Projected Climate Change Effects on Water Availability of the Metropolitan Region of São Paulo

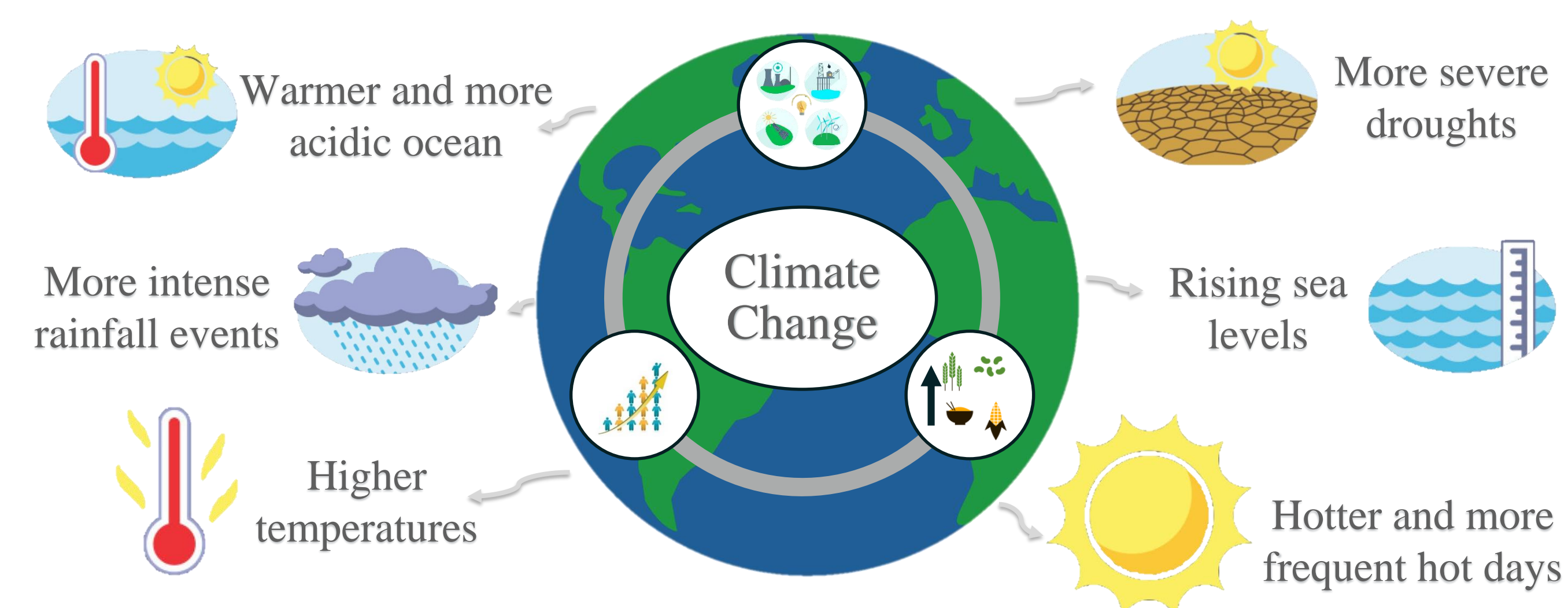HWS Hydrology and Water Security Research Group — UFMS

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INTRODUCTION

Warmer and more acidic ocean
More severe droughts
More intense rainfall events
Rising sea levels
Higher temperatures
Hotter and more frequent hot days
Climate Change

Demand — Water Availability
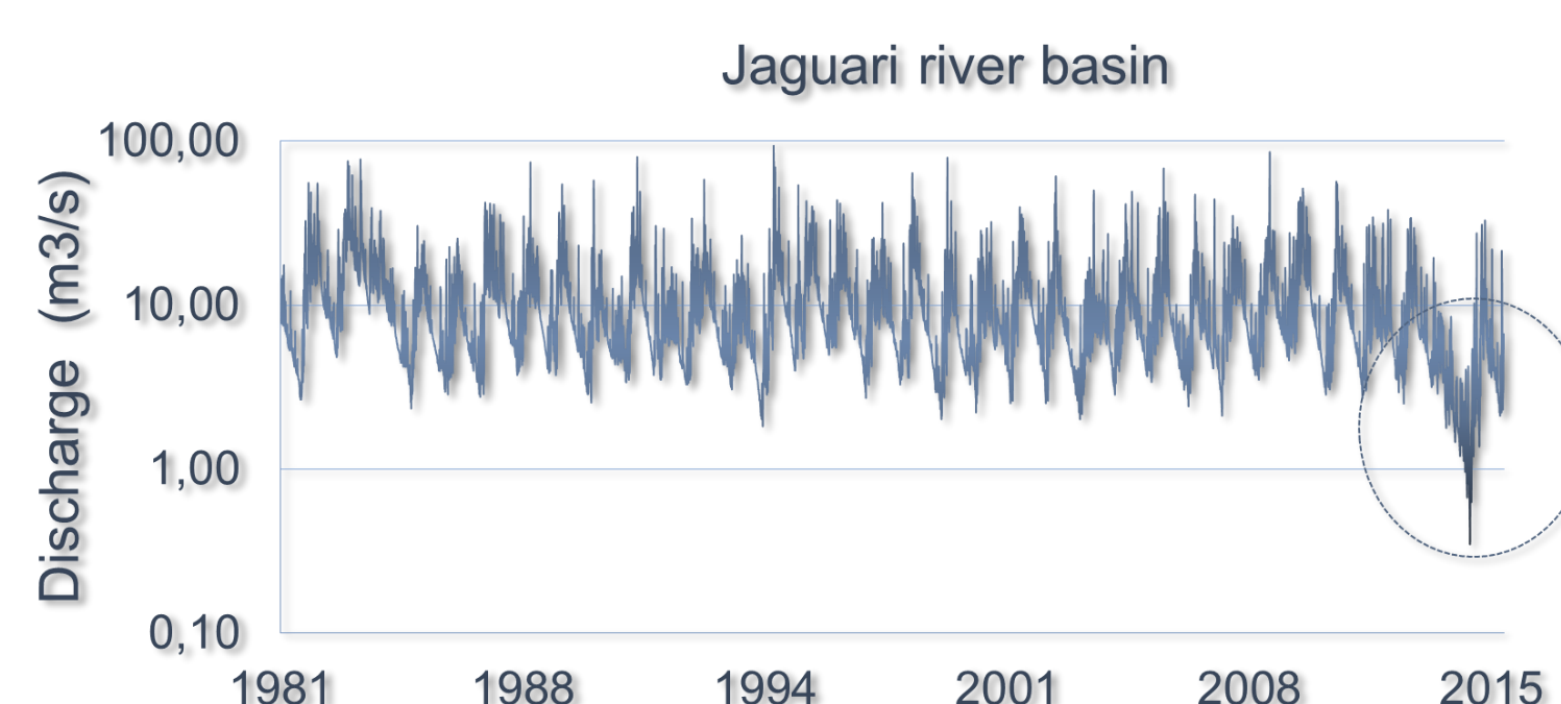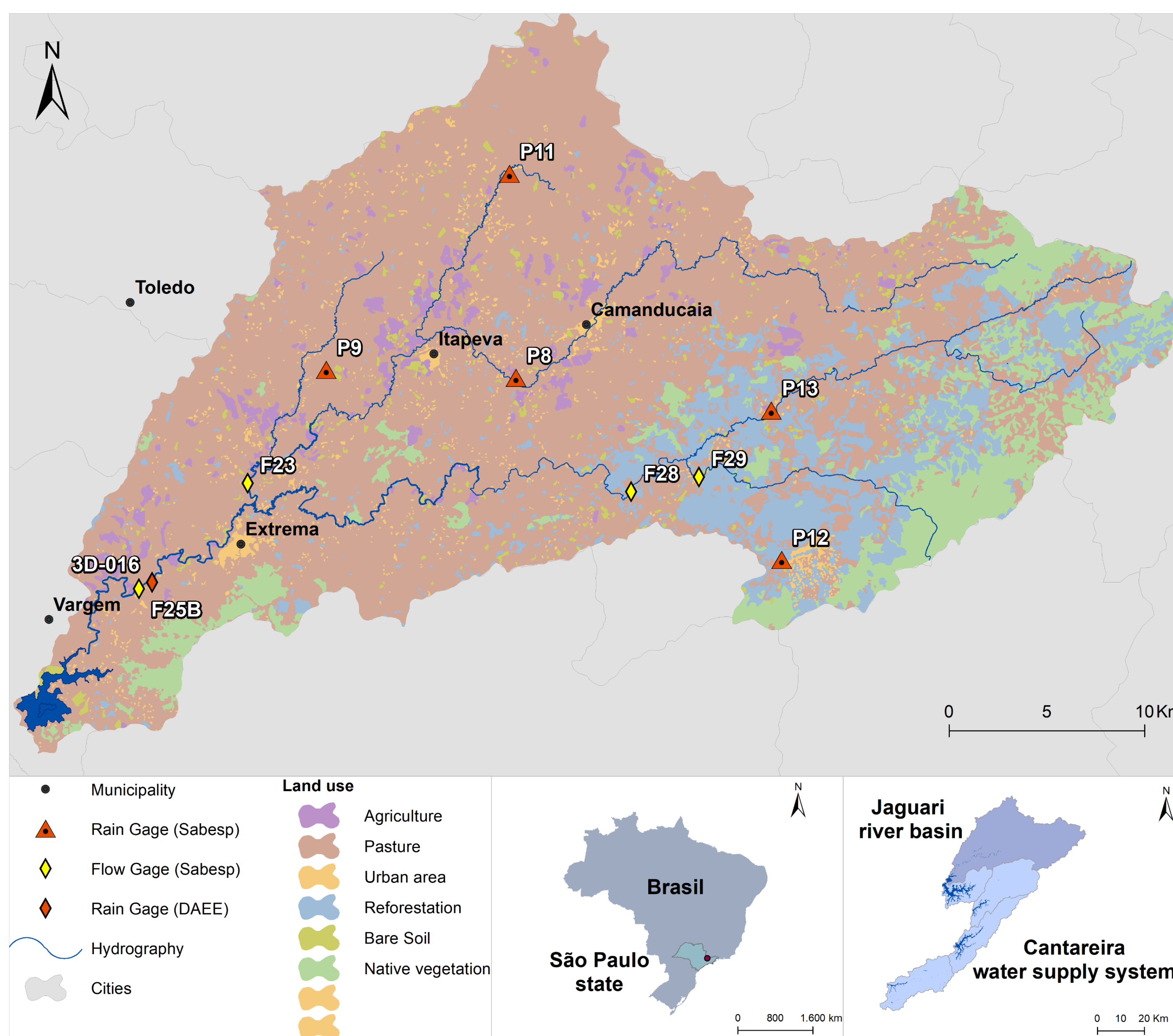
➤ Achieving a balance between water availability and demand is one of the most pressing environmental challenges in the twenty-first century.

➤ The Southeast region of Brazil experienced two major droughts
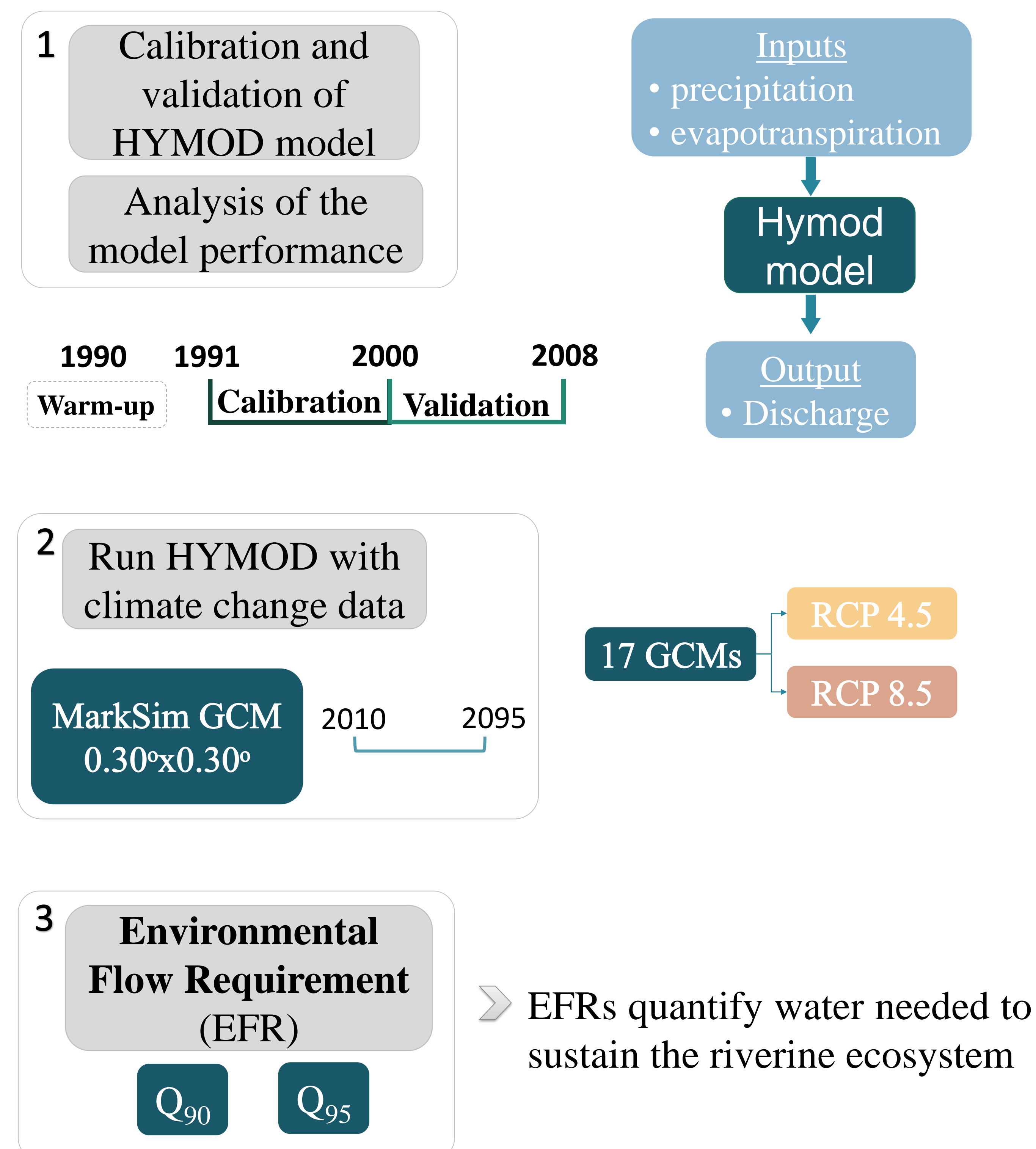
2000   2014-2015

Jaguari river basin

➤ It was the driest calendar year in its 123 years record.
➤ Exposed Brazil's biggest metropolis to a crippling water crisis.

N

Municipality
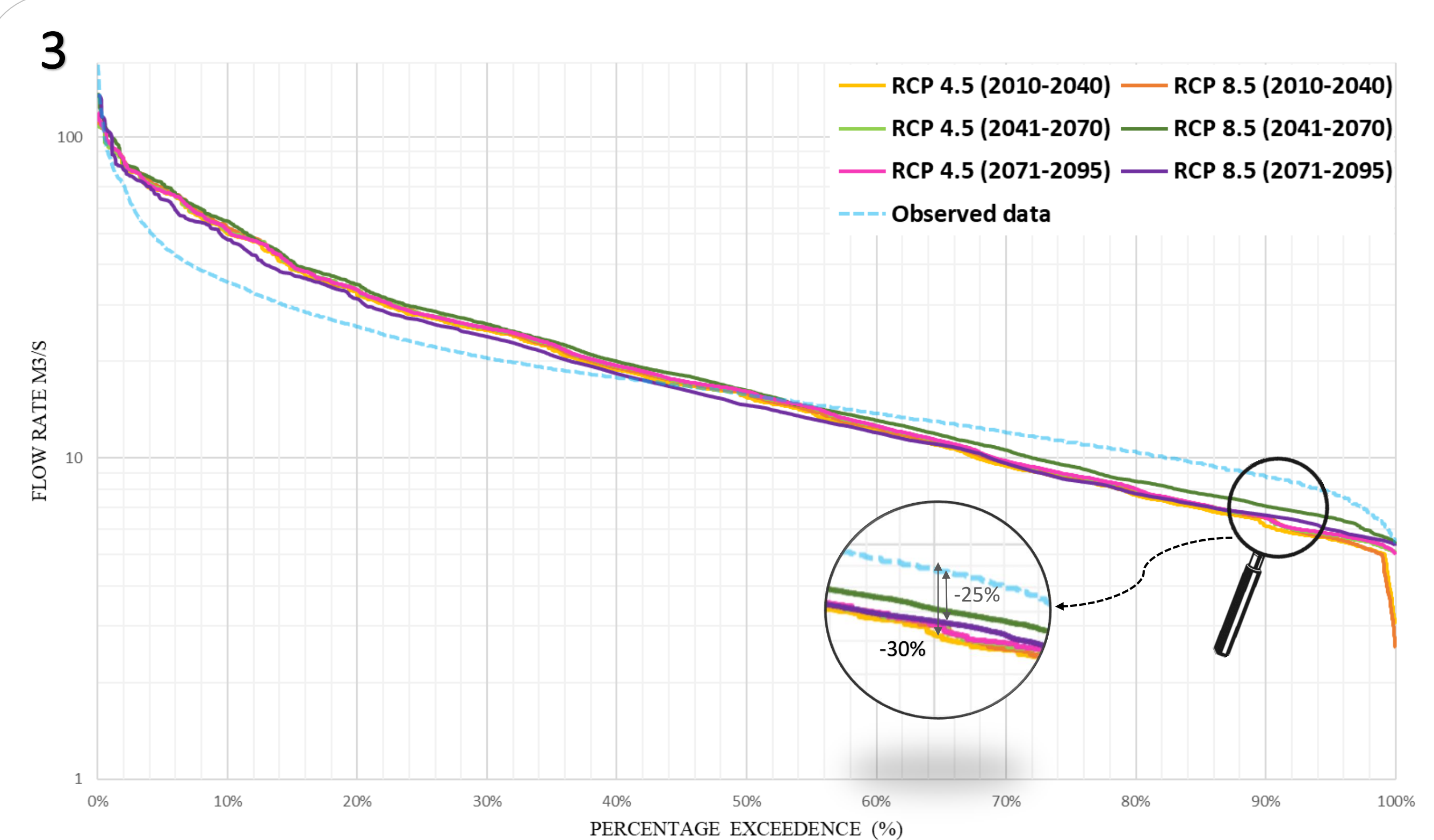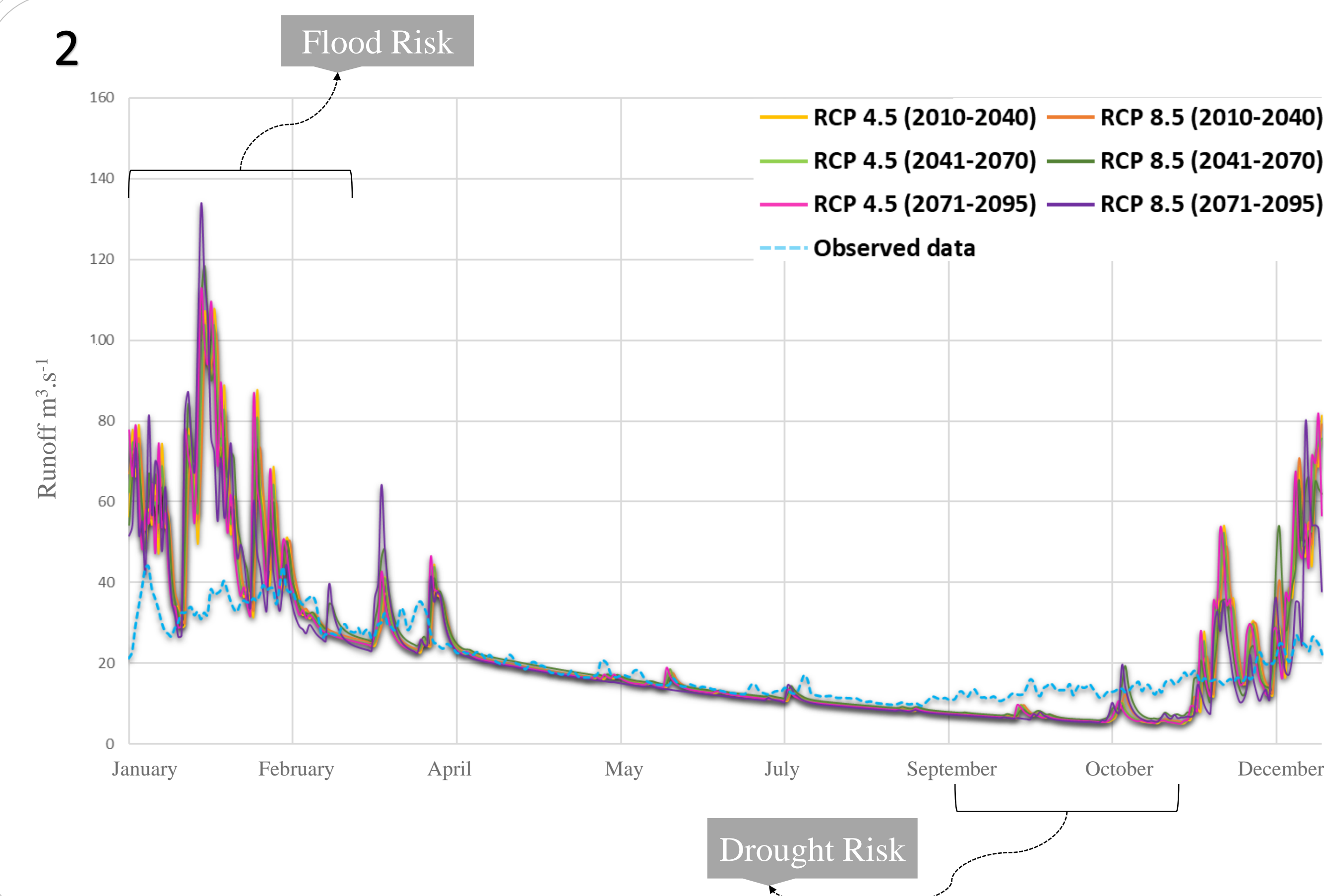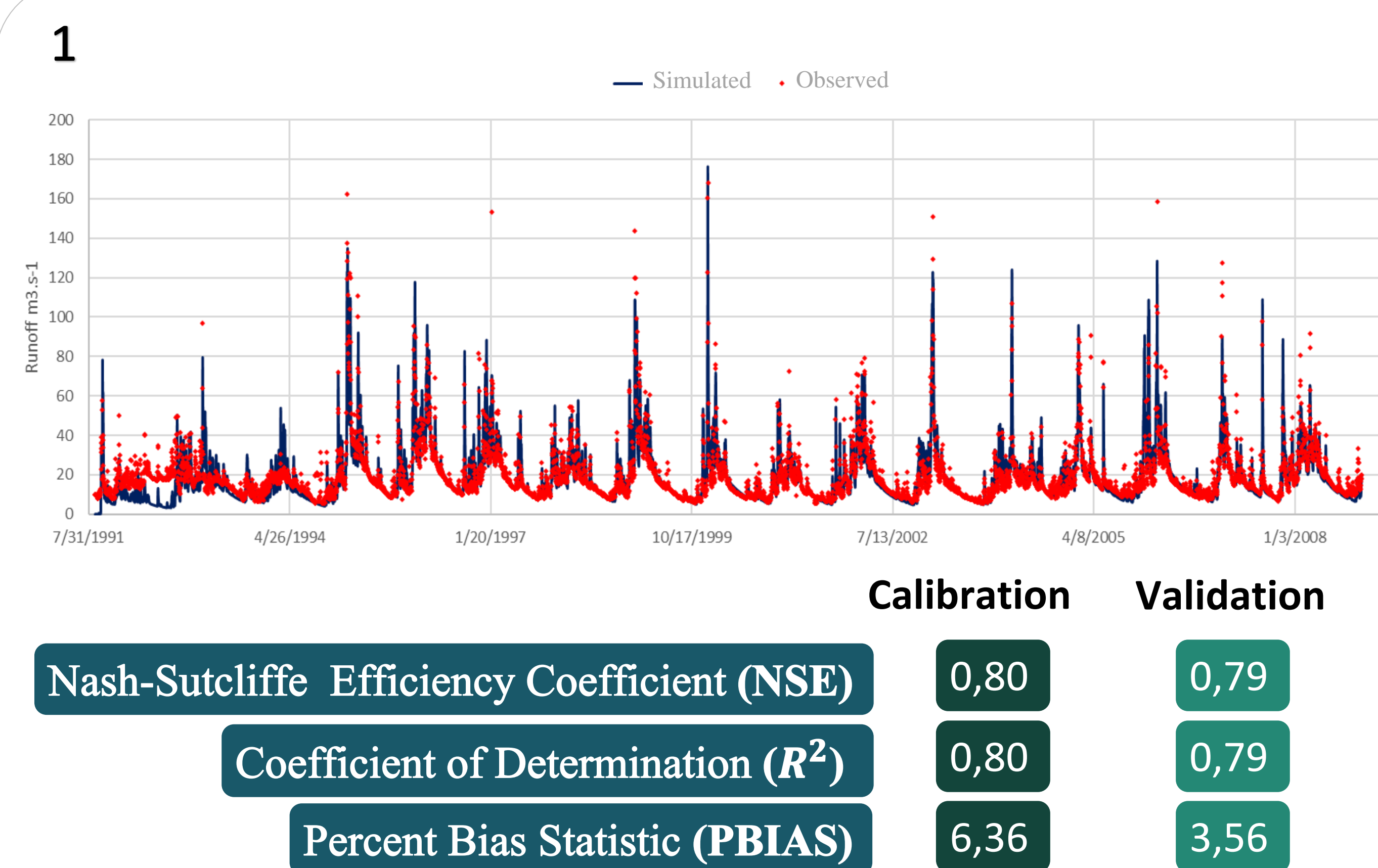Rain Gage (Sabesp)
Flow Gage (Sabesp)
Rain Gage (DAEE)
Hydrography
Cities

Land use
Agriculture
Pasture
Urban area
Reforestation
Bare Soil
Native vegetation

Brasil
São Paulo state

Jaguari river basin
Cantareira water supply system

MATERIALS & METHODS

We assessed the influence of climate change on water availability in the Jaguari Basin using a modeling approach.

1 Calibration and validation of HYMOD model
Analysis of the model performance

Inputs
• precipitation
• evapotranspiration

Hymod model

Output
• Discharge

1990   1991   2000   2008
Warm-up | Calibration | Validation

2 Run HYMOD with climate change data

MarkSim GCM 0.30°x0.30°   2010 — 2095

17 GCMs
RCP 4.5
RCP 8.5

3 Environmental Flow Requirement (EFR)

➤ EFRs quantify water needed to sustain the riverine ecosystem

Q_{90} Q_{95}

RESULTS

1

— Simulated   • Observed

	Calibration	Validation
Nash-Sutcliffe Efficiency Coefficient (NSE)	0,80	0,79
Coefficient of Determination (R^2)	0,80	0,79
Percent Bias Statistic (PBIAS)	6,36	3,56

2

Flood Risk
Drought Risk
RCP 4.5 (2010-2040) — RCP 8.5 (2010-2040)
RCP 4.5 (2041-2070) — RCP 8.5 (2041-2070)
RCP 4.5 (2071-2095) — RCP 8.5 (2071-2095)
Observed data

3

RCP 4.5 (2010-2040) — RCP 8.5 (2010-2040)
RCP 4.5 (2041-2070) — RCP 8.5 (2041-2070)
RCP 4.5 (2071-2095) — RCP 8.5 (2071-2095)
Observed data
-25% -30%

CONCLUSIONS

✓ The projected climatic changes reflect a higher interannual variability, therefore, increasing the risk of drought and flood

✓ Our findings indicate that the water discharge could not be enough for future water demand

✓ Our results expose the fragility of the studied basin, presenting technical and scientific information focusing on guiding plans and strategies to deal with water scarcity situations.

FUTURE WORK

A continued analysis of **Water Security Indicators** will be conduted in Sao Paulo Metropolitan Region. We will provide an important overview of climate change impacts on future water vulnerability and scarcity in the Jaguari basin, which can be used to guide the basin's water security plans and strategies.