Supplementary Materials

Usefulness of Global Root Zone Soil Moisture Product for Streamflow Prediction of Ungauged Basins

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7 pages, 3 tables, 5 figures

Tables

Table S1. Percent of impervious area for land use

Land use	Percent impervious area (%)	Reference*
Residential	44.0	1
Industrial	79.0	1
Commercial	62.0	1
Education	47.0	1
Transportation	95.0	1
Institutional	34.0	2
Agricultural	2.0	2
Forest	1.9	2
Open urban land	1.1	2

* References are as follows: 1. NIER (2014); 2. U.S.EPA (2015)

Table S2. Saturated hydraulic conductivity (K_S) for hydrologic soil group by NRCS

Soil Group	Range of K_s (mm/day)	Average of K_s (mm/day)
Type A	182.88 - 274.32	228.60
Type B	91.44 - 182.88	137.16
Type C	30.48-91.44	60.96
Type D	0- 30.48	15.24

Table S3. 5-day antecedent rainfall depth for antecedent soil moisture condition (AMC) adjustment

Soil Group	5-day antecedent rainfall depth (mm)	
	Growing seasons	Dormant season
I	Less than 35.56	Less than 12.70
II	35.56-53.34	12.70-27.94
III	Over 53.34	Over 27.94

Figures

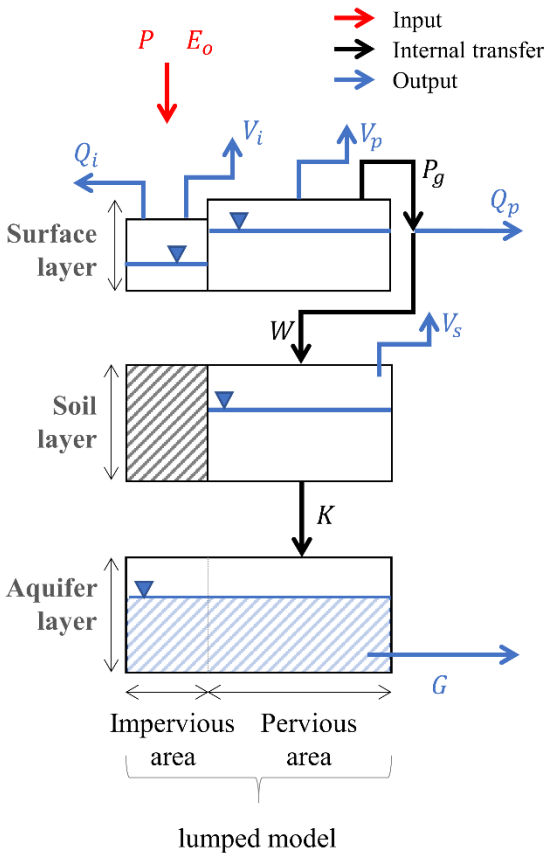

Figure S1. Schematic diagram of lumped hydrological model. P is precipitation; E_o is reference evapotranspiration; V_i is evaporation at impervious area; V_p is evapotranspiration at pervious area; V_s is evapotranspiration in soil layer; Q_i and Q_p is surface flow at impervious area and at pervious area respectively; W is wetting (or infiltration) from surface layer to soil layer; K is percolation from soil layer to aquifer layer; and G is subsurface flow.

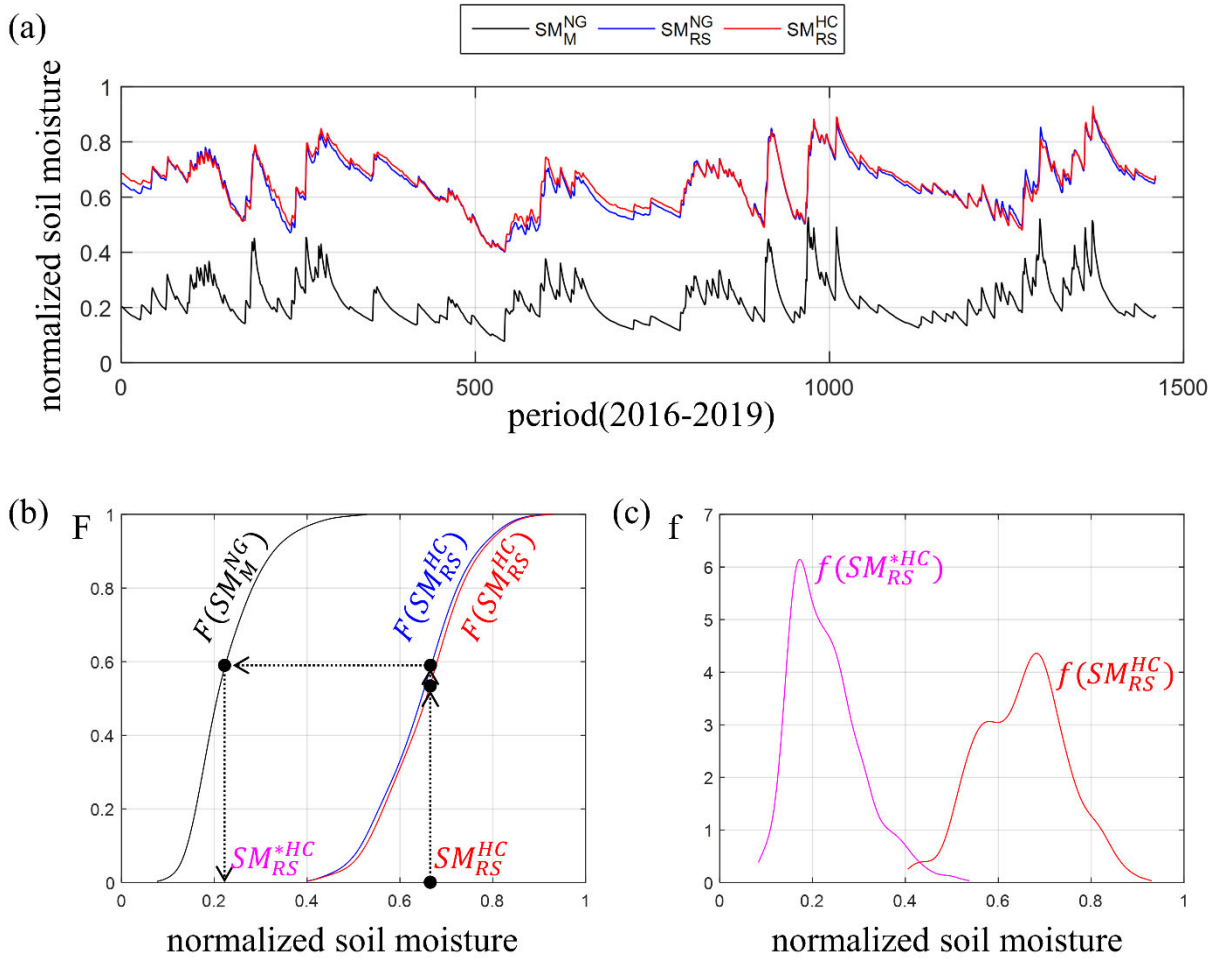

Figure S2. Results of bias-correction for global root zone soil moisture (GRZSM) based on remotely sensed data. In Fig. S2(a), SM_G^{NG} and SM_G^{HC} is spatially averaged GRZSM time series for Hapcheon dam and Namgang dam watersheds, respectively, and SM_M^{NG} is soil moisture time series simulated by the model calibrated using observed stream flow data. In Fig. S2(b), $F(SM_G^{NG})$ and $F(SM_G^{HC})$ is the cumulative probability distribution of GRZSM time series in Hapcheon dam and Namgang dam watershed, respectively, and $F(SM_M^{NG})$ is the cumulative probability distribution of soil moisture time series simulated by the model using observed stream flow data. Fig. S2(c) shows the probability distribution of raw GRZSM data (f(SM_G^{HC})) and the probability distribution of bias-corrected GRZSM data (f(SM_G^{*HC})) for Hapcheon dam watershed.

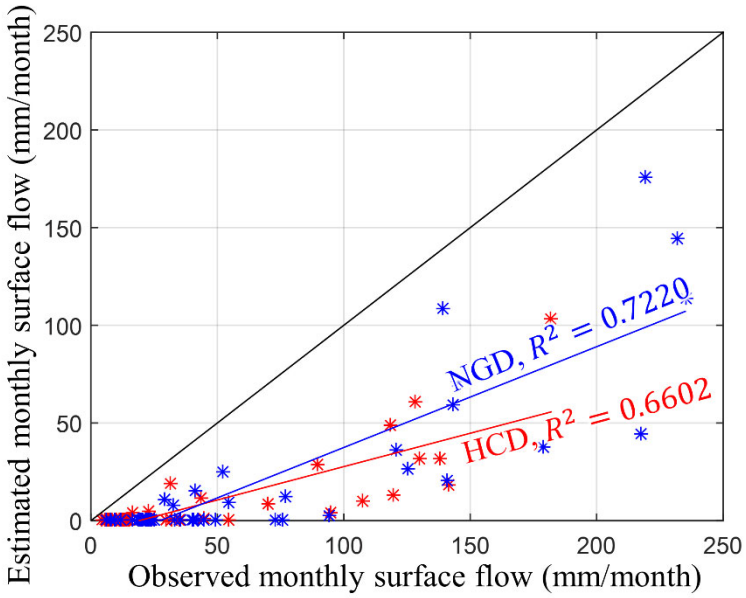

Figure S3. Monthly surface flow estimated by using NRCS-CN method and observed monthly stream flow at Hapchen Dam watershed (red color) and at Namgang Dam watershed (blue color).

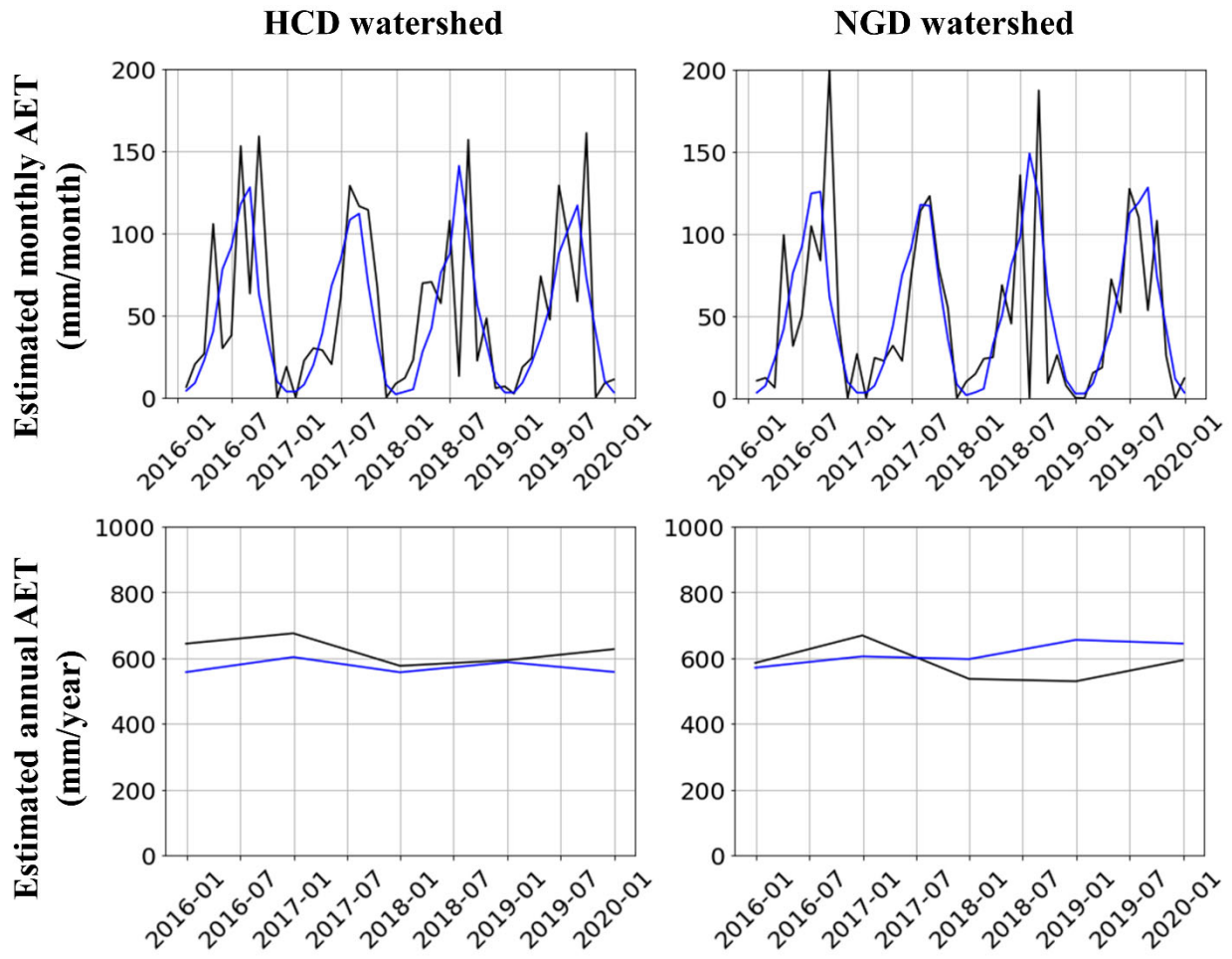

Figure S4. Monthly and annual actual evapotranspiration estimated by using GCR (blue color) and observed (black color) at Hapchen Dam watershed and at Namgang Dam watershed.

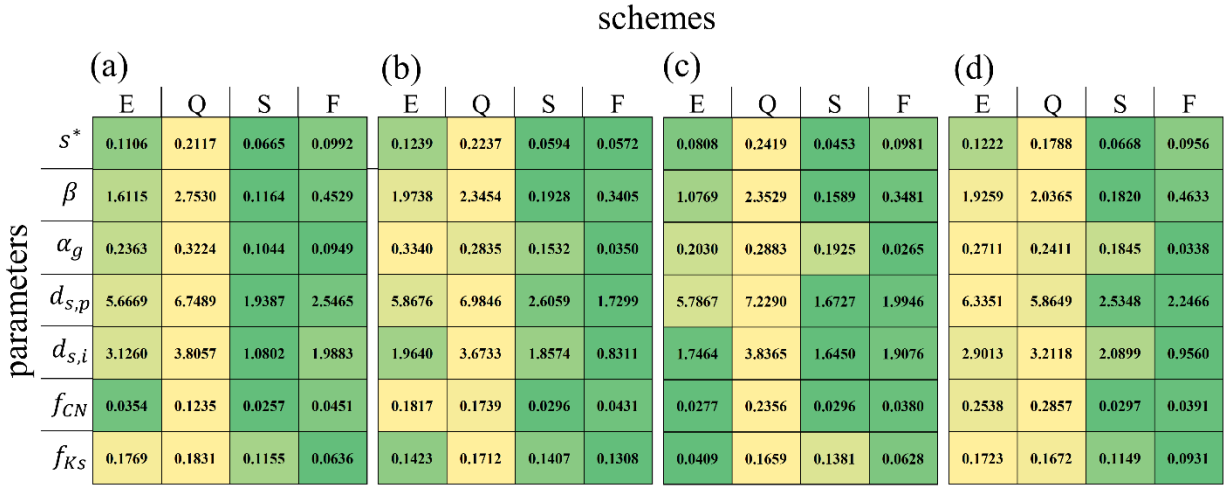

Figure S5. Standard deviations of parameter ensemble for calibration schemes at the application of (a) HCD_A, (b) HCD_B, (c) NGD_A, and (d) NGD_B.

References

1. National Institute of Environmental Research (NIER). *A Research on Control Targets and Strategies for Impervious Surface Management*; R&D Final Report: Hwaseong, Korea, 2014.
2. United States Environmental Protection Agency (US EPA). *Storm Water Management Model User's Manual Version 5.1;* U.S. Environmental Protection Agency: Washington, DC, USA, 2015.