

Figure S1. Locations of catchments for (a) raw GSIM dataset; (b) after the first step selection; and (c) the second step selection.

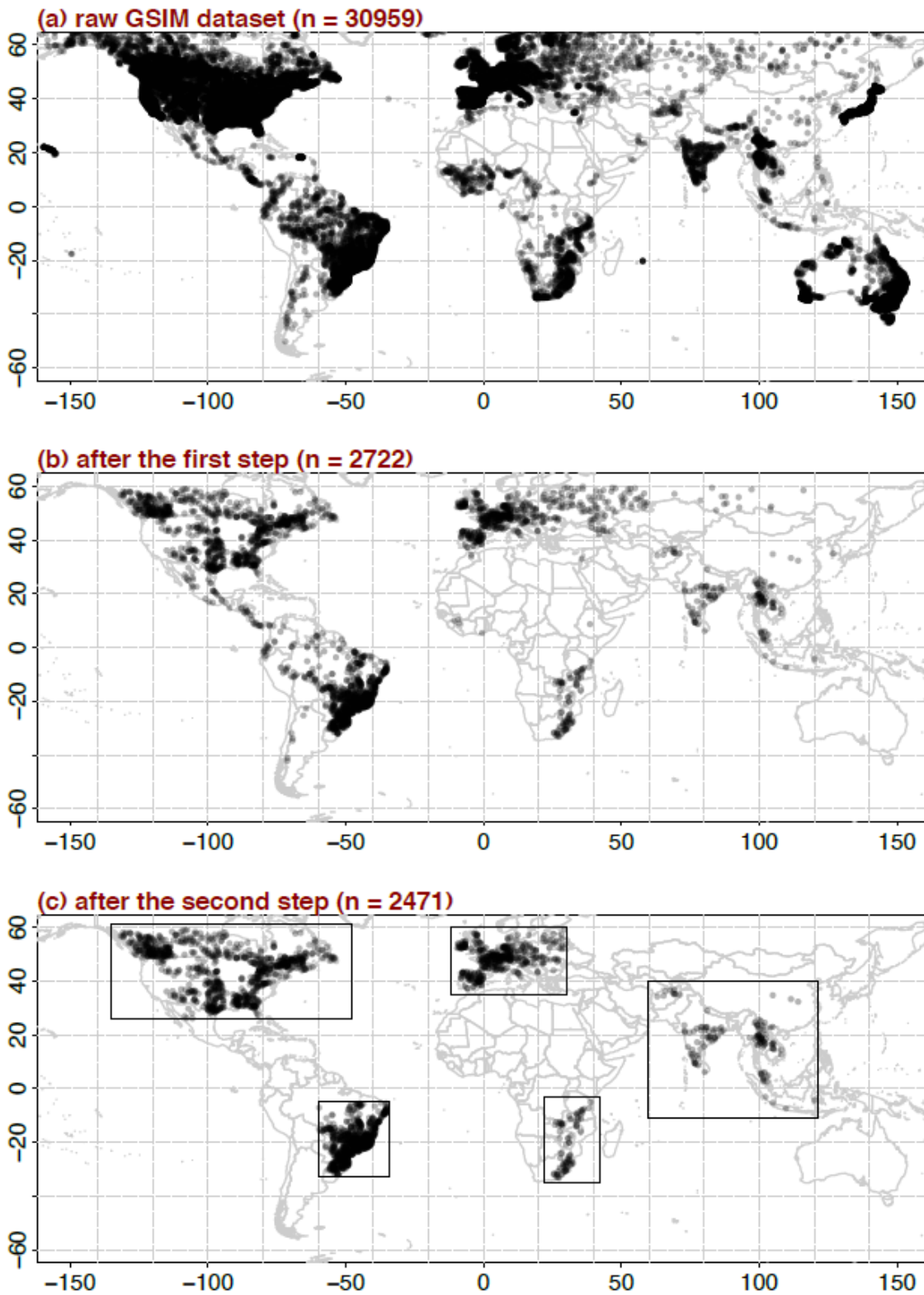


Figure S2. Histogram of original climatological streamflow in training and testing set (two top panels) and log-transform climatological streamflow in training and testing set (two bottom panels).

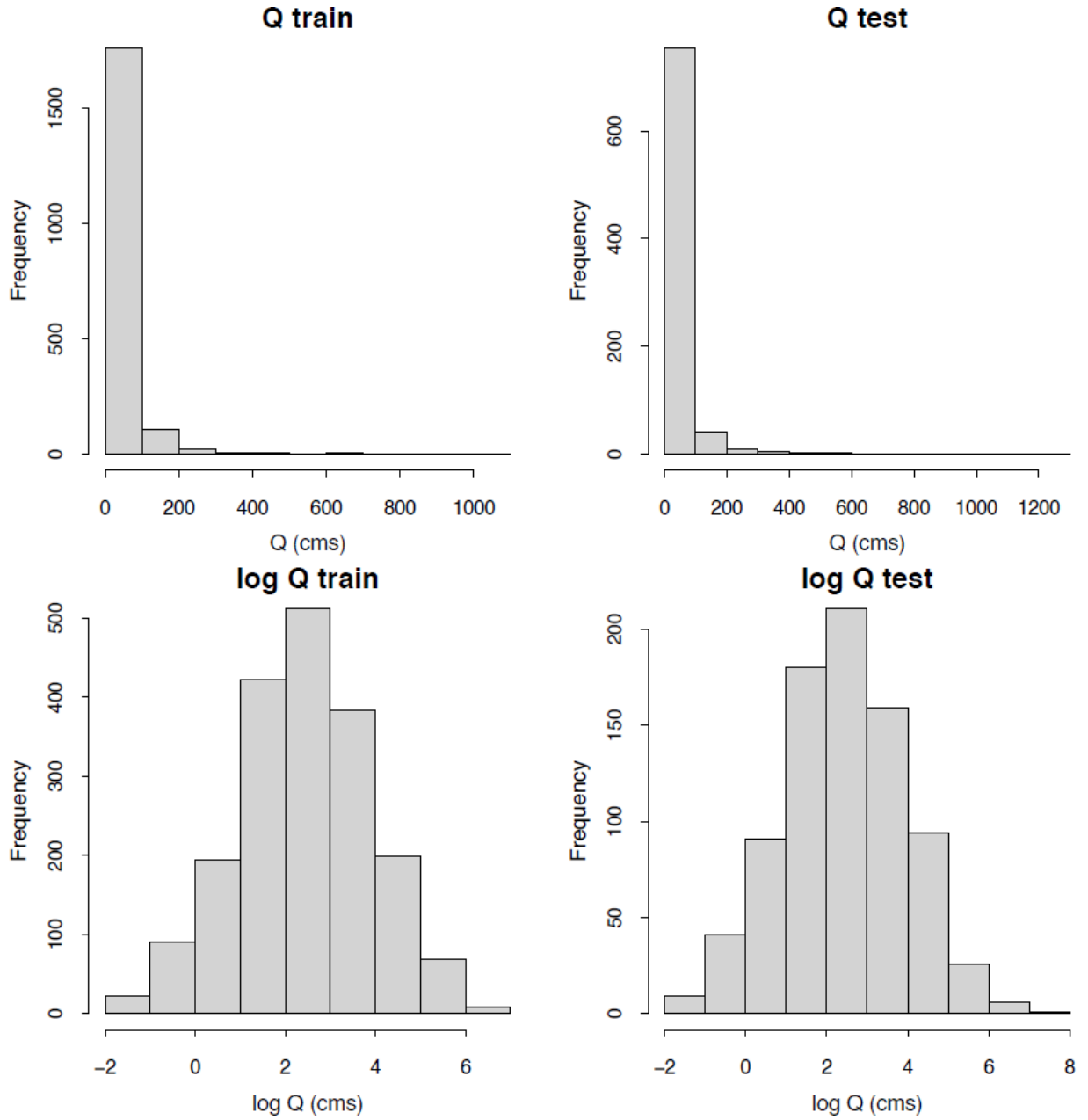


Table S1. KGE scores for testing datasets of local-based ML algorithms for T1 (South Africa) and T2 (Central Asia). Values denote median and standard deviation (in parentheses) derived from 100 simulations.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>T1</b>												
SVM	0.54 (0.25)	0.5 (0.27)	0.43 (0.1)	0.64 (0.2)	0.65 (0.23)	0.61 (0.16)	0.61 (0.28)	0.4 (0.16)	0.52 (0.25)	0.49 (0.3)	0.26 (0.1)	0.49 (0.21)
RF	0.34 (0.19)	0.34 (0.21)	0.5 (0.16)	0.44 (0.17)	0.39 (0.2)	0.48 (0.22)	0.32 (0.24)	0.33 (0.19)	0.27 (0.18)	0.26 (0.19)	0.23 (0.16)	0.28 (0.2)
XGB	0.4 (0.17)	0.48 (0.16)	0.54 (0.13)	0.55 (0.16)	0.57 (0.19)	0.58 (0.14)	0.5 (0.18)	0.45 (0.21)	0.34 (0.21)	0.33 (0.17)	0.27 (0.17)	0.34 (0.16)
<b>T2</b>												
SVM	0.63 (0.1)	0.59 (0.16)	0.61 (0.12)	0.65 (0.1)	0.66 (0.08)	0.44 (0.16)	0.58 (0.11)	0.66 (0.1)	0.56 (0.14)	0.54 (0.11)	0.64 (0.09)	0.68 (0.08)
RF	0.28 (0.17)	0.36 (0.14)	0.4 (0.15)	0.44 (0.14)	0.5 (0.1)	0.16 (0.13)	0.34 (0.15)	0.39 (0.14)	0.36 (0.18)	0.29 (0.14)	0.4 (0.11)	0.4 (0.16)
XGB	0.4 (0.14)	0.4 (0.14)	0.46 (0.14)	0.54 (0.12)	0.52 (0.1)	0.28 (0.13)	0.39 (0.16)	0.45 (0.13)	0.43 (0.17)	0.42 (0.13)	0.49 (0.12)	0.47 (0.12)

Table S2. KGE scores for testing datasets of source-based ML algorithms for EX3 (forced input from Western Europe dataset) and EX7 (forced input from a combined dataset from North America, South America, and Western Europe). Values denote median and standard deviation (in parentheses) derived from 100 simulations. Under score values indicate the best performance among three models for a month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>EX1 (North America)</b>												
SVM	0.76 (0.03)	0.74 (0.03)	0.77 (0.03)	<u>0.81</u> (0.03)	<u>0.82</u> (0.03)	0.83 (0.03)	<u>0.82</u> (0.03)	<u>0.81</u> (0.03)	<u>0.81</u> (0.03)	0.78 (0.03)	0.79 (0.04)	0.83 (0.03)
RF	0.78 (0.03)	0.77 (0.03)	0.78 (0.03)	0.77 (0.03)	0.76 (0.04)	0.8 (0.03)	0.79 (0.03)	0.73 (0.04)	0.75 (0.04)	0.76 (0.03)	0.78 (0.03)	0.78 (0.03)
XGB	<u>0.82</u> (0.03)	<u>0.8</u> (0.03)	<u>0.81</u> (0.02)	0.79 (0.03)	0.81 (0.03)	<u>0.85</u> (0.02)	0.81 (0.03)	0.8 (0.03)	0.8 (0.03)	<u>0.8</u> (0.03)	<u>0.82</u> (0.02)	<u>0.84</u> (0.03)
<b>EX2 (South America)</b>												
SVM	<u>0.81</u> (0.03)	<u>0.8</u> (0.03)	<u>0.8</u> (0.03)	<u>0.76</u> (0.04)	0.68 (0.04)	<u>0.75</u> (0.03)	<u>0.76</u> (0.03)	<u>0.76</u> (0.03)	<u>0.79</u> (0.03)	<u>0.82</u> (0.03)	<u>0.82</u> (0.03)	<u>0.8</u> (0.03)
RF	0.77 (0.04)	0.74 (0.03)	0.72 (0.04)	0.7 (0.05)	0.7 (0.04)	0.68 (0.05)	0.65 (0.05)	0.64 (0.04)	0.71 (0.04)	0.74 (0.04)	0.74 (0.04)	0.75 (0.04)
XGB	<u>0.81</u> (0.03)	0.79 (0.03)	0.78 (0.04)	0.73 (0.04)	<u>0.74</u> (0.04)	0.72 (0.04)	0.7 (0.04)	0.71 (0.03)	0.75 (0.03)	0.76 (0.03)	0.77 (0.04)	0.78 (0.04)
<b>EX3 (Western Europe)</b>												
SVM	<u>0.74</u> (0.05)	<u>0.72</u> (0.06)	<u>0.77</u> (0.04)	<u>0.8</u> (0.05)	<u>0.83</u> (0.04)	<u>0.83</u> (0.04)	<u>0.85</u> (0.03)	<u>0.84</u> (0.03)	<u>0.84</u> (0.03)	<u>0.83</u> (0.03)	<u>0.82</u> (0.03)	<u>0.77</u> (0.04)
RF	0.63 (0.06)	0.62 (0.08)	0.65 (0.06)	0.68 (0.06)	0.64 (0.09)	0.58 (0.09)	0.68 (0.05)	0.67 (0.05)	0.68 (0.05)	0.57 (0.08)	0.64 (0.05)	0.66 (0.06)
XGB	0.7 (0.04)	0.68 (0.04)	0.72 (0.05)	0.71 (0.05)	0.72 (0.06)	0.7 (0.06)	0.72 (0.04)	0.73 (0.05)	0.72 (0.04)	0.69 (0.05)	0.71 (0.04)	0.71 (0.05)
<b>EX4 (North America + South America)</b>												
SVM	0.85 (0.02)	0.84 (0.02)	0.81 (0.02)	0.78 (0.02)	0.78 (0.02)	0.8 (0.02)	<u>0.8</u> (0.02)	<u>0.8</u> (0.02)	<u>0.8</u> (0.02)	0.81 (0.02)	0.82 (0.02)	0.84 (0.02)
RF	0.83 (0.02)	0.82 (0.02)	0.81 (0.02)	0.77 (0.03)	0.74 (0.03)	0.78 (0.03)	0.75 (0.03)	0.72 (0.03)	0.74 (0.03)	0.77 (0.03)	0.79 (0.02)	0.83 (0.02)
XGB	<u>0.87</u> (0.02)	<u>0.86</u> (0.02)	<u>0.85</u> (0.02)	<u>0.82</u> (0.02)	<u>0.81</u> (0.02)	<u>0.82</u> (0.02)	0.79 (0.02)	<u>0.8</u> (0.02)	<u>0.8</u> (0.02)	<u>0.83</u> (0.02)	<u>0.83</u> (0.02)	<u>0.86</u> (0.02)
<b>EX5 (North America + Western Europe)</b>												
SVM	<u>0.82</u> (0.02)	0.8 (0.02)	0.79 (0.02)	<u>0.81</u> (0.02)	<u>0.85</u> (0.02)	<u>0.86</u> (0.02)	<u>0.87</u> (0.02)	<u>0.85</u> (0.02)	<u>0.84</u> (0.02)	<u>0.8</u> (0.02)	0.81 (0.02)	0.82 (0.02)
RF	0.78 (0.03)	0.75 (0.03)	0.77 (0.03)	0.75 (0.03)	0.76 (0.03)	0.76 (0.04)	0.79 (0.03)	0.77 (0.03)	0.73 (0.03)	0.73 (0.03)	0.77 (0.03)	0.79 (0.03)
XGB	<u>0.83</u> (0.02)	<u>0.82</u> (0.02)	<u>0.8</u> (0.02)	0.8 (0.02)	0.83 (0.02)	0.84 (0.03)	0.83 (0.02)	0.81 (0.02)	0.78 (0.02)	0.79 (0.02)	<u>0.82</u> (0.02)	<u>0.84</u> (0.02)
<b>EX6 (South America + Western Europe)</b>												
SVM	<u>0.79</u> (0.03)	<u>0.76</u> (0.03)	<u>0.79</u> (0.03)	0.7 (0.03)	0.75 (0.03)	<u>0.78</u> (0.03)	<u>0.81</u> (0.02)	<u>0.81</u> (0.02)	<u>0.83</u> (0.02)	<u>0.83</u> (0.03)	<u>0.81</u> (0.02)	<u>0.8</u> (0.03)
RF	0.69 (0.04)	0.7 (0.04)	0.71 (0.04)	0.71 (0.03)	0.71 (0.03)	0.71 (0.03)	0.72 (0.04)	0.72 (0.03)	0.71 (0.03)	0.74 (0.03)	0.7 (0.04)	0.73 (0.03)
XGB	0.78 (0.03)	<u>0.76</u> (0.03)	0.76 (0.03)	<u>0.73</u> (0.03)	<u>0.76</u> (0.02)	0.77 (0.03)	0.78 (0.02)	0.77 (0.03)	0.78 (0.02)	0.78 (0.02)	0.77 (0.03)	0.77 (0.03)

<b>EX7 (North America + South America + Western Europe)</b>												
SVM	0.84 (0.02)	0.83 (0.02)	0.8 (0.02)	0.78 (0.02)	0.79 (0.02)	0.81 (0.02)	<u>0.82</u> (0.02)	<u>0.82</u> (0.02)	<u>0.81</u> (0.02)	<u>0.81</u> (0.02)	<u>0.82</u> (0.02)	0.82 (0.02)
RF	0.81 (0.02)	0.81 (0.02)	0.78 (0.02)	0.76 (0.03)	0.74 (0.03)	0.76 (0.03)	0.77 (0.02)	0.74 (0.02)	0.75 (0.02)	0.77 (0.02)	0.77 (0.02)	0.81 (0.02)
XGB	<u>0.86</u> (0.02)	<u>0.84</u> (0.01)	<u>0.82</u> (0.02)	<u>0.81</u> (0.02)	<u>0.8</u> (0.02)	<u>0.83</u> (0.02)	<u>0.82</u> (0.02)	0.8 (0.02)	<u>0.81</u> (0.02)	<u>0.81</u> (0.02)	<u>0.82</u> (0.02)	<u>0.85</u> (0.02)