Representing South Indian water tanks in a hydrologic model using remote sensing data

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Introduction

- **Water tanks**

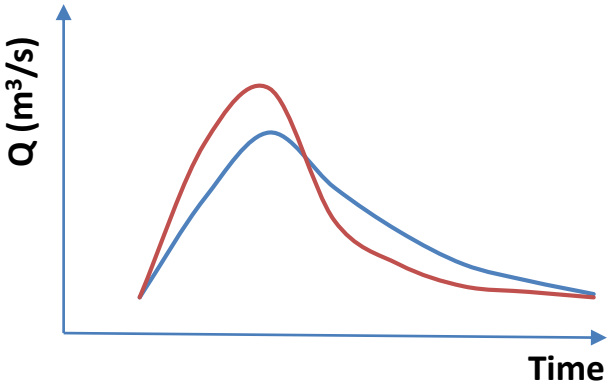
  traditional water use systems in India that store water during the rainy season

UNDP-Climate, 2016

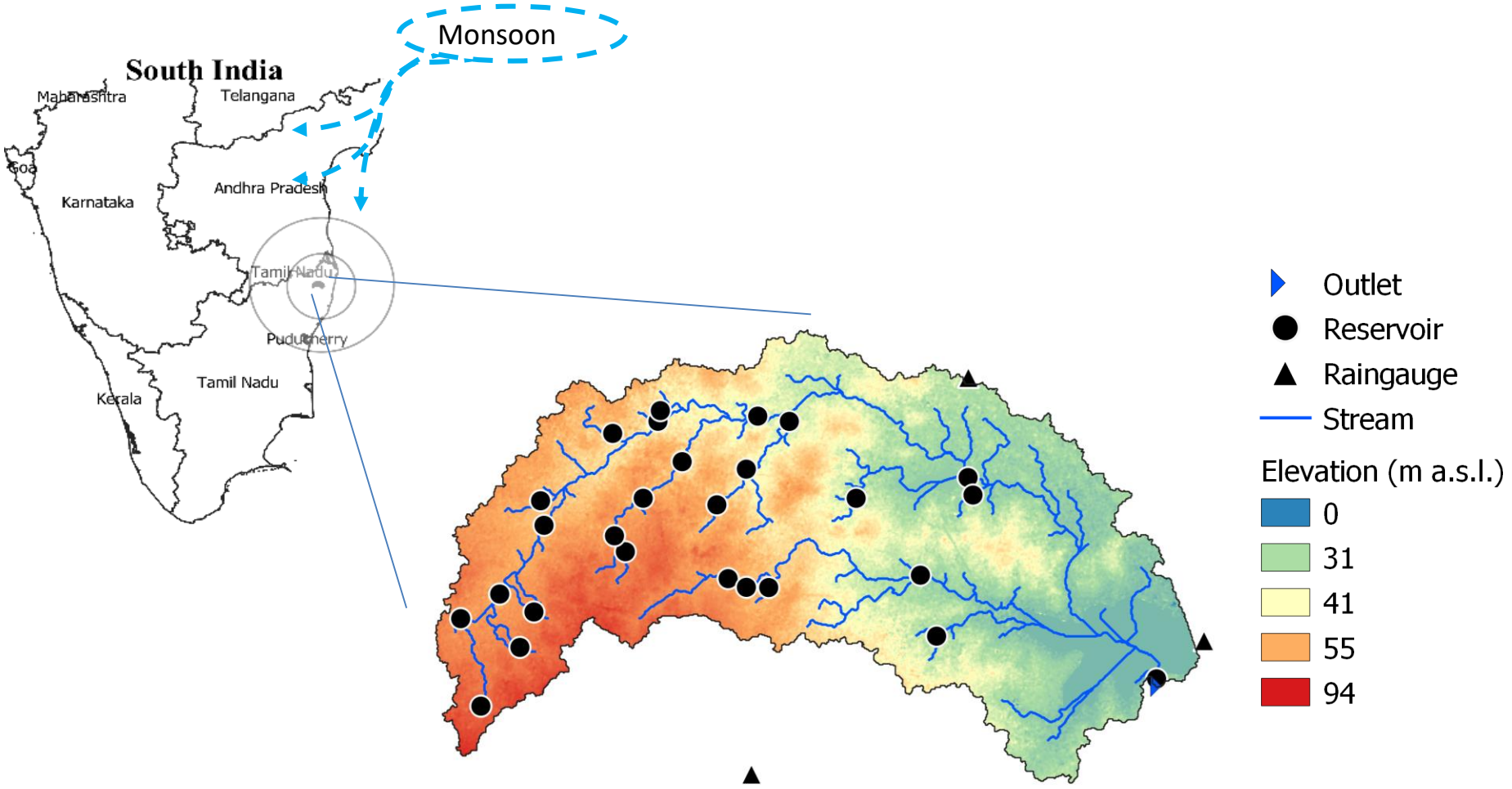
- **Hydrological effect**

  delay of surface runoff

  higher groundwater recharge

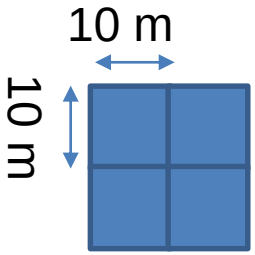


Study area: Adyar basin



Detection of water storage of tanks

- The satellite scenes for the period: 2016 to 2020



Cloud cover

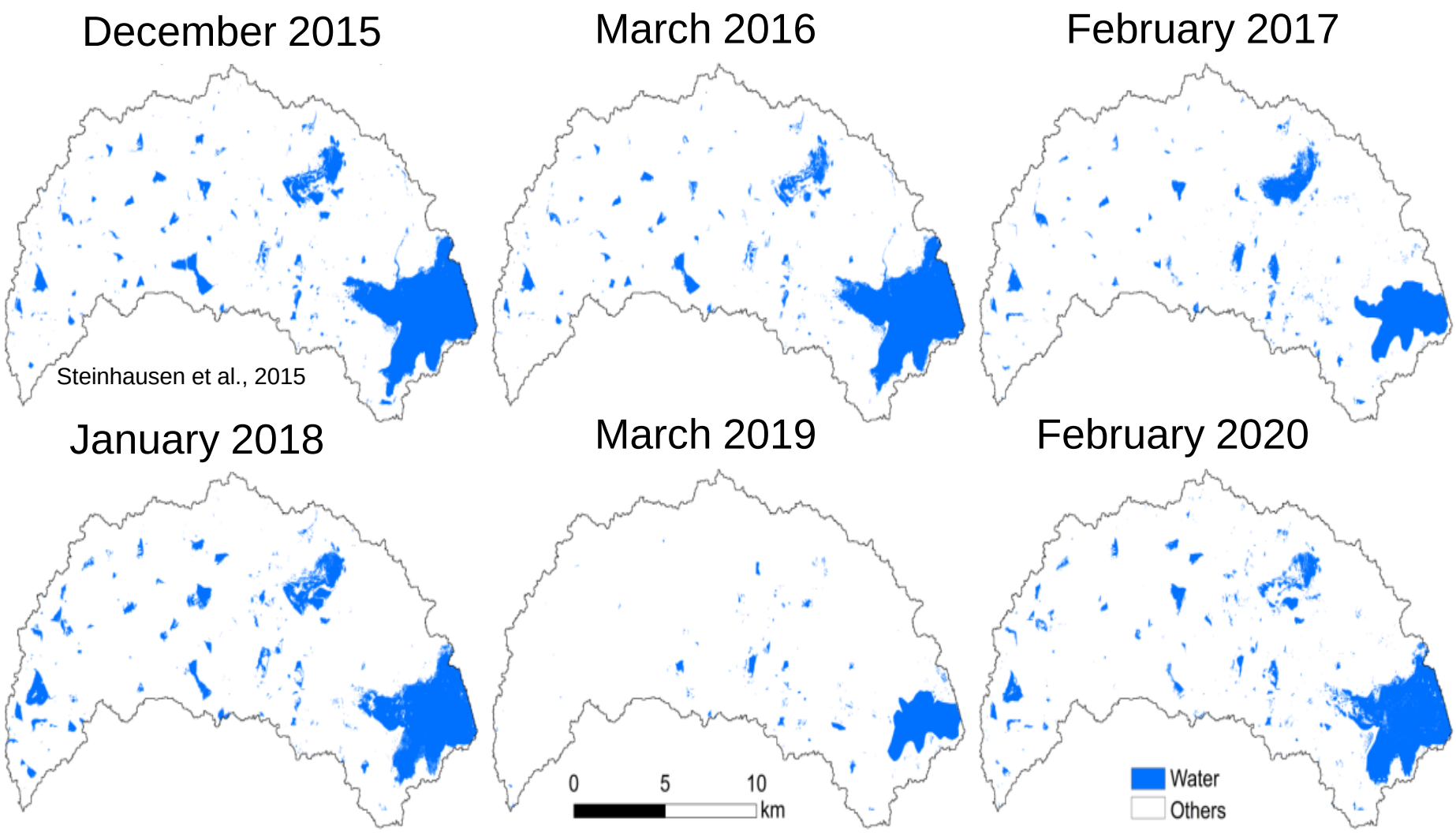
10% <

10% >

Landsat image, 2017

- Between 50 and 65 ground truth polygons of water
- Supervised classification using Random Forest

Water storage of tanks



Implementing water tanks in SWAT+

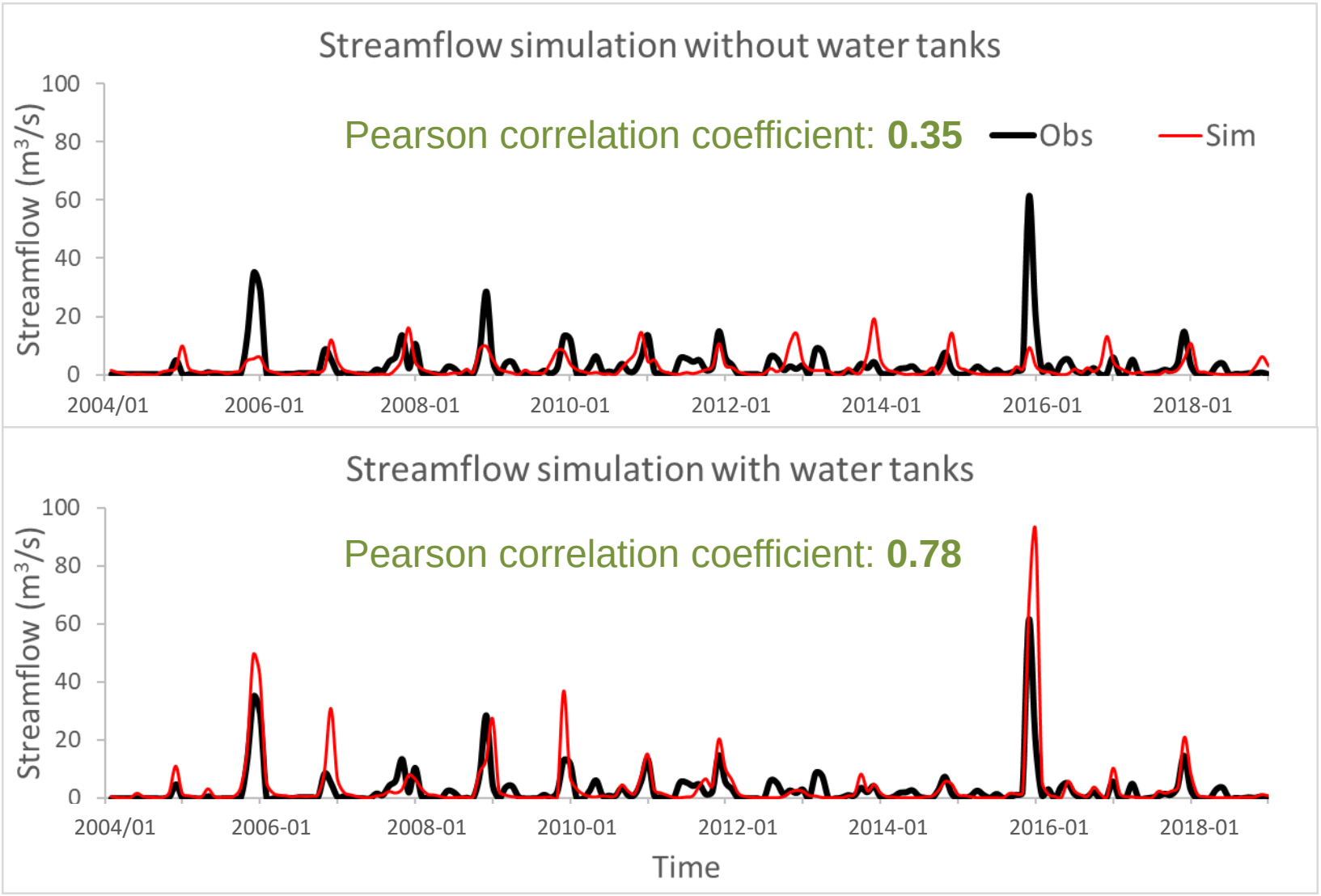
- Reservoir

Parameter	Unit	Description
SUB-BASIN	–	Number of the sub-basin in which the reservoir is located
IYRES	–	The operational year
RES_ESA	ha	Reservoir surface area when the reservoir is filled to the emergency spillway
RES_PSA	ha	Reservoir surface area when the reservoir is filled to the principal spillway
RES_EVOL	10^4 m^3	Volume needed to fill the reservoir to the emergency spillway
RES_PVOL	10^4 m^3	Volume needed to fill the reservoir to the principal spillway
RES_VOL	10^4 m^3	Initial reservoir volume

Volume (m^3) = Area (m^2) * Depth (m)

	small	large
Depth:	**1 m**	**5 m**

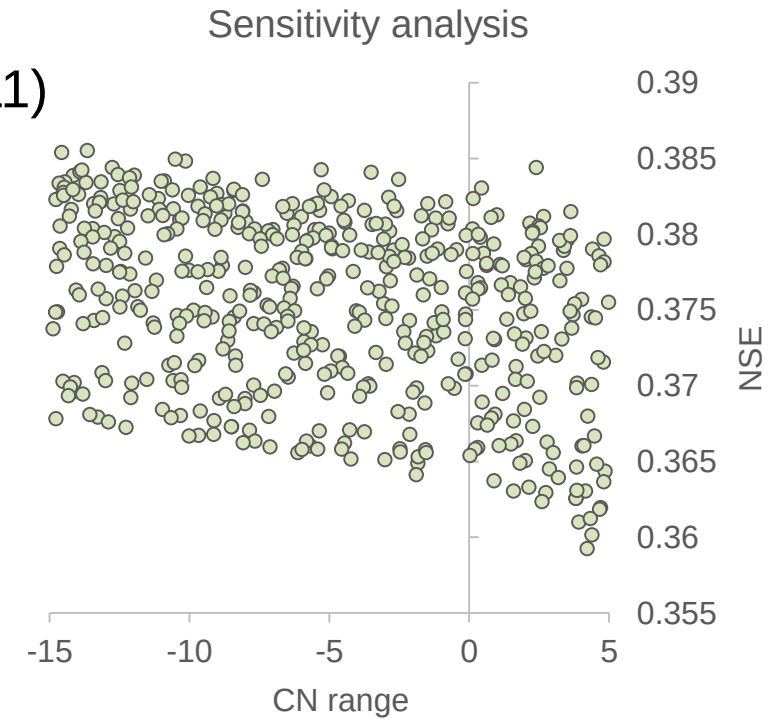
Model performance



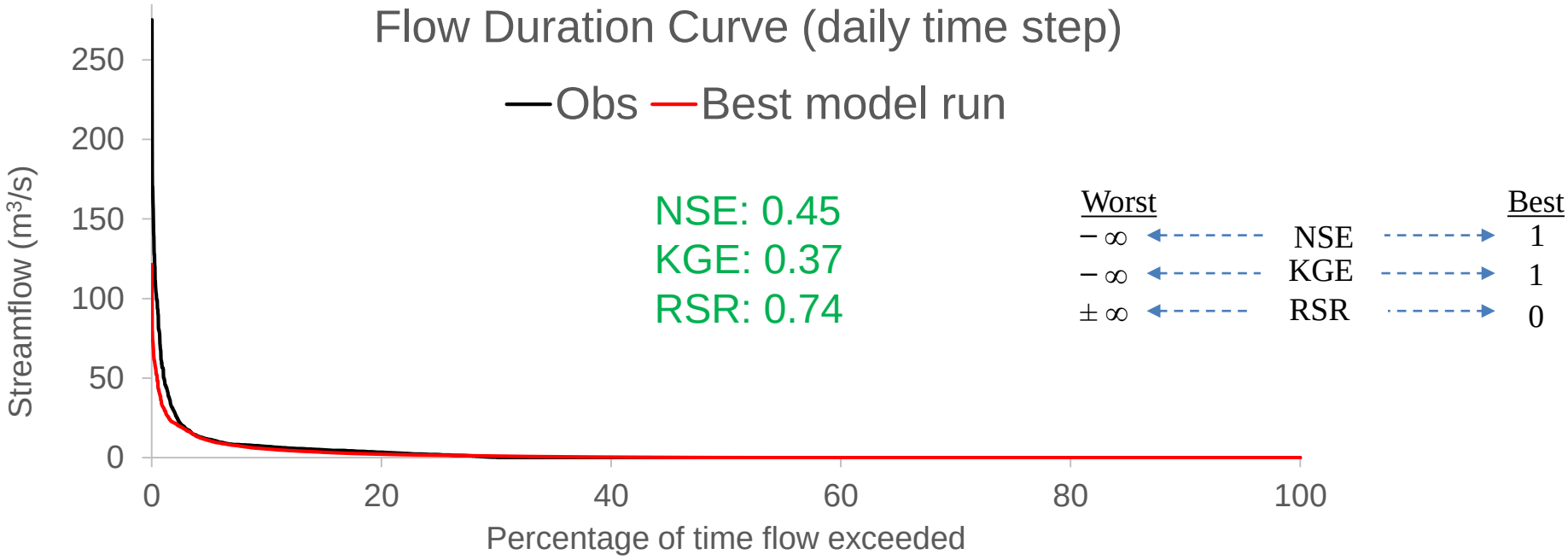
Model calibration

Total hydrologic parameters					
CN2	SOL_AWC	ESCO	K.SOL	REVAP_CO	GW_DELAY
SURLAG	CH_N1	EPCO	ALPHA_BF		RCHRG_DP

- Sensitivity analysis
- Governing hydrologic parameters (9 out of 11)
- **5000** parameter combinations
- Selection of the best model run (KGE)



Model Performance



Model performance (monthly time step)

	Time Period	NSE	KGE	RSR
Entire period	2004-2018	0.69	0.63	0.55
Calibration period	2004-2011	0.61	0.56	0.62
Validation period	2012-2018	0.76	0.67	0.48
Water tanks' area detection period	2015-2018	0.81	0.76	0.43

Summary

- Remote sensing analysis is beneficial for parametrization of water tanks.

- Including water tanks in a hydrologic model can improve the model performance.

- Due to extreme climate conditions cluster calibration (separate model calibration for monsoon and nonmonson seasons) is recomended.

Thank you for your attention!

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Water tank, Chennai, India (Daniel Rosado, 2019)