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EGU22-6116

Improving the realism of distributed hydrological models in mountainous catchments using remotely sensed observations

Nicolás Vásquez[1], Pablo Mendoza[1,2], Nicolás Cortés[1], Naoki Mizukami[3]

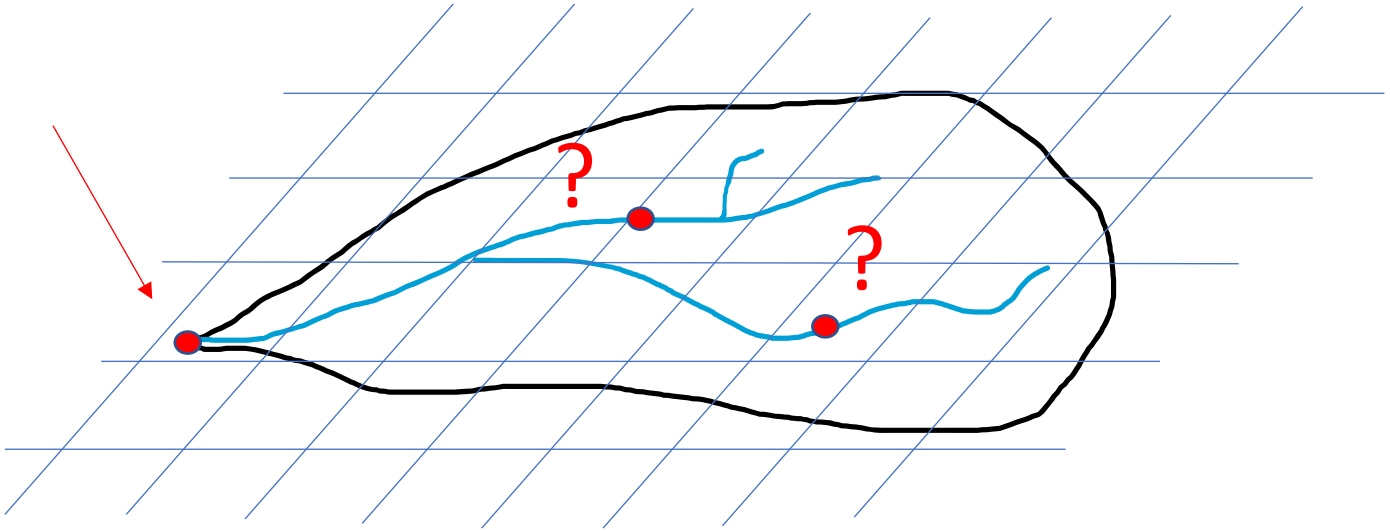
[1]Department of Civil Engineering, Universidad de Chile, Chile

[2] Advanced Mining Technology Center (AMTC), Universidad de Chile, Chile

[3] National Center for. Atmospheric Research (NCAR)

Conguillio National Park
Araucanía, Chile

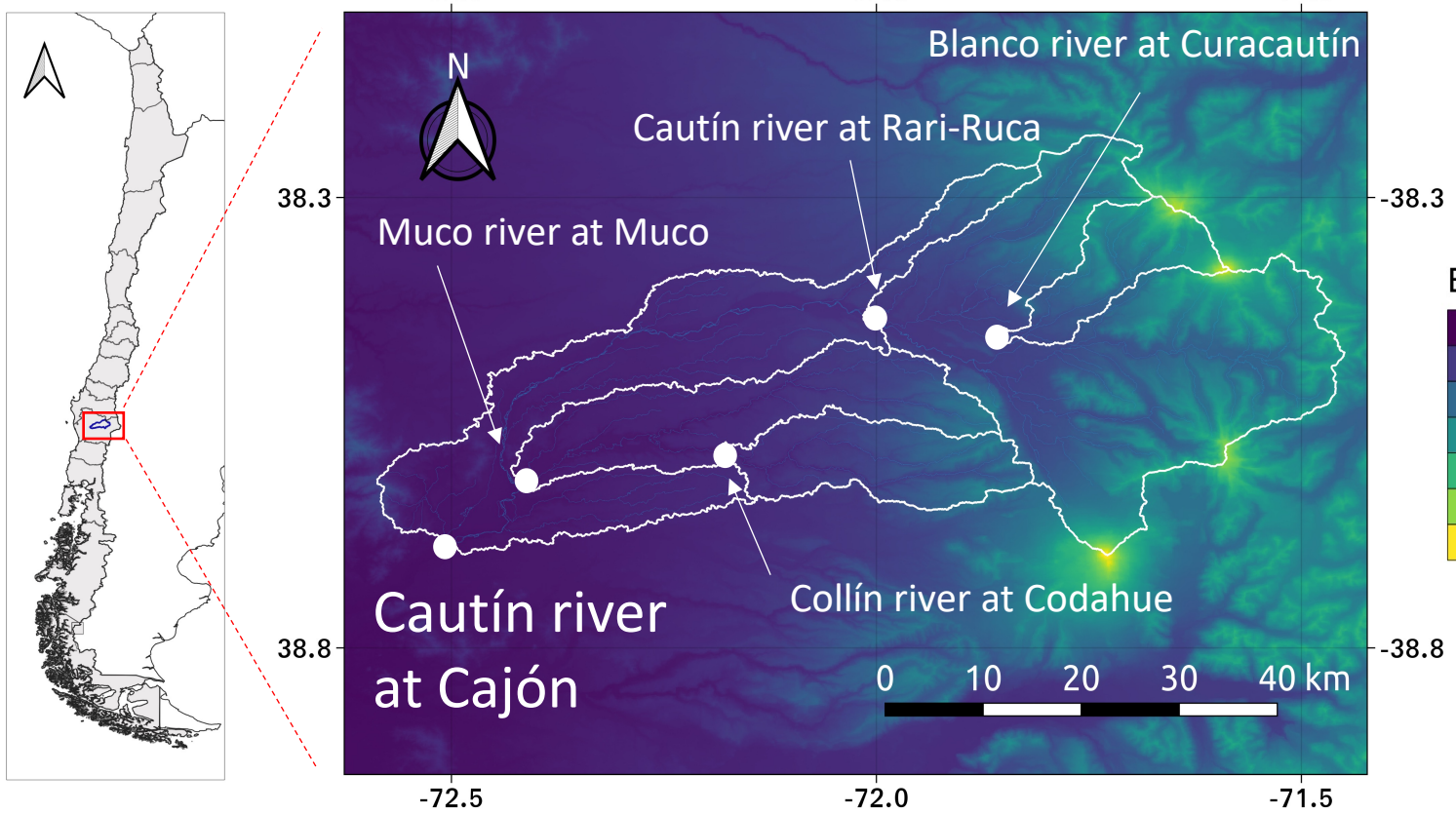
Motivation

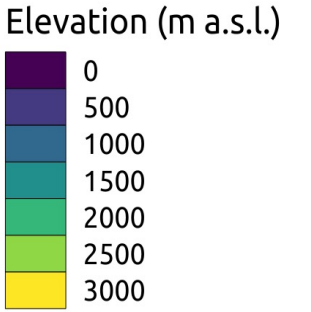


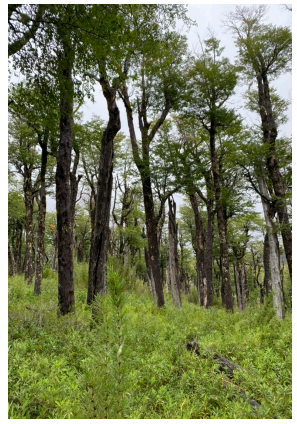
- Spatial patterns or additional information has been used to improve spatial model fidelity in the calibration of distributed hyd. models.
- However, the impact of the inclusion of more data in the calibration process on the Q-performance at interior ungauged sub-basins remains a challenging task in the calibration of distributed hyd. models.

How does the inclusion of spatial patterns in the calibration affect the streamflow performance at interior ungauged points?

Study Area


-72.5
-72.0
-71.5
N
Blanco river at Curacautín
Cautín river at Rari-Ruca
38.3
-38.3
Muco river at Muco
Collín river at Codahue
Cautín river at Cajón
38.8
-38.8
0 10 20 30 40 km
-72.5
-72.0
-71.5


Elevation (m a.s.l.)
0
500
1000
1500
2000
2500
3000



~ 3000 m
~ 100 km

Methodology

- Hydrological model: VIC model (Liang et al., 1994) + mizuRoute (Mizukami et al., 2016)
- Streamflow metric: KGE (Gupta et al., 2009).
- Spatial patterns metrics: SB and SP from Dembelé et al. (2020)

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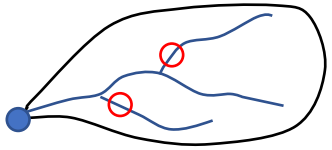
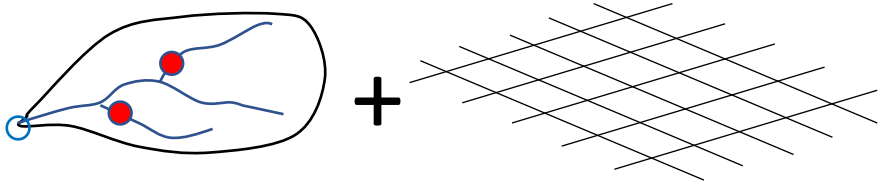
	Calibration	Evaluation	
1		 ET, SM, fSCA & LST	Benchmark

- Evaluation catchments
- Calibrated catchments

ET: MOD16 (Mu et al., 2011)
SM: ESA-CCI v6 (Gruber et al., 2019)
fSCA: MODIS (Riggs et al., 2006)
LST: MODIS (Wan et al., 1999)

Methodology

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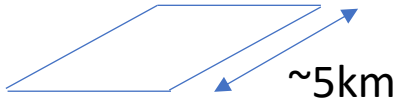
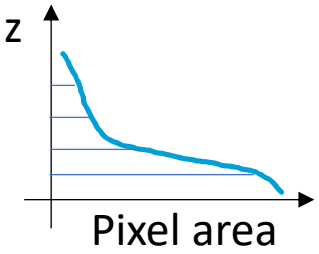
Model Set-up

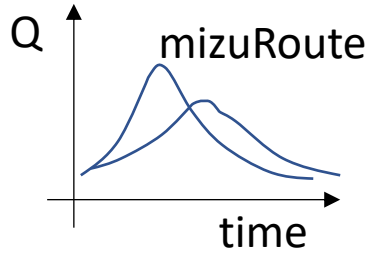


$\Delta t = 3hr$

Murillo et al. (2022, in review)



Mizukami et al. (2016)



Calibration

SCE-UA (Duan et al., 1992)
OSTRICH (Mattot, 2017)

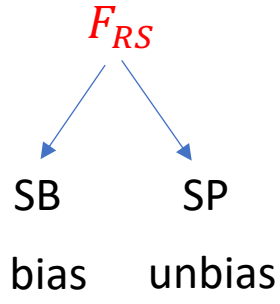
$$Fobj = \begin{cases} KGE(Q) \\ \sqrt{(1-KGE(Q_1)^2+(1-KGE(Q_2)^2} \\ \sqrt{(1-KGE(Q_1))^2+(1-F_{RS})^2} \end{cases}$$

Outlet Q-gauge

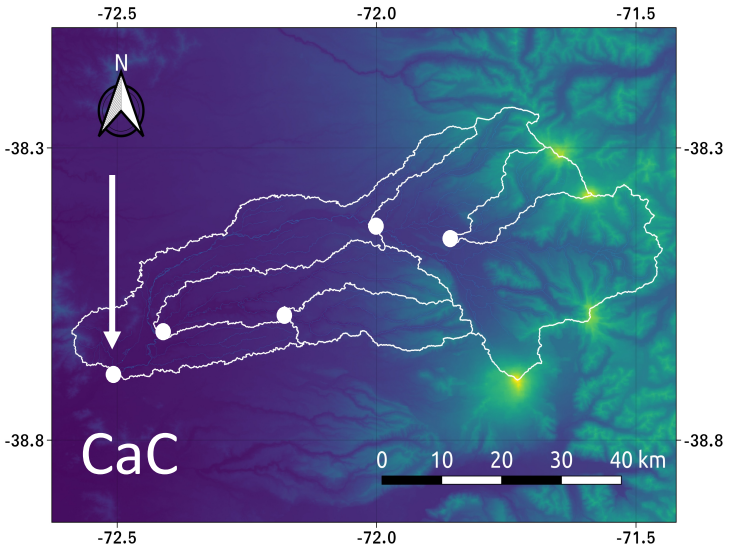
Outlet and inner Q-gauge

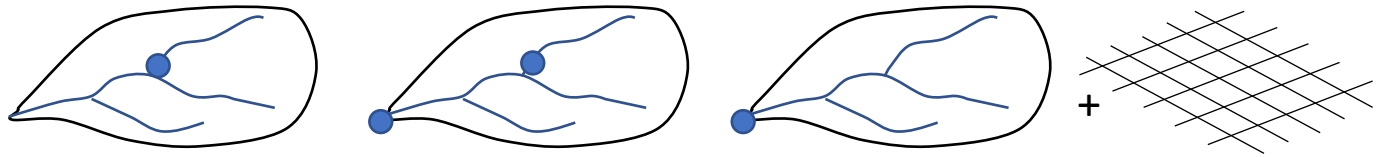
Outlet Q-gauge + spatial patterns

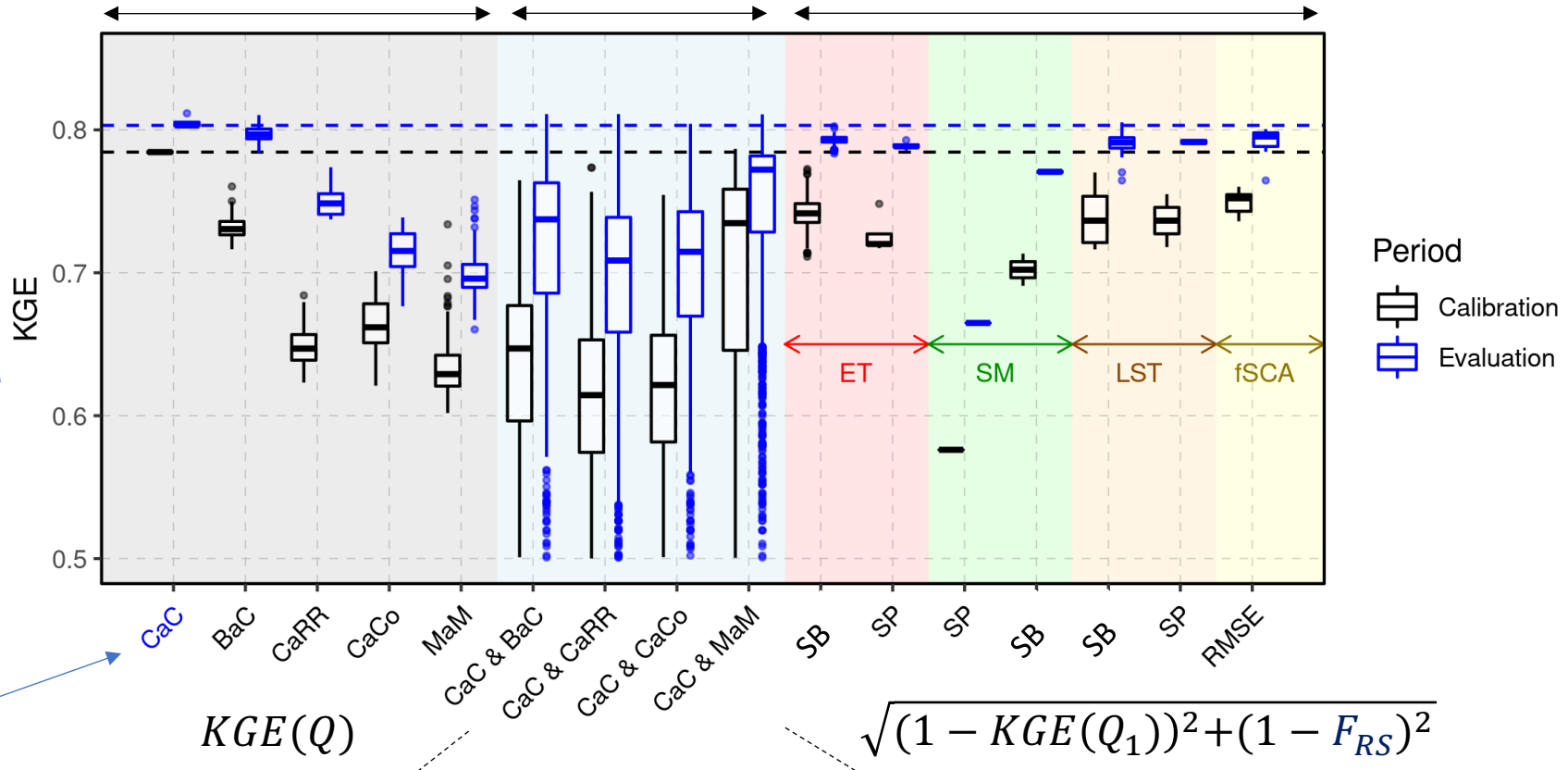
Dembele et al. (2020)



Results







Outlet Basin

$KGE(Q)$

$\sqrt{(1-KGE(Q_1)^2+(1-KGE(Q_2)^2}$

$\sqrt{(1-KGE(Q_1))^2+(1-F_{RS})^2}$

$$\sqrt{(1-KGE(Q_1))^2+(1-F_{RS})^2}$$

Q-outlet

Spatial patterns

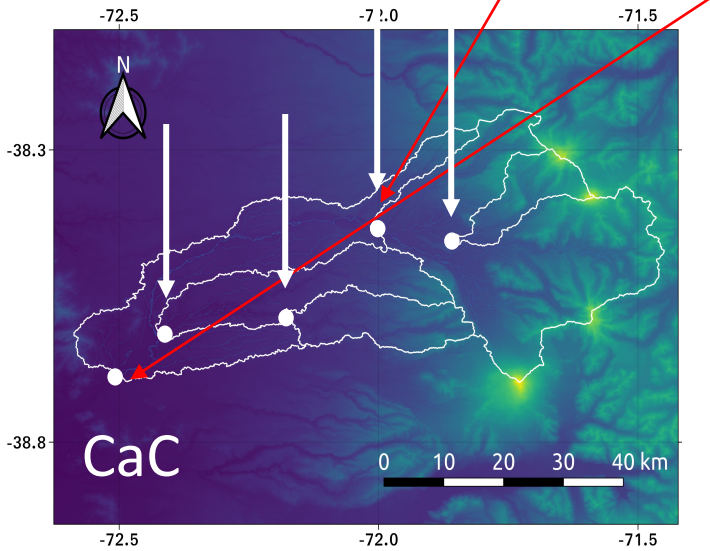
$$\sqrt{(1-KGE(Q_1))^2+(1-KGE(Q_2))^2}$$

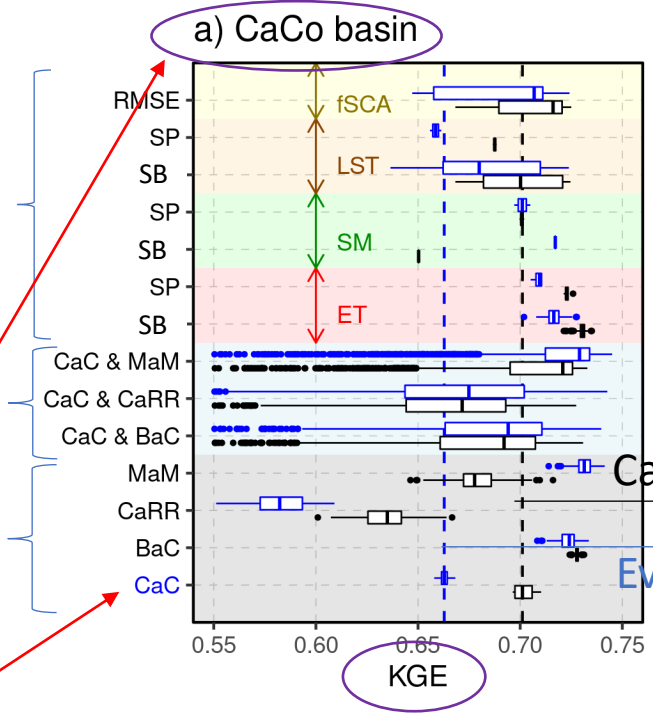
Gauge 1

Gauge 2

$KGE(Q)$

Gauge 1

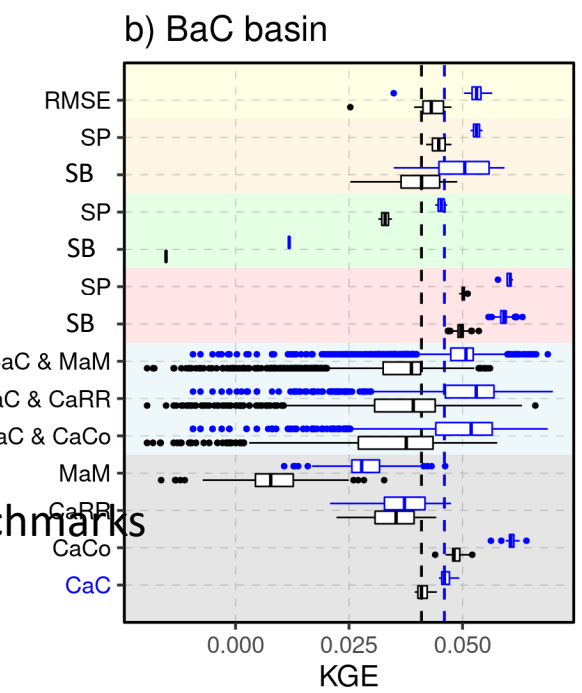


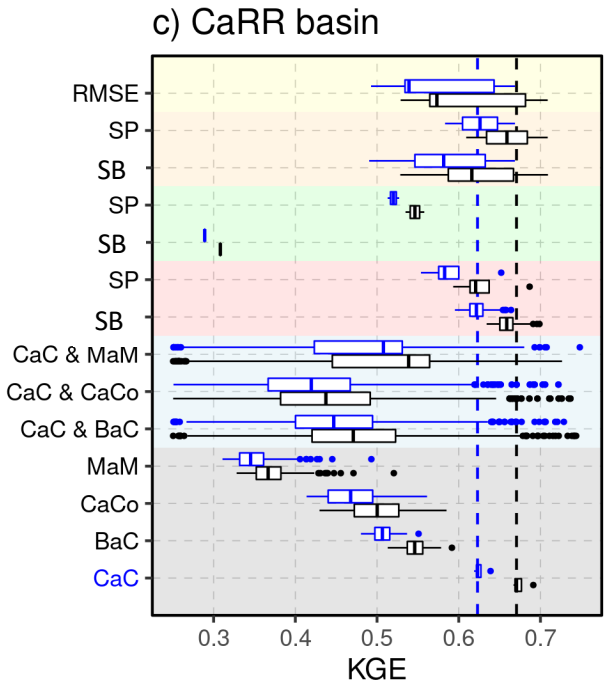


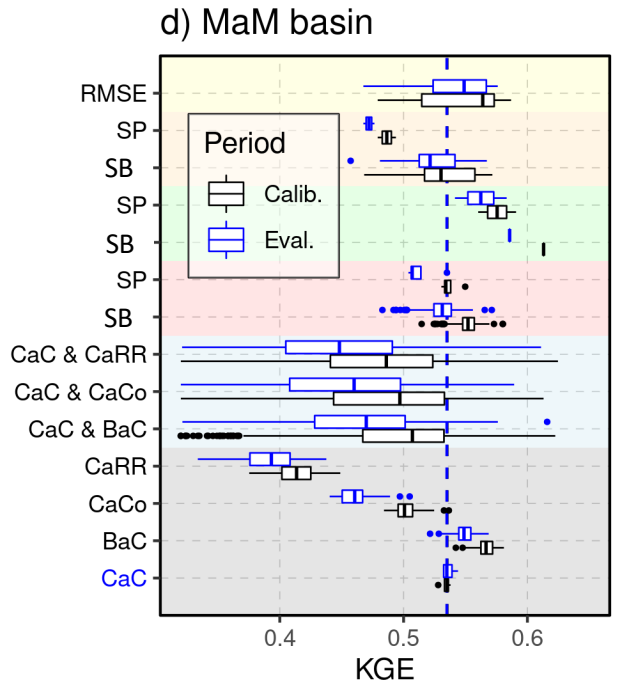
Calibration

Benchmarks

Evaluation







Take home messages

- Interior “ungauged” points improve Q-performance when the model is calibrated with Q(outlet) + RS simultaneously.

- (Not shown) Including remote sensing data in the F_{obj} slitghly decrease Q-performance at the outlet point.

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nicolas.vasquez.pl@uchile.cl

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Thank you

View from the Villarica volcano
Araucanía , Chile

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