The State of Hydrology (Research) in South Africa: Towards a 10-year Science Plan
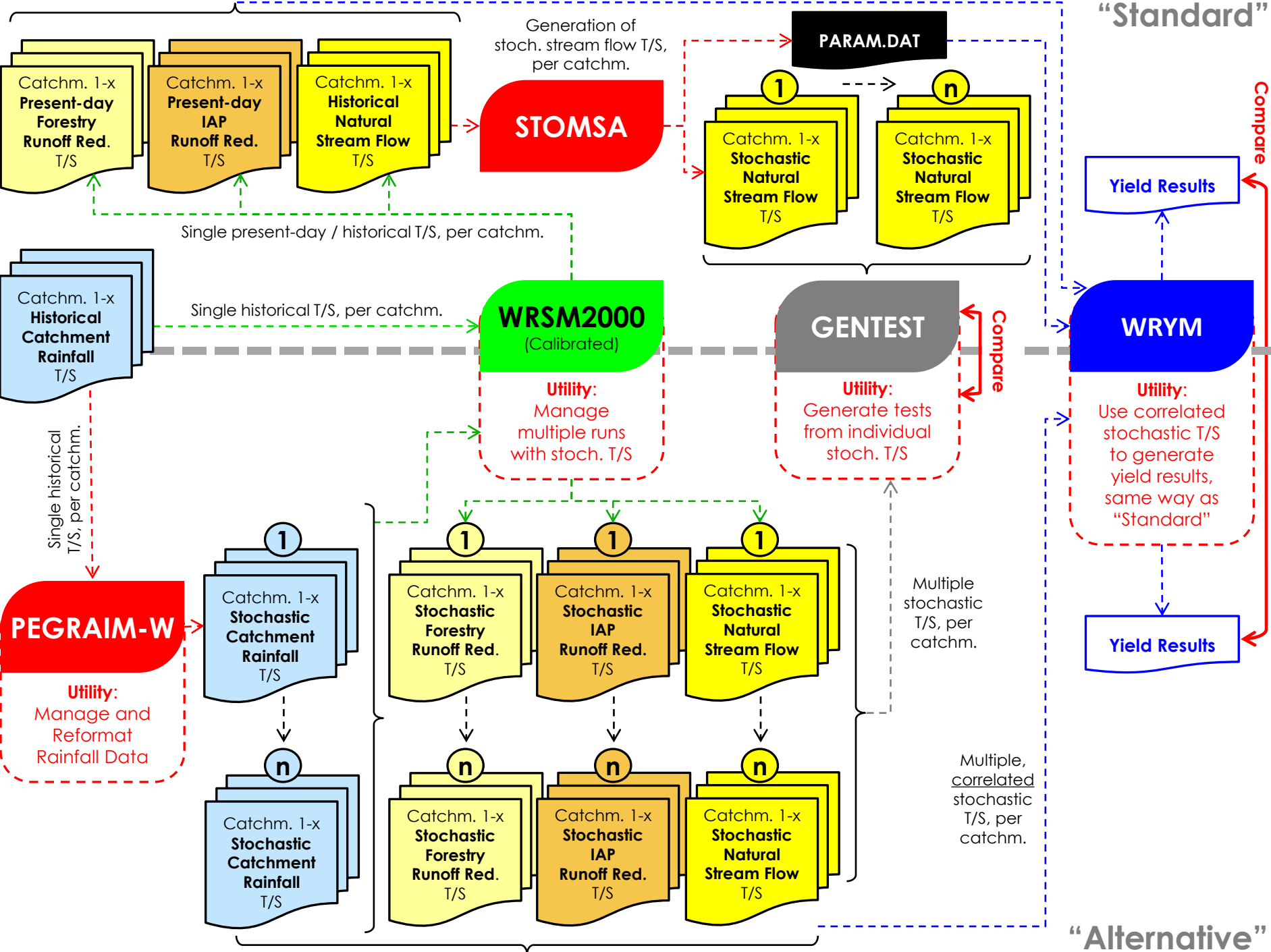
Application of Monthly Stochastic Rainfall in Risk-based Water Resources Yield Assessments (WRC Project K5/2155)

Monday, 31 March 2014, WRC

Project summary

- Risk-based yields → Yield
  → Assurance

- Stochastic hydrology → **Stream flows** → STOMSA

  → **Rainfall** → Explicit modelling
  → Climate change
  → Uncertainty

  → PEGRAIM-W

- Conclusion: Yield results compare well

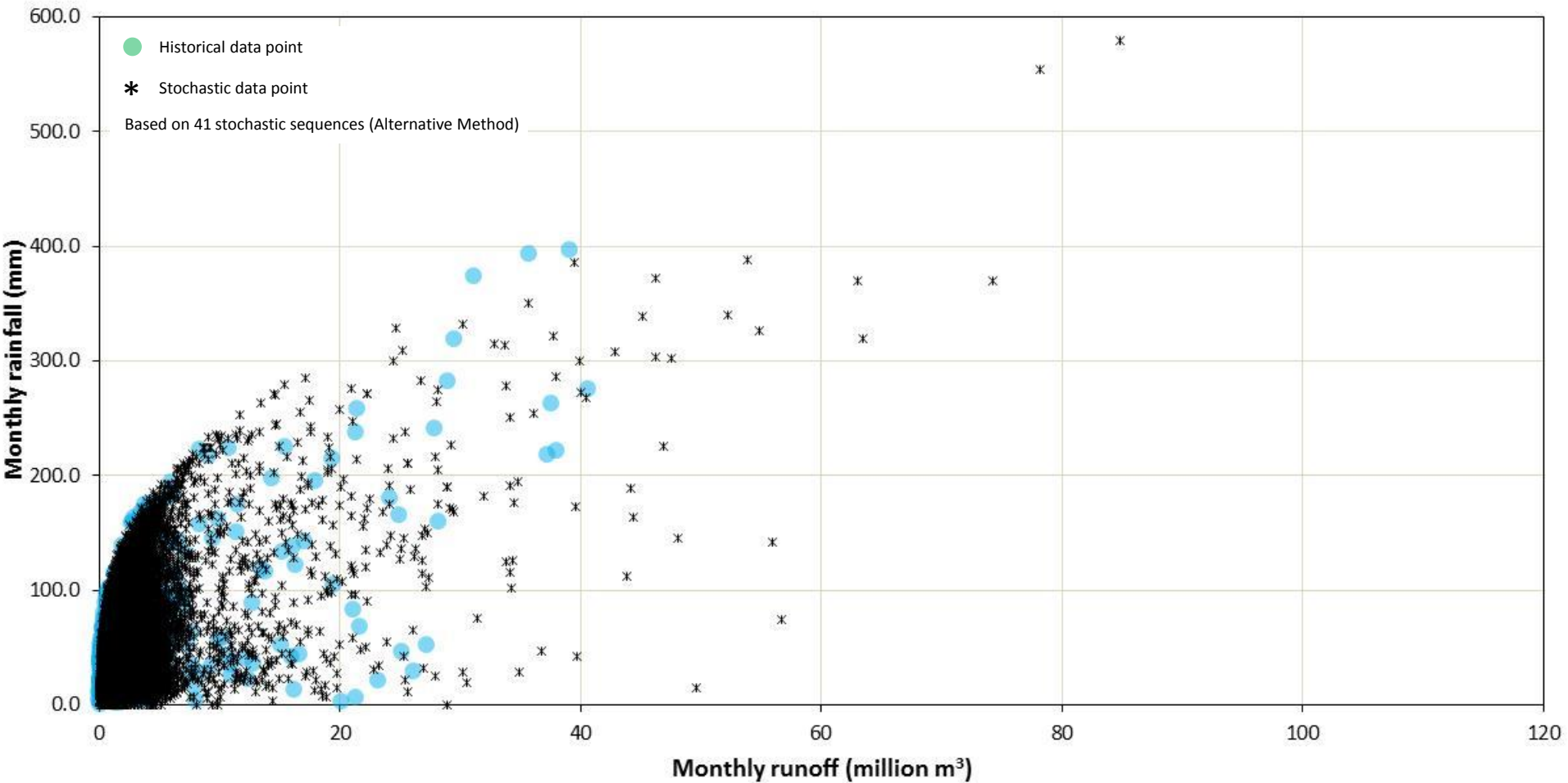- Recommendation: Implement as alternative

"Standard"

Generation of stoch. stream flow T/S, per catchm.

PARAM.DAT

Catchm. 1-x **Present-day Forestry Runoff Red.** T/S

Catchm. 1-x **Present-day IAP Runoff Red.** T/S

Catchm. 1-x **Historical Natural Stream Flow** T/S

STOMSA

1

n

Catchm. 1-x **Stochastic Natural Stream Flow** T/S

Catchm. 1-x **Stochastic Natural Stream Flow** T/S

Compare

Yield Results

Single present-day / historical T/S, per catchm.

Catchm. 1-x **Historical Catchment Rainfall** T/S

Single historical T/S, per catchm.

WRSM2000 (Calibrated)

GENTEST

WRYM

Utility: Manage multiple runs with stoch. T/S

Utility: Generate tests from individual stoch. T/S

Compare

Utility: Use correlated stochastic T/S to generate yield results, same way as "Standard"

Single historical T/S, per catchm.

PEGRAIM-W

1

Catchm. 1-x **Stochastic Catchment Rainfall** T/S

1

Catchm. 1-x **Stochastic Forestry Runoff Red.** T/S

1

Catchm. 1-x **Stochastic IAP Runoff Red.** T/S

1

Catchm. 1-x **Stochastic Natural Stream Flow** T/S

Multiple stochastic T/S, per catchm.

Utility: Manage and Reformat Rainfall Data

n

Catchm. 1-x **Stochastic Catchment Rainfall** T/S

n

Catchm. 1-x **Stochastic Forestry Runoff Red.** T/S

n

Catchm. 1-x **Stochastic IAP Runoff Red.** T/S

n

Catchm. 1-x **Stochastic Natural Stream Flow** T/S

Multiple, correlated stochastic T/S, per catchm.

Yield Results

"Alternative"

Legend

- Provinces
- Test Case Locations

Limpopo

Gauteng

Mpumalanga

Swaziland

North West

Northern Cape

Free State

KwaZulu-Natal

Lesotho

Eastern Cape

Western Cape

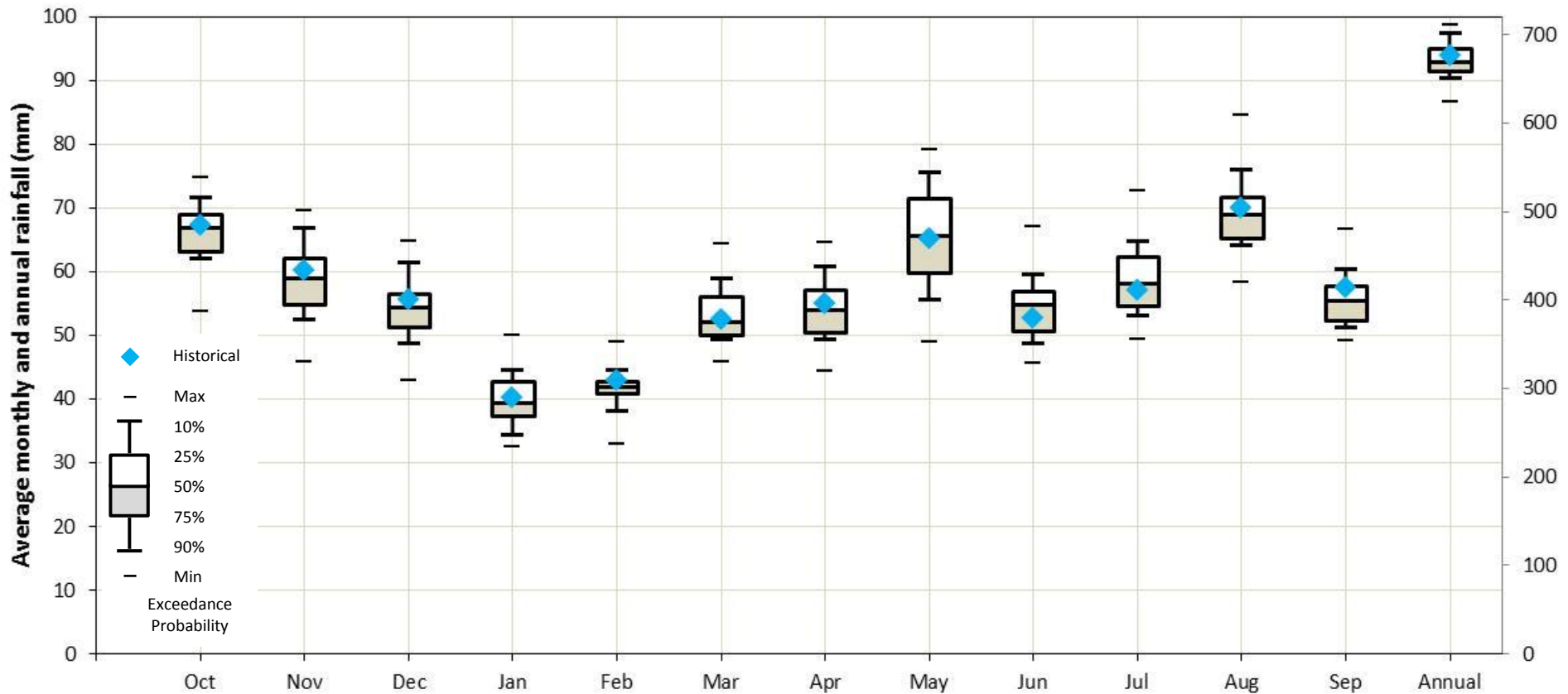0   150   300   600 Kilometers

Kouga Dam (L82C)

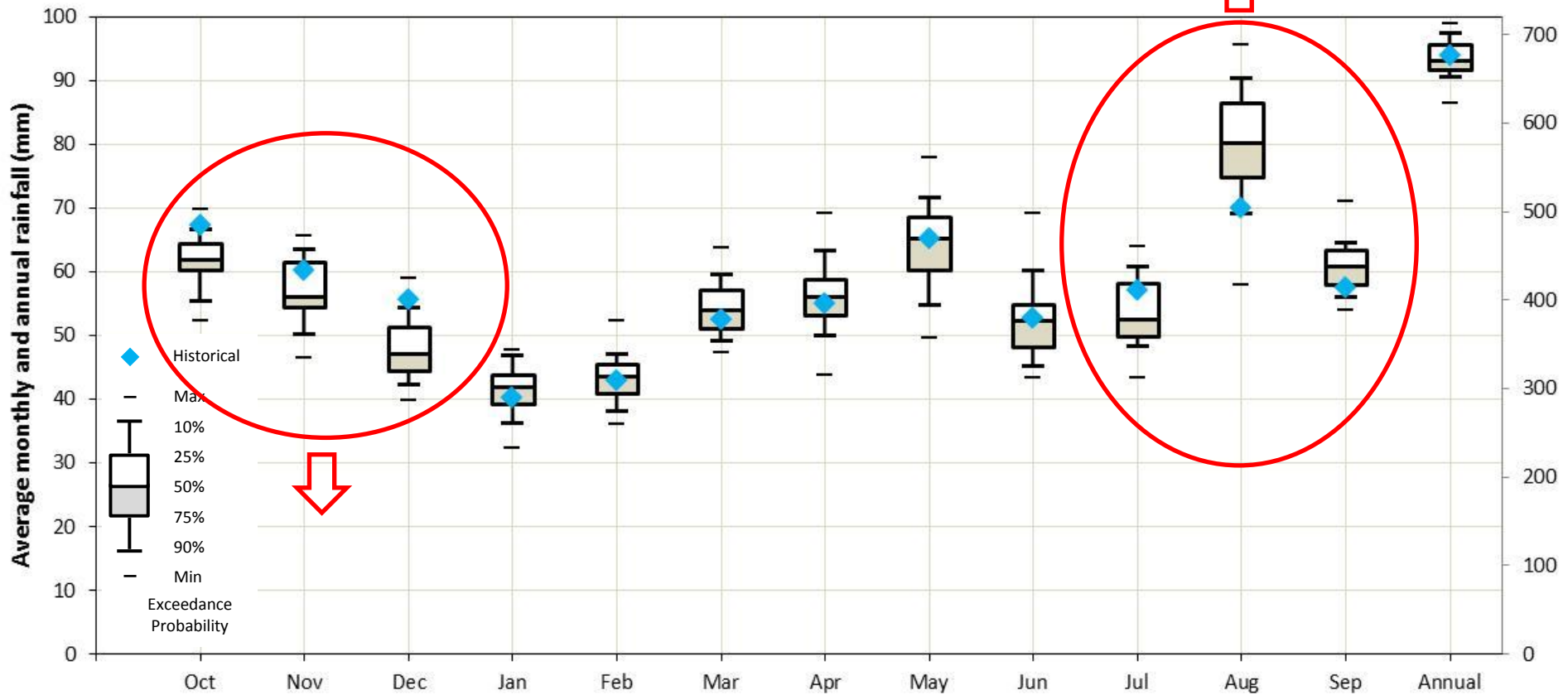# L82C ("Alternative"-method)
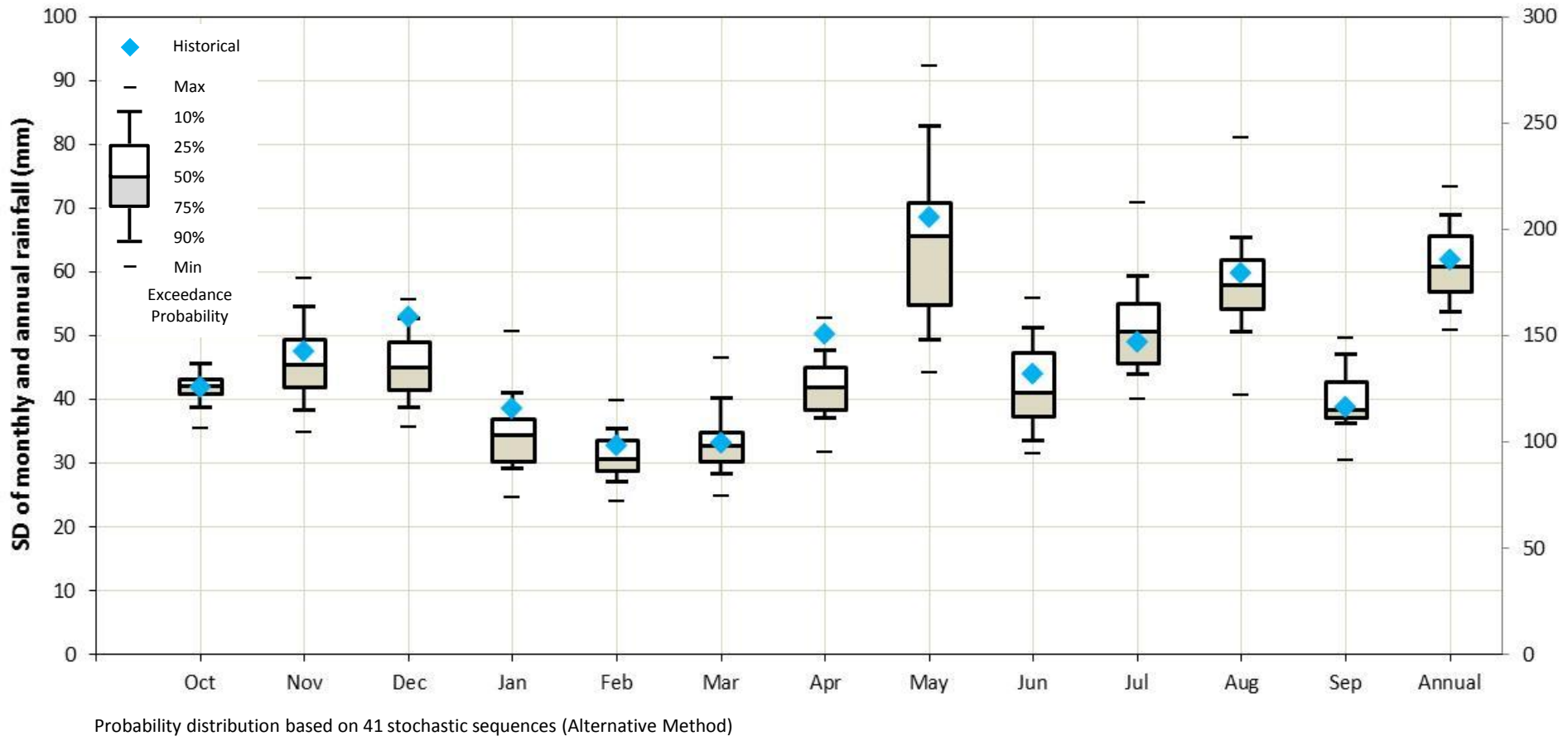
L82C ("Standard"-method)

L82C ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)
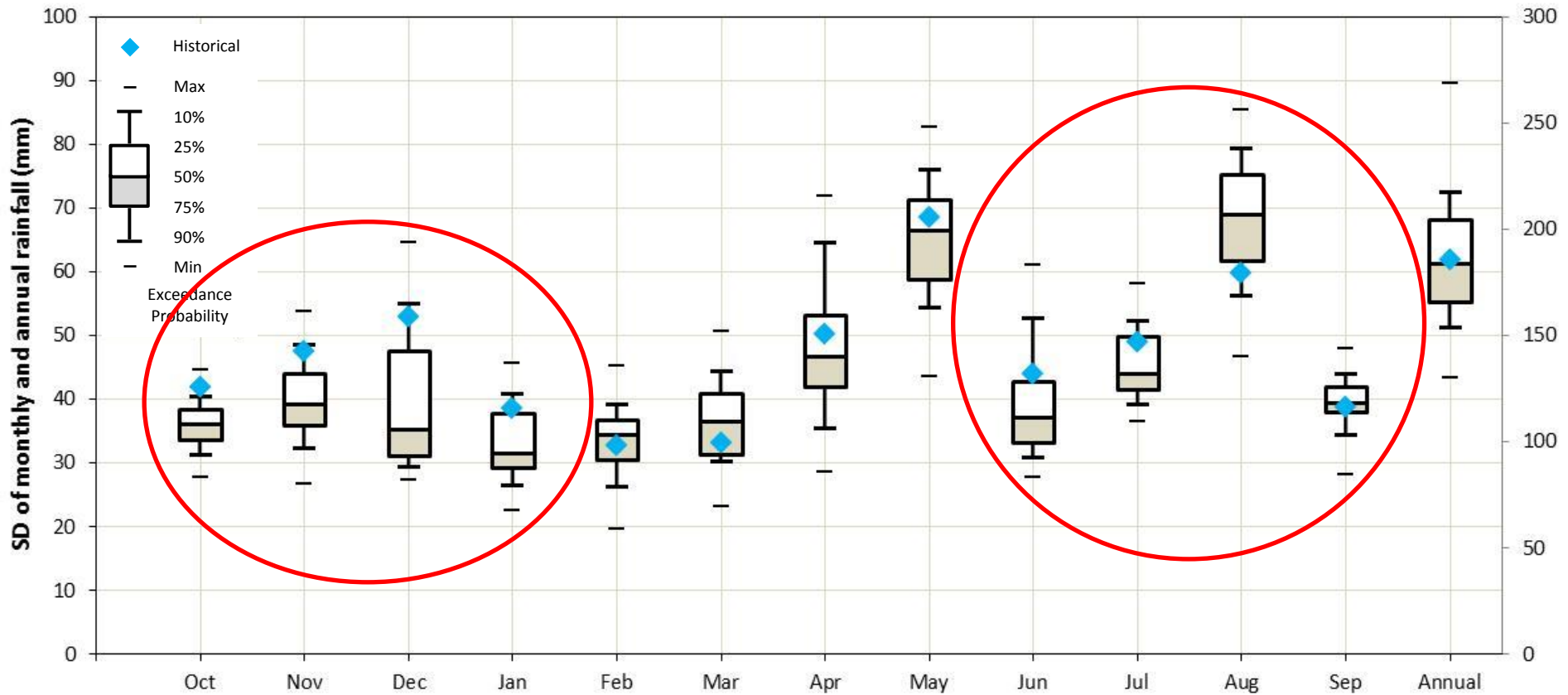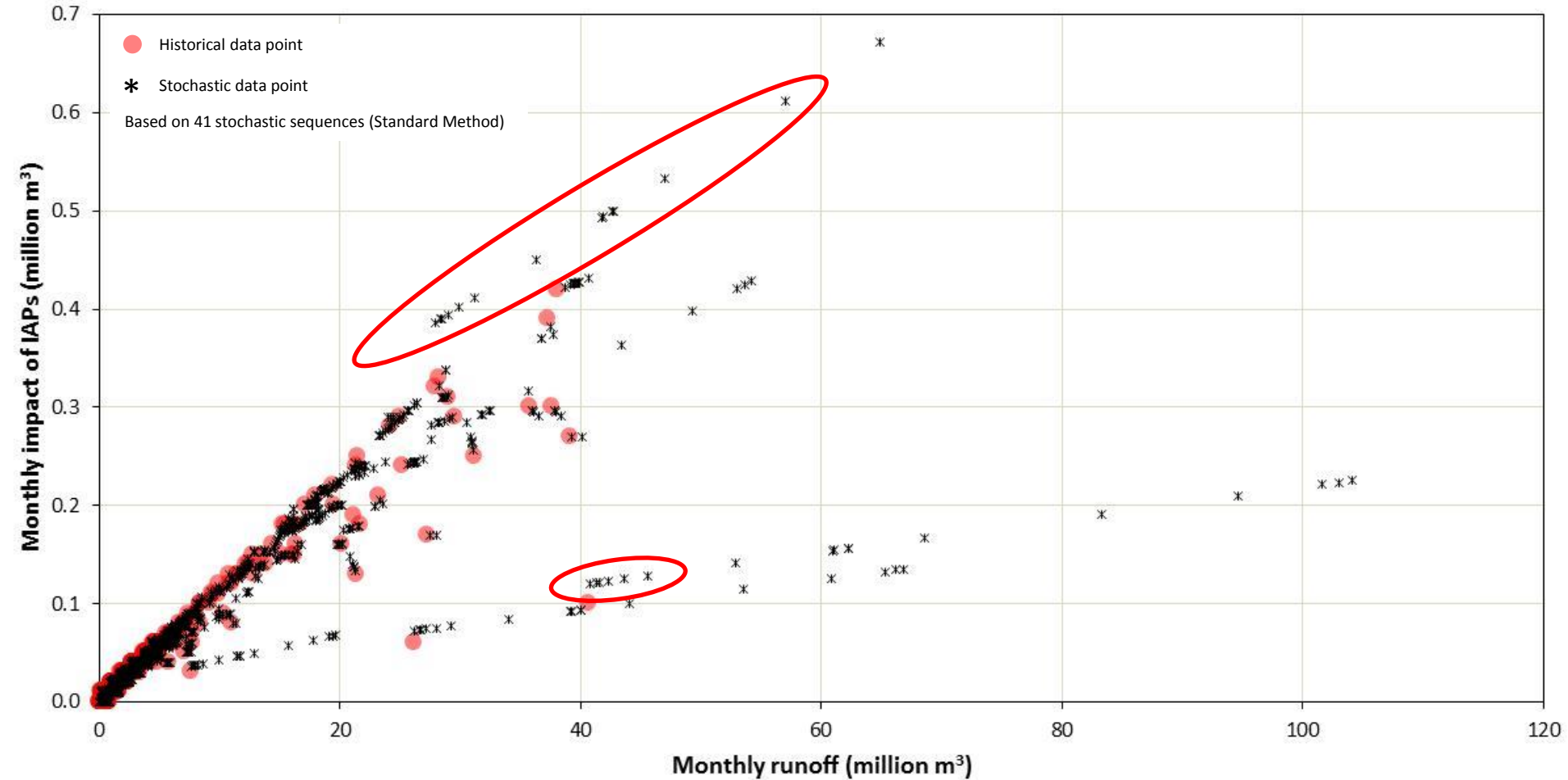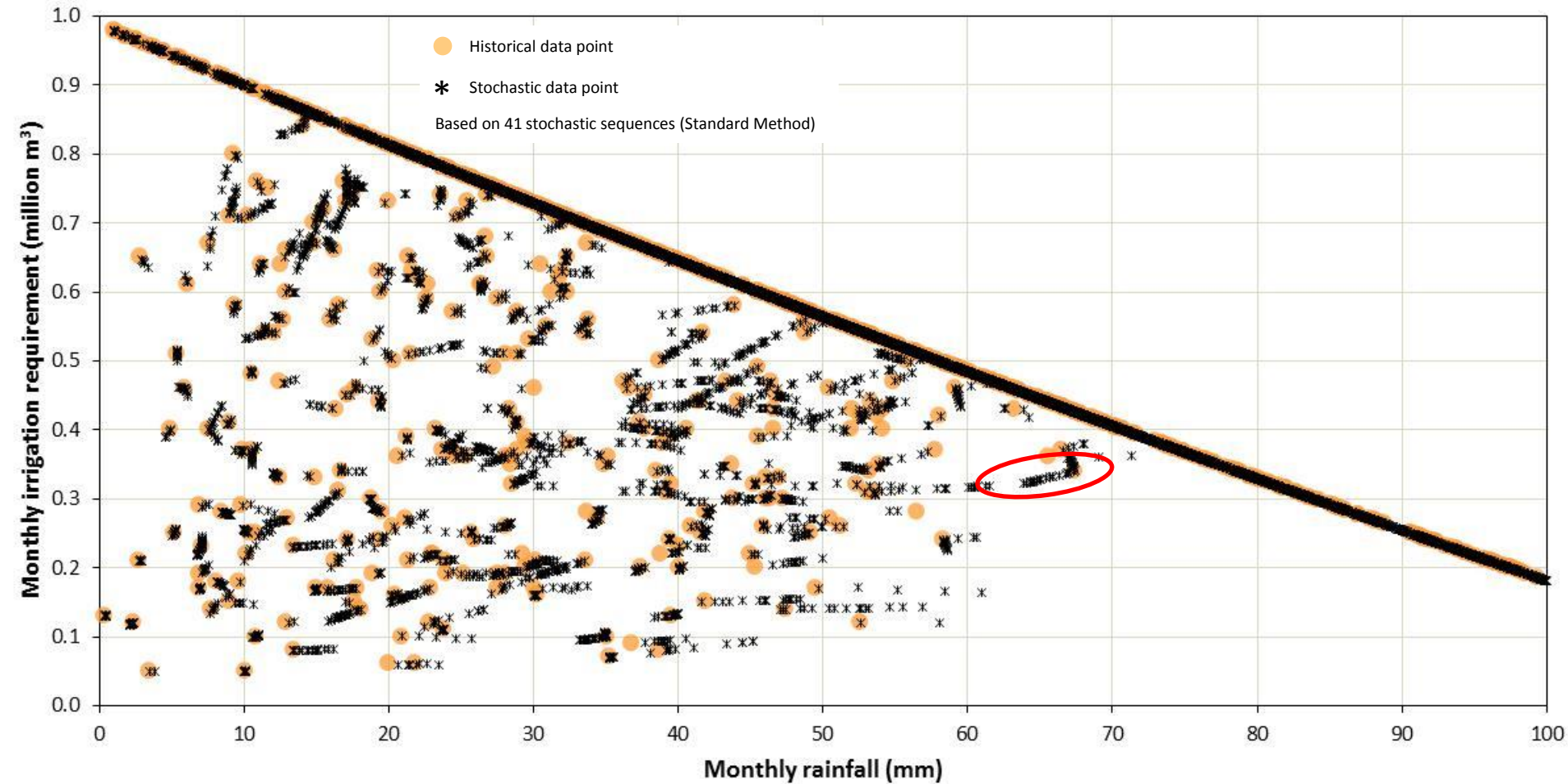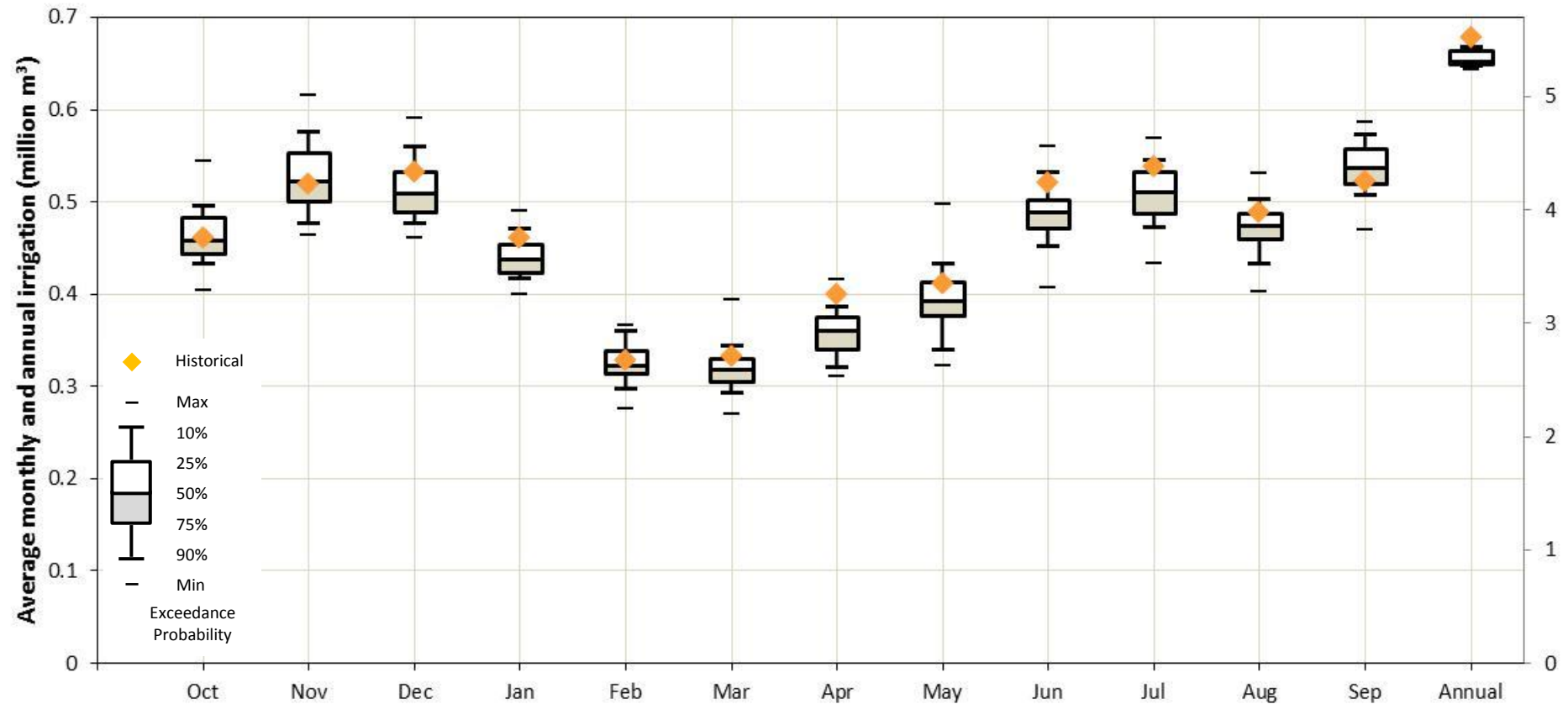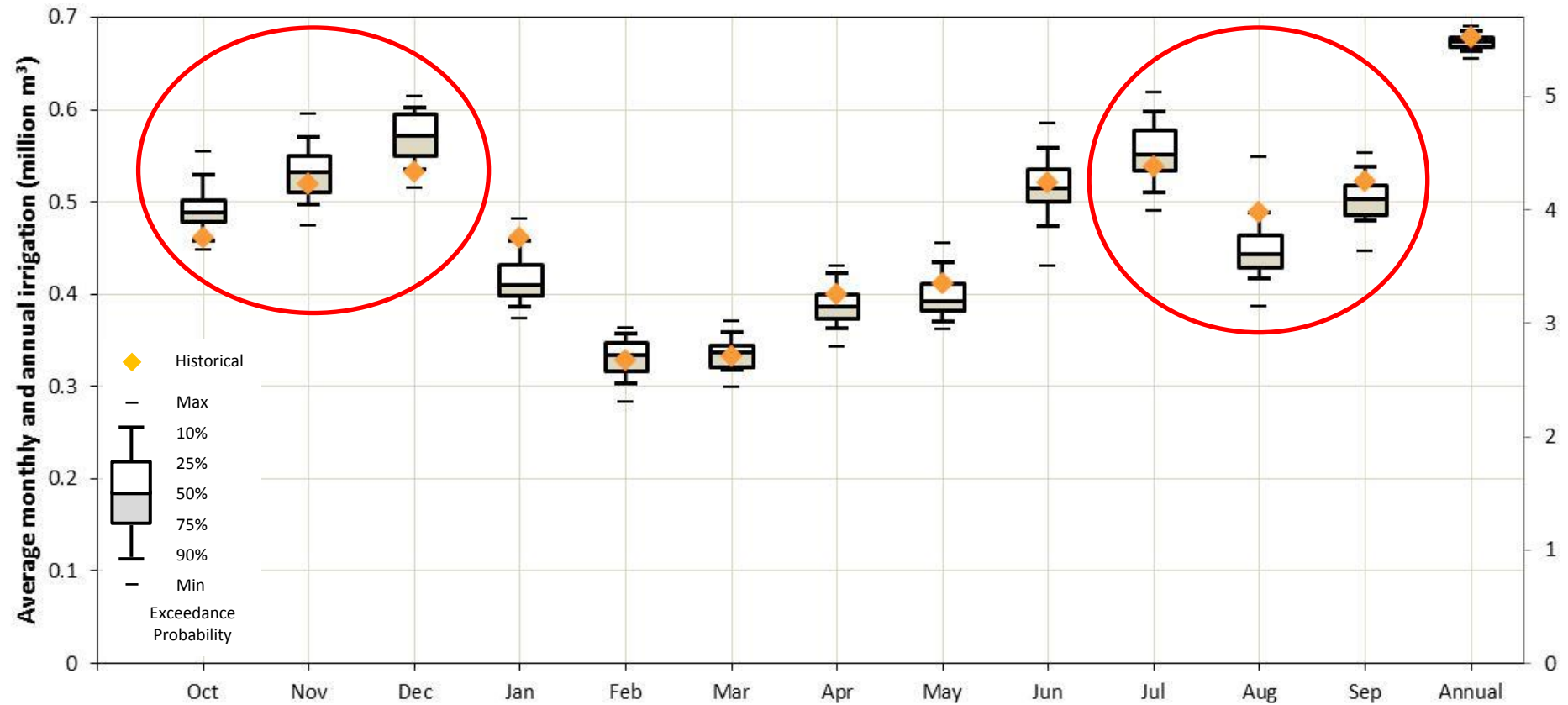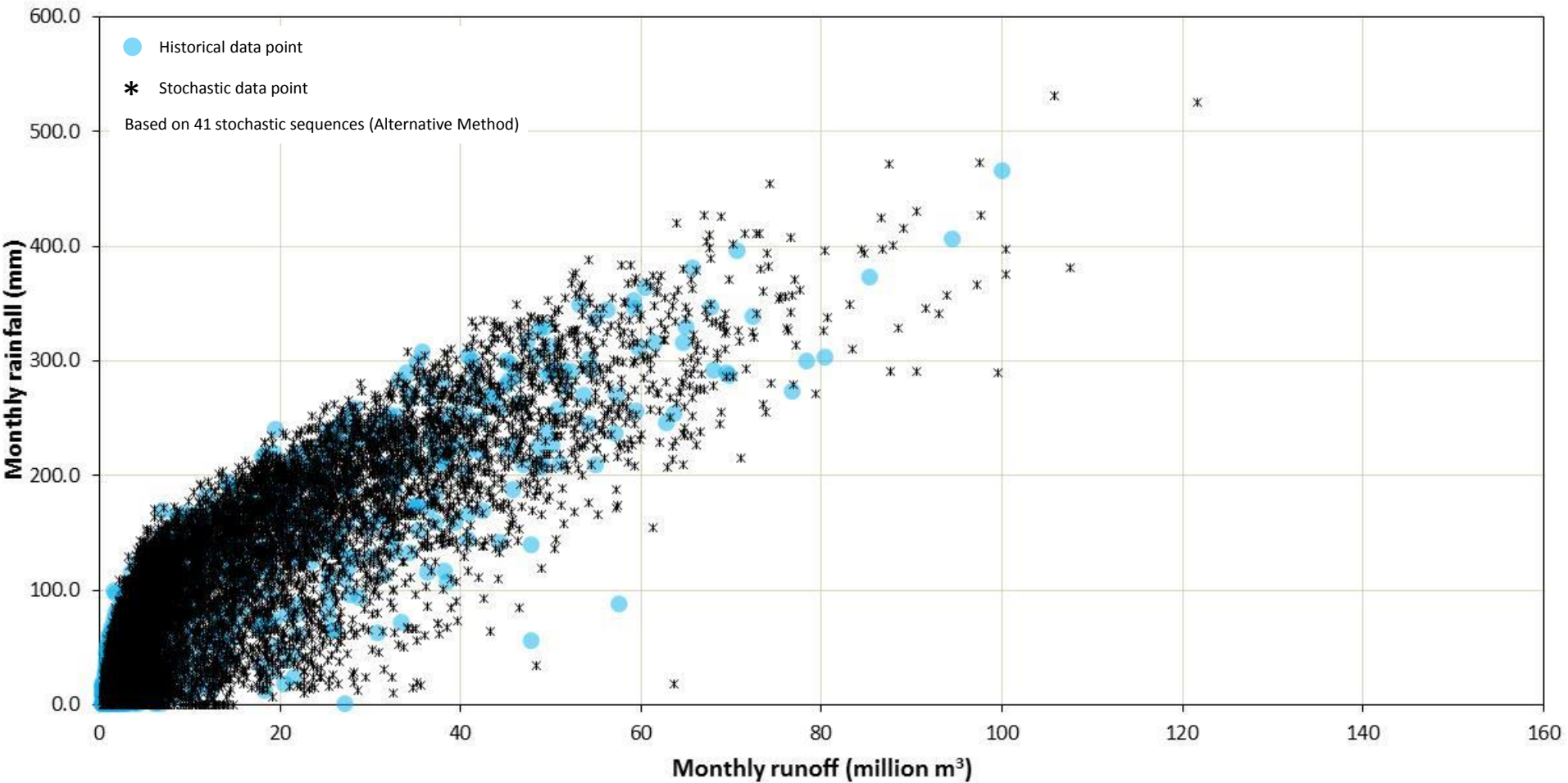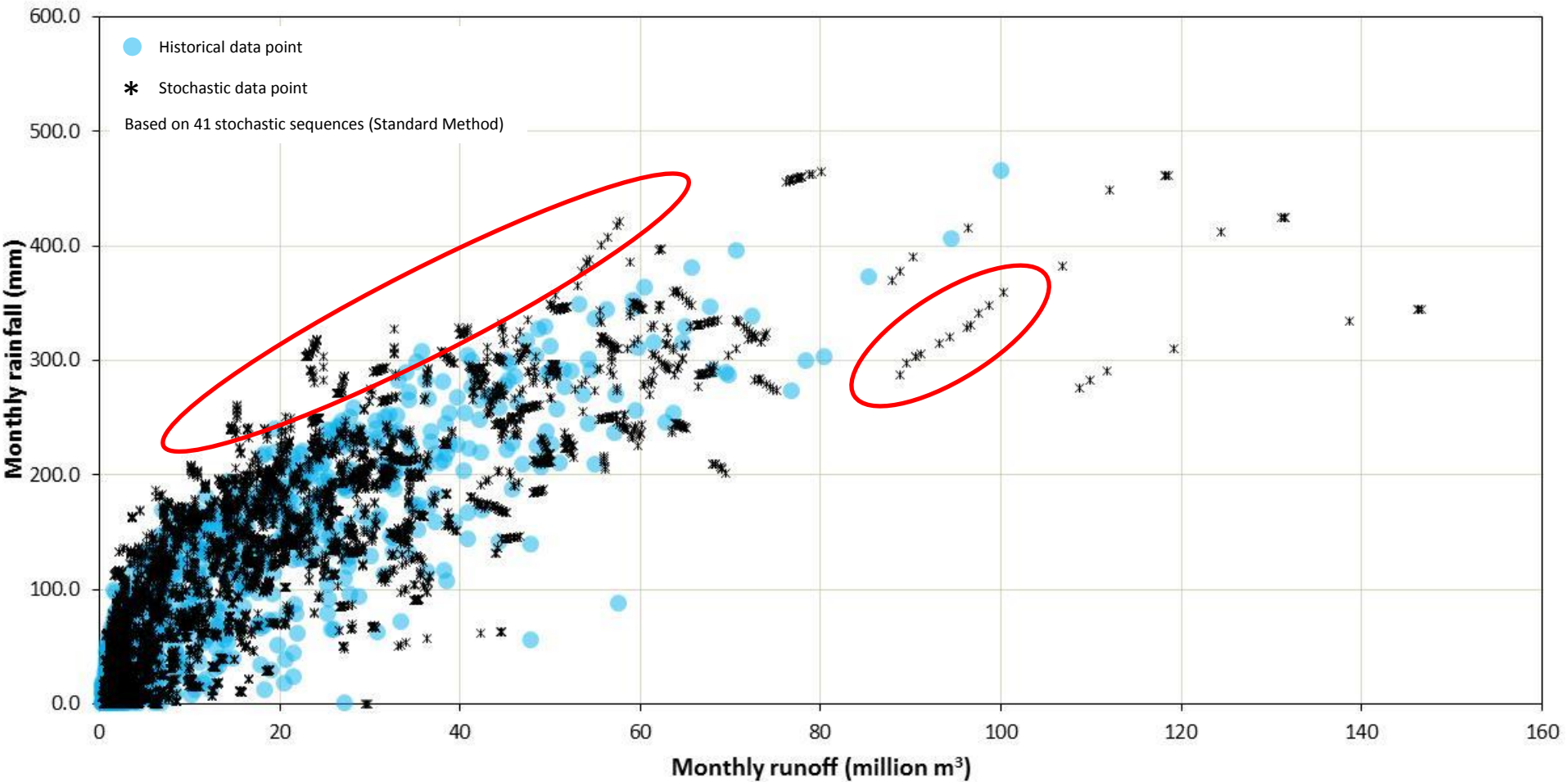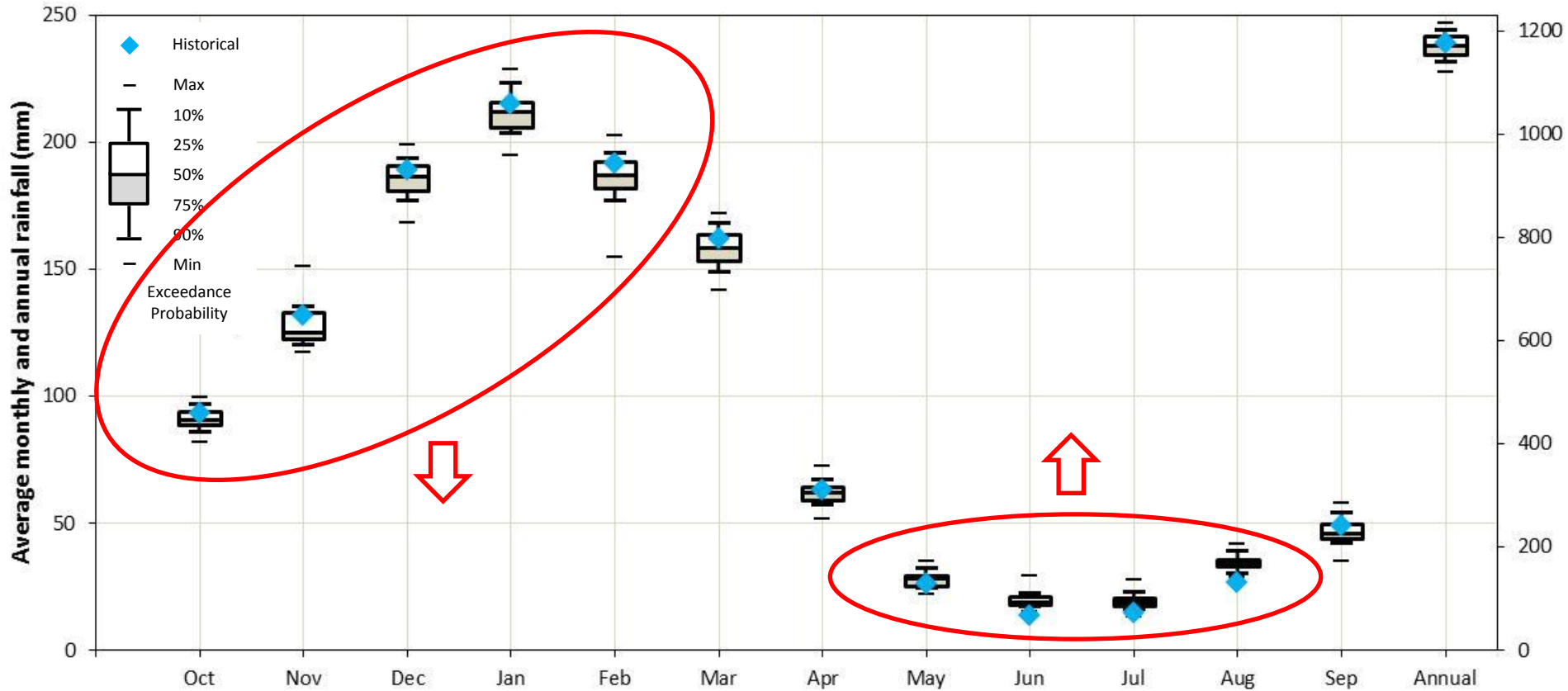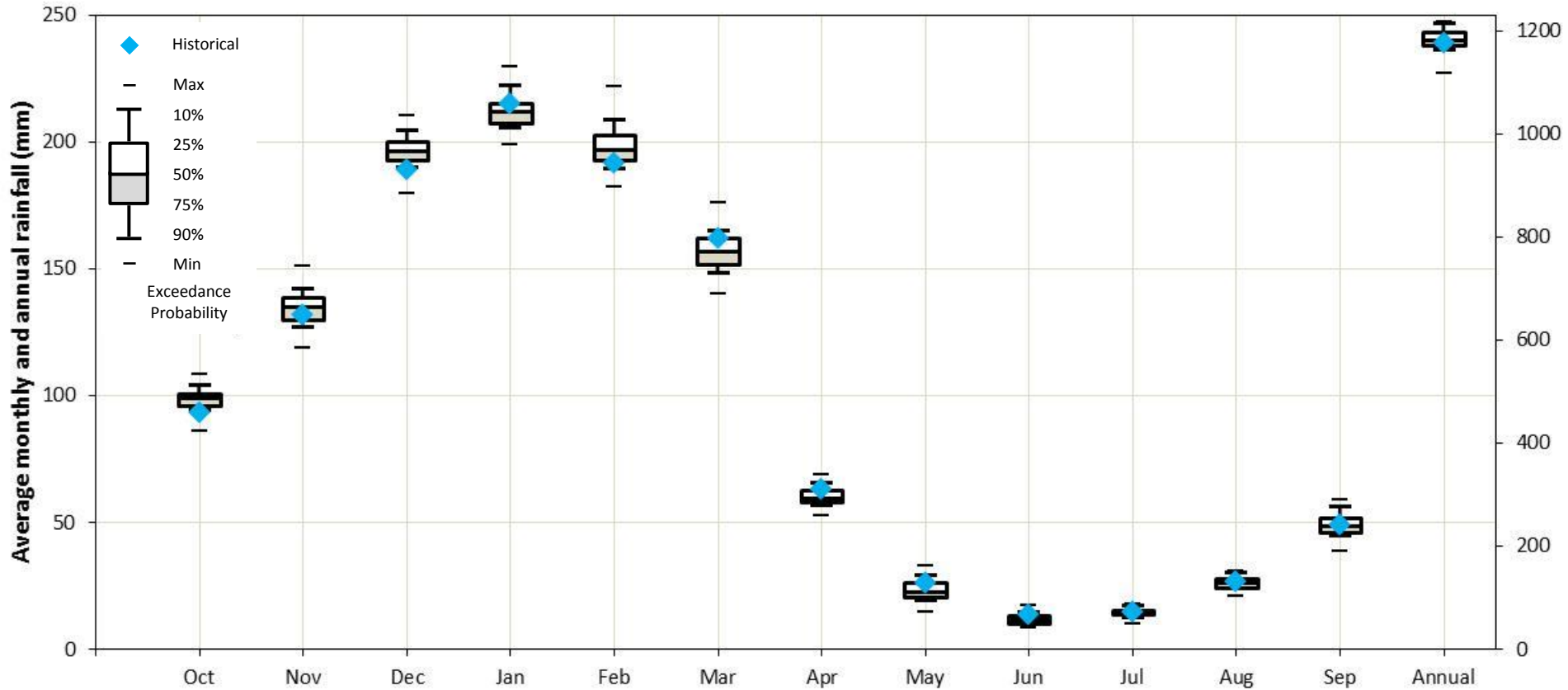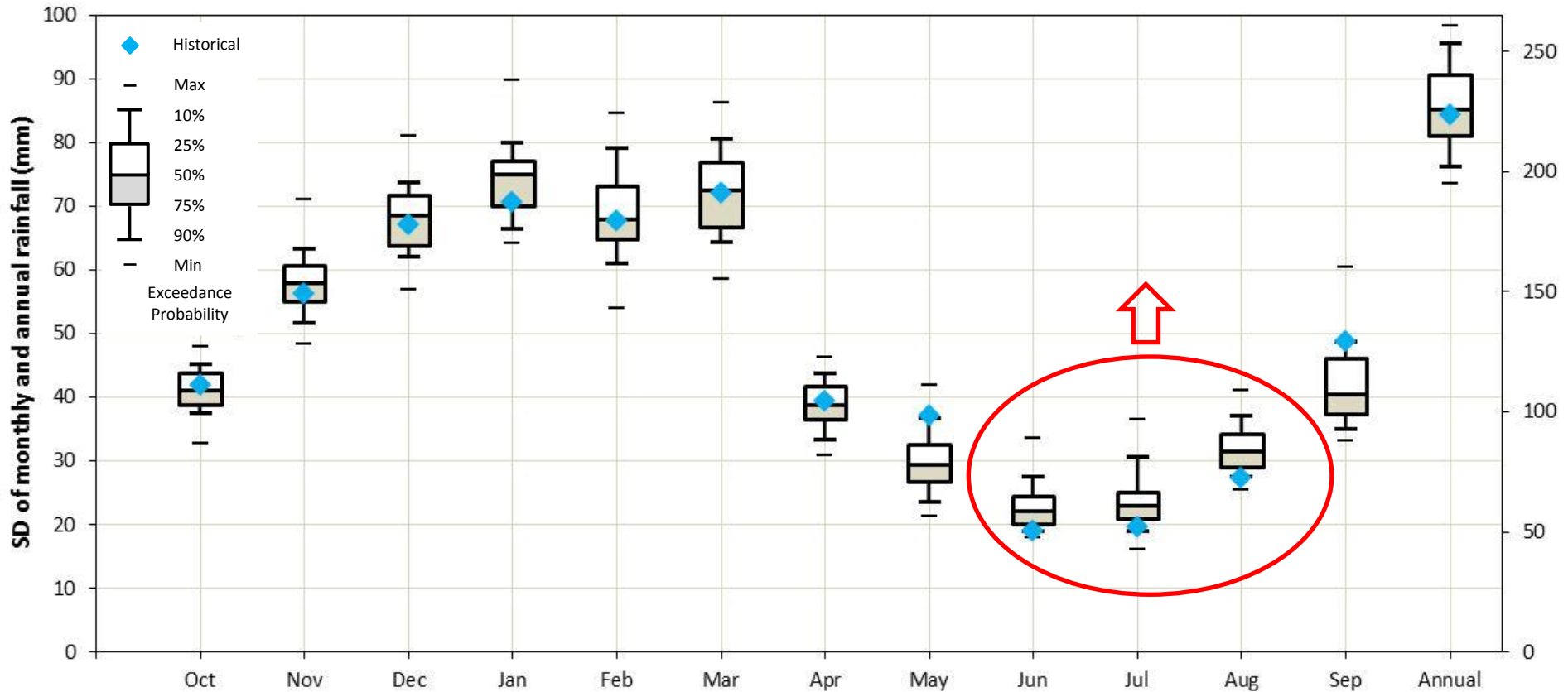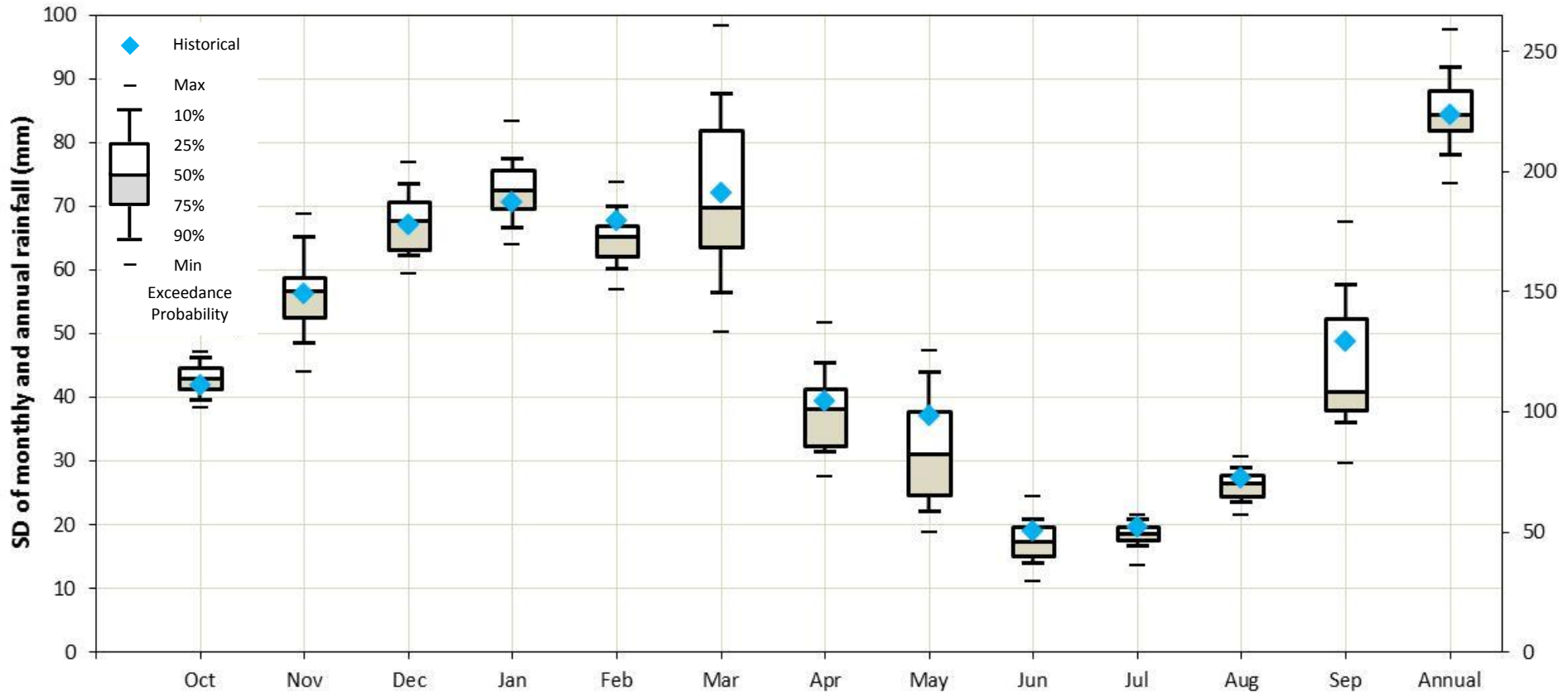
L82C ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

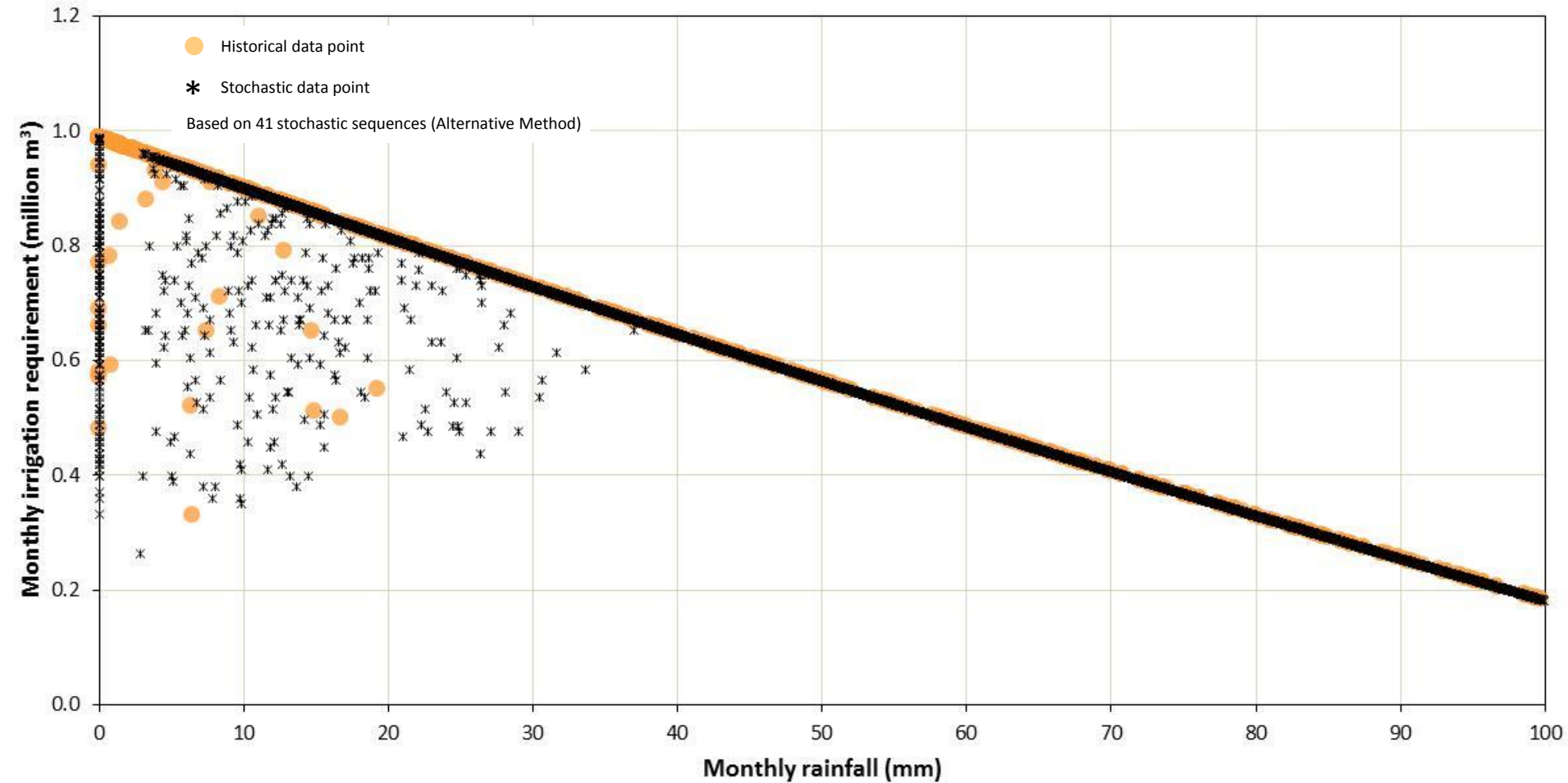# L82C ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)
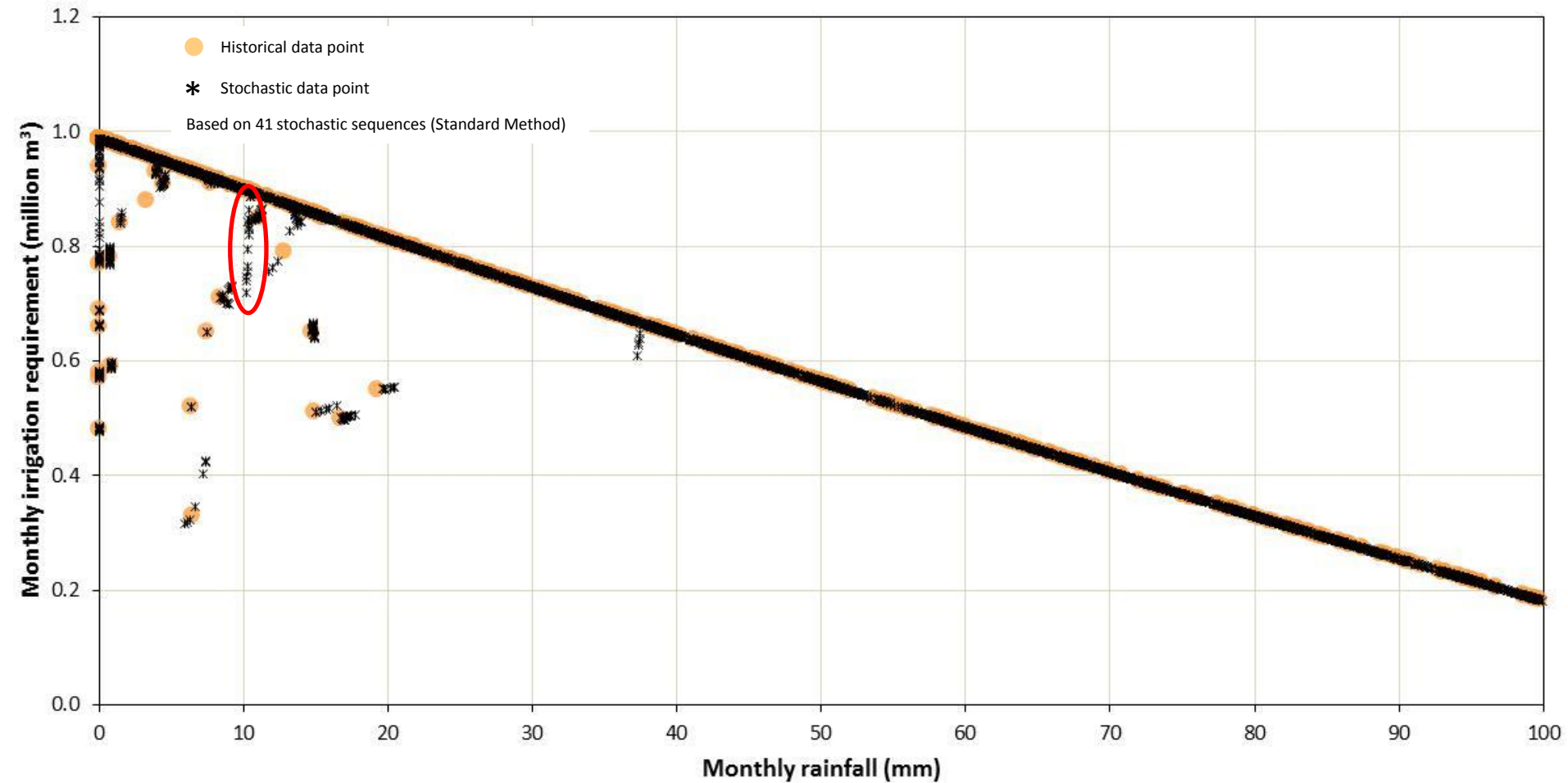
L82C ("Standard"-method)

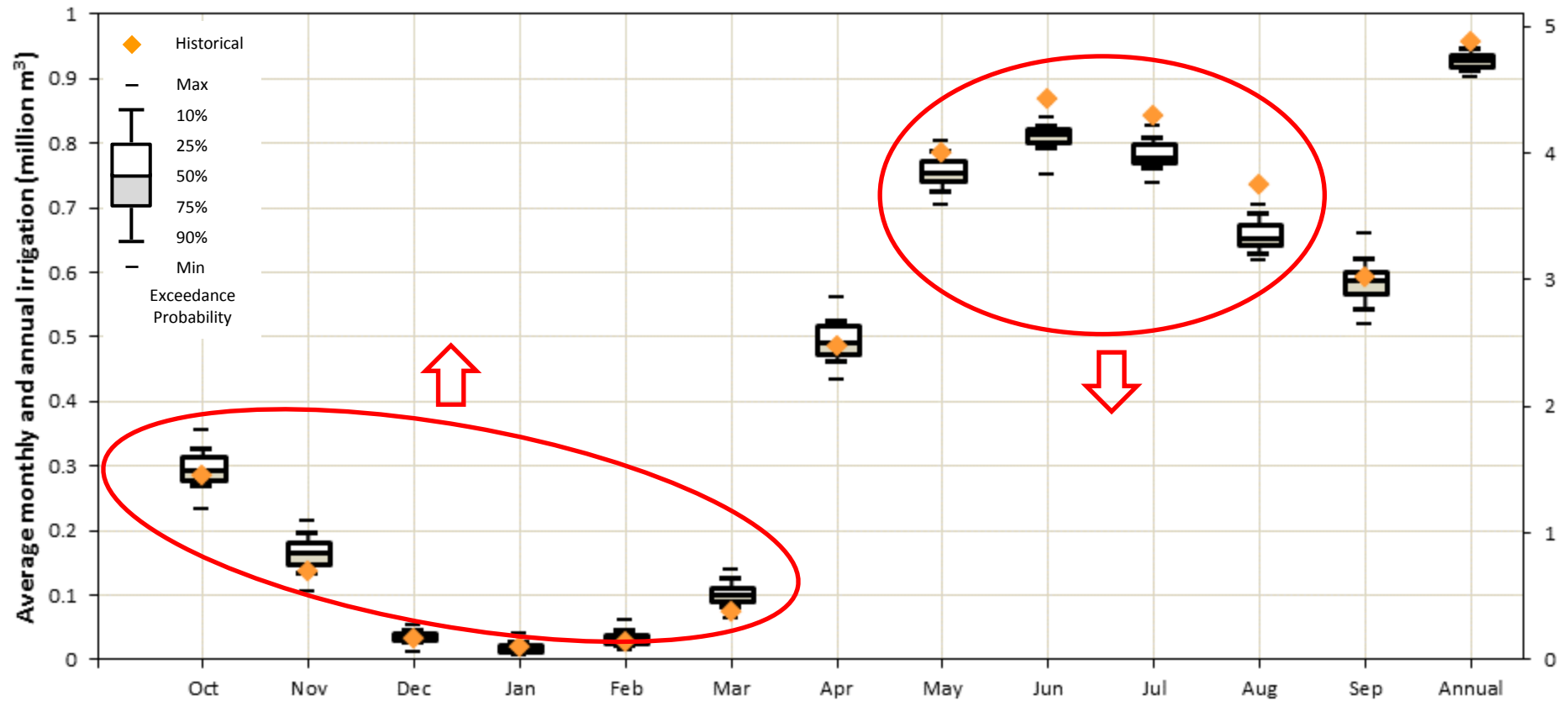Probability distribution based on 41 stochastic sequences (Standard Method)

L82C ("Alternative"-method)

L82C ("Standard"-method)

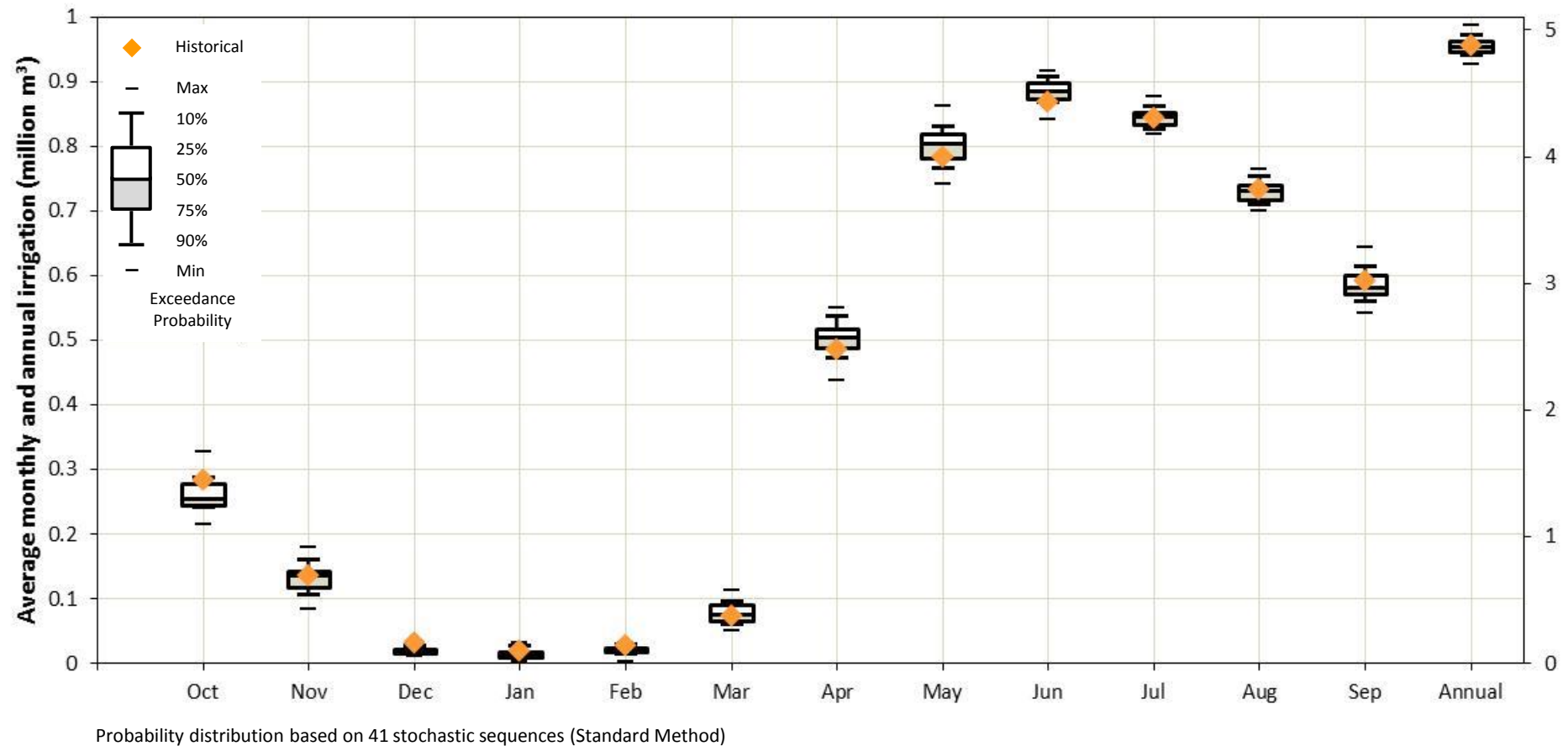# L82C ("Alternative"-method)

L82C ("Standard"-method)

L82C ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)

L82C ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

Proposed Smithfield Dam (U10B)

U10B ("Alternative"-method)

U10B ("Standard"-method)

U10B ("Alternative"-method)

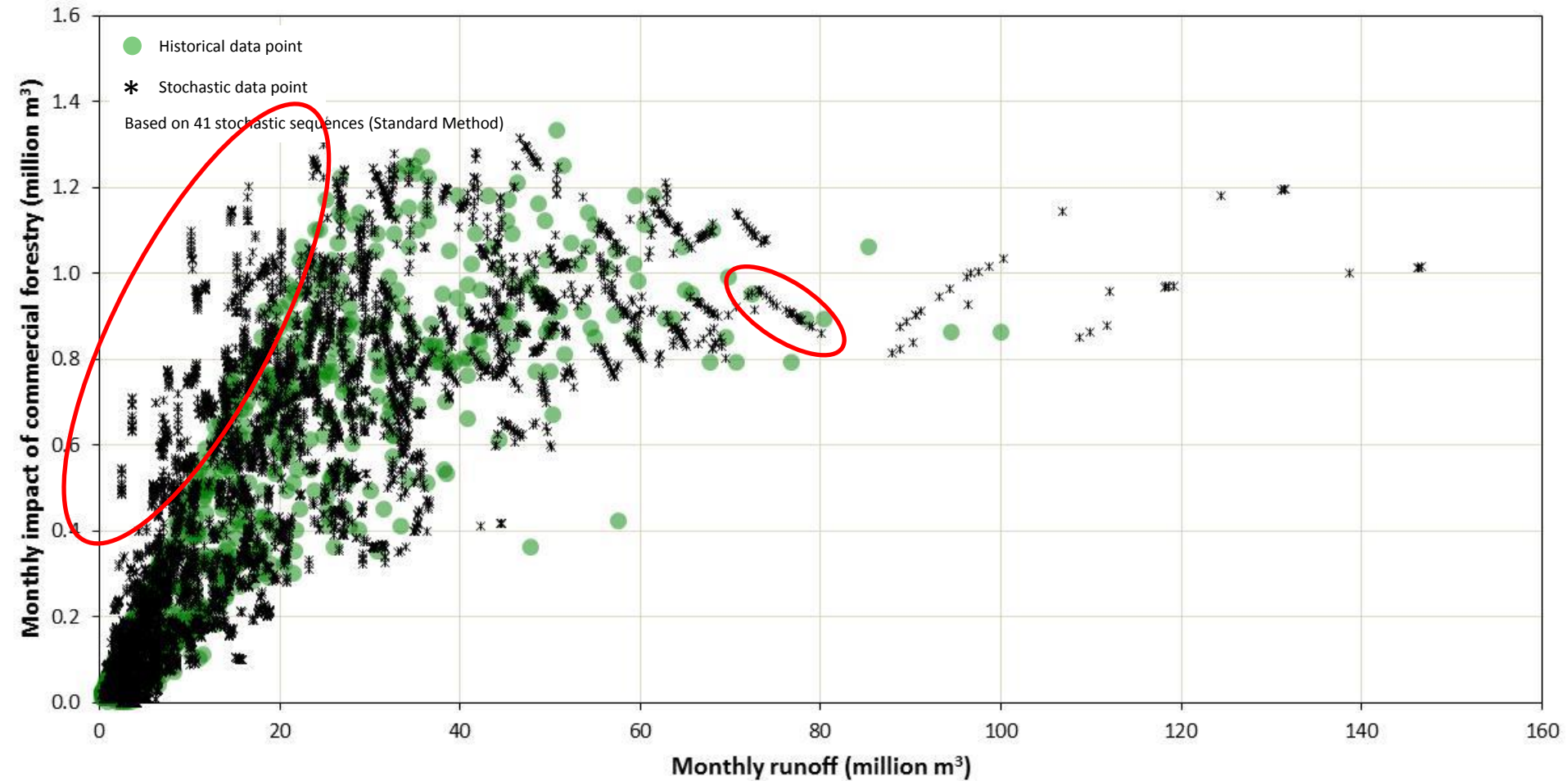Probability distribution based on 41 stochastic sequences (Alternative Method)
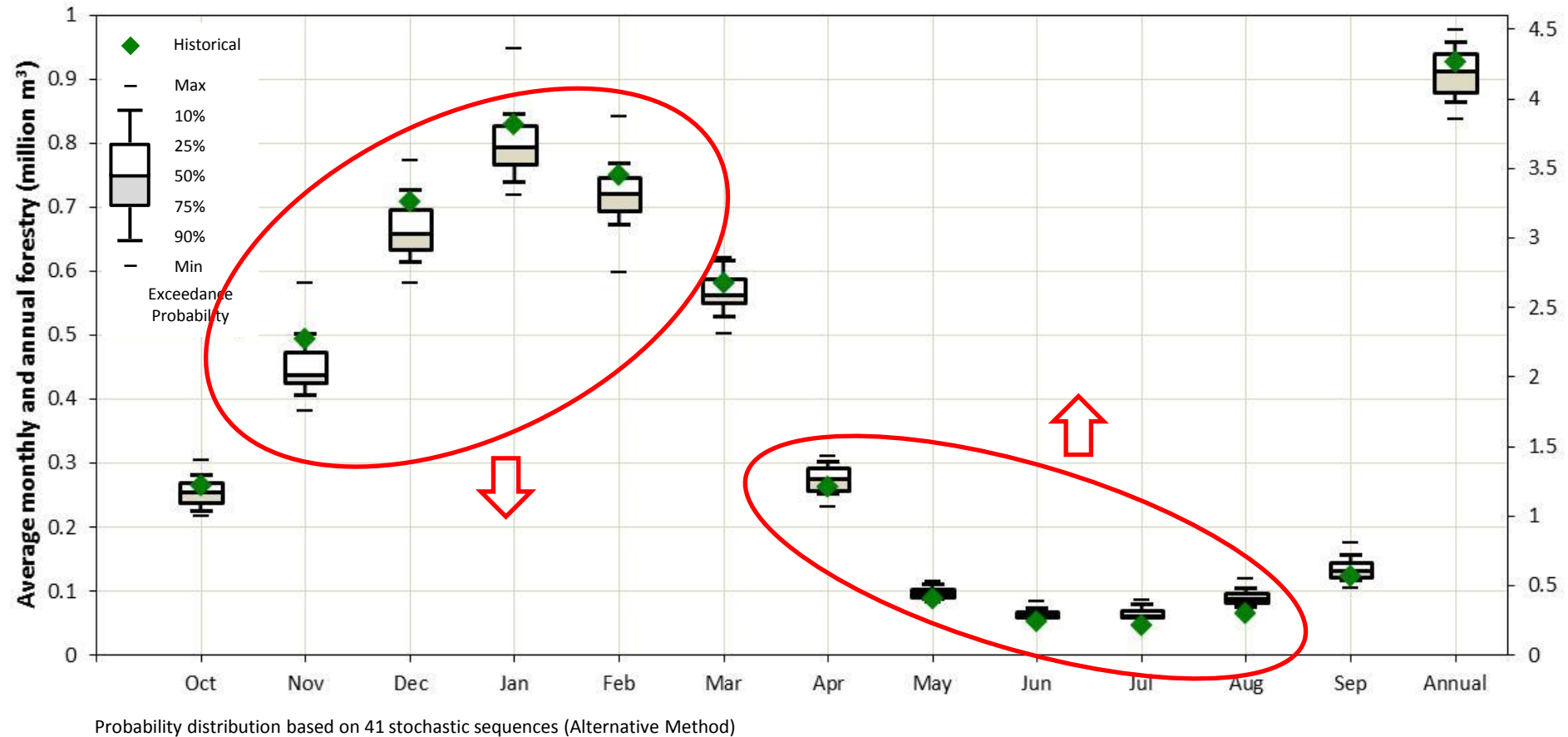
U10B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

U10B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)

U10B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

U10B ("Alternative"-method)
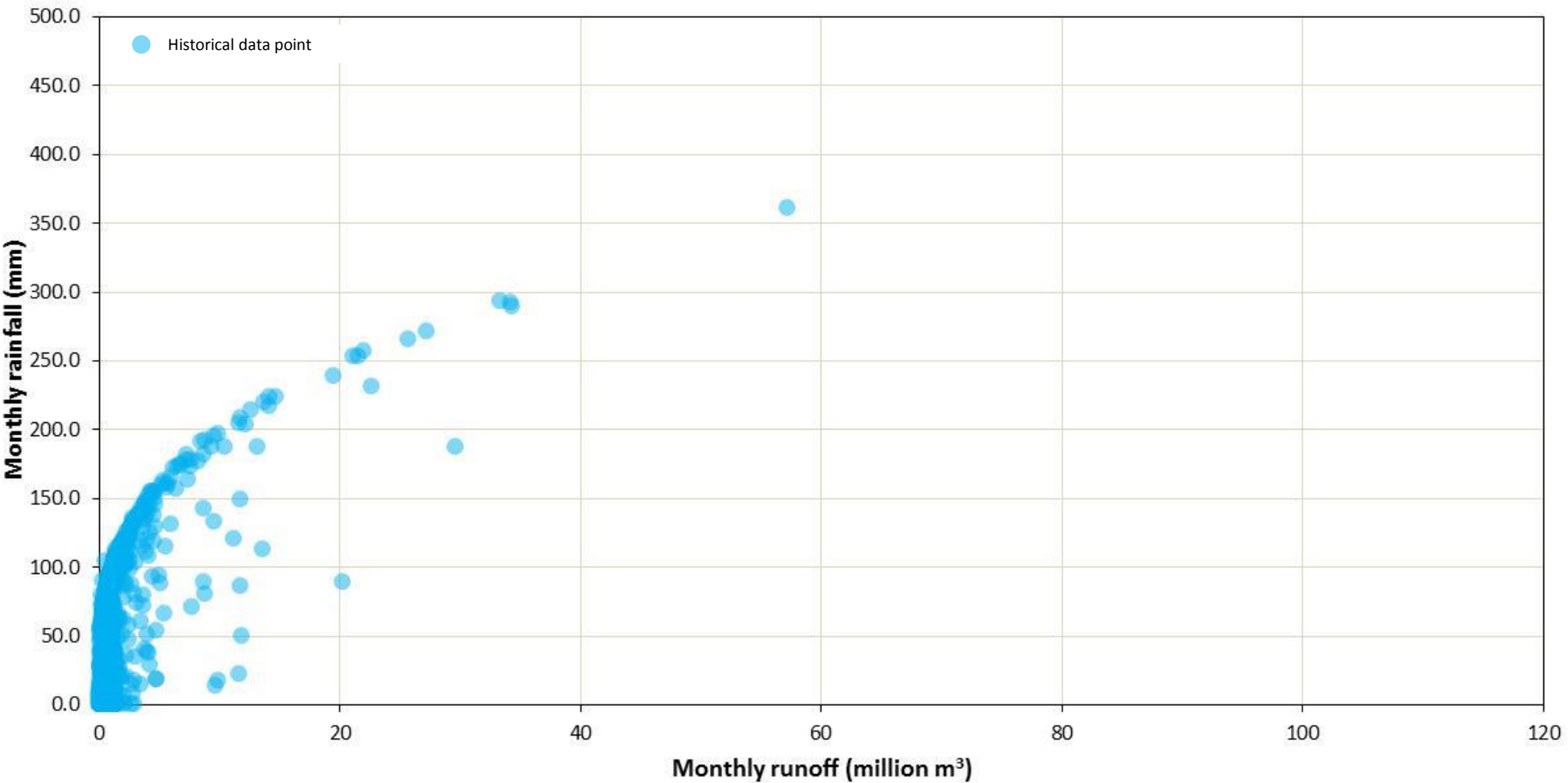
U10B ("Standard"-method)

U10B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)

U10B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

U10B ("Alternative"-method)

U10B ("Standard"-method)

U10B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)

U10B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

Marico-Bosveld Dam (A31B)
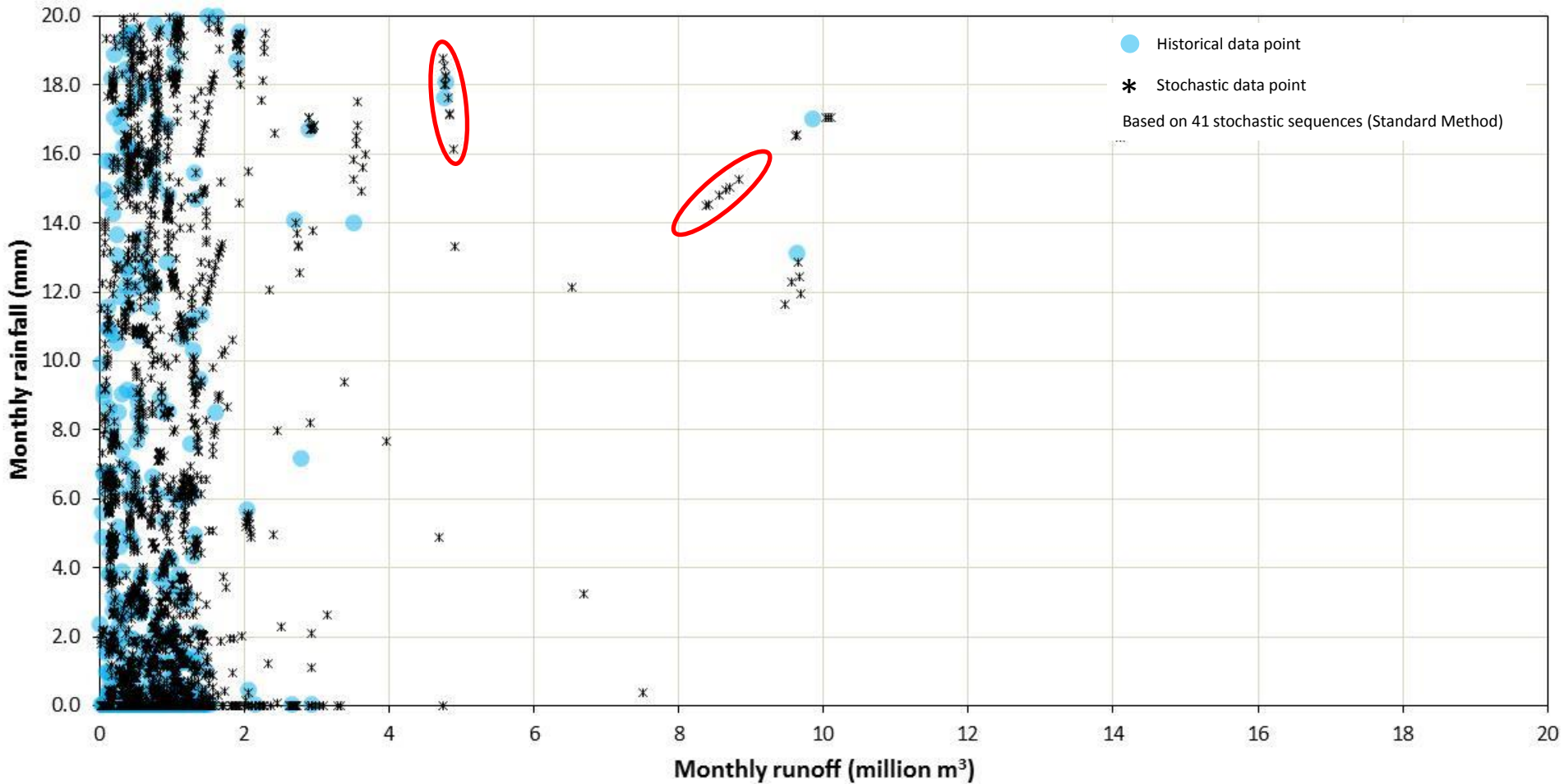
A31B (Historical)

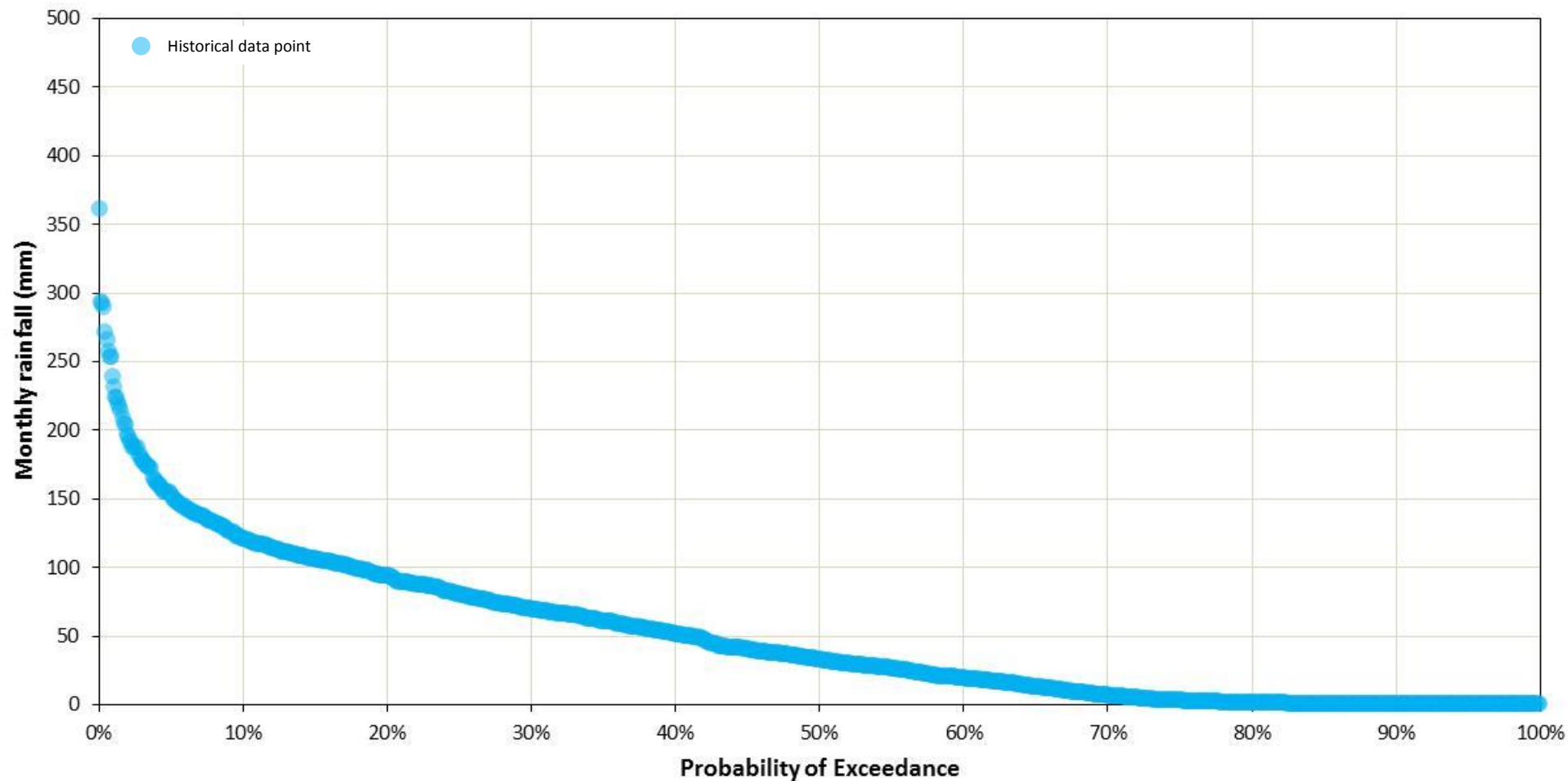# A31B ("Alternative"-method)
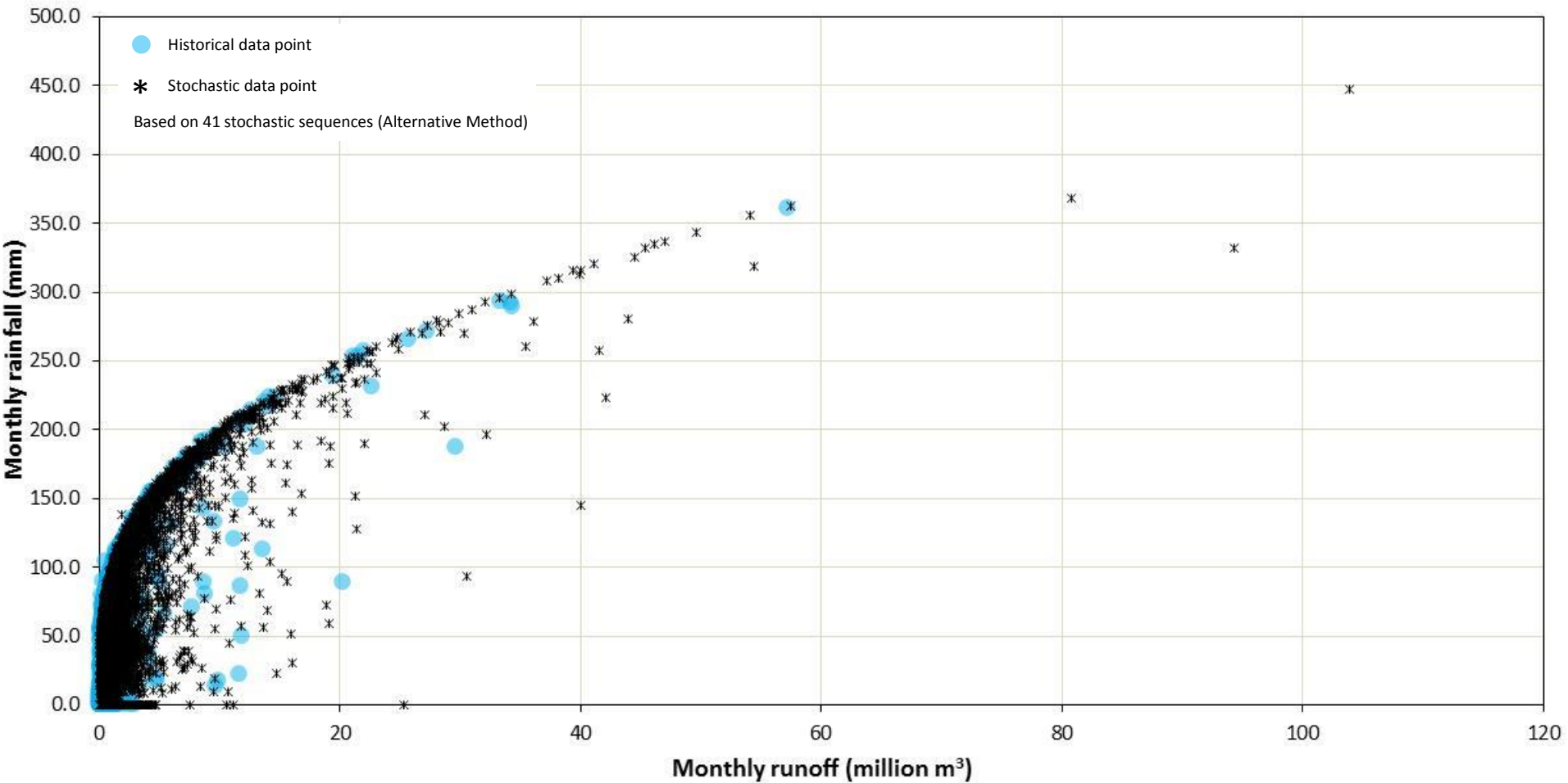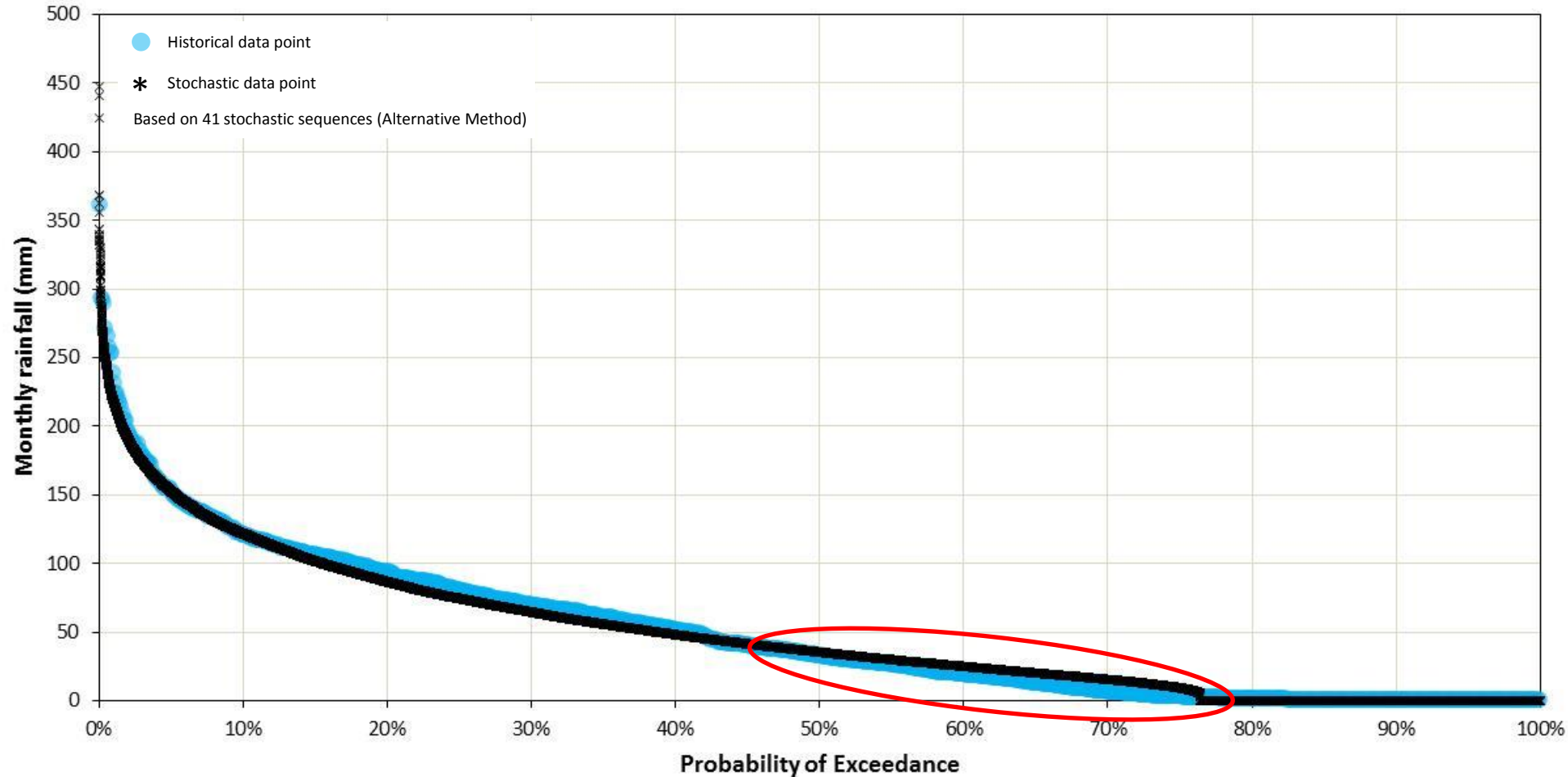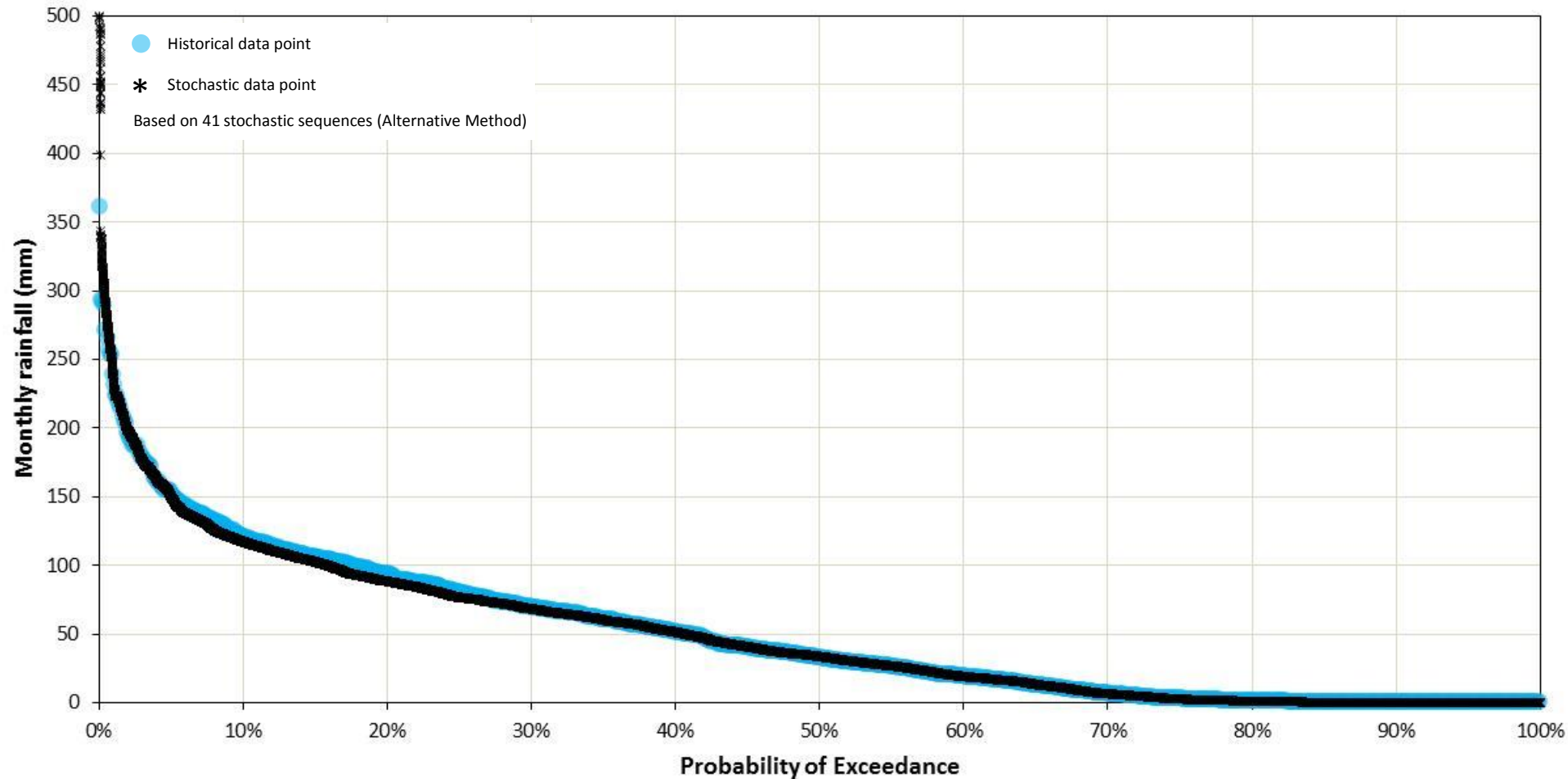
A31B ("Standard"-method)
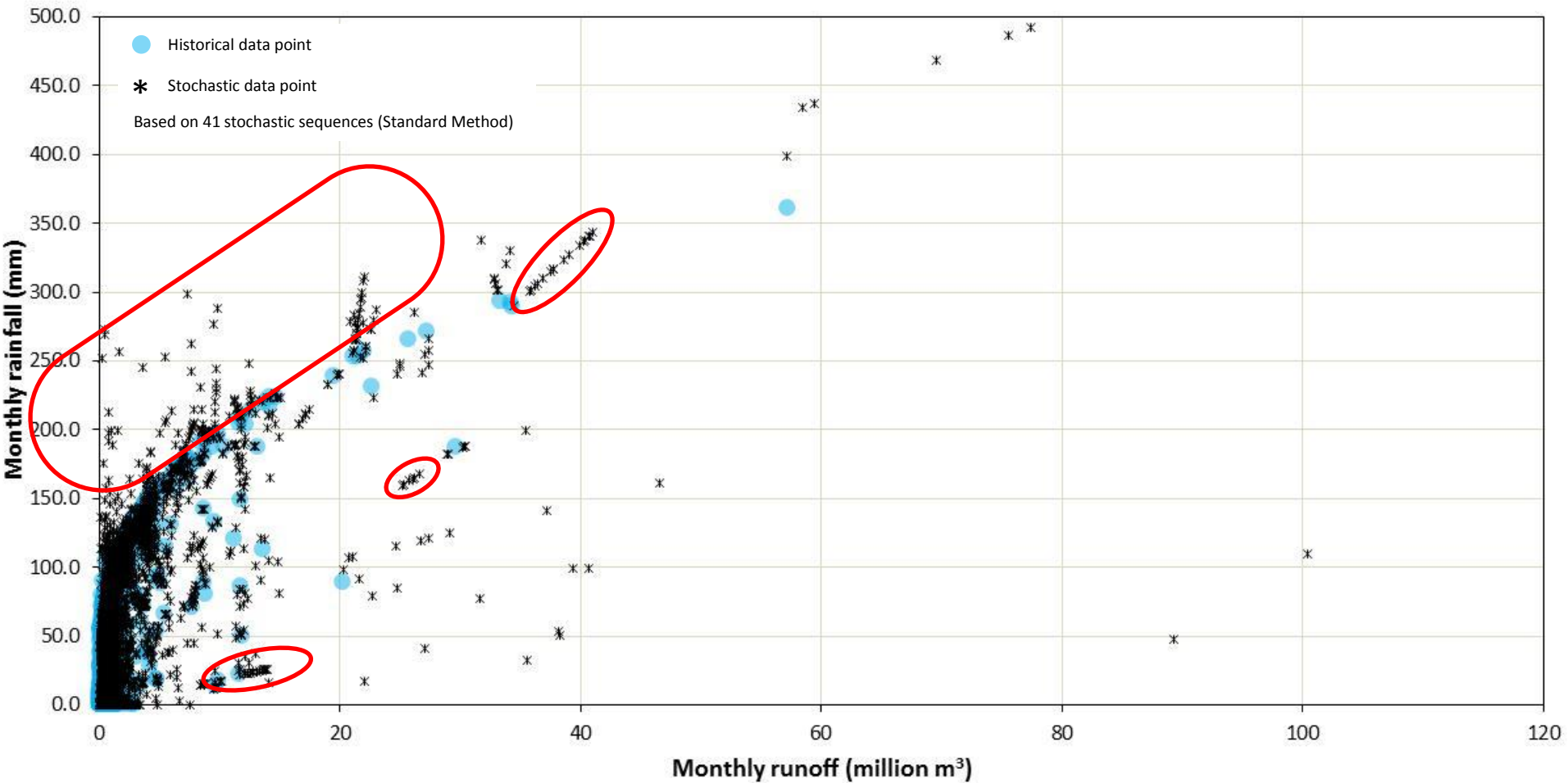
A31B ("Alternative"-method)
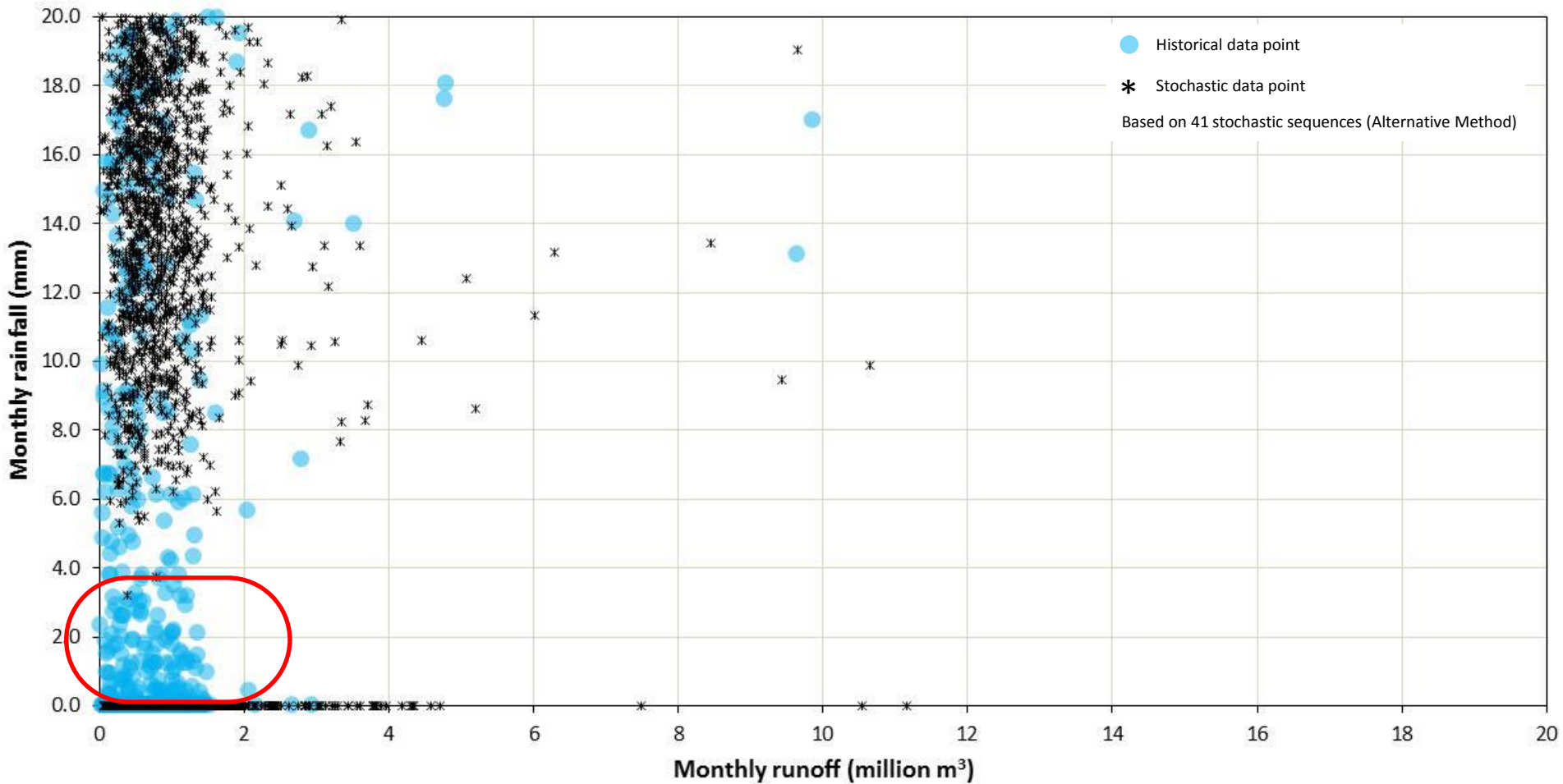
A31B ("Standard"-method)
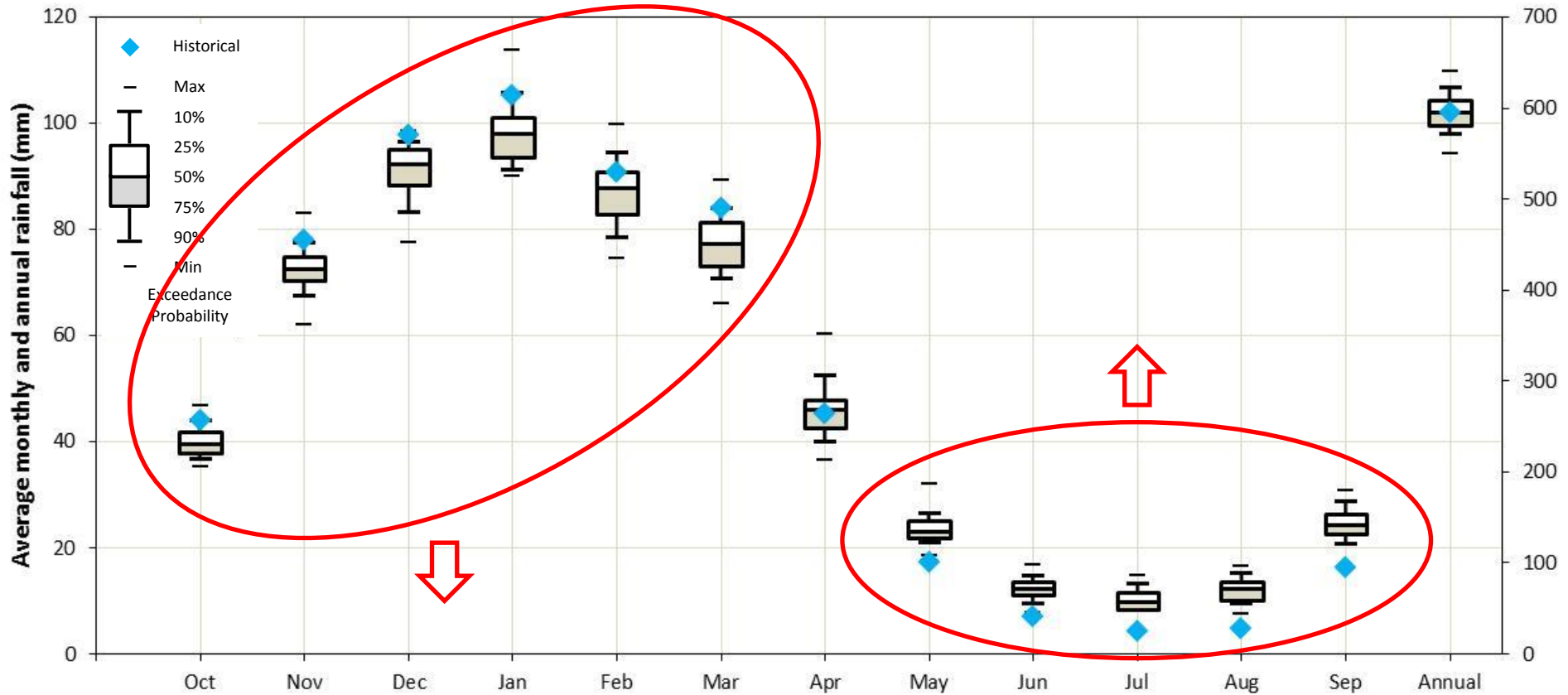
A31B (Historical)

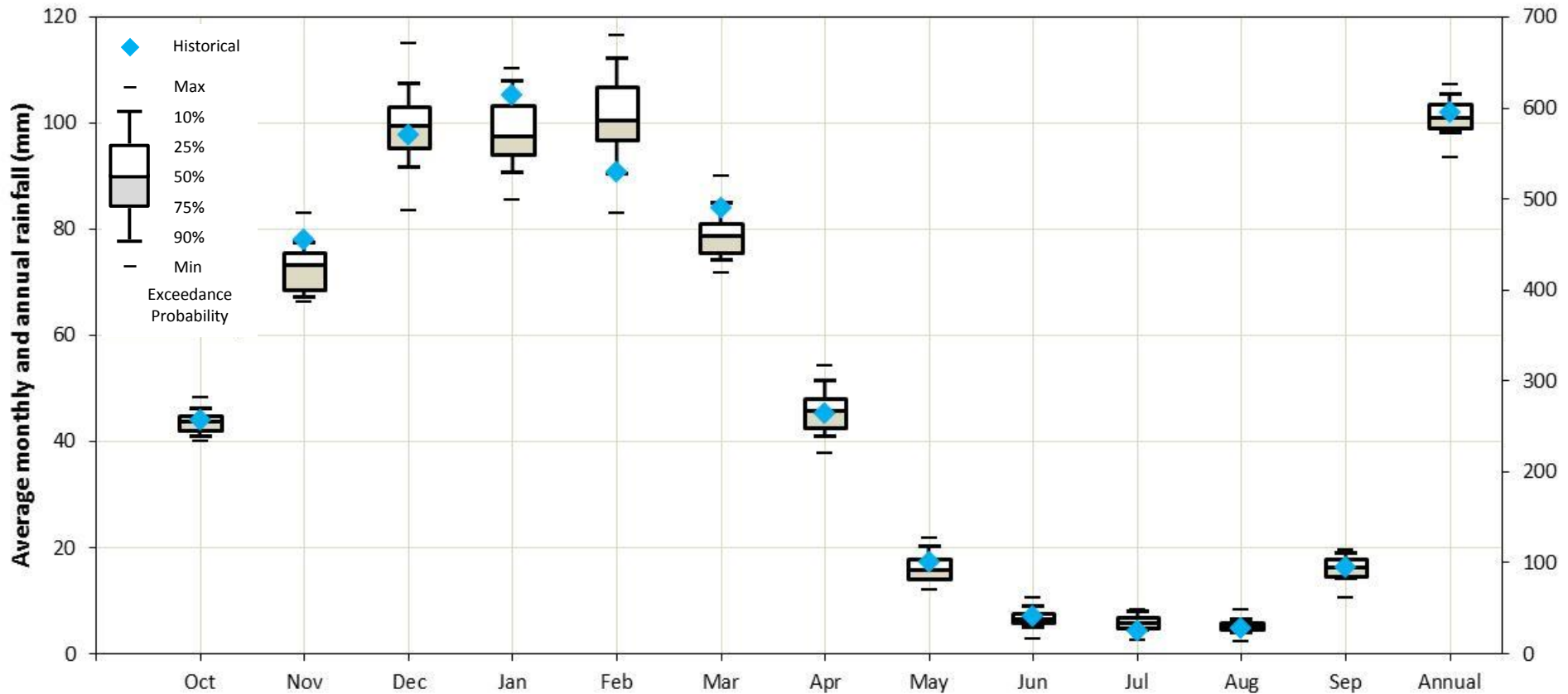# A31B ("Alternative"-method)

A31B ("Standard"-method)

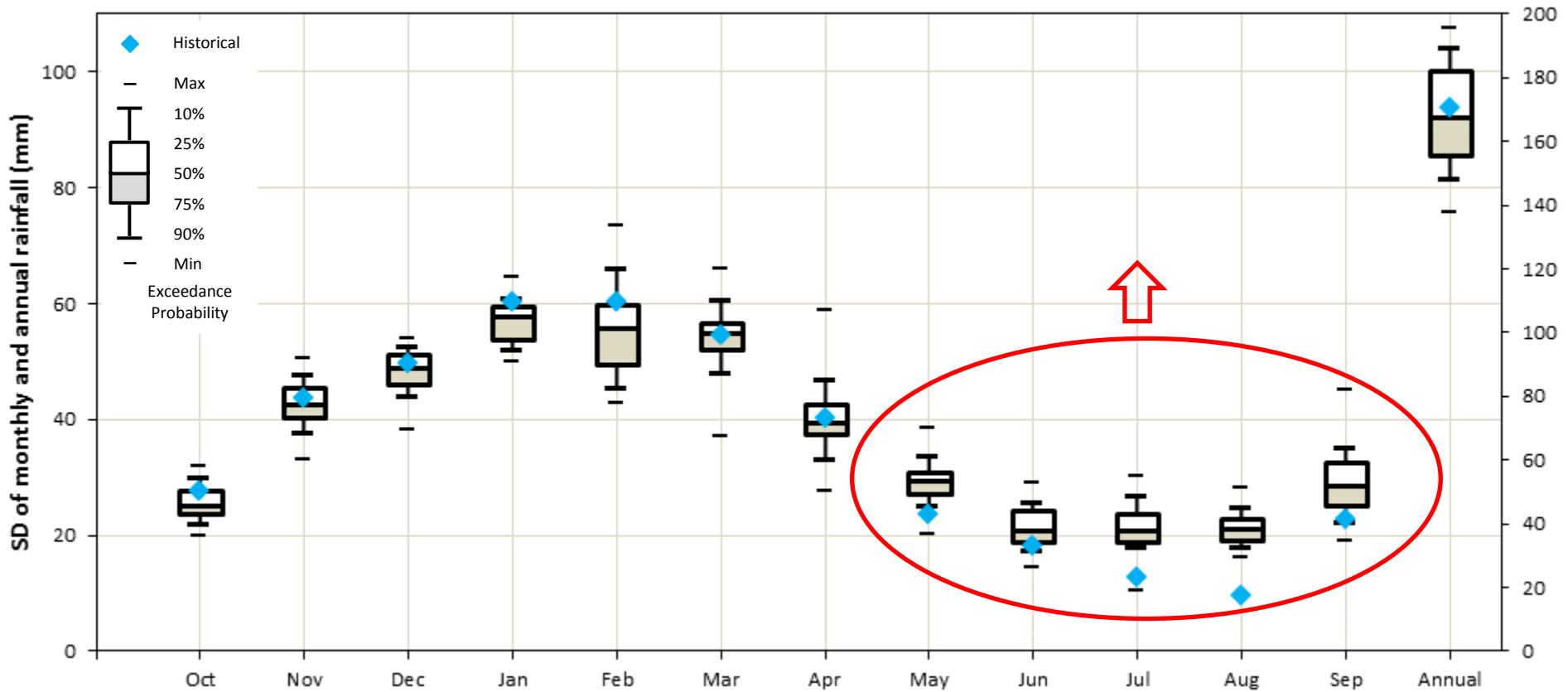# A31B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)
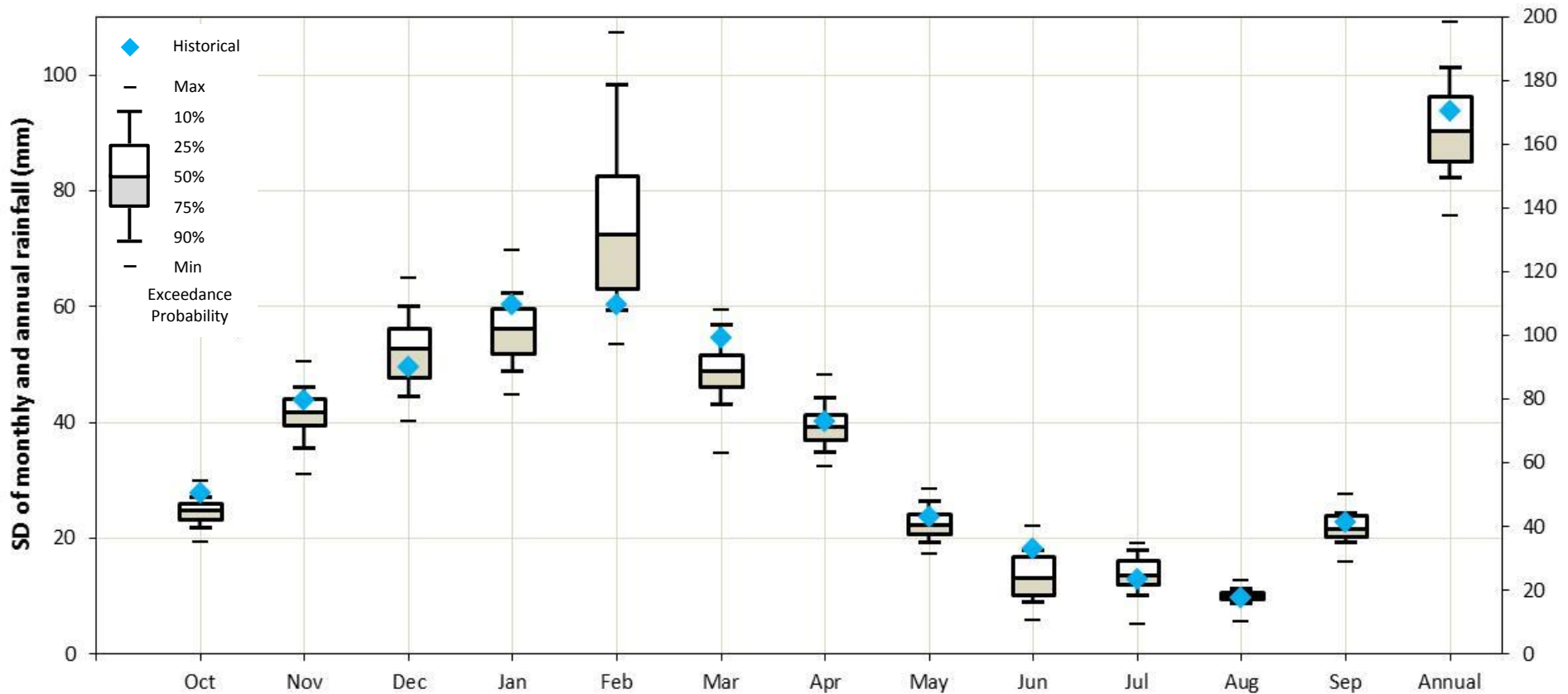
A31B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

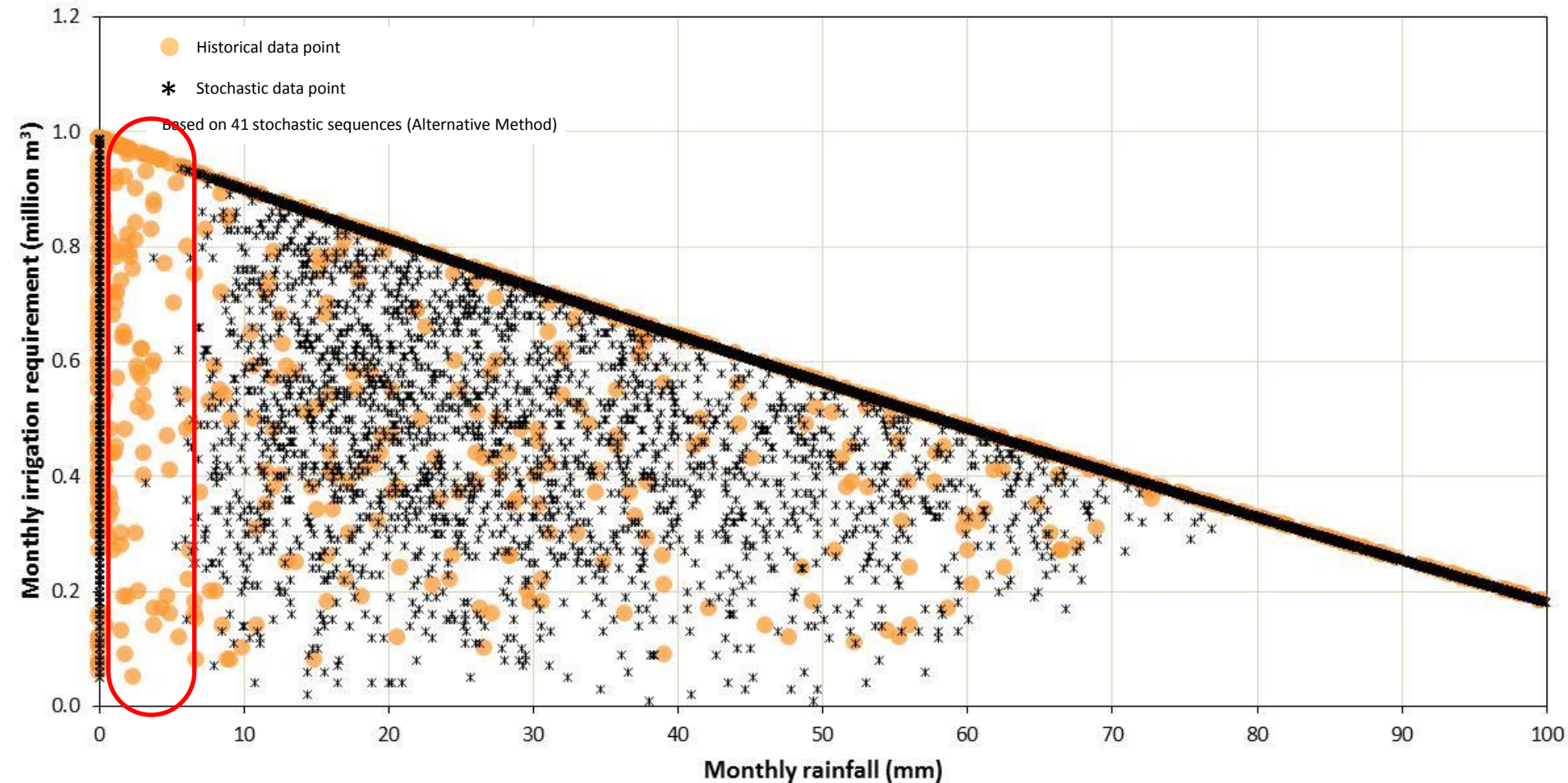# A31B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)
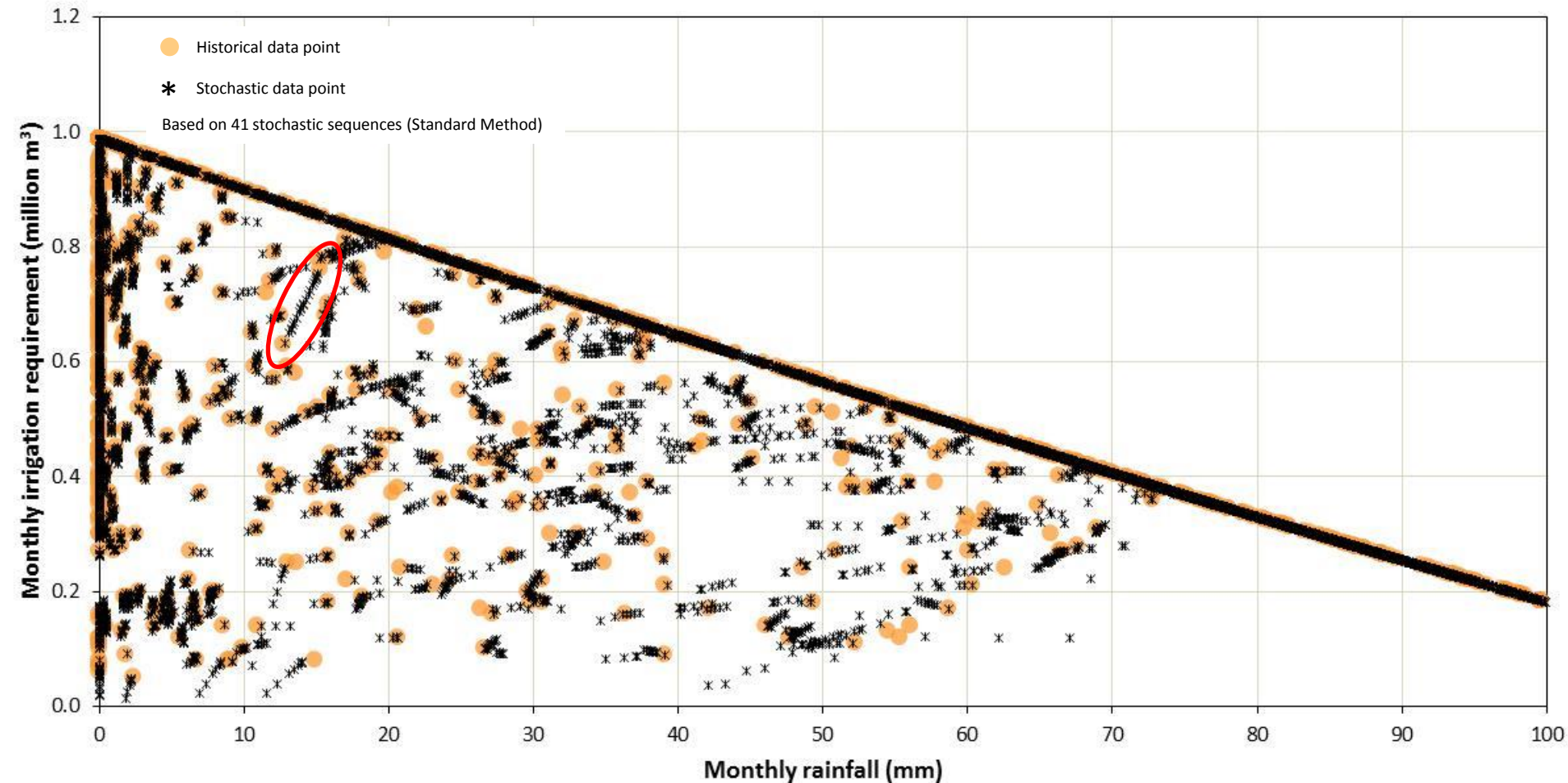
A31B ("Standard"-method)

Probability distribution based on 41 stochastic sequences (Standard Method)

A31B ("Alternative"-method)

A31B ("Standard"-method)

A31B ("Alternative"-method)

Probability distribution based on 41 stochastic sequences (Alternative Method)

A31B ("Standard"-method)

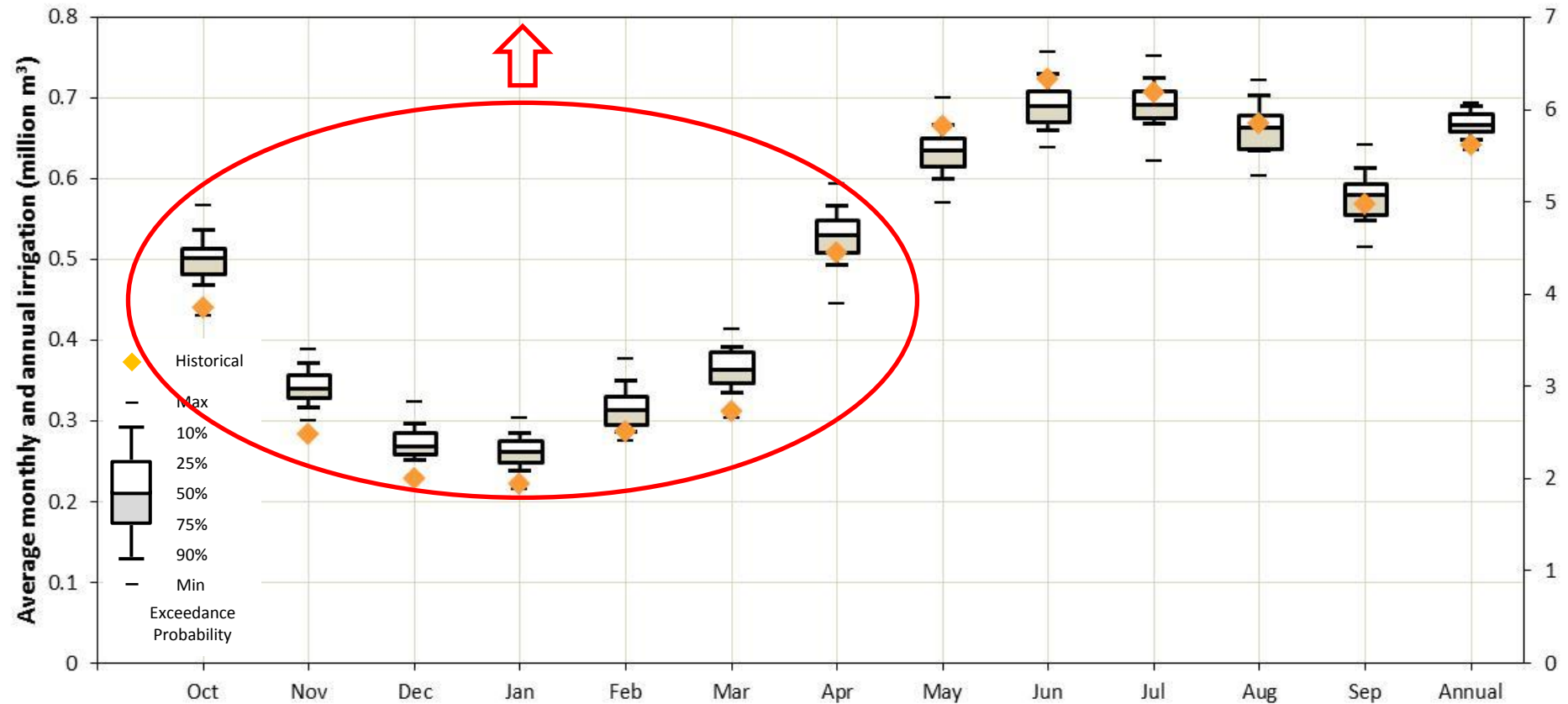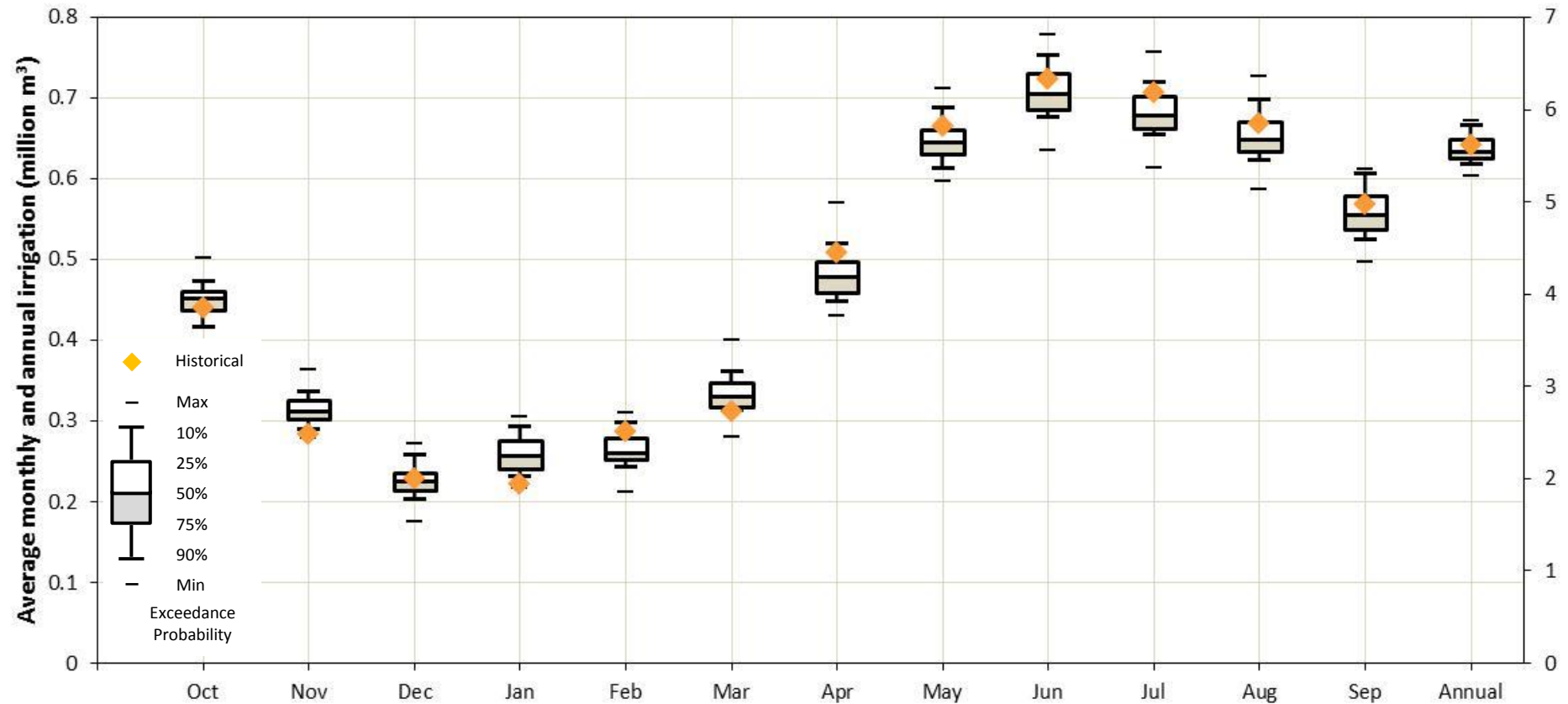Probability distribution based on 41 stochastic sequences (Standard Method)