1 *Supplement of*

2 **Global 1km Land Surface Parameters for Kilometer-Scale Earth System Modeling**

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7   Table S1 MODIS land cover classes and corresponding PFTs and non-vegetation land units

MODIS LC_Type5	#	PFTs and non-vegetation land units
Non-Vegetated Lands	0	Bare soil
Evergreen Needleleaf Trees	1	Needleleaf evergreen tree, temperate (NET Temperate)
	2	Needleleaf evergreen tree, boreal (NET Boreal)
Deciduous Needleleaf Trees	3	Needleleaf deciduous tree, boreal (NDT Boreal)
Evergreen Broadleaf Trees	4	Broadleaf evergreen tree, tropical (BET Tropical)
	5	Broadleaf evergreen tree, temperate (BET Temperate)
Deciduous Broadleaf Trees	6	Broadleaf deciduous tree, tropical (BDT Tropical)
	7	Broadleaf deciduous tree, temperate (BDT Temperate)
	8	Broadleaf deciduous tree, boreal (BDT Boreal)
Shrub	9	Broadleaf evergreen shrub, temperate (BES Temperate)
	10	Broadleaf deciduous shrub, temperate (BDS Temperate)
	11	Broadleaf deciduous shrub, boreal (BDS Boreal)
Grass	12	C3 grass, arctic
	13	C3 grass
	14	C4 grass
Cereal Croplands / Broadleaf Croplands	15	Crop
Water Bodies	16	Lake
	17	Ocean
Permanent Snow and Ice	18	Glacier
Urban and Built-up Lands	19	Urban

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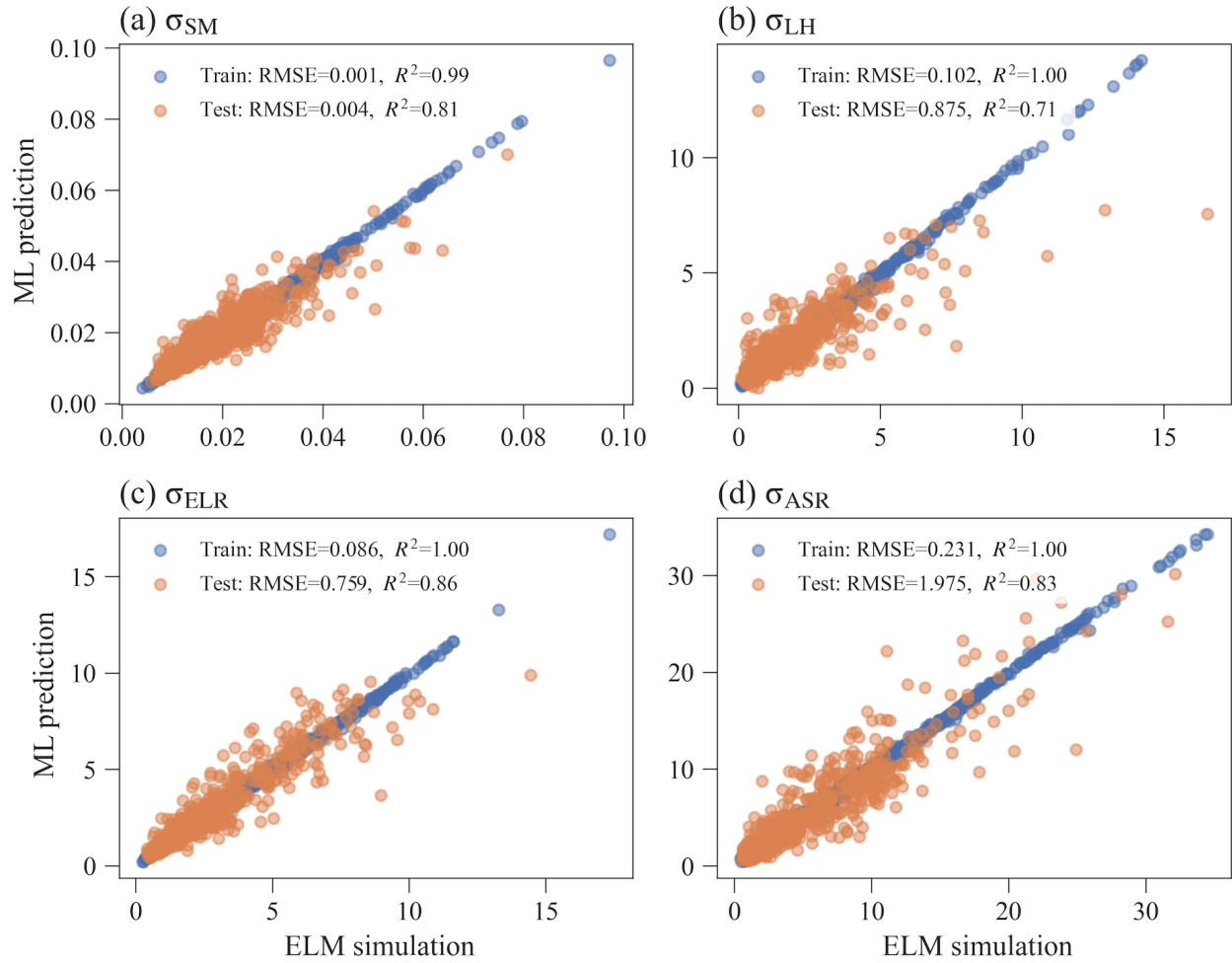
10   Table S2. The ratio between canopy height top and bottom in default ELM2/CLM5 and their

11   example values for each PFT.

#	PFTs	Ratio	Example height	
			Canopy top height	Canopy bottom height
1	Needleleaf evergreen tree, temperate (NET Temperate)	0.500	17	8.5
2	Needleleaf evergreen tree, boreal (NET Boreal)	0.500	17	8.5
3	Needleleaf deciduous tree, boreal (NDT Boreal)	0.500	14	7
4	Broadleaf evergreen tree, tropical (BET Tropical)	0.029	35	1
5	Broadleaf evergreen tree, temperate (BET Temperate)	0.029	35	1
6	Broadleaf deciduous tree, tropical (BDT Tropical)	0.556	18	10
7	Broadleaf deciduous tree, temperate (BDT Temperate)	0.575	20	11.5
8	Broadleaf deciduous tree, boreal (BDT Boreal)	0.575	20	11.5
9	Broadleaf evergreen shrub, temperate (BES Temperate)	0.200	0.5	0.1
10	Broadleaf deciduous shrub, temperate (BDS Temperate)	0.200	0.5	0.1
11	Broadleaf deciduous shrub, boreal (BDS Boreal)	0.200	0.5	0.1
12	C3 grass, arctic	0.020	0.5	0.01
13	C3 grass	0.020	0.5	0.01
14	C4 grass	0.020	0.5	0.01
15	Crop	0.020	0.5	0.01

12   *Grids with canopy top height less than 0.1 m are assigned 0.1 m.

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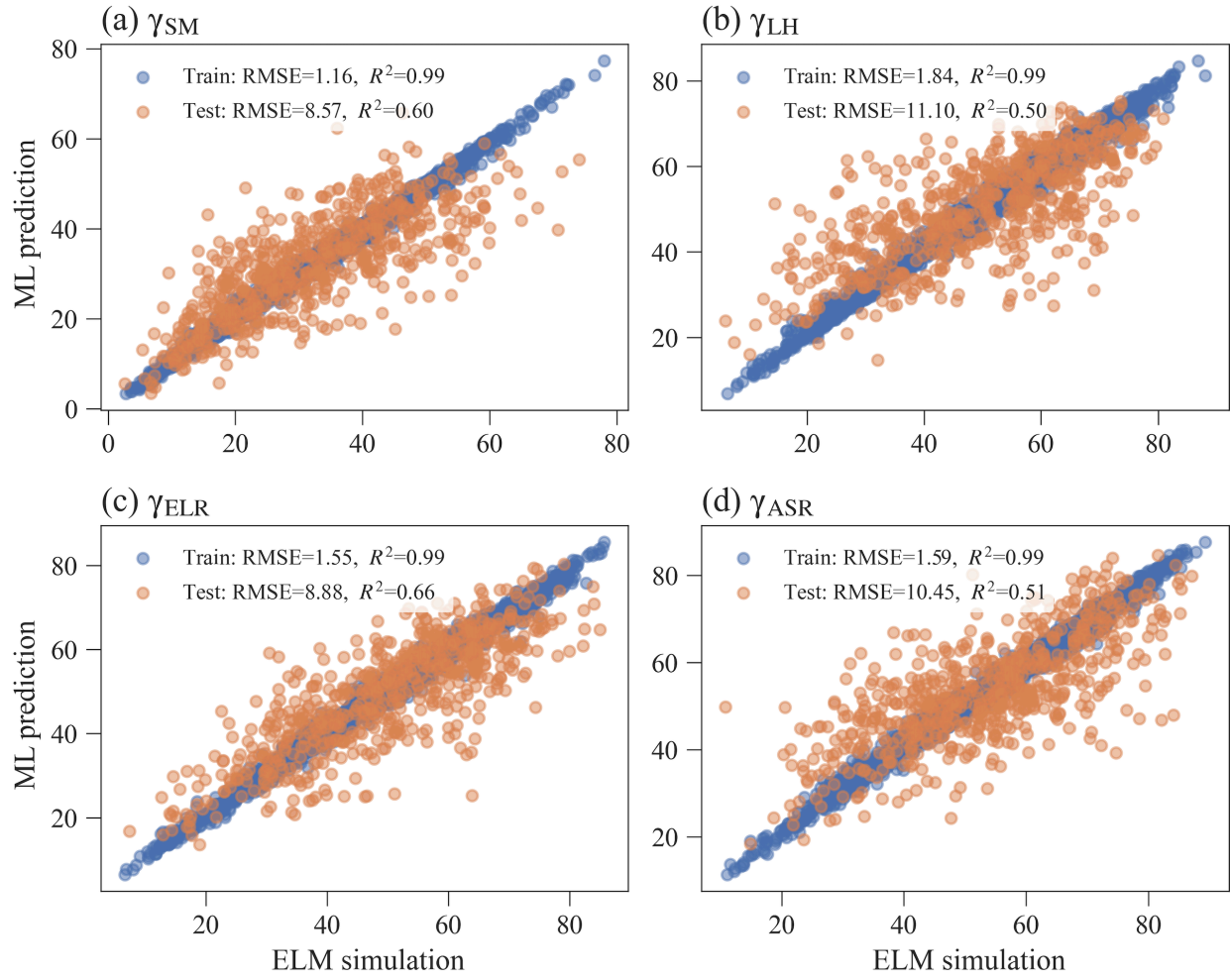
14   Figure S1. The performance of ML models during training and testing for predicting the spatial

15   standard deviation of (a) SM, (b) LH, (c) ELR, and (d) ASR.

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17   Figure S2. The performance of ML models in the training and testing samples for predicting the

18   spatial information loss of (a) SM, (b) LH, (c) ELR, and (d) ASR.

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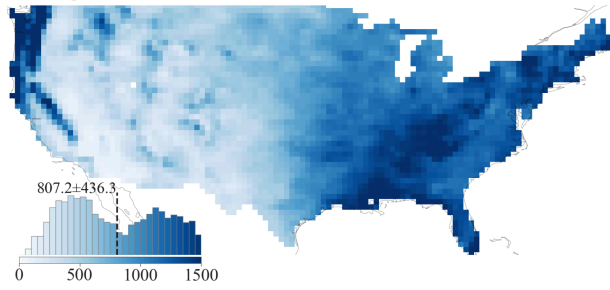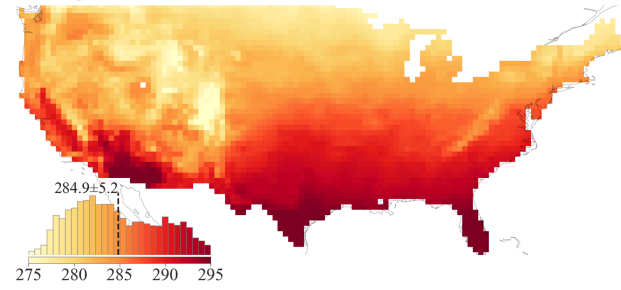
20   Figure S3. Annual mean precipitation and temperature over CONUS at 0.5º resolution.