Supplementary Materials

Hydrological Impact of the New ECMWF Multi-Layer Snow Scheme

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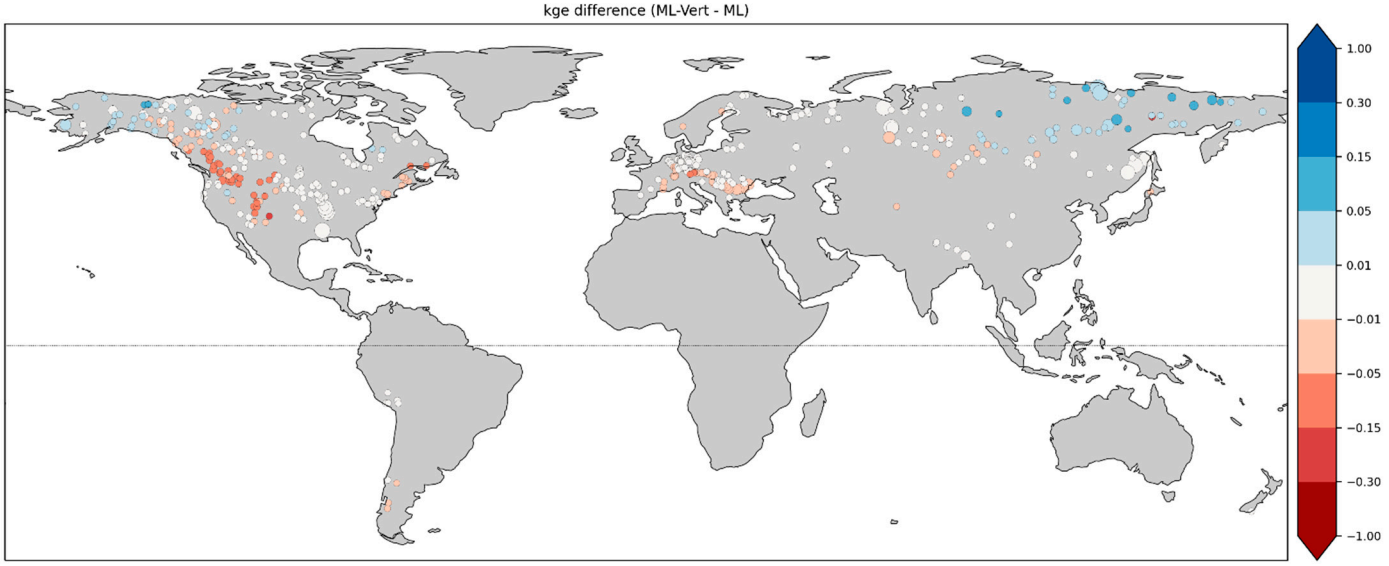

Figure S1. Difference of the Kling-Gupta efficiency (kge) between ML-Vert, the experiment with modified snow vertical discretisation over complex terrain with at least 25 cm snow depth, and ML, the default multi-layer experiment, across all 453 stations, calculated on daily river discharge over 1980-2018. Improvements in ML-Vert are indicated by blue dots. Size of the dots represent the catchment area.

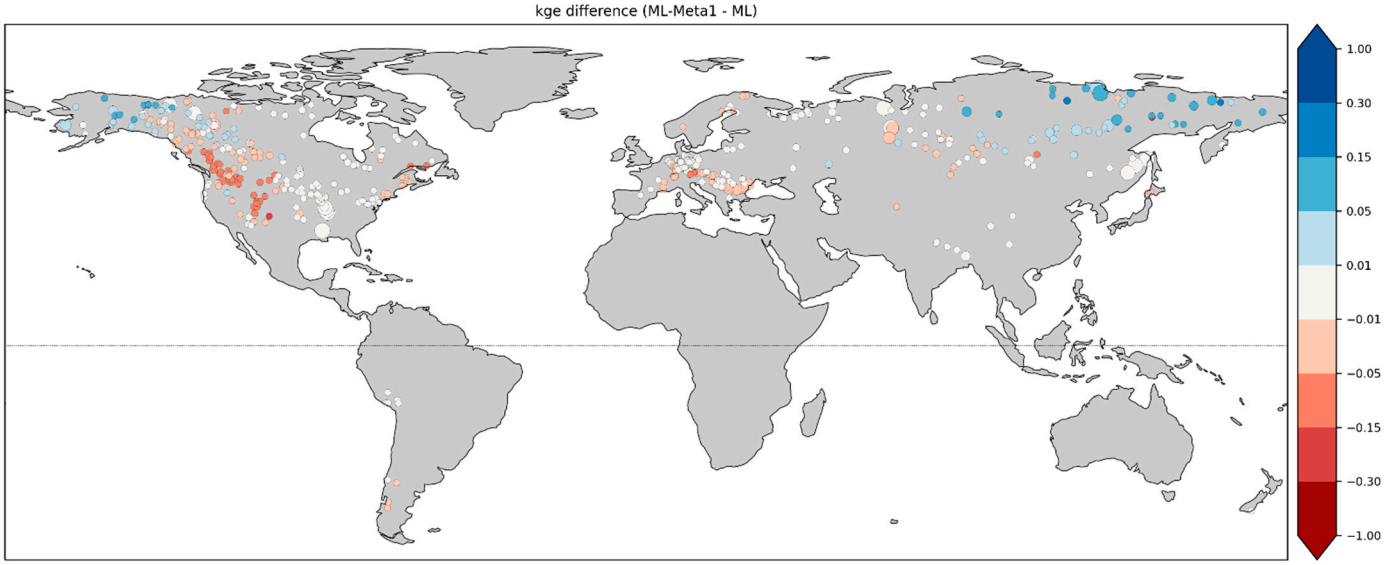

Figure S2. As Figure S1, but *kge* difference between ML-Meta1 (the 1st modification of the destructive metamorphism of the snow with variable c_ξ parameter values across the snow layers, together with ML-Vert) and ML.

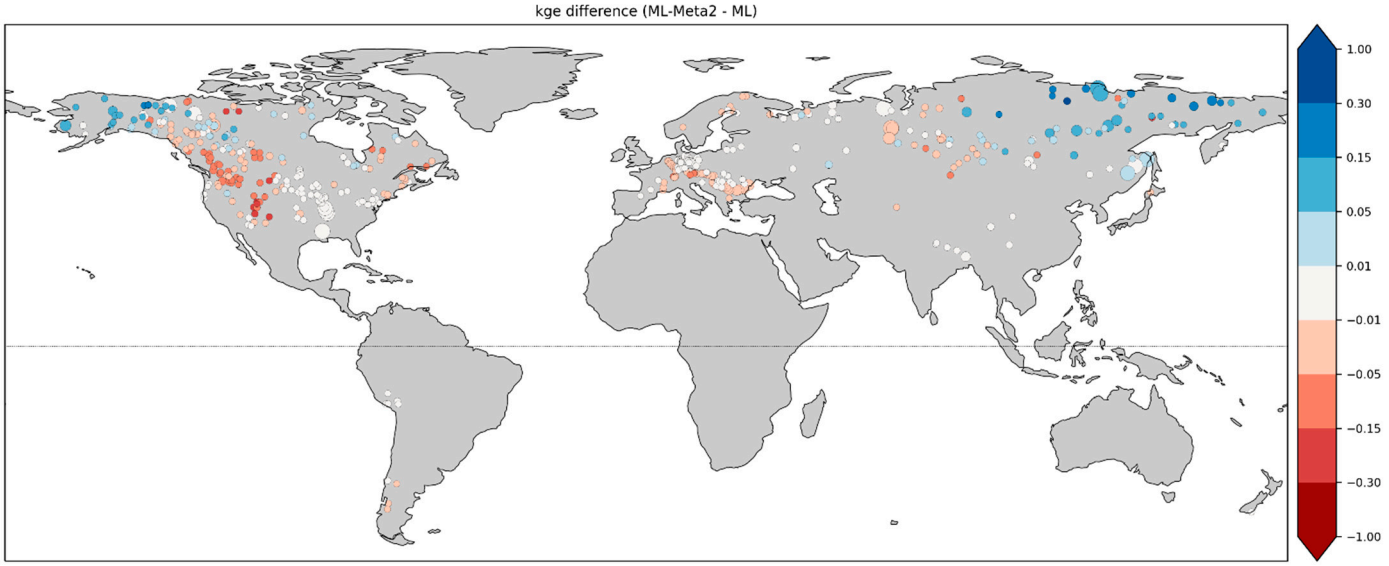

Figure S3. As Figure S1, but *kge* difference between ML-Meta2 (the 2nd modification of the destructive metamorphism of the snow with one c_ξ parameter value as in Anderson et al. 1976, together with ML-Vert) and ML.

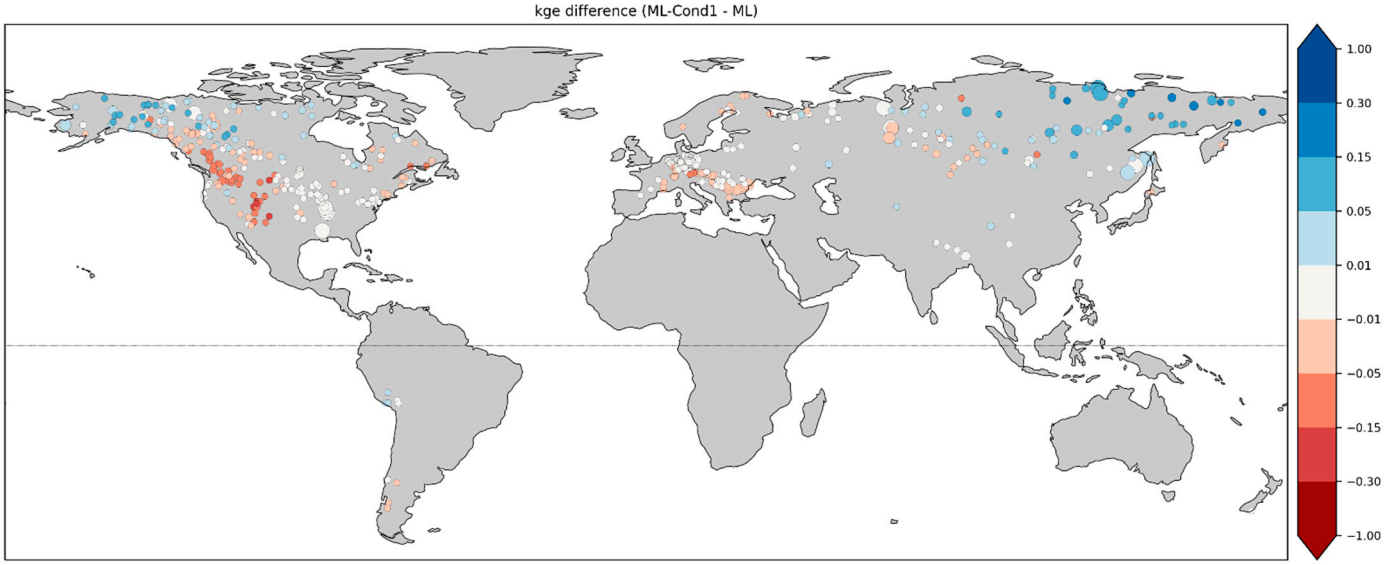

Figure S4. As Figure S1, but *kge* difference between ML-Cond1 (ML-Meta1 together with the snow-soil thermal conductivity computation with the revised parameter $l_b = 0.5$) and ML.

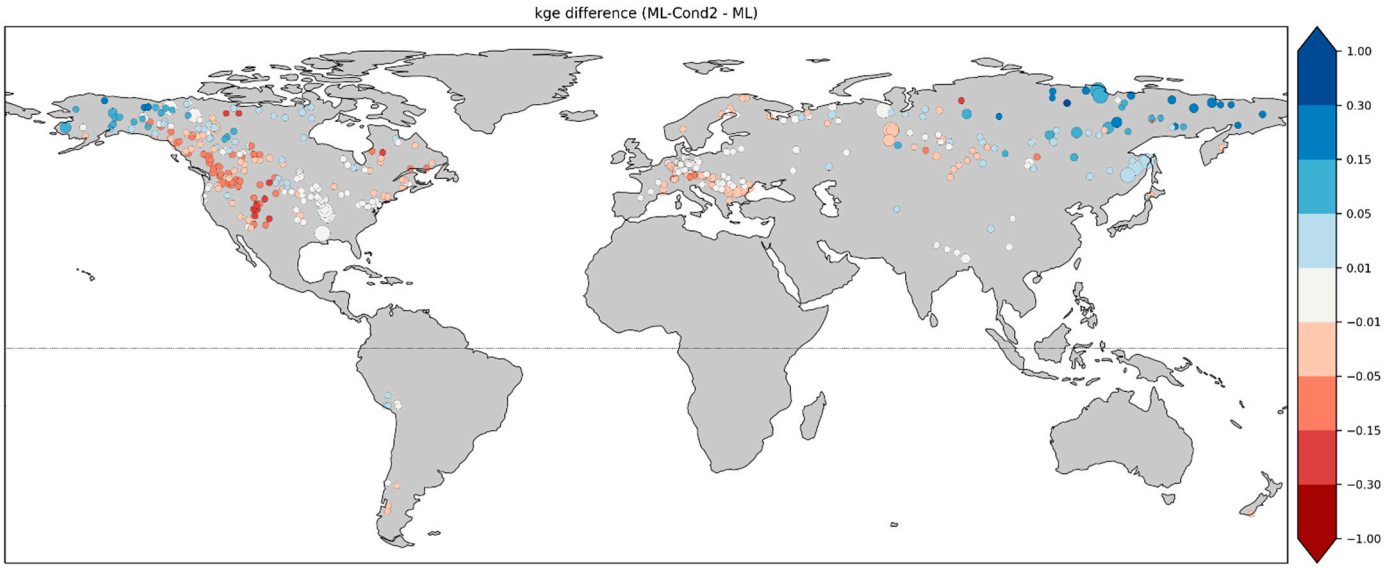

Figure S5. As Figure S1, but *kge* difference between ML-Cond2 (ML-Meta2 together with the snow-soil thermal conductivity computation with the revised parameter $l_b = 0.5$) and ML.

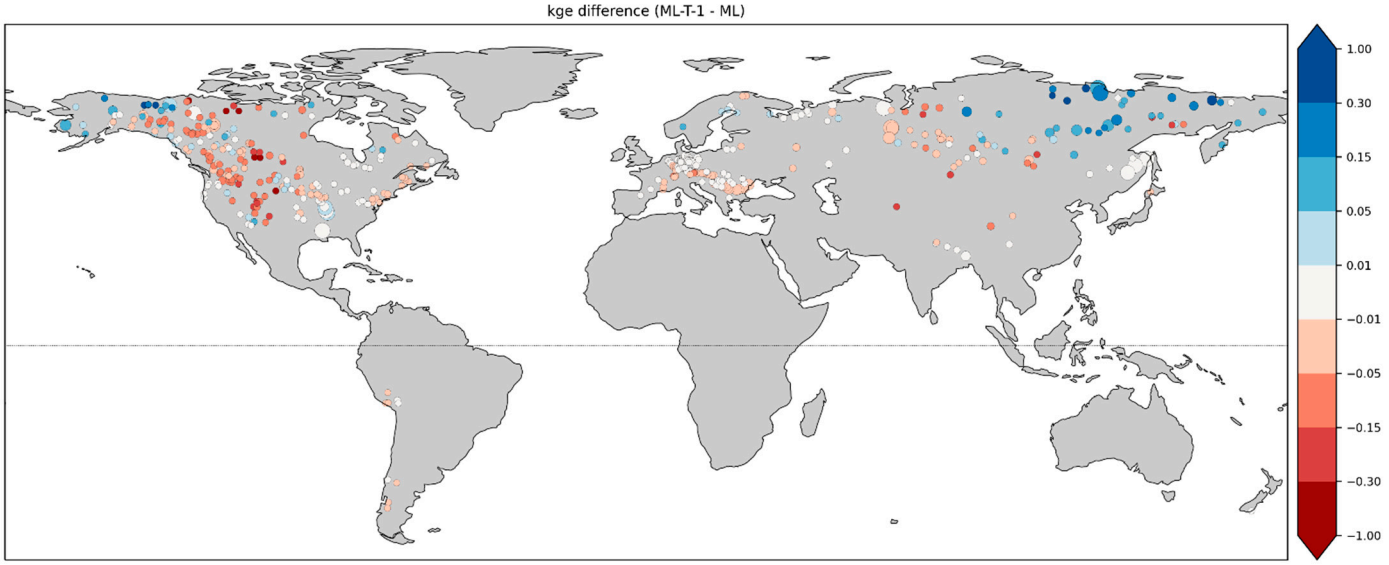

Figure S6. As Figure S1, but *kge* difference between ML-T-1 (change of the soil freeze parameter T_{Fr} from the default -3 to -1 °C added onto ML-Meta1) and ML.

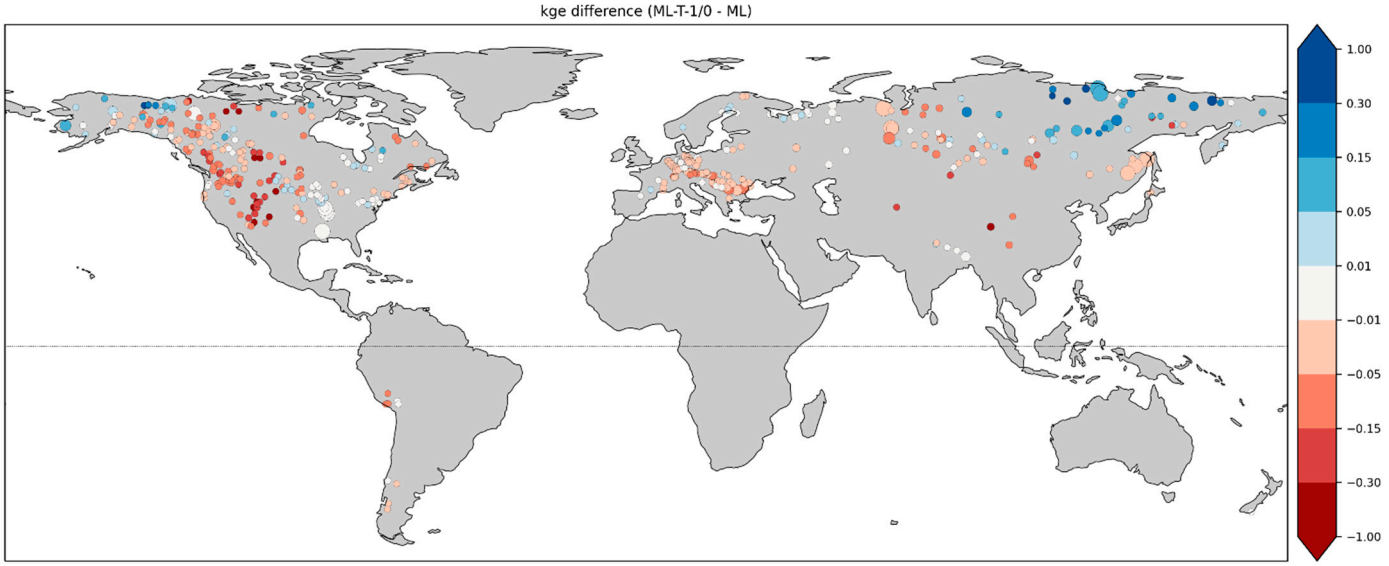

Figure S7. As Figure S1, but *kge* difference between ML-T-1/0 (change of the freeze temperature T_{Fr} to -1 °C and thaw temperature T_{Th} from the default +1 to 0 °C, added onto ML-Meta1) and ML.

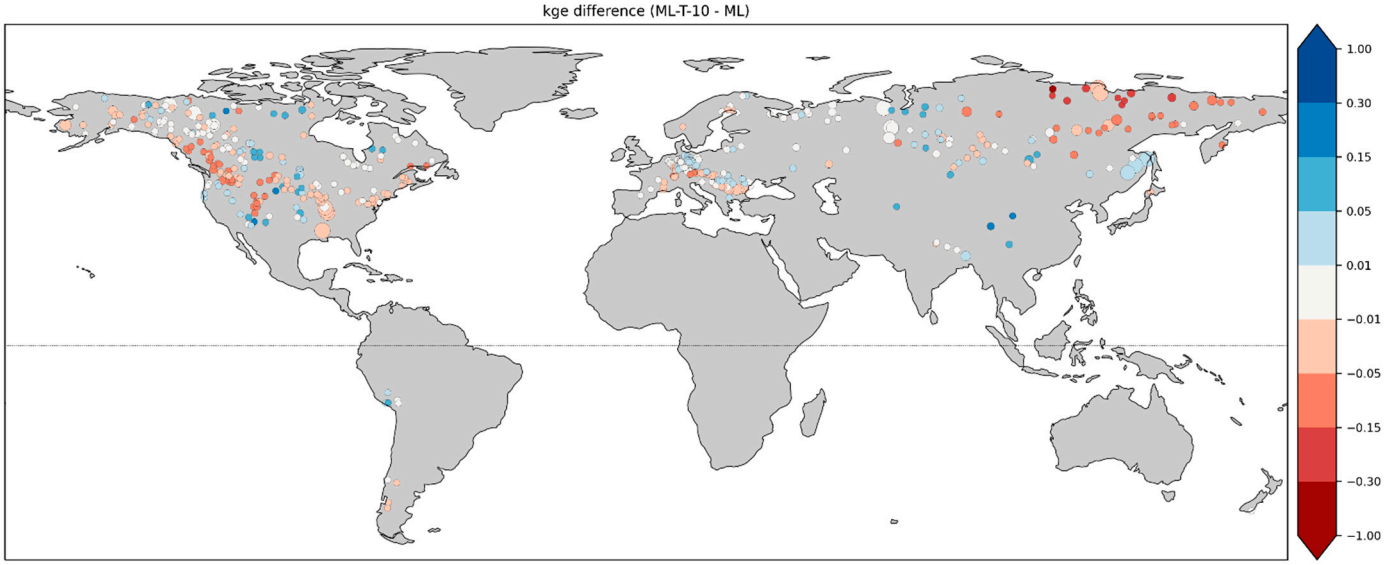

Figure S8. As Figure S1, but *kge* difference between ML-T-10 ($[T_{Fr}, T_{Th}]$ *changed to* [-10.5, -10], added onto ML-Meta1) and ML.

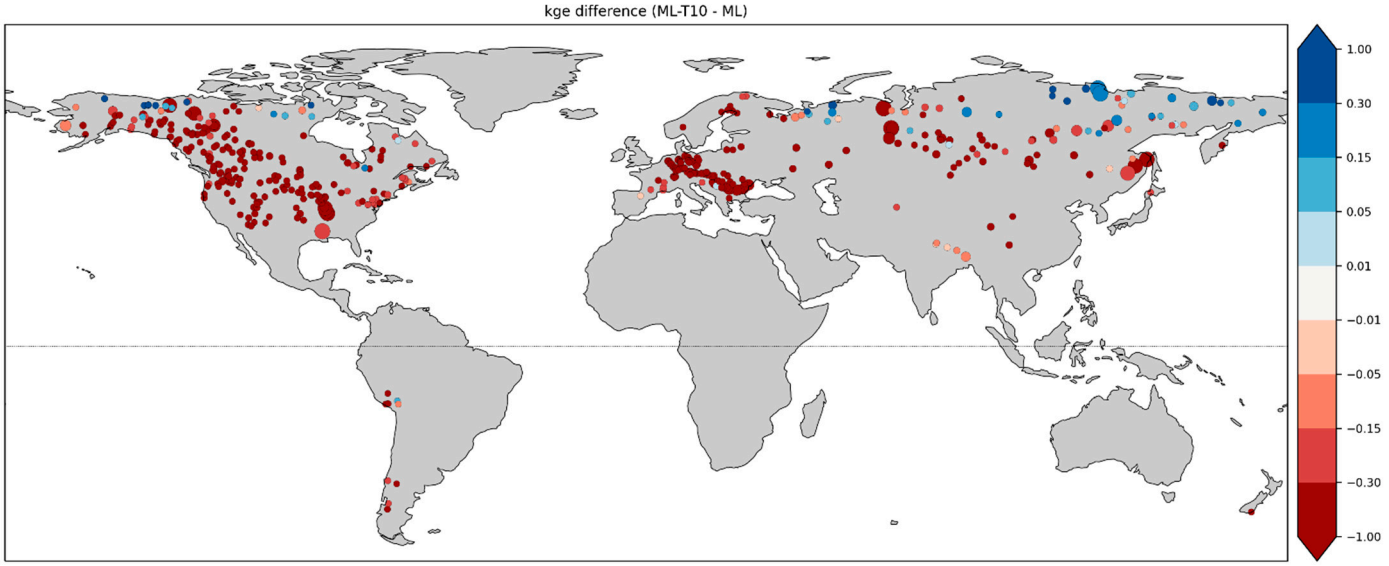

Figure S9. As Figure S1, but *kge* difference between ML-T10 ($[T_{Fr}, T_{Th}]$ *changed to* [+10, +10.5], added onto ML-Meta1) and ML.