7 | 34.4 | 30.3 | 26.1 | 22.8 | 19.8 |
| 90 | 45.5 | 41.8 | 39.8 | 38.0 | 35.2 | 33.0 | 29.1 | 25.1 | 21.9 | 19.0 |
| 95 | 43.8 | 40.2 | 38.3 | 36.6 | 33.9 | 31.8 | 28.0 | 24.2 | 21.1 | 18.3 |
| 100 | 42.2 | 38.7 | 36.9 | 35.2 | 32.7 | 30.6 | 27.0 | 23.3 | 20.3 | 17.7 |
| 105 | 40.7 | 37.4 | 35.6 | 34.0 | 31.5 | 29.6 | 26.1 | 22.5 | 19.6 | 17.1 |
| 110 | 39.3 | 36.1 | 34.4 | 32.9 | 30.5 | 28.6 | 25.2 | 21.8 | 19.0 | 16.5 |
| 115 | 38.1 | 34.9 | 33.3 | 31.8 | 29.5 | 27.7 | 24.4 | 21.1 | 18.4 | 16.0 |
| 120 | 36.9 | 33.8 | 32.3 | 30.8 | 28.6 | 26.8 | 23.7 | 20.4 | 17.9 | 15.5 |
| 125 | 35.8 | 32.8 | 31.3 | 29.9 | 27.7 | 26.0 | 23.0 | 19.8 | 17.3 | 15.1 |
| 130 | 34.7 | 31.9 | 30.4 | 29.0 | 26.9 | 25.2 | 22.3 | 19.3 | 16.8 | 14.7 |
| 135 | 33.7 | 31.0 | 29.5 | 28.2 | 26.2 | 24.5 | 21.7 | 18.7 | 16.4 | 14.3 |
| 140 | 32.8 | 30.1 | 28.7 | 27.4 | 25.5 | 23.9 | 21.1 | 18.2 | 16.0 | 13.9 |
| 145 | 31.9 | 29.3 | 28.0 | 26.7 | 24.8 | 23.3 | 20.6 | 17.8 | 15.6 | 13.6 |
| 150 | 31.1 | 28.6 | 27.3 | 26.0 | 24.2 | 22.7 | 20.1 | 17.3 | 15.2 | 13.2 |
| 155 | 30.4 | 27.9 | 26.6 | 25.4 | 23.6 | 22.1 | 19.6 | 16.9 | 14.8 | 12.9 |
| 160 | 29.6 | 27.2 | 25.9 | 24.8 | 23.0 | 21.6 | 19.1 | 16.5 | 14.5 | 12.6 |
| 165 | 28.9 | 26.6 | 25.3 | 24.2 | 22.5 | 21.1 | 18.7 | 16.1 | 14.1 | 12.3 |
| 170 | 28.3 | 26.0 | 24.8 | 23.6 | 22.0 | 20.6 | 18.2 | 15.8 | 13.8 | 12.1 |
| 175 | 27.6 | 25.4 | 24.2 | 23.1 | 21.5 | 20.1 | 17.8 | 15.4 | 13.5 | 11.8 |
| 180 | 27.0 | 24.8 | 23.7 | 22.6 | 21.0 | 19.7 | 17.5 | 15.1 | 13.2 | 11.6 |

米沢降雨強度曲線
 (昭和25年～令和2年 (H.1～H.5年欠測) (資料数:66個))

