

# Enhancing NWM Parameter Regionalization to Improve Physical Similarity Representation While Accounting for Uncertainties

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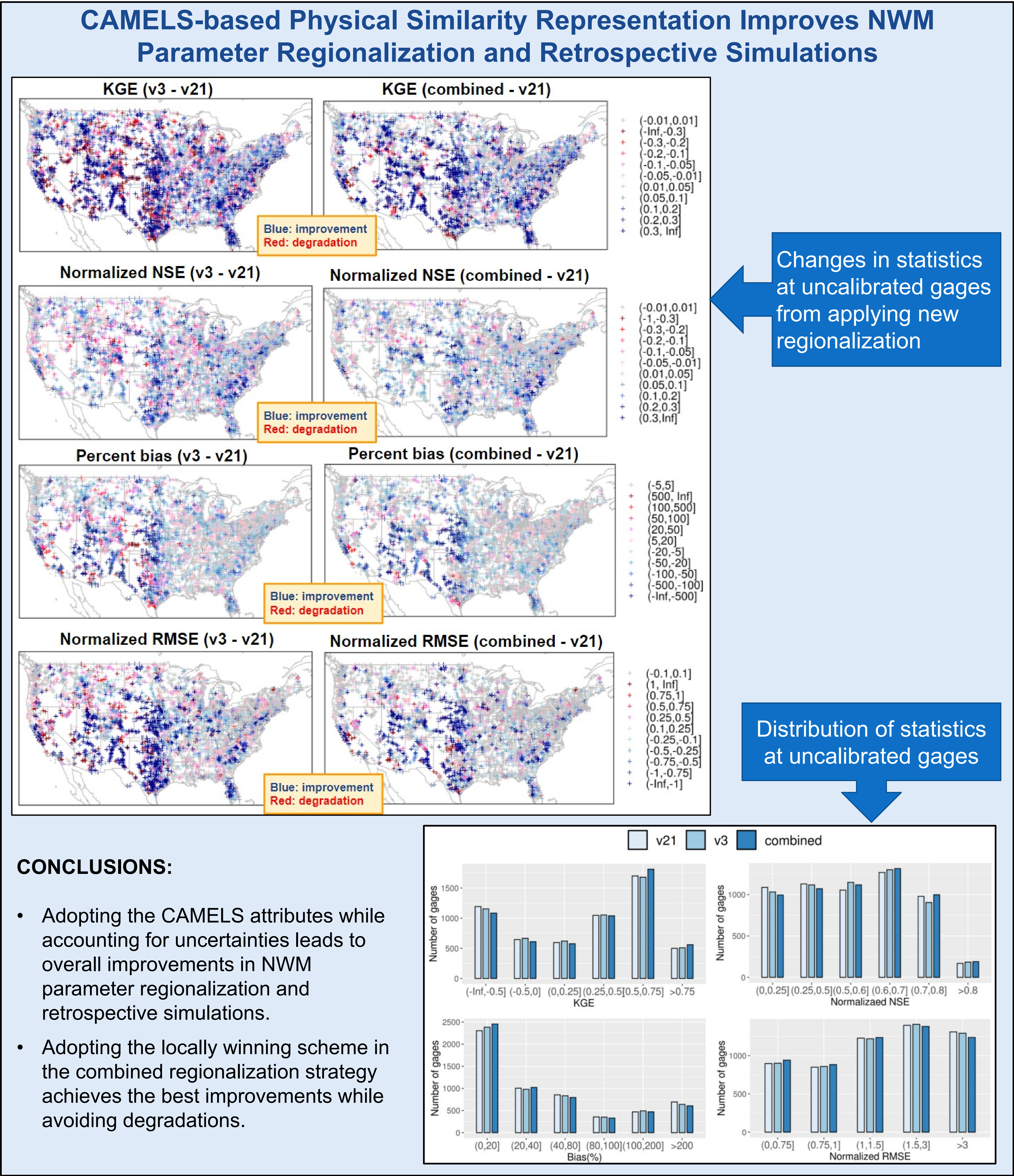
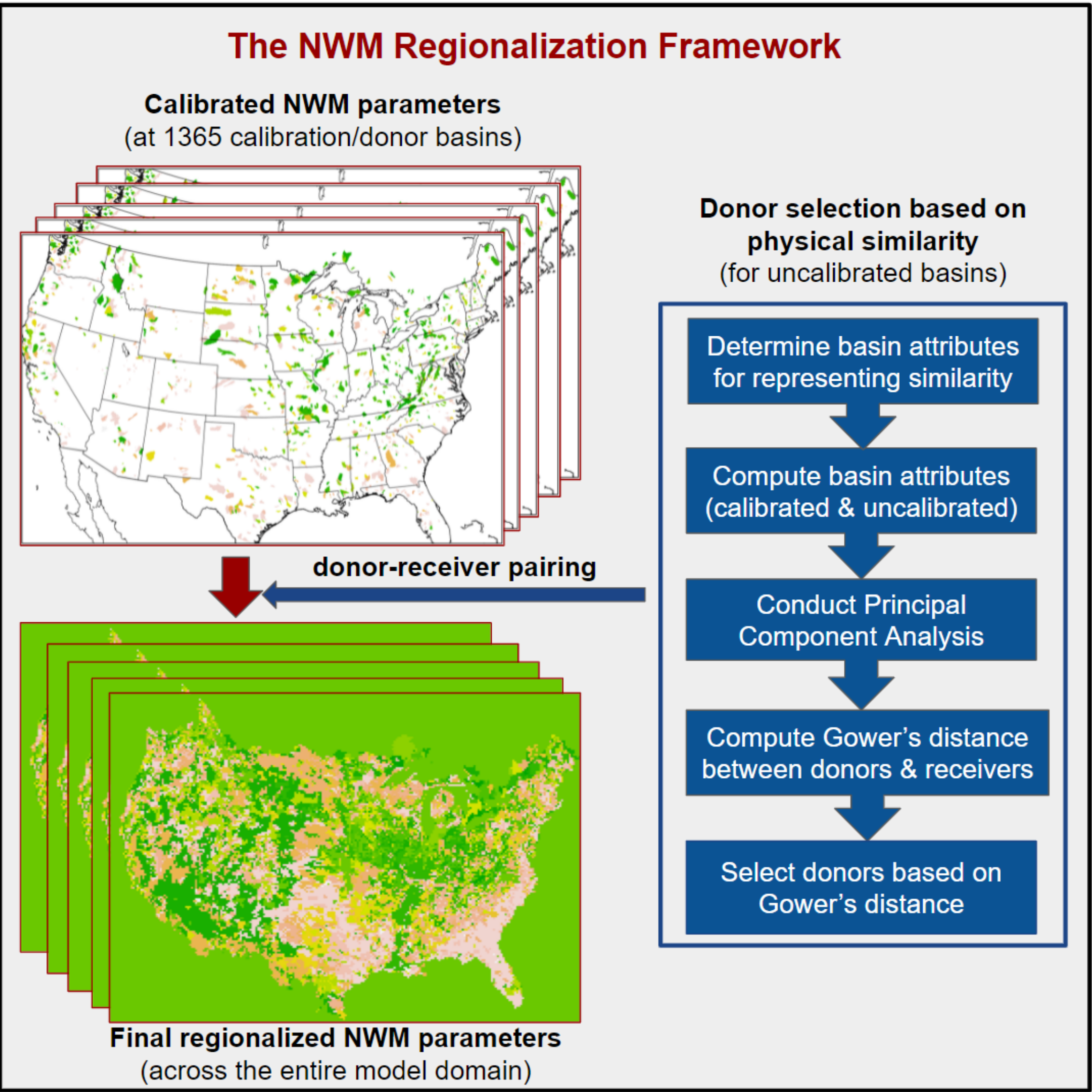
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## Introduction

The National Water Model (NWM) uses a physical similarity regionalization framework to transfer model parameters from calibrated basins to uncalibrated areas. Here we discuss the enhancements on the current NWM v2.1 regionalization for use in NWM v3.0 by adopting the attributes from the Catchment Attributes and Meteorology for Large-Sample Studies (CAMELS) while accounting for uncertainties in parameter calibration and donor selection.

## NWM Regionalization Framework

The NWM parameters are transferred from individual calibration basins (donors) to the uncalibrated areas (receivers) within the model domain, using donor-receiver pairing derived from physical similarity measured by the Gower's distance (Gower, 1971) between the physical attributes of donors and receivers.



## Enhancements Proposed for NWM v3 Regionalization

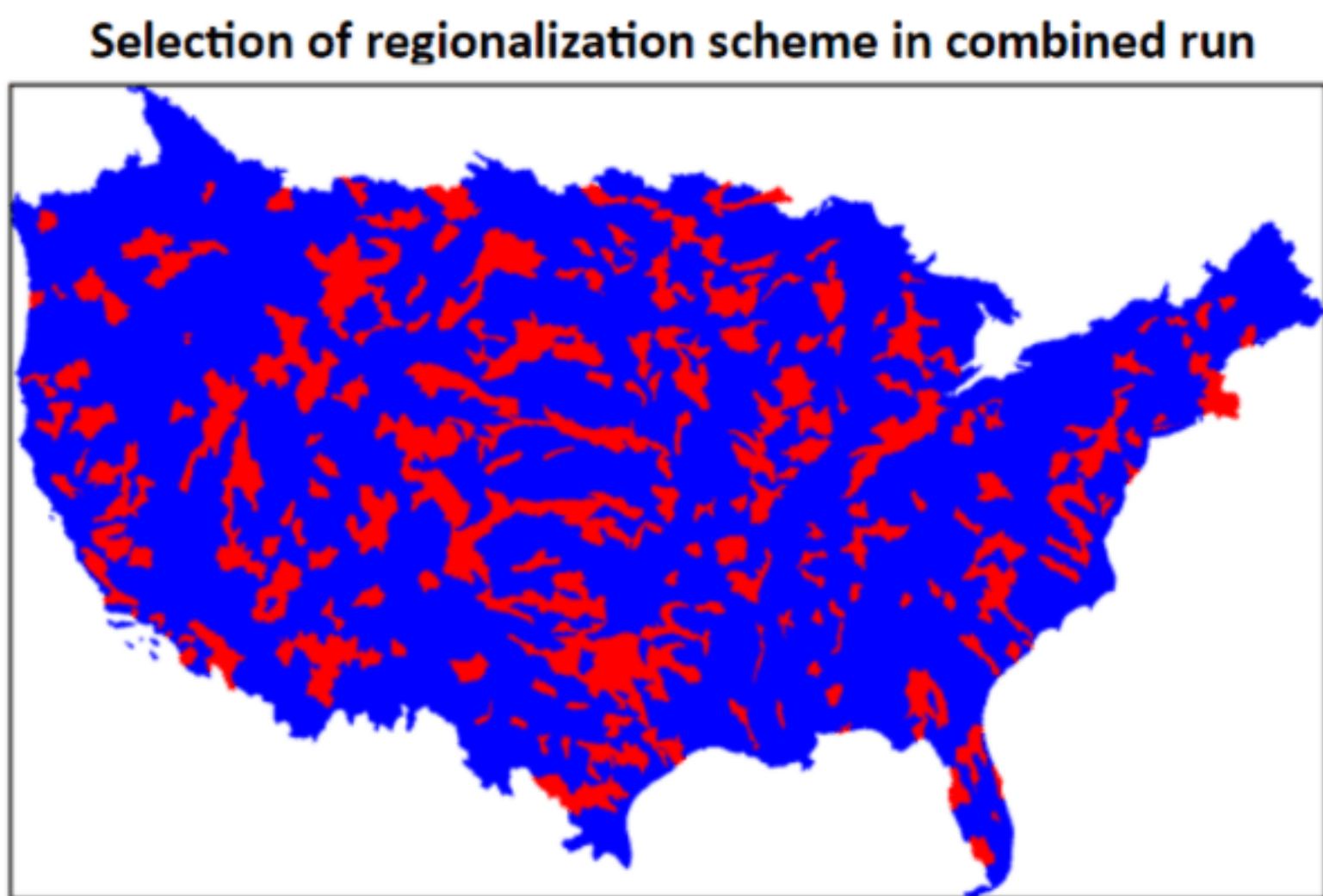
We propose to improve the representativeness of basin attributes in characterizing physical similarity and to account for uncertainties involved in parameter estimation and donor selection.

Description	NWM v2.1 (implemented)	NWM v3.0 (proposed)	Motivation
Conceptual model	Hydrologic Landscape Regions (Winter 2001)	CAMELS (Newman et al. 2014)	Improve physical similarity representation
Catchment attribute categories	Climate, topography, land cover, soil	Climate, topography, land cover, soil, geology, streamflow signature	Improve physical similarity representation
Number of catchment attributes used	12	41	Improve physical similarity representation
Donor parameters	A single optimal parameter set for each donor	Multiple near-optimal parameter sets for each donor	Account for uncertainty in parameter calibration
Number of donors	A single donor for each receiver	Multiple equivalent donors for each receiver	Account for uncertainty in donor selection

## Experimental Setup for Performance Assessment

Three 5-year (2011-2015) retrospective experiments:

- v21:** NWM v2.1 with existing regionalization
- v3:** NWM v2.1 with enhancements proposed for v3.0
- combined (v3 + v21):** adopting the better performing scheme for any given HUC8 region across CONUS based on median KGE from 1 & 2



## REFERENCES:

Gower, J. C., 1971. A general coefficient of similarity and some of its properties. *Biometrics*, 27(4), p. 859.  
Newman, A.J., K. Sampson, M.P. Clark, A. Bock, R. J. Viger, and D. Blodgett, 2014: A large-sample watershed-scale hydrometeorological dataset for the contiguous USA. Boulder, CO: UCAR/NCAR. <https://dx.doi.org/10.5065/D6MW2F4D>  
Winter, T. C. (2001) The concept of hydrologic landscapes. *J. Am. Water Resour. Assoc.* 37, 335–349.

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