

Purpose

This study aims to construct a drought early warning and preparedness framework, based on drought severity-duration-frequency (SDF) curves and standard precipitation index (SPI), is proposed for a water resources system (i.e. Tsengwen Reservoir and its downstream area) in southern Taiwan.

The drought SDF curves were developed and the emergency response actions were optimally planned for mitigating the water shortages of different durations and return periods. The water shortage prediction models were established for predicting water shortages (severities) for different durations which can be linked to the SDF curves for obtaining the corresponding return periods and the suggested emergency response actions.

Water Shortage Prediction Models

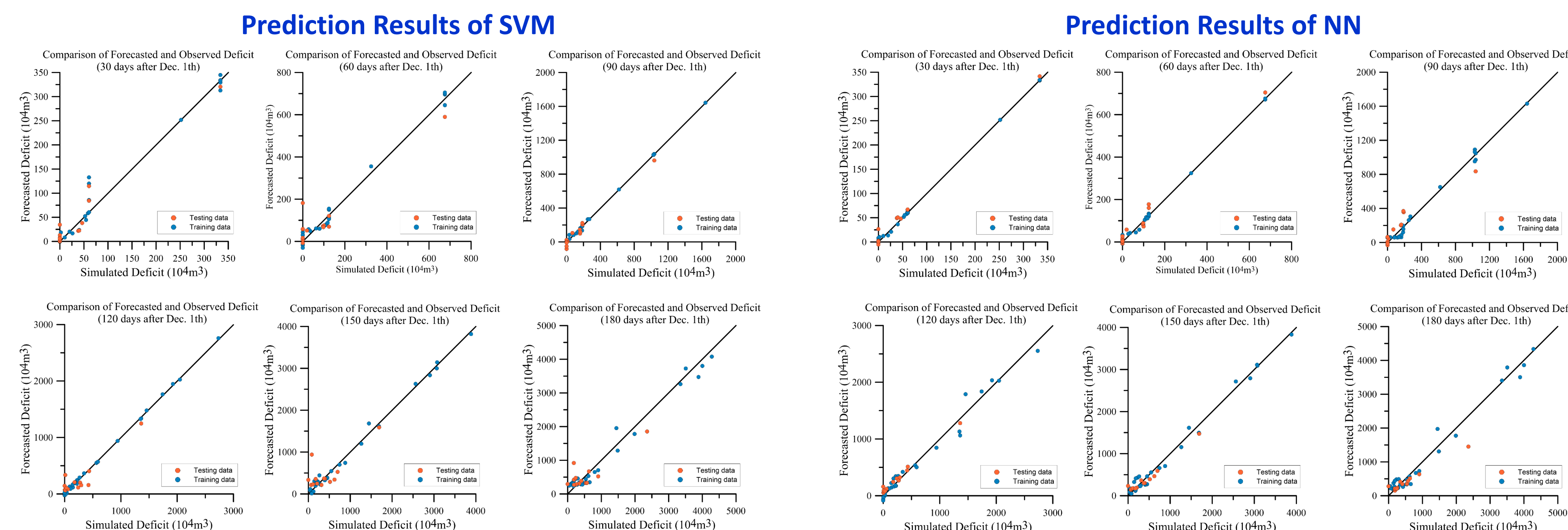
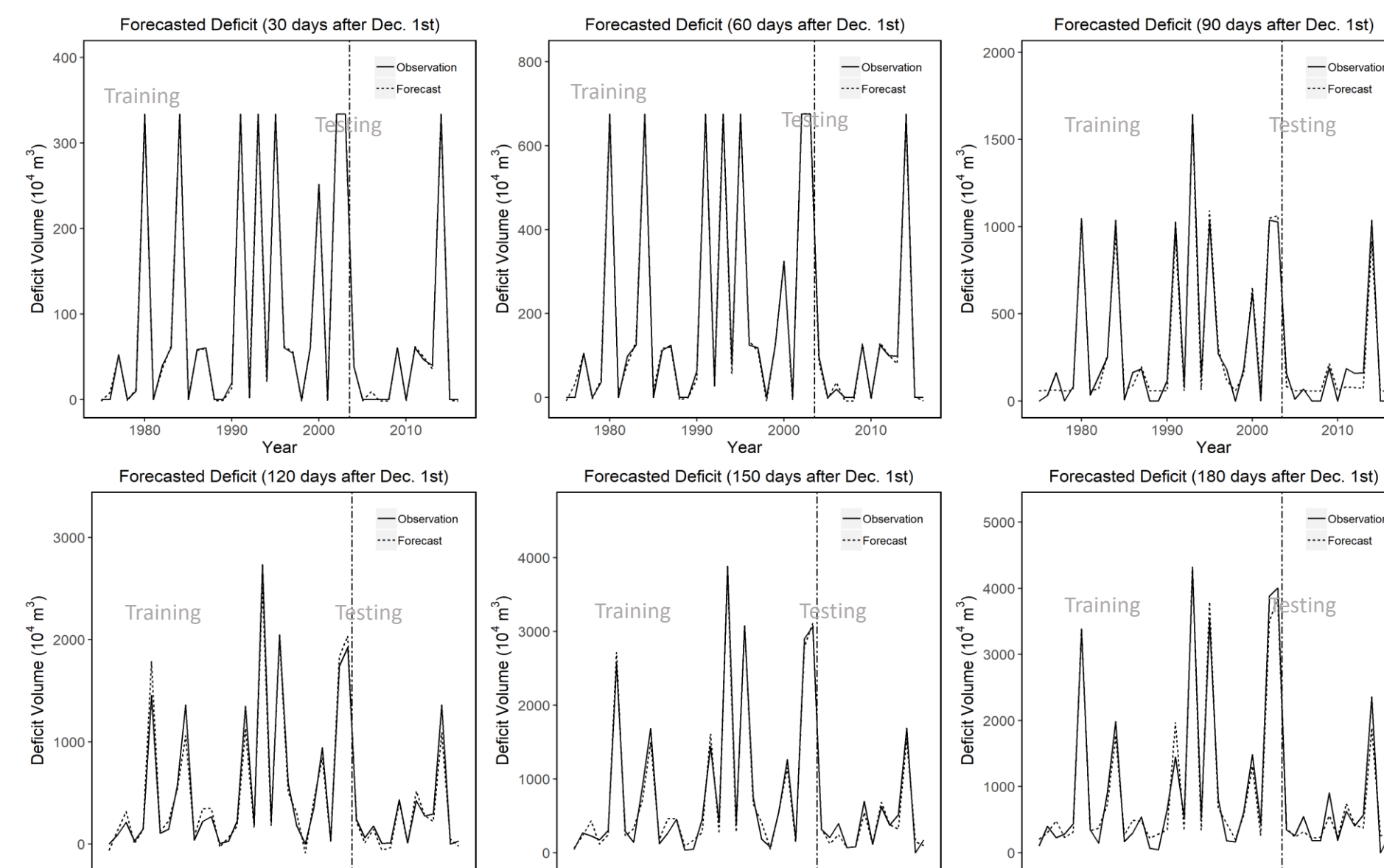
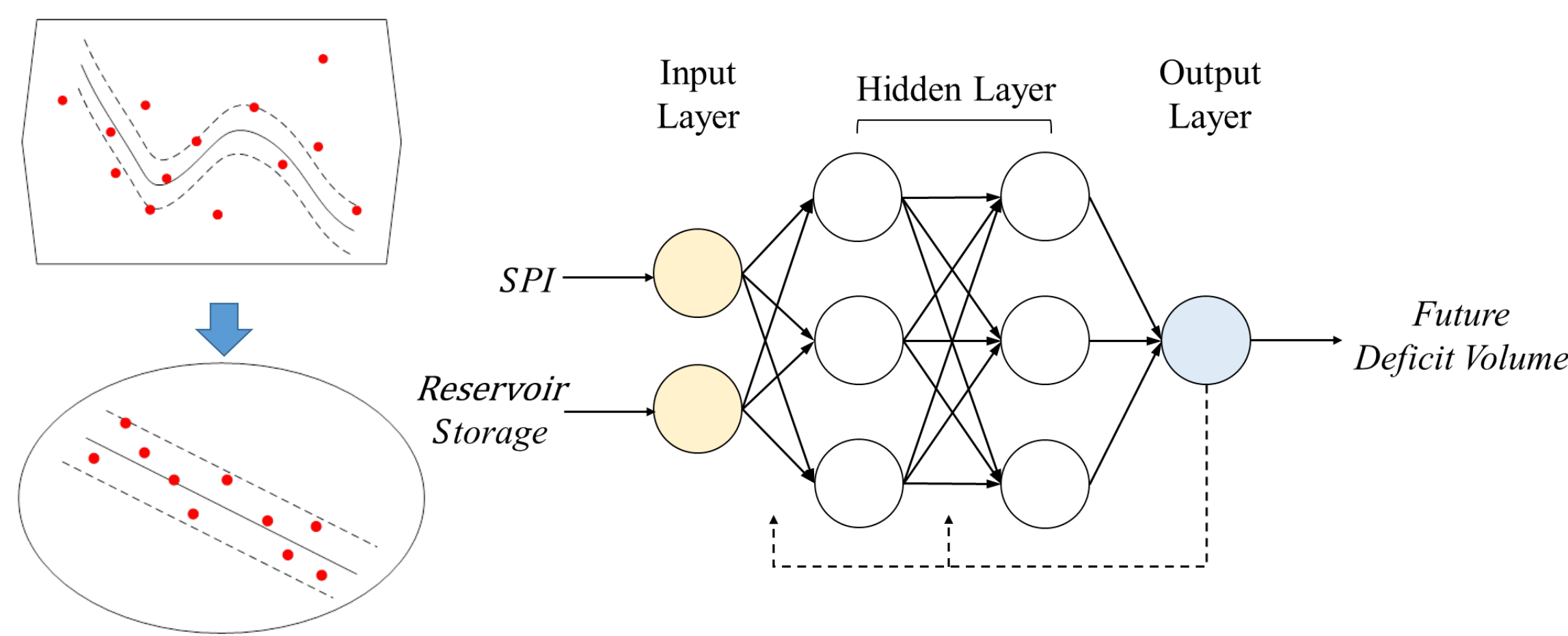
$$WS_{t,D} = f(SPI_t, RS_t)$$

$f()$: SVM and Backpropagation NN

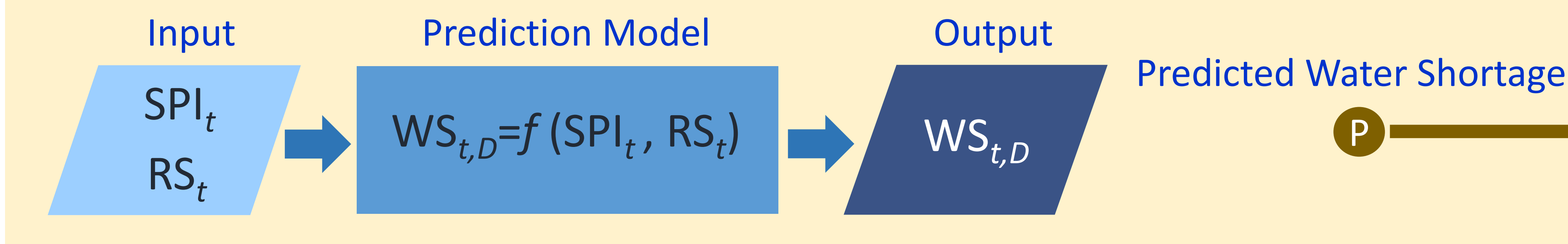
$WS_{t,D}$: Water Shortage for D days ahead at time t

SPI_t : SPIs of different timescales at time t

RS_t : Reservoir storage at time t



Water Shortage Prediction during Dry Period



Acknowledgement

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Drought SDF curves

Frequency Analysis for $WS_{max,D}$

$WS_{T-yr,D}$ for plotting SDF curves

$WS_{max,D}$: annual maximum WS for D days

$WS_{T-yr,D}$: WS (severity) for T-yr and D days

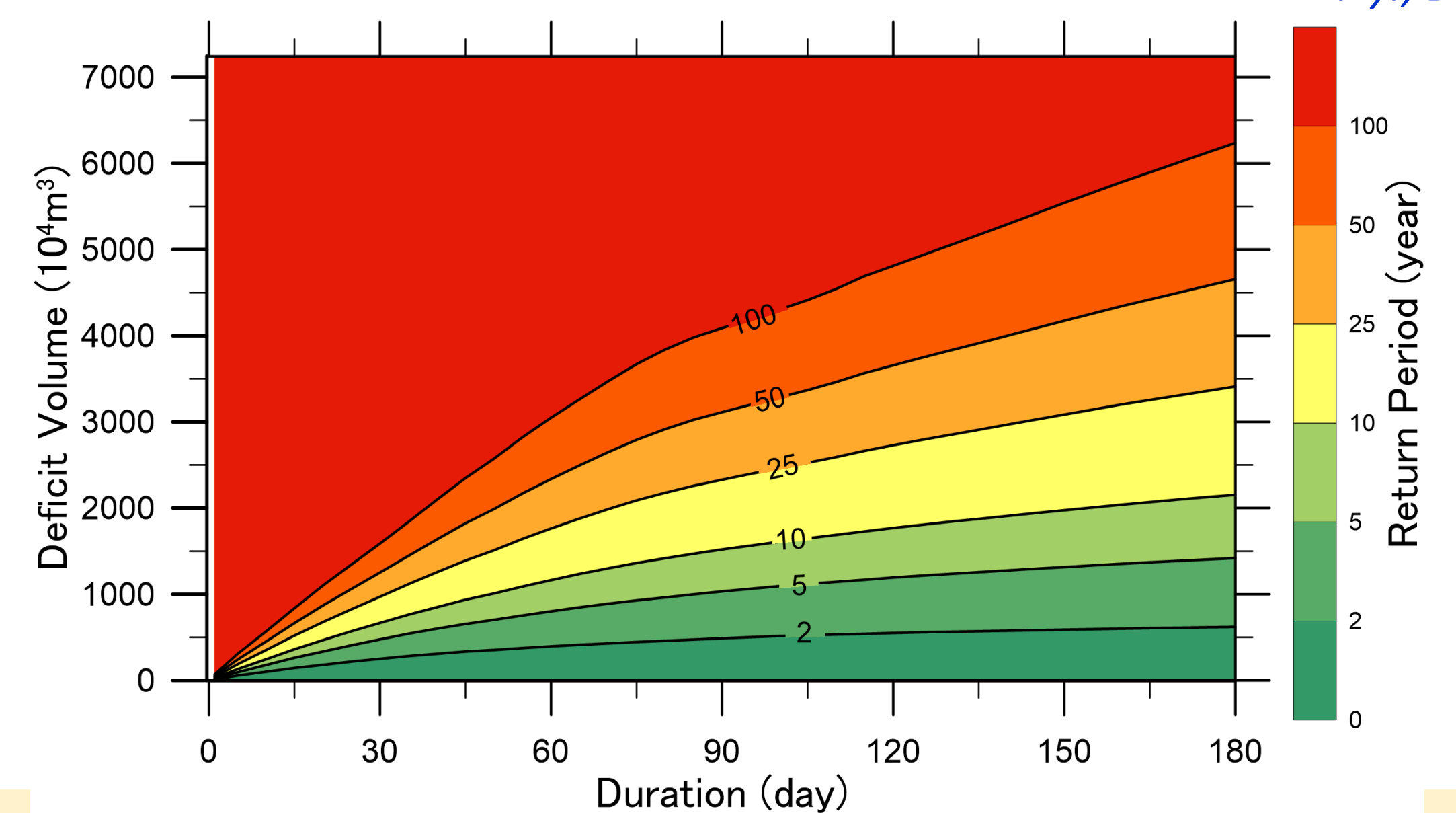
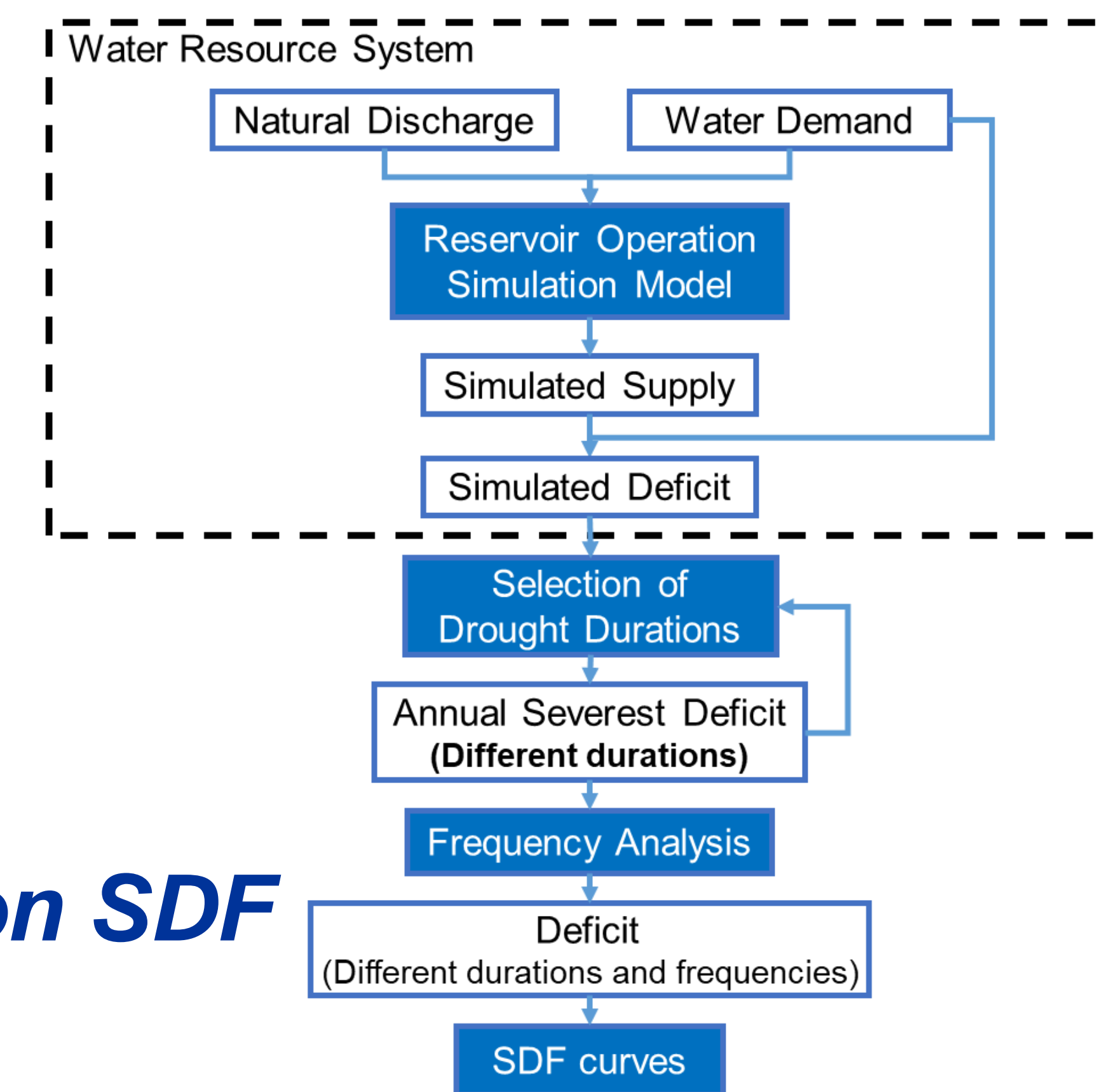
T-yr : return Period (frequency) ; D : duration

Emergency Response Actions based on SDF

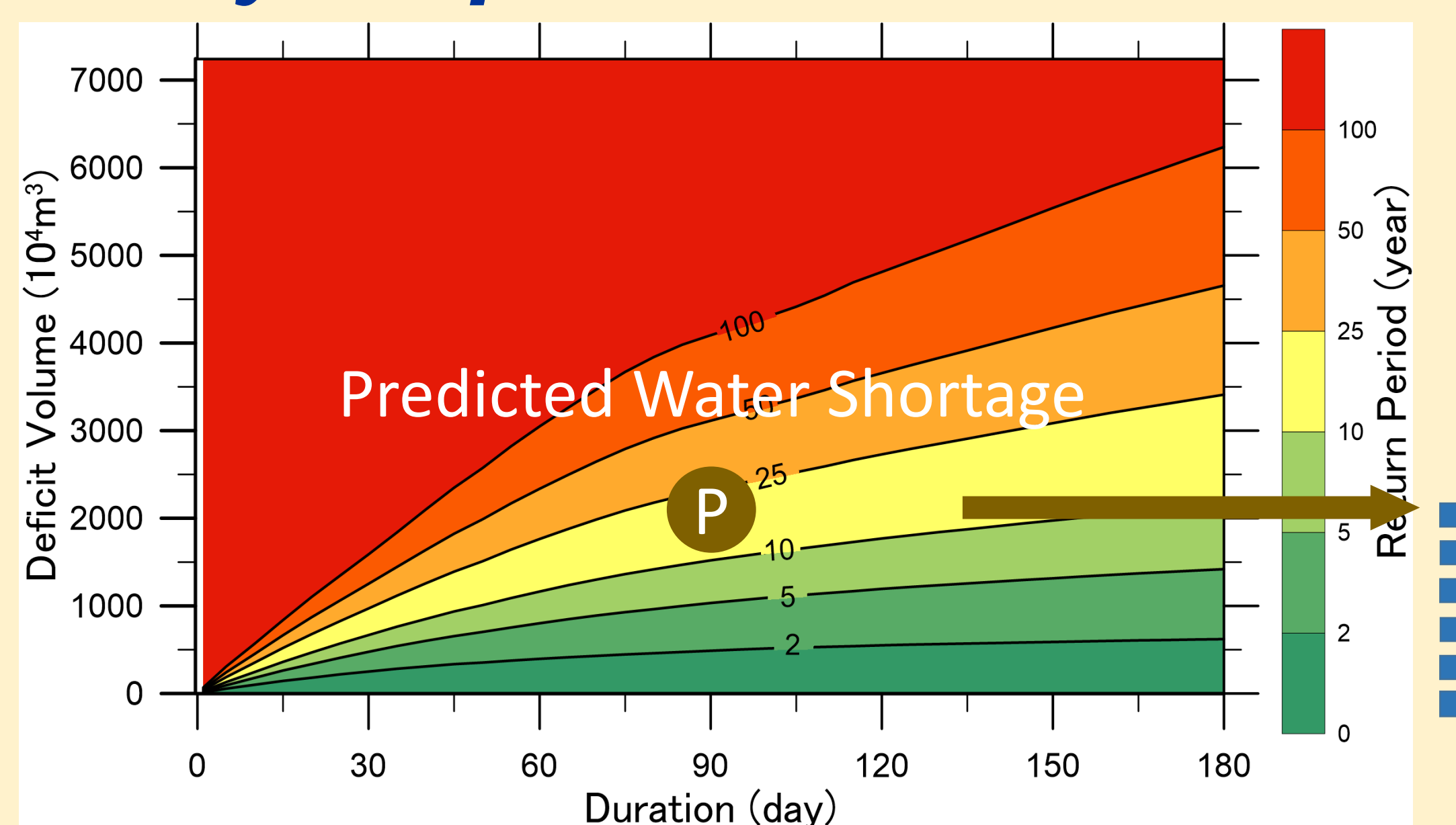
Planning Different Actions for $WS_{T-yr,D}$

Moderate Action for low design drought $WS_{T-yr,D}$

Vigorous Action for high design drought $WS_{T-yr,D}$



Early Preparedness for Potential Water Shortage



Emergency Response Actions

- Fallowing agricultural land
 - Transferring agricultural water
 - Cross-regional water supply
 - Pumping ground water
 - Introducing water rationing
 - Reducing water pressure
- Vigorous ↑ Moderate

Emergency Response Actions

- Fallowing agricultural land
 - Transferring agricultural water
 - Cross-regional water supply
 - Pumping ground water (S)
 - Introducing water rationing (S)
 - Reducing water pressure (S)
- suggested actions