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Supplement of

A China dataset of soil properties for land surface modelling (version 2, CSDLv2)

Gaosong Shi et al.

Correspondence to: Wei Shangguan (shgwei@mail.sysu.edu.cn)

Contents

S1 The frequency distributions of soil properties

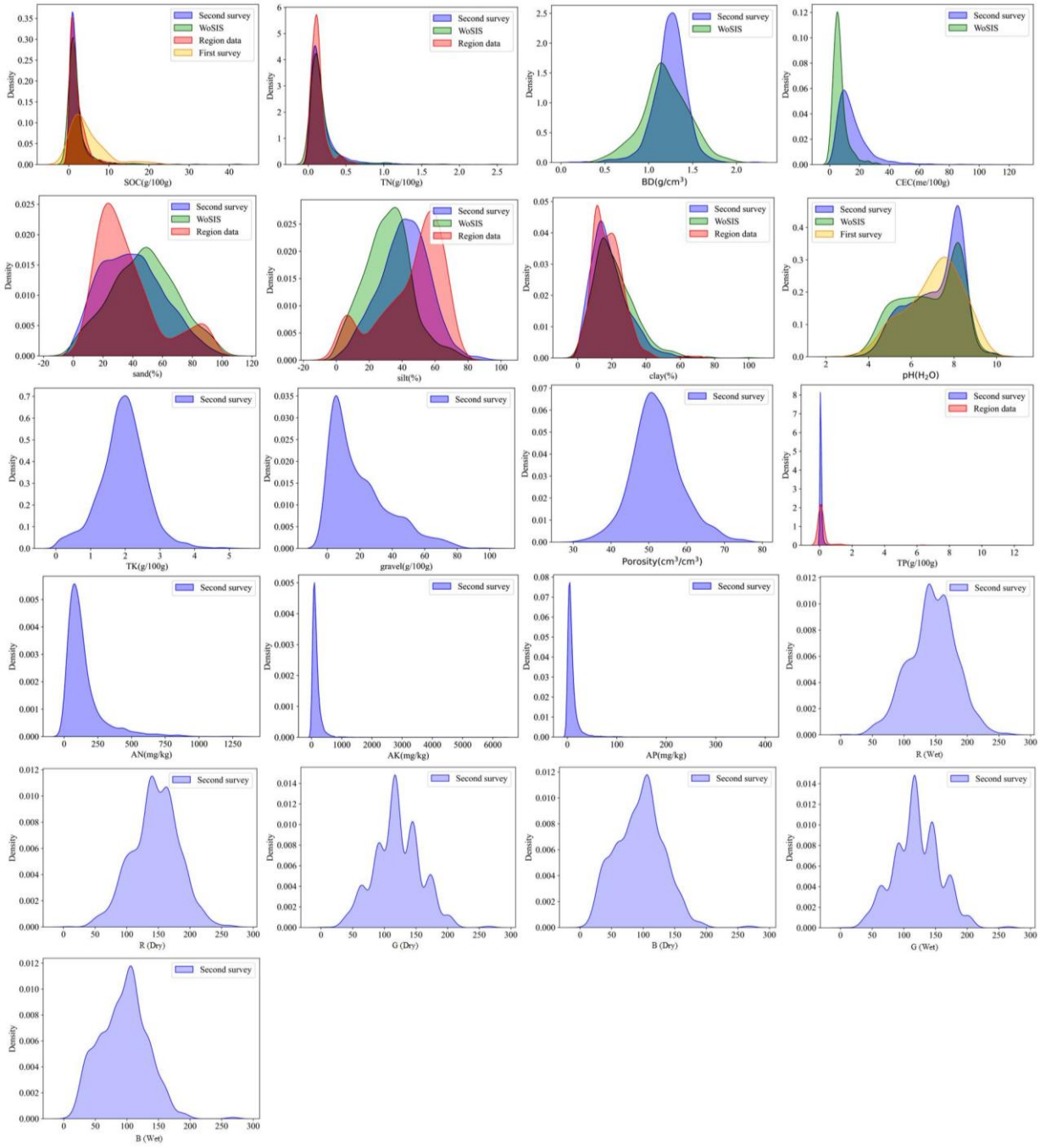


Figure S1. The frequency distributions of soil properties at 0-5 cm depth interval.

S2 Bulk density (BD)

S2.1 Prediction maps

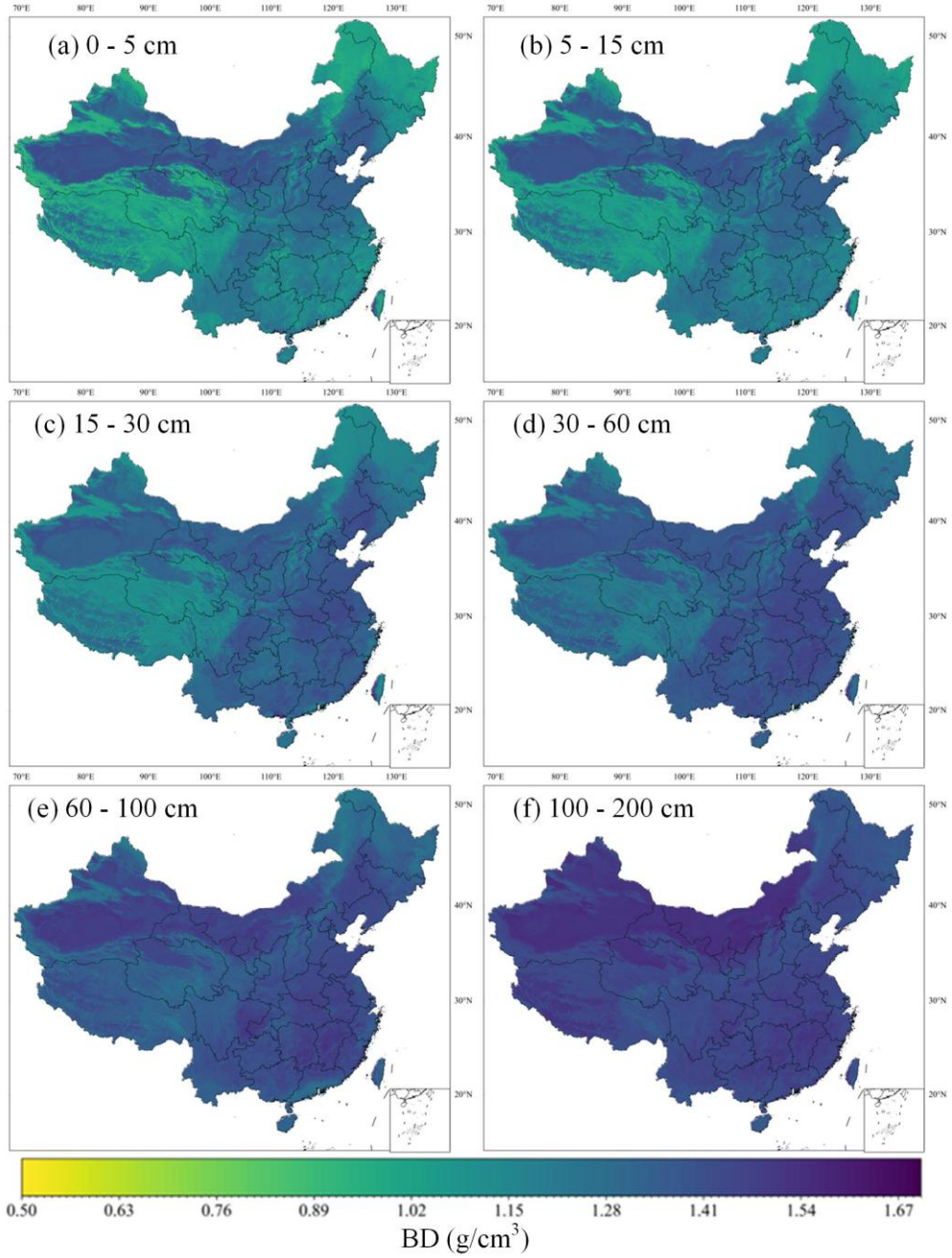


Figure S2. The predicted maps of bulk density (BD) at multiple depths (g/cm^3). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S2.2 Accuracy assessment

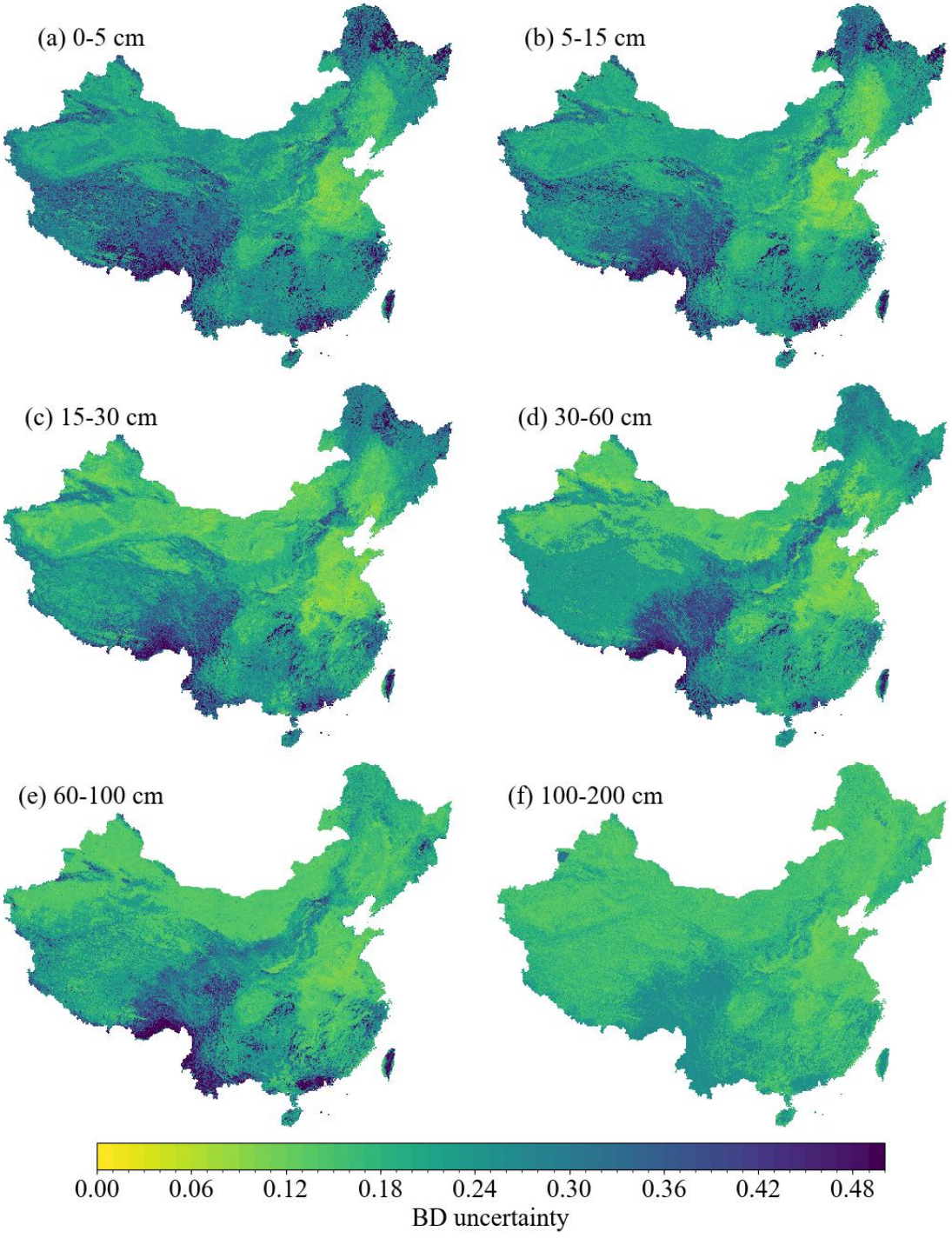


Figure S3. The maps of uncertainty of bulk density (BD) predictions at the six depth intervals.

S2.3 Variable importance

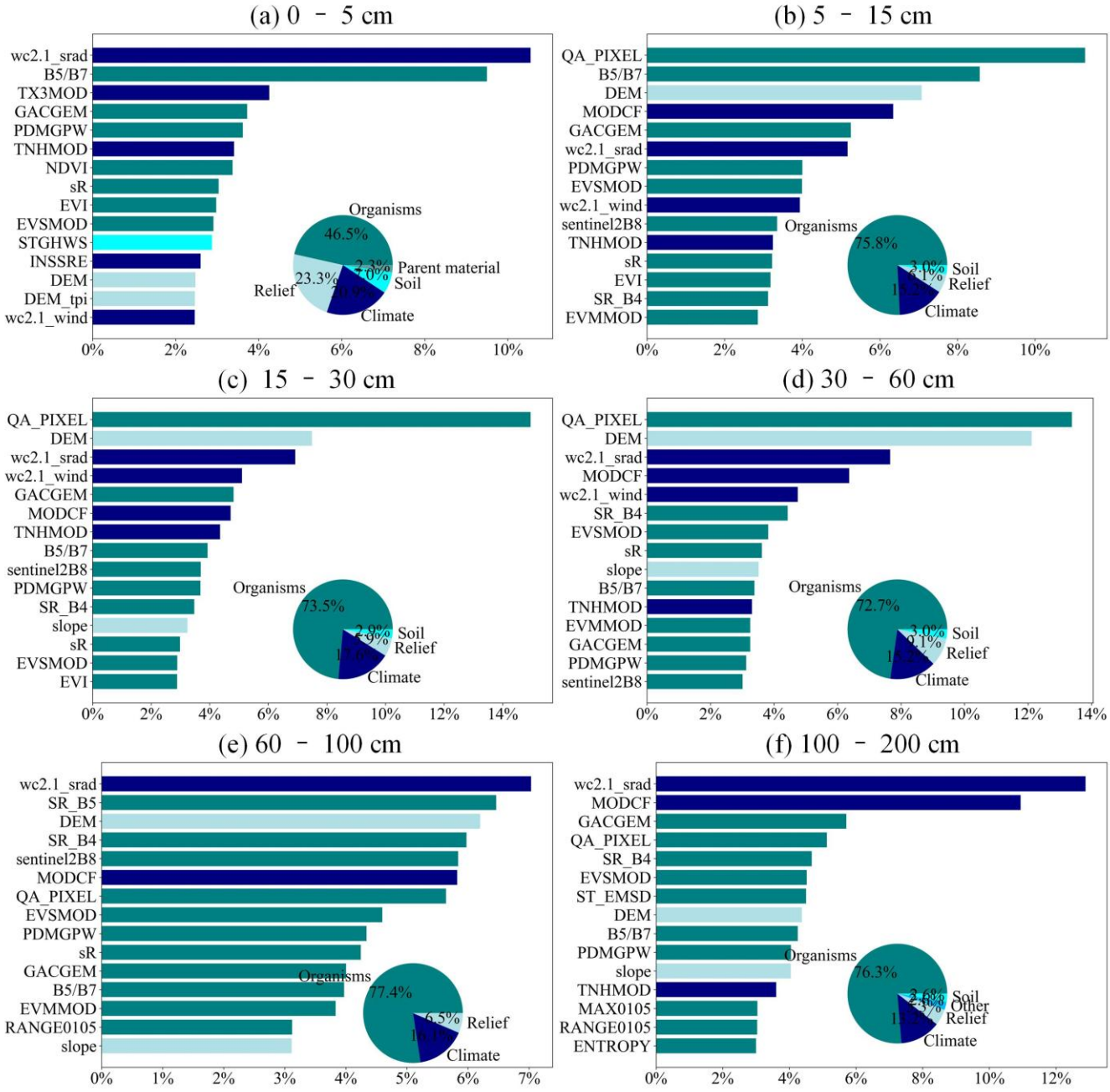


Figure S4. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of bulk density (BD) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S3 Sand

S3.1 Prediction maps

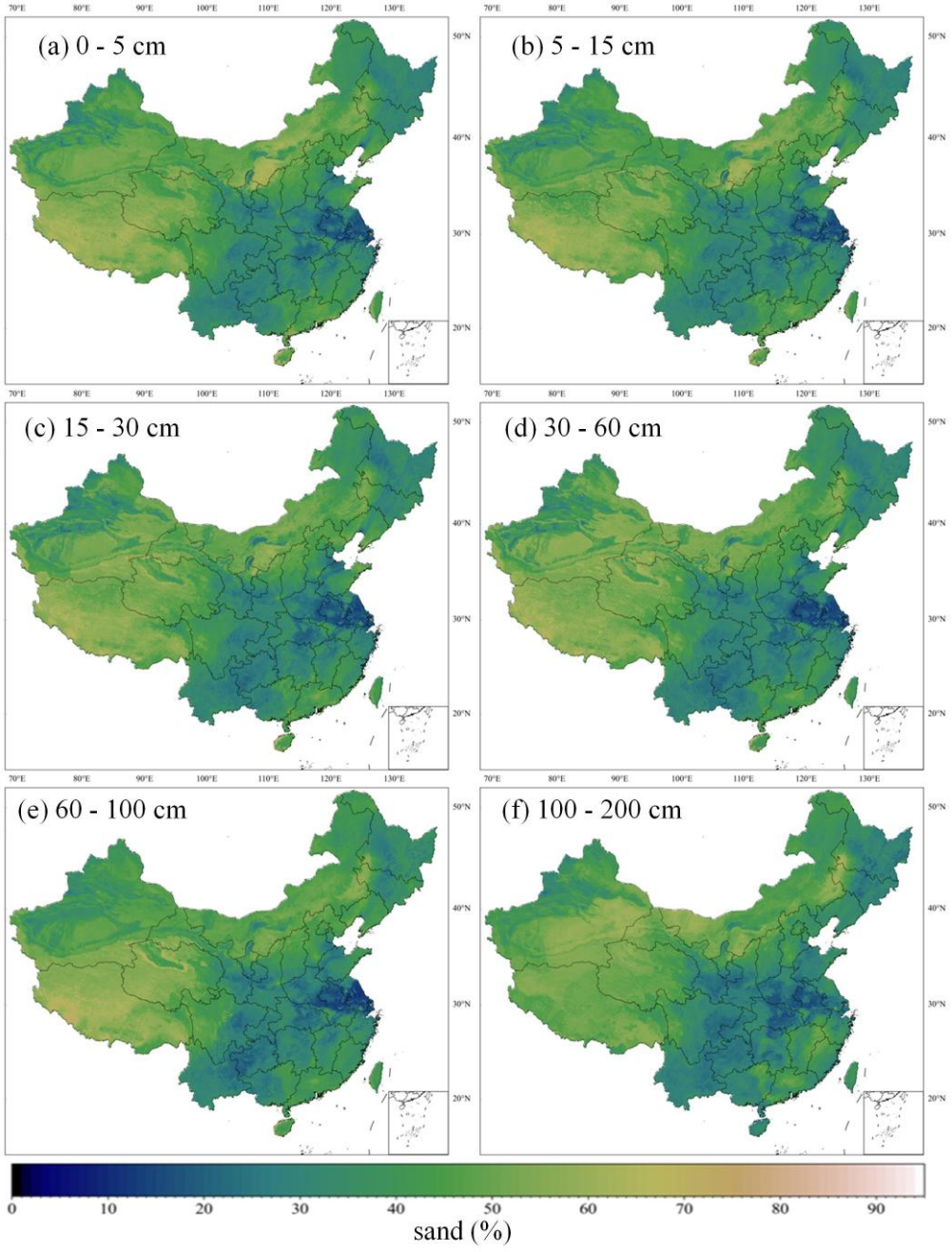


Figure S5. The predicted maps of sand content at multiple depths (%). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S3.2 Accuracy assessment

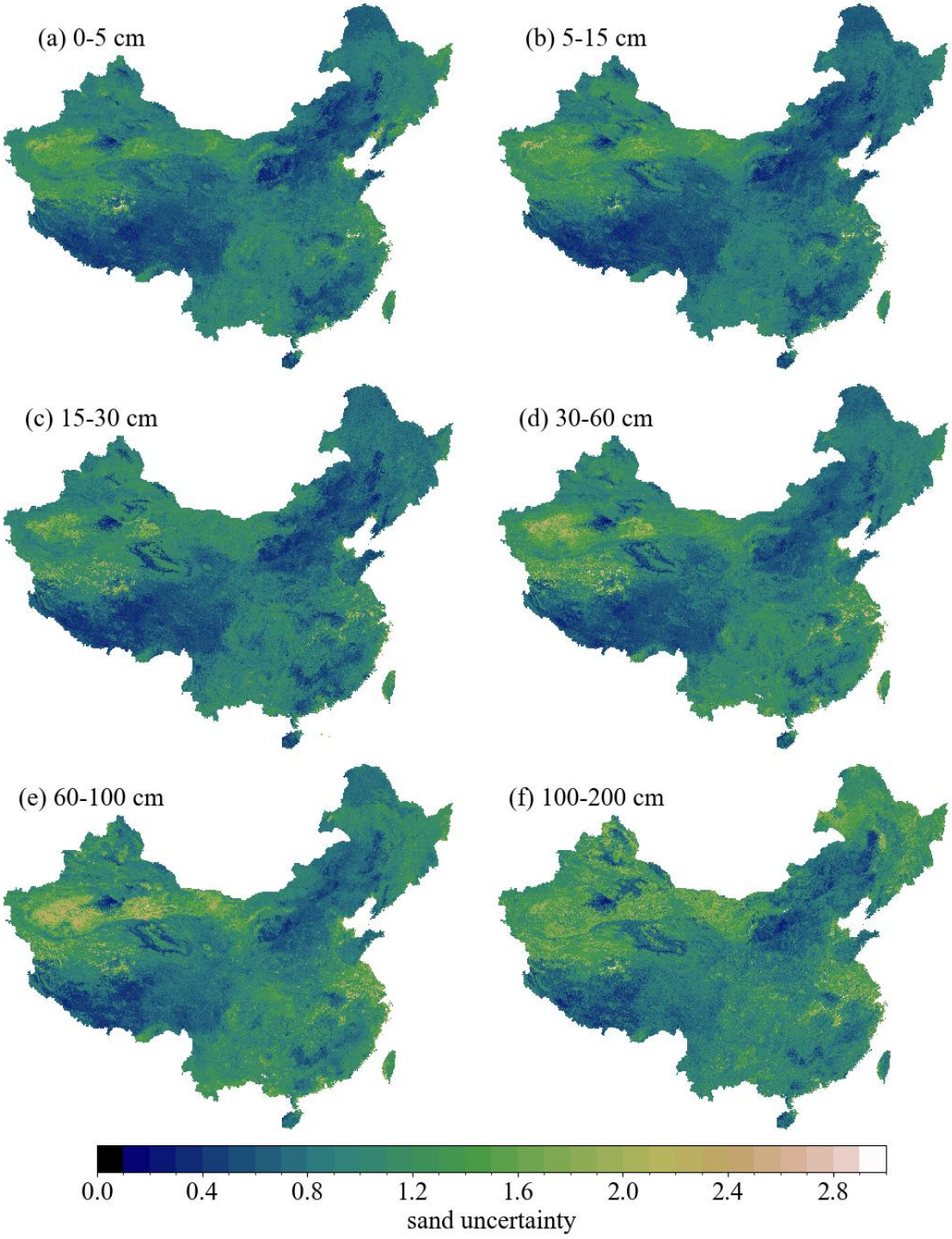


Figure S6. The maps of uncertainty of sand content predictions at the six depth intervals.

S3.3 Variable importance

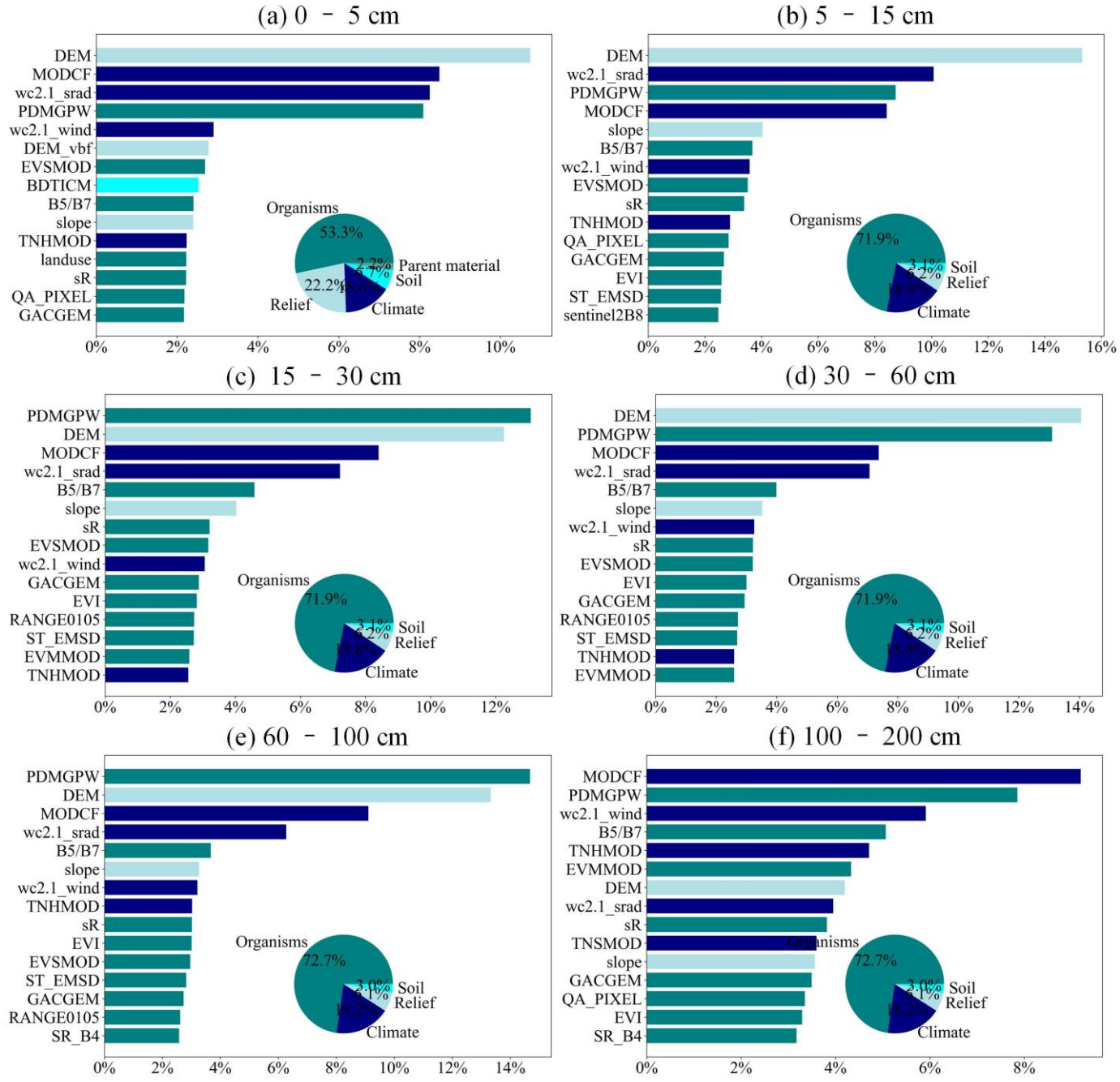


Figure S7. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of sand at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S4 Silt

S4.1 Prediction maps

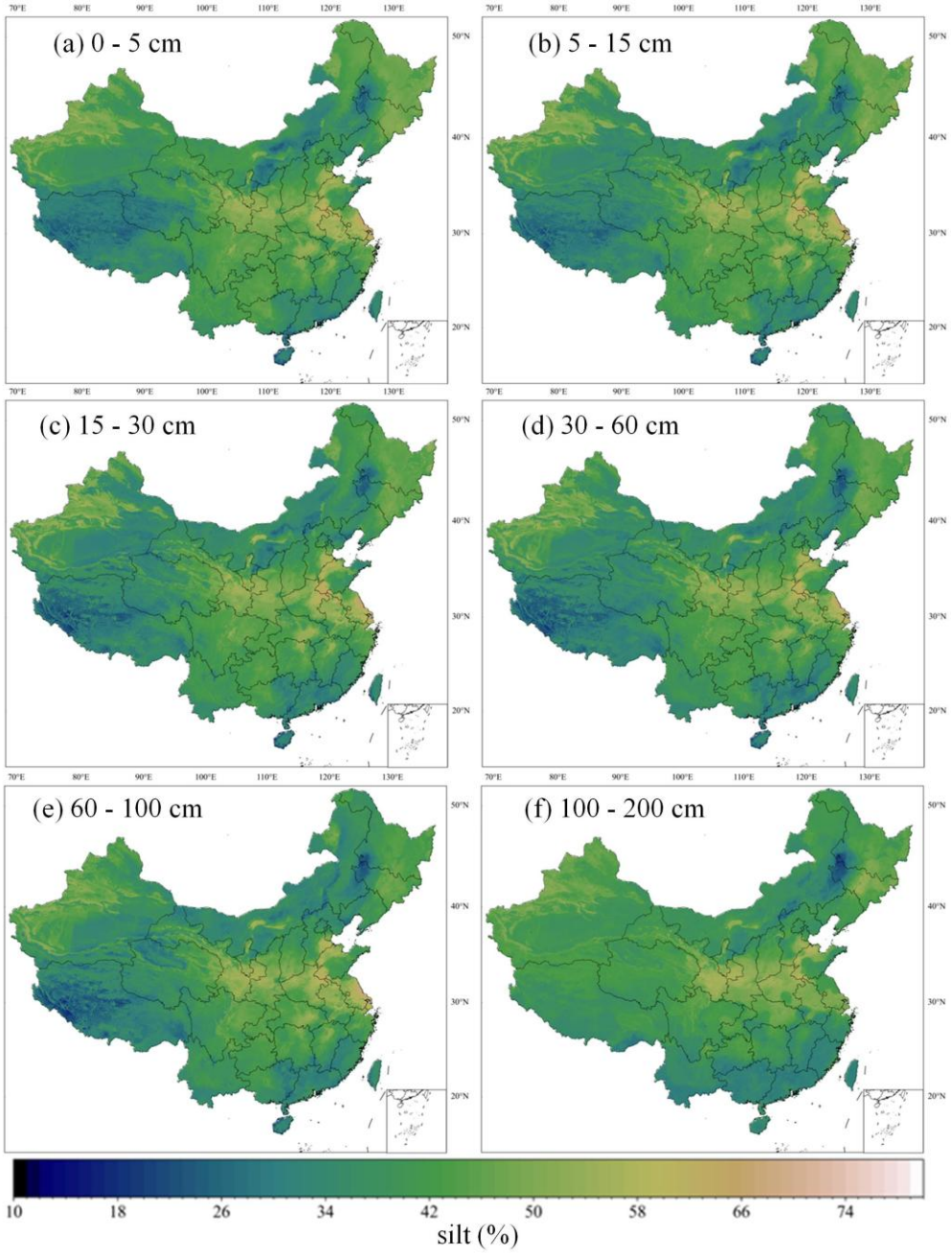


Figure S8. The predicted maps of silt content at multiple depths (%). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S4.2 Accuracy assessment

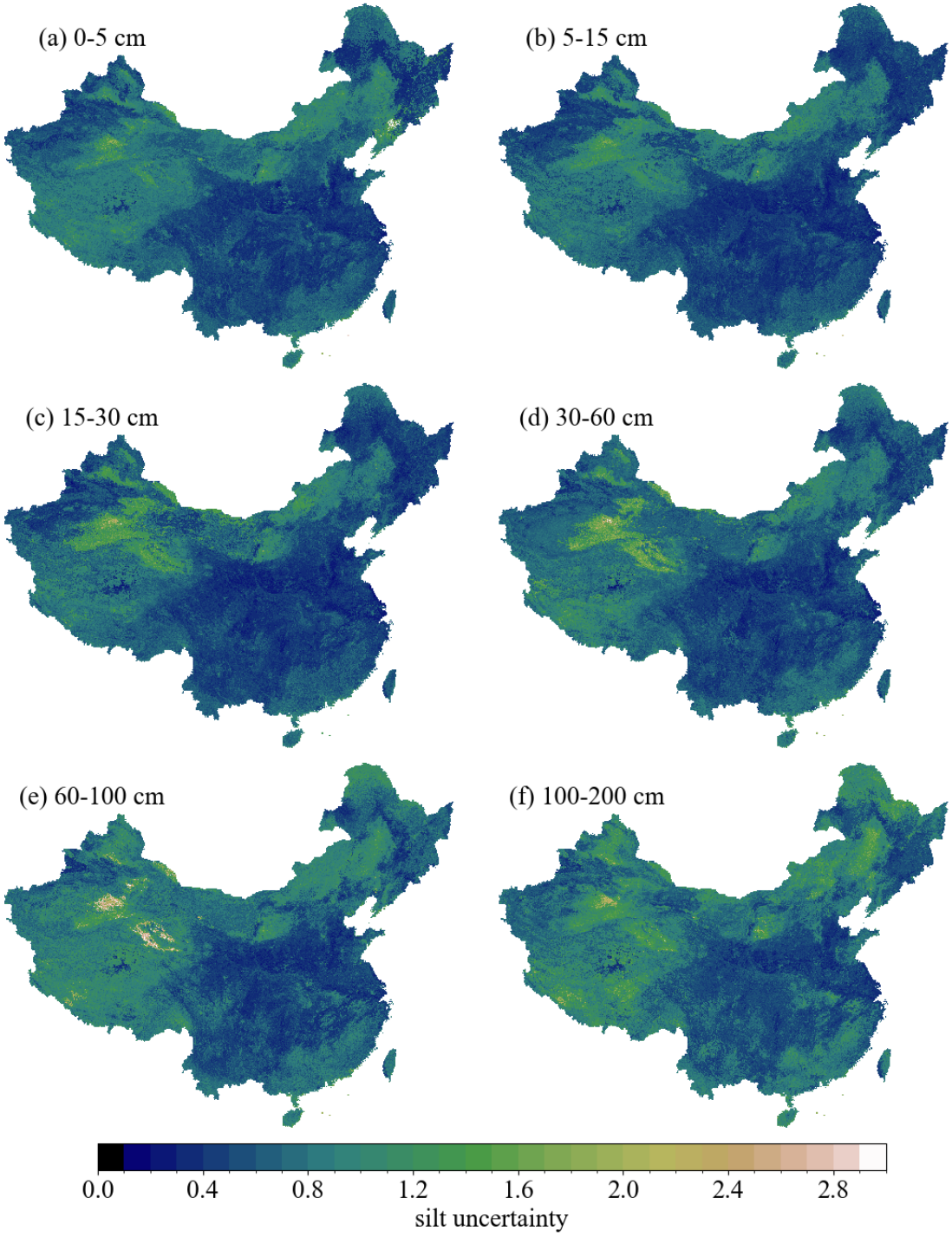


Figure S9. The maps of uncertainty of silt content predictions at the six depth intervals.

S4.3 Variable importance

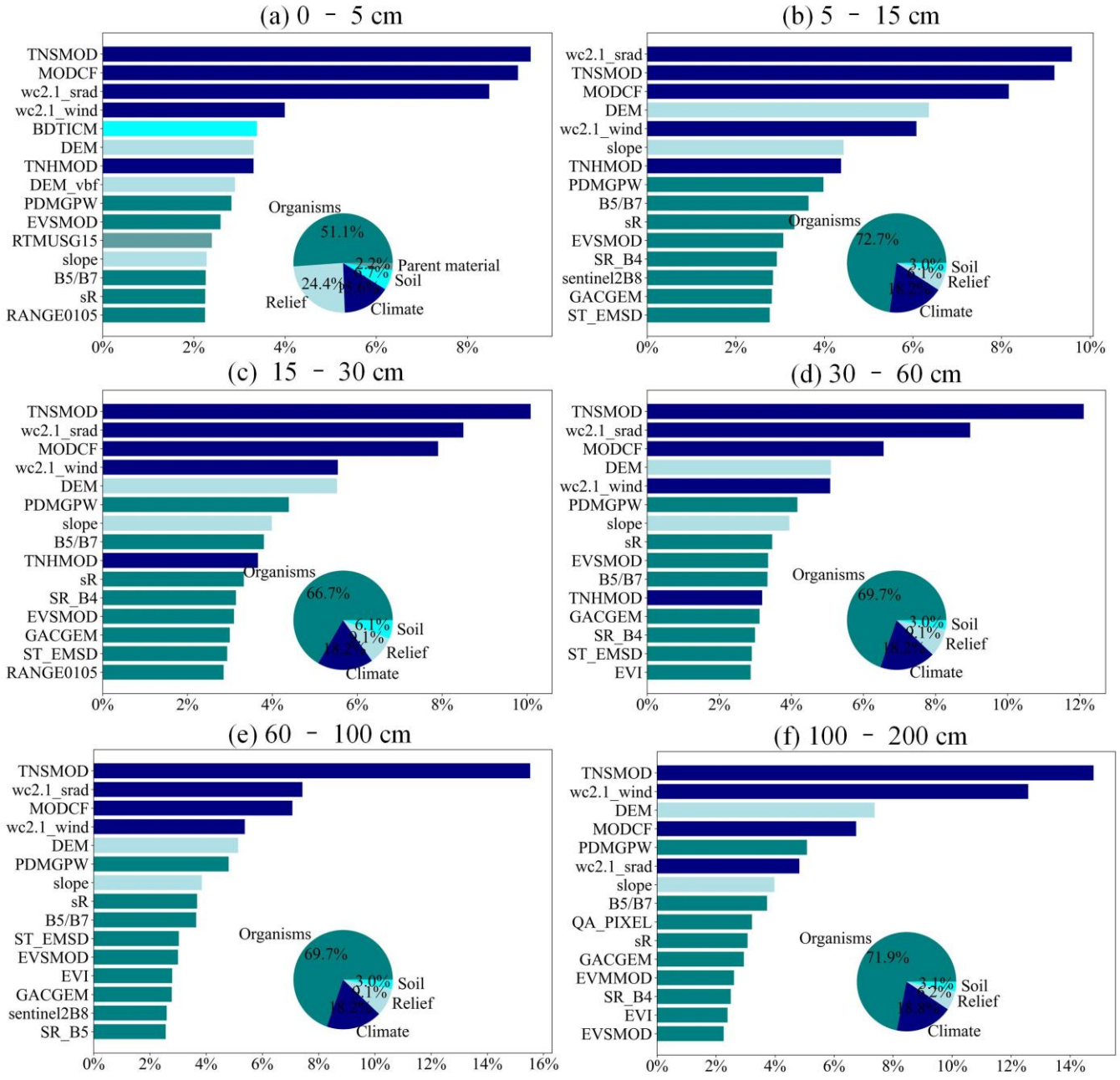


Figure S10. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of silt at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S5 Clay

S5.1 Prediction maps

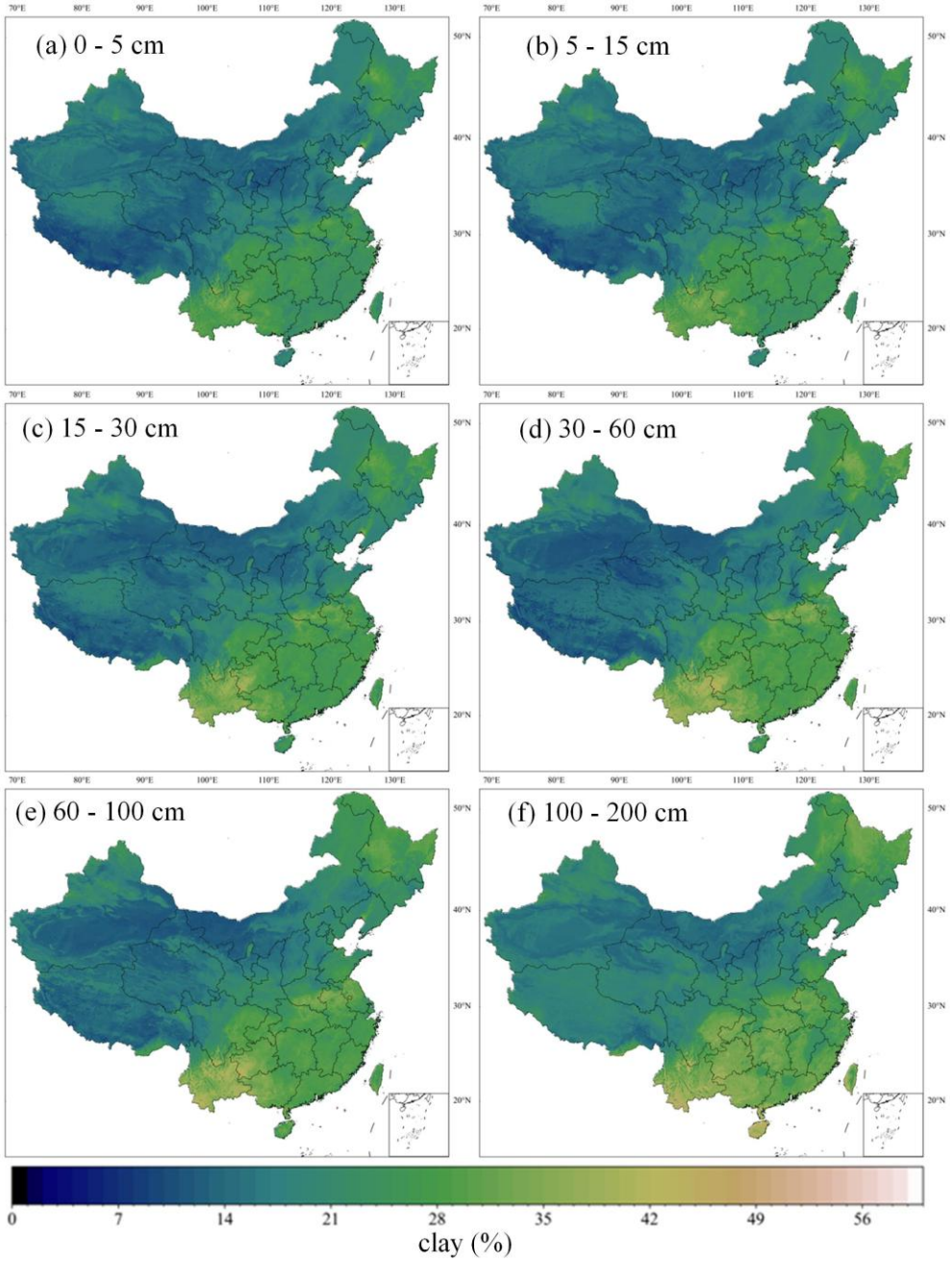


Figure S11. The predicted maps of clay content at multiple depths (%). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

45 **S5.2 Accuracy assessment**

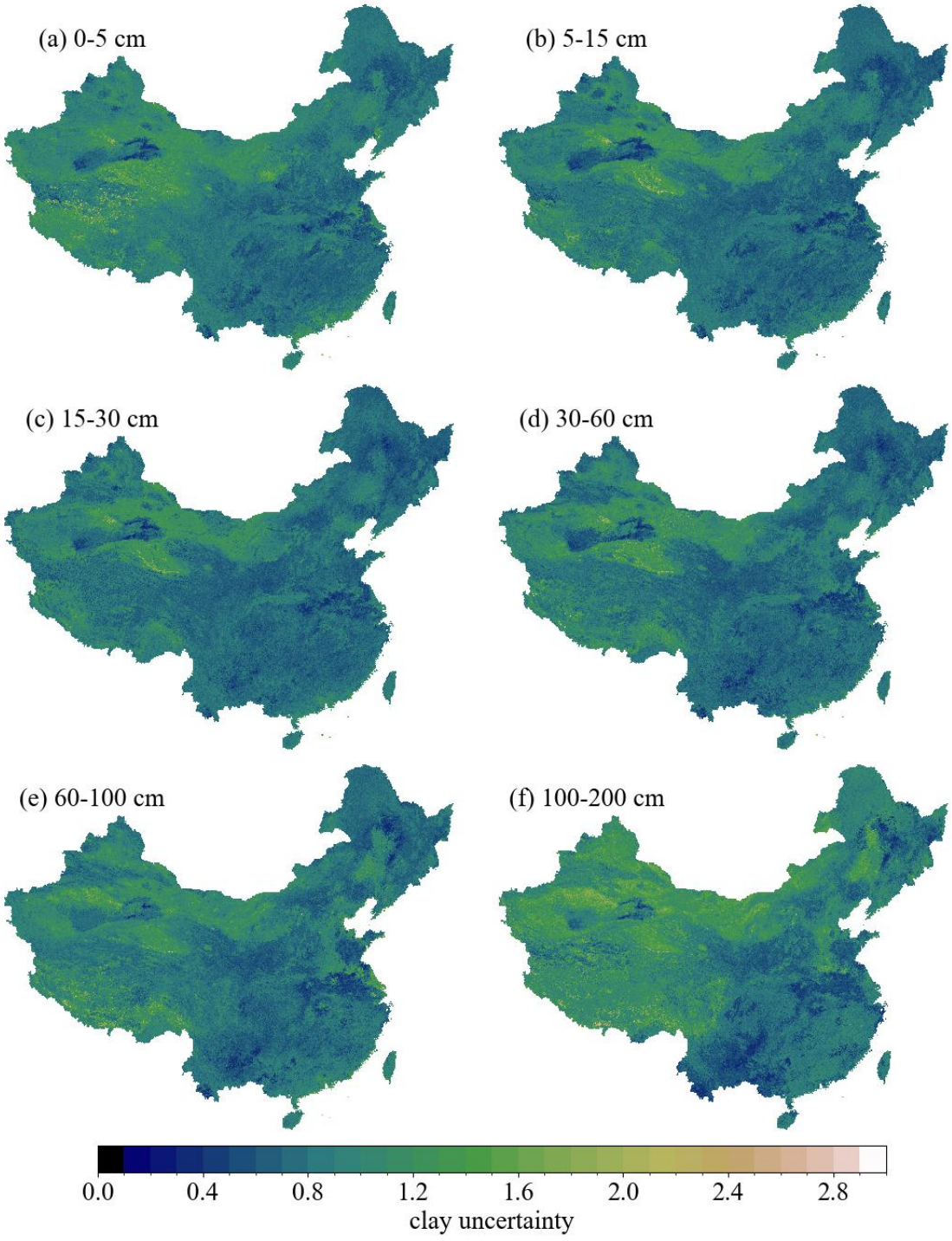


Figure S12. The maps of uncertainty of clay content predictions at the six depth intervals.

S5.3 Variable importance

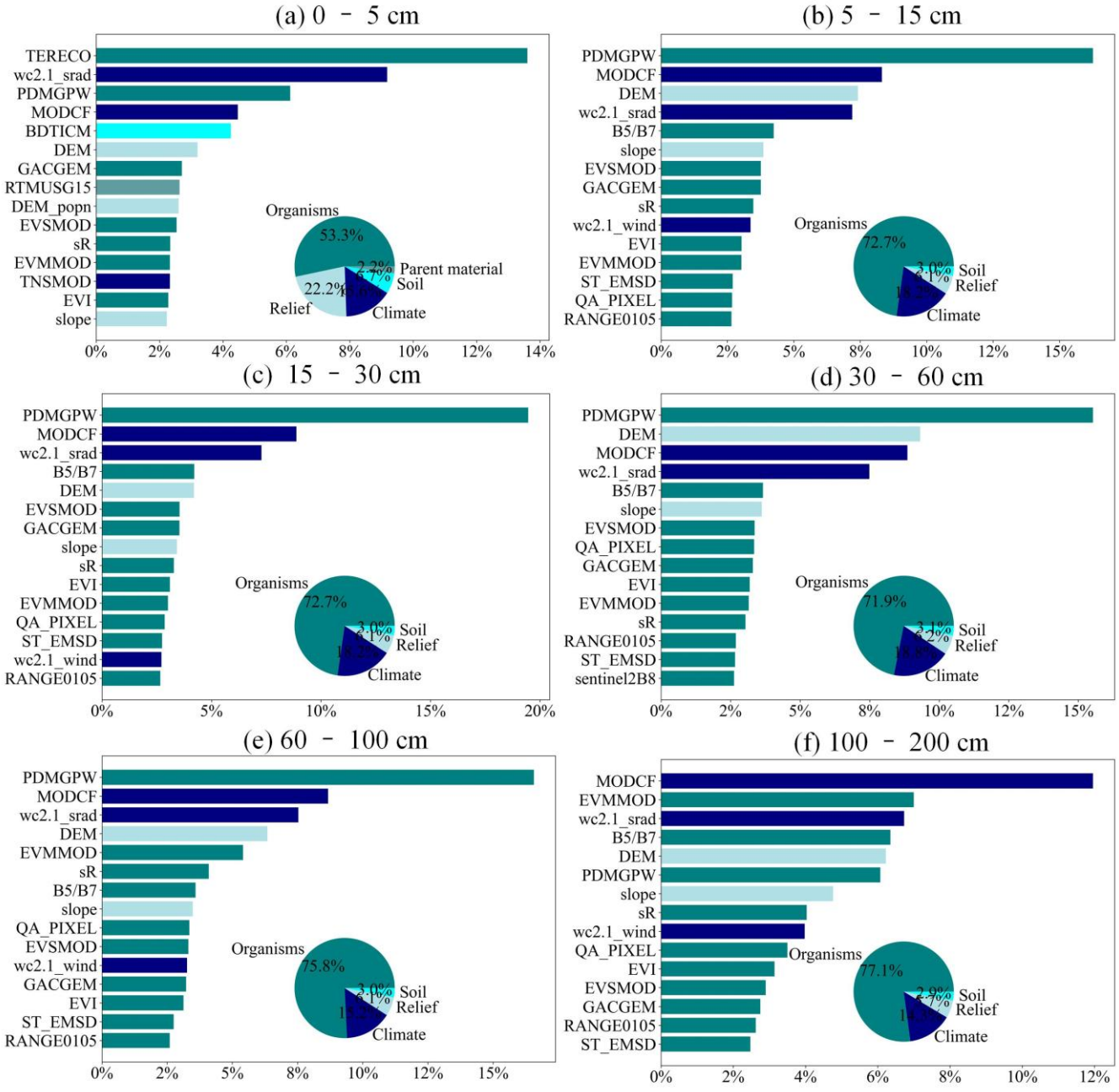


Figure S13. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of clay at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S6 Rock fragment (gravel)

S6.1 Prediction maps

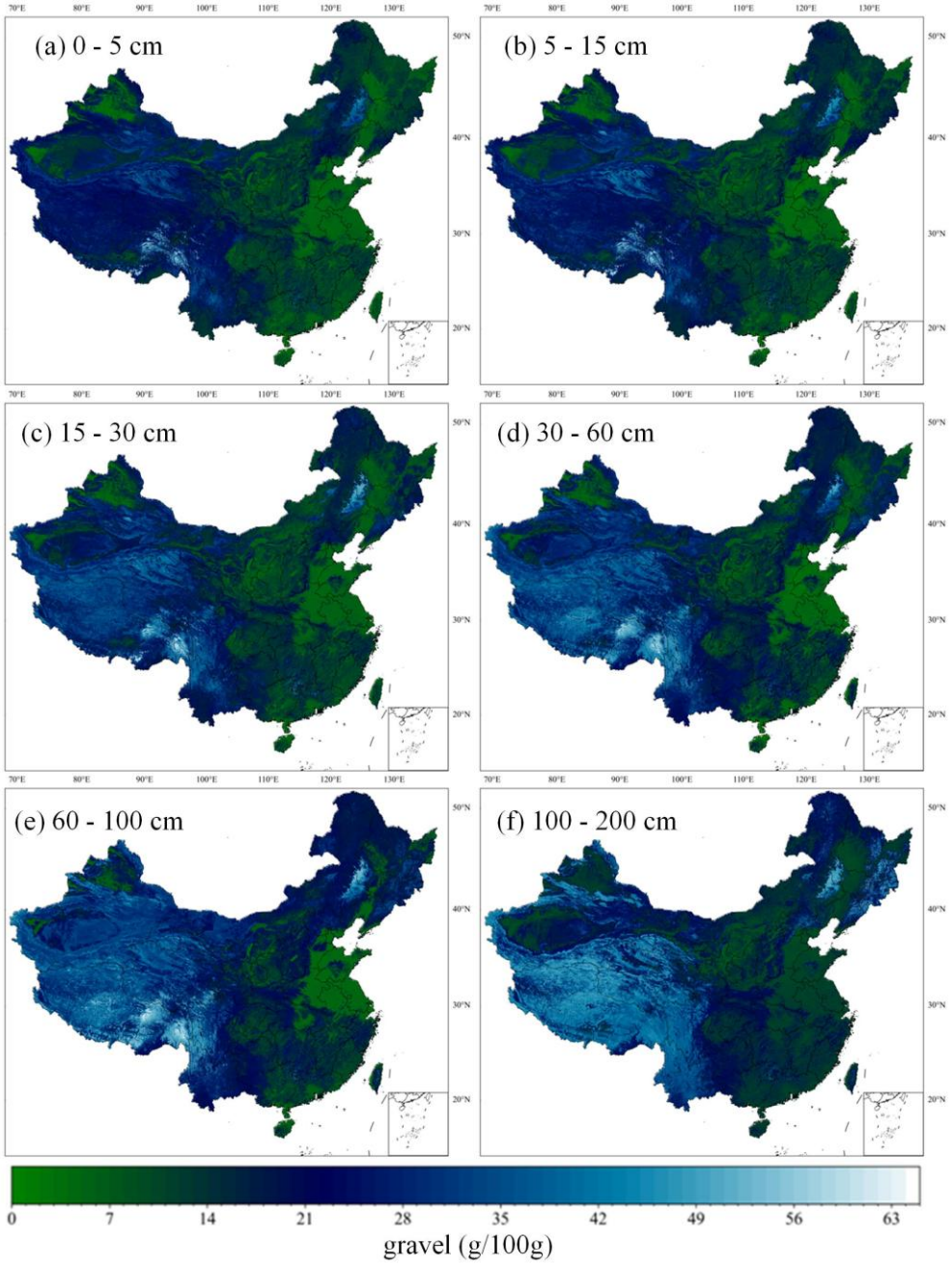


Figure S14. The predicted maps of Rock fragment (gravel) content at multiple depths (g/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S6.2 Accuracy assessment

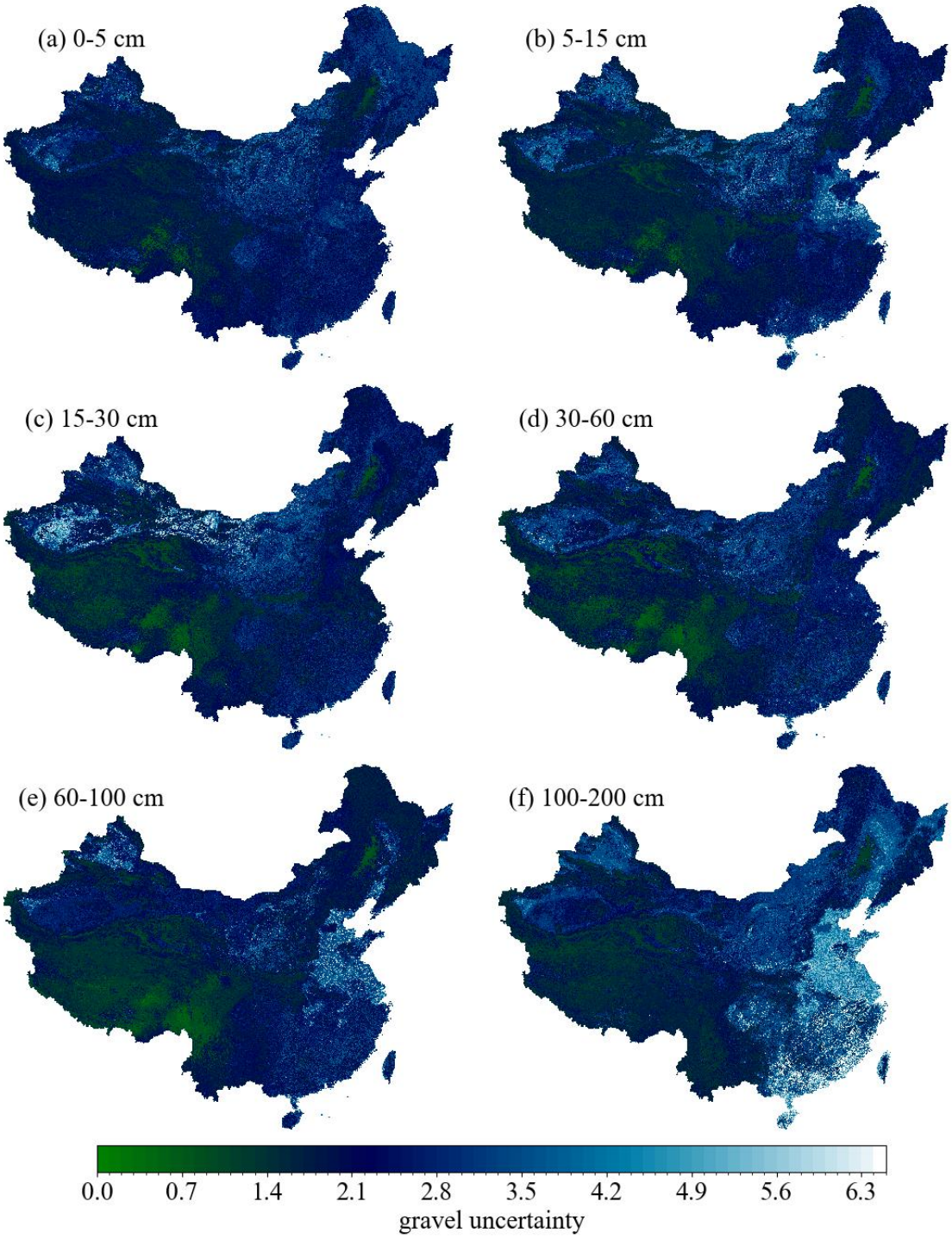


Figure S15. The maps of uncertainty of rock fragment (gravel) predictions at the six depth intervals.

S6.3 Variable importance

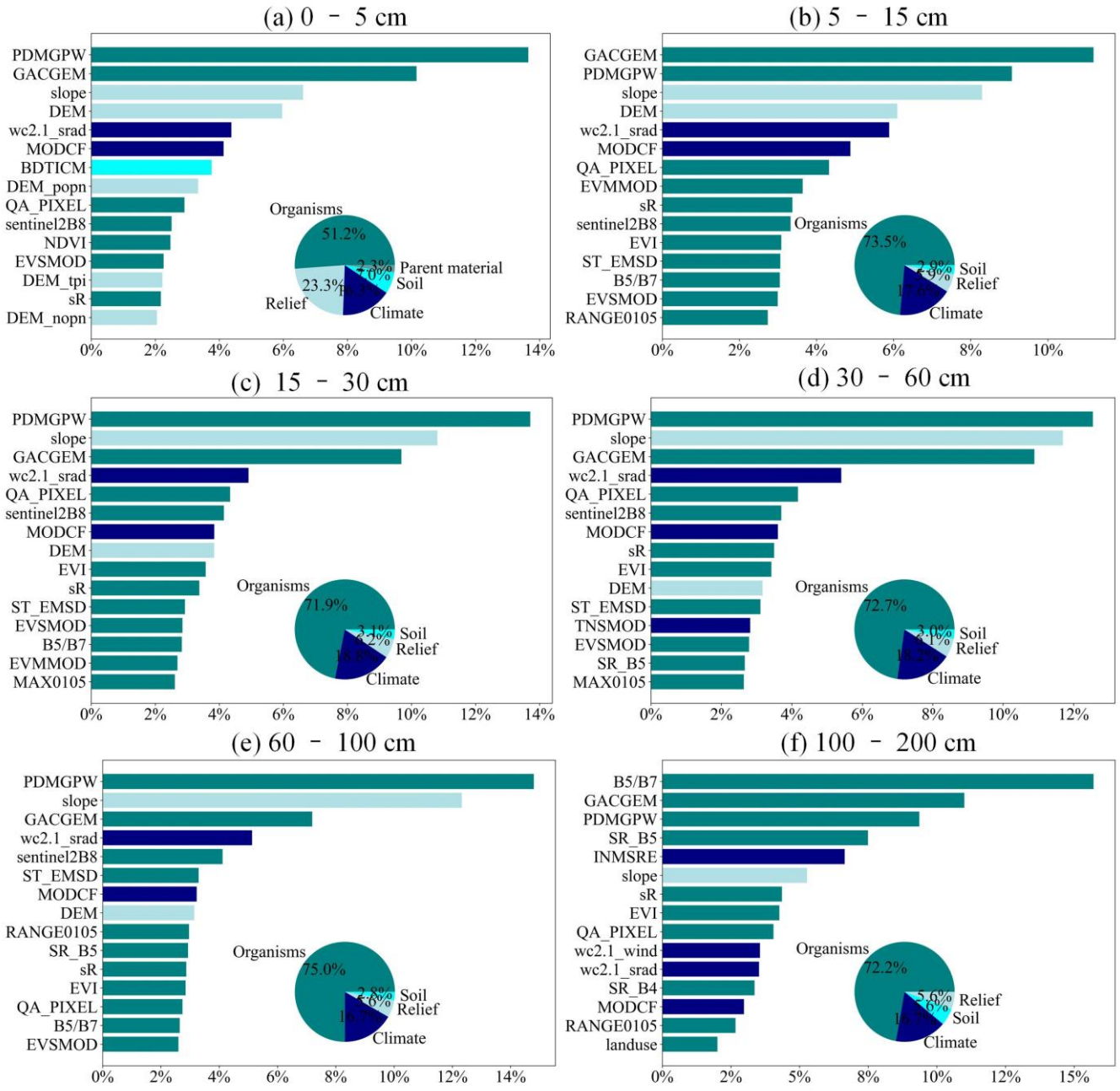


Figure S16. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of rock fragment (gravel) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S7 Porosity

S7.1 Prediction maps

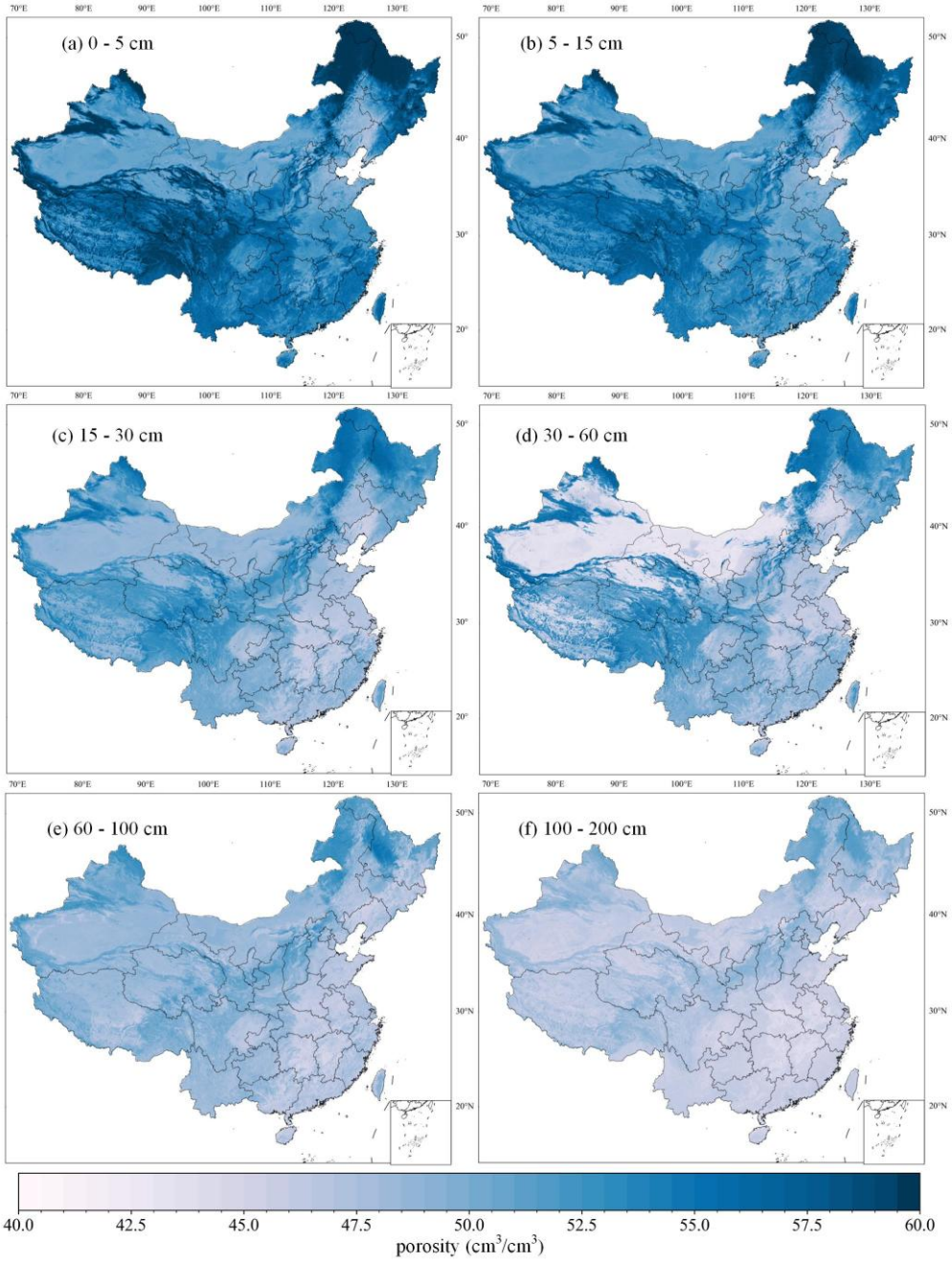


Figure S17. The predicted maps of porosity at multiple depths (cm^3/cm^3). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S7.2 Accuracy assessment

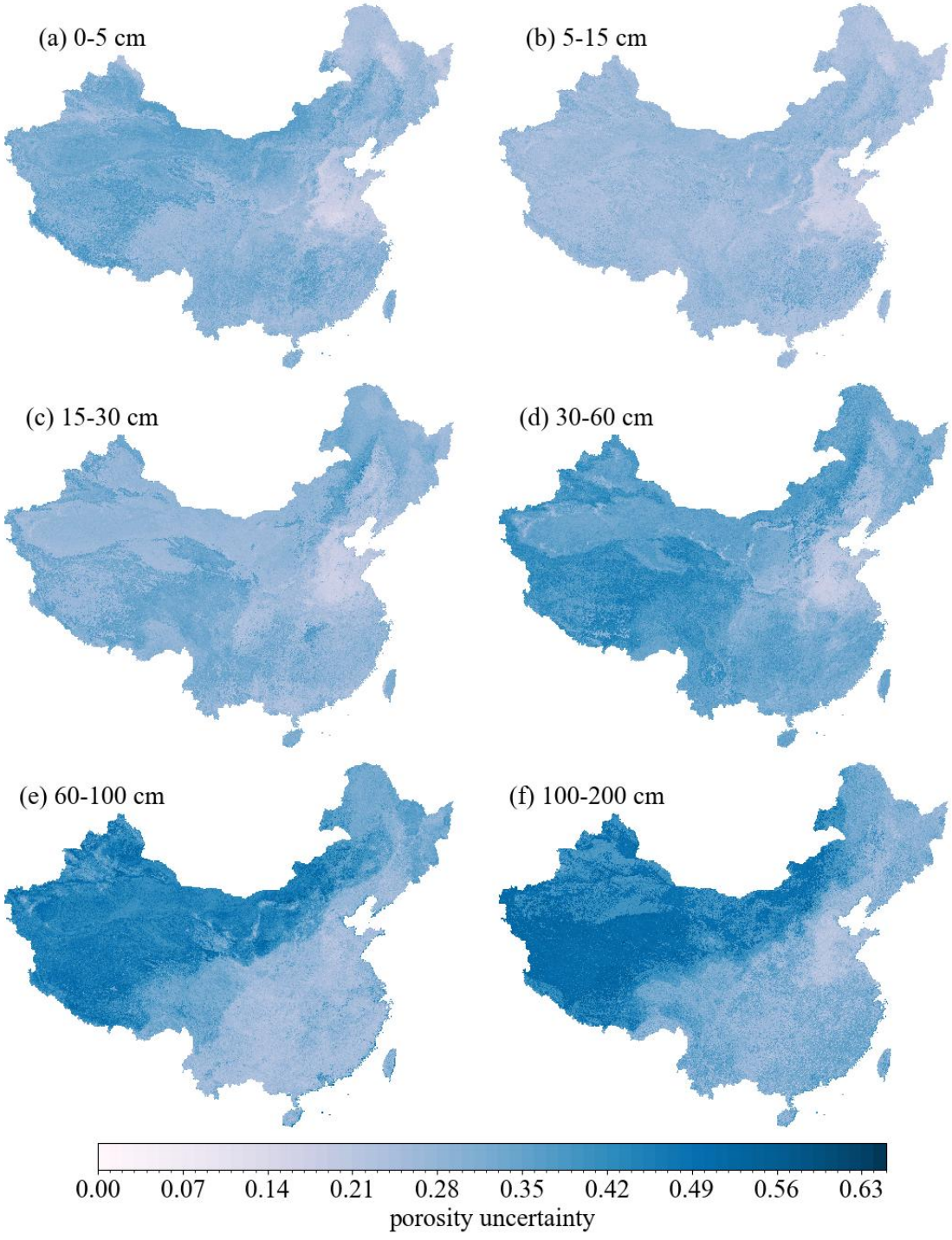


Figure S18. The maps of uncertainty of porosity predictions at the six depth intervals.

S7.3 Variable importance

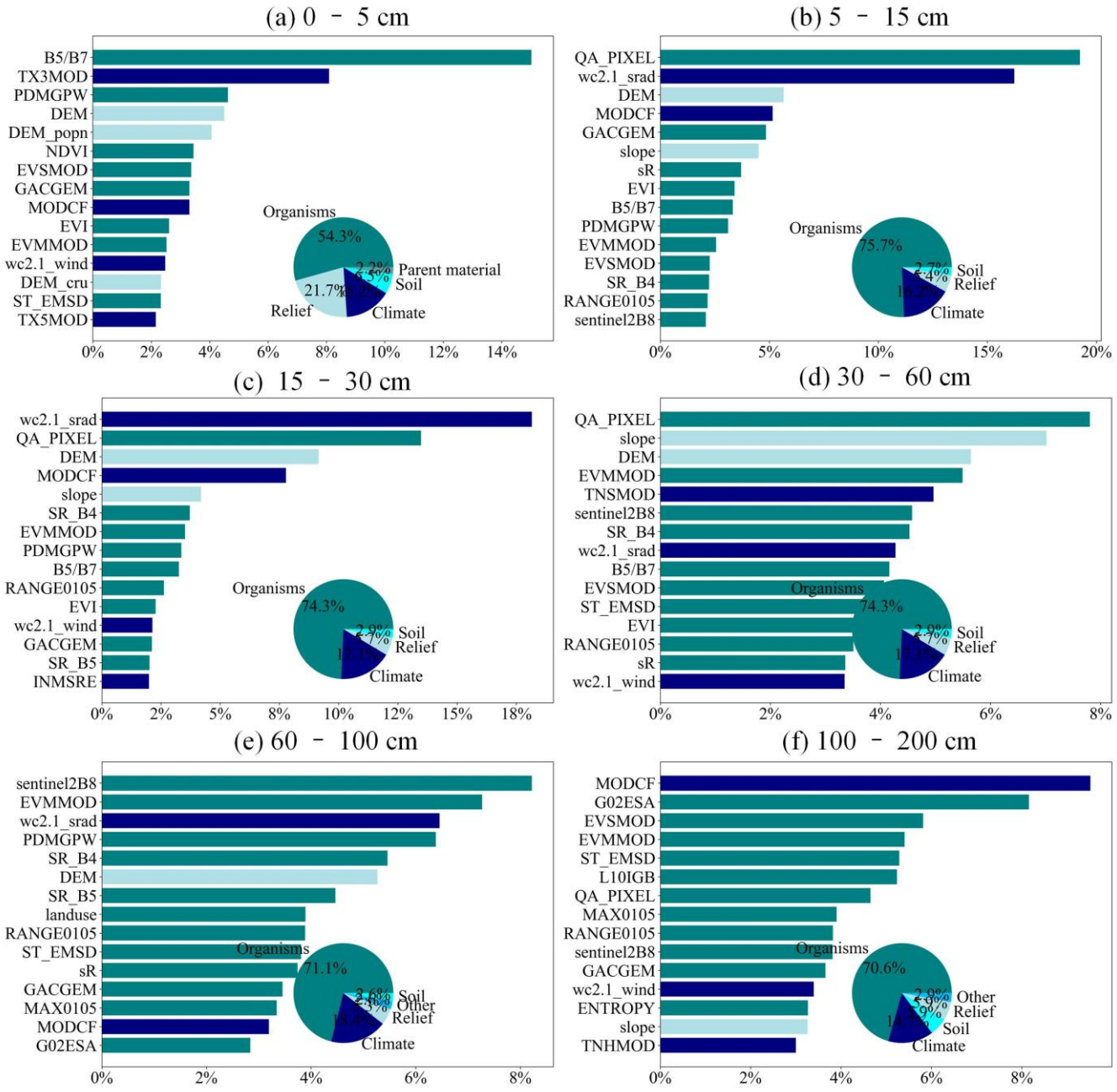


Figure S19. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of porosity at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S8 Red (R) of wet soil color

S8.1 Prediction maps

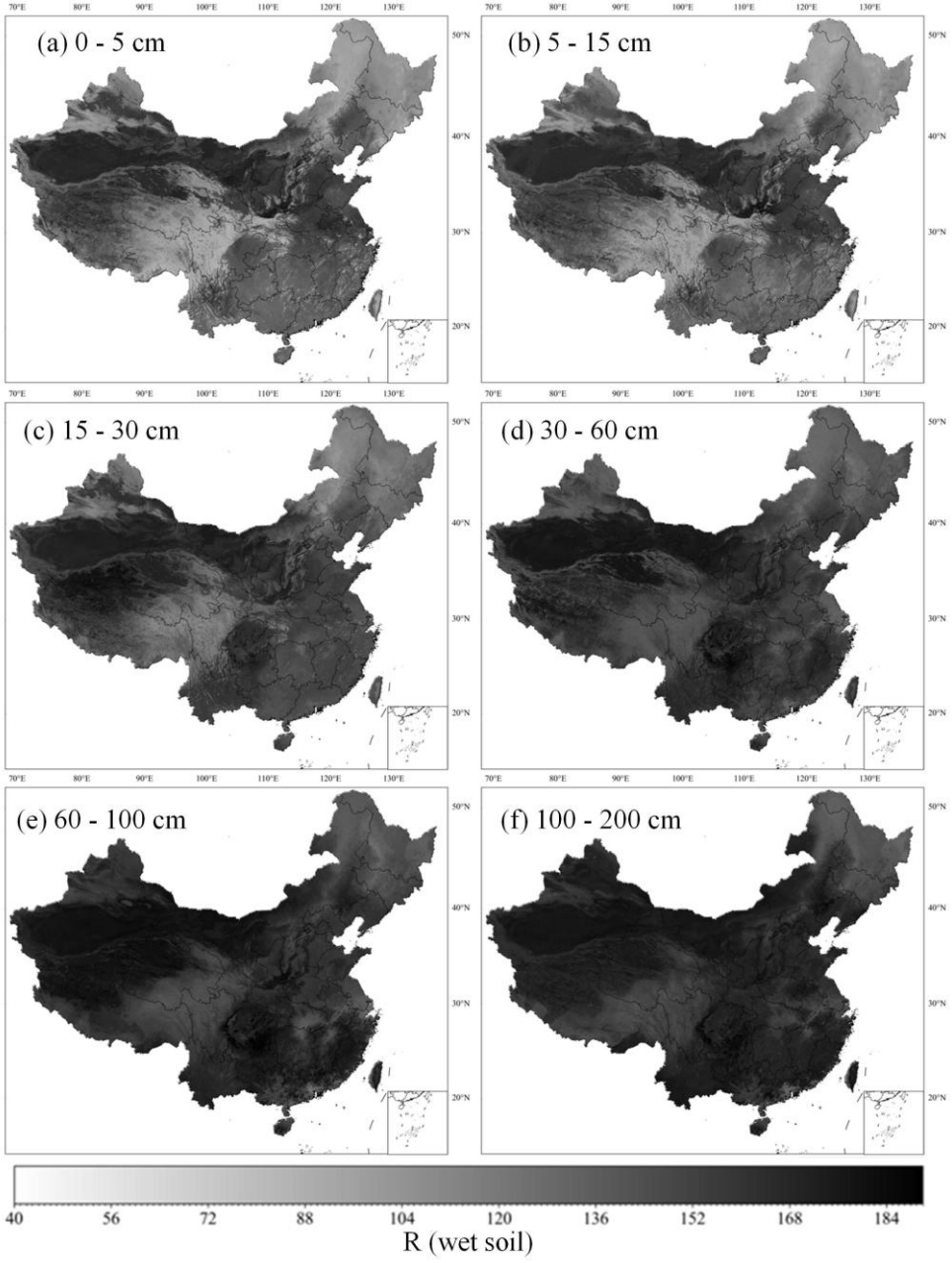


Figure S20. The predicted maps of the red (R) component of wet soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The R component represents the red channel in the RGB soil color system.

S8.2 Accuracy assessment

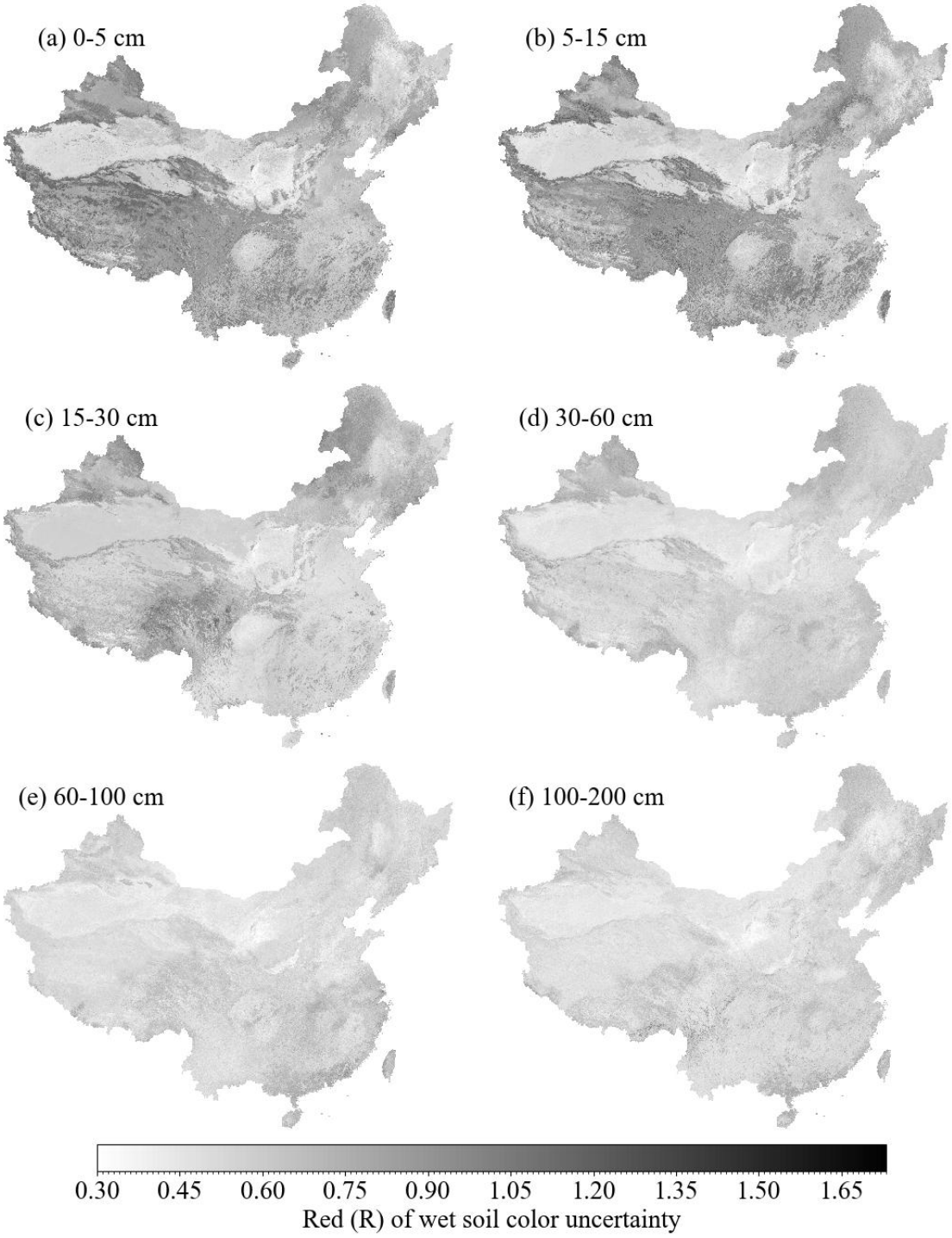


Figure S21. The maps of uncertainty of the red (R) component of wet soil color predictions at the six depth intervals.

S8.3 Variable importance

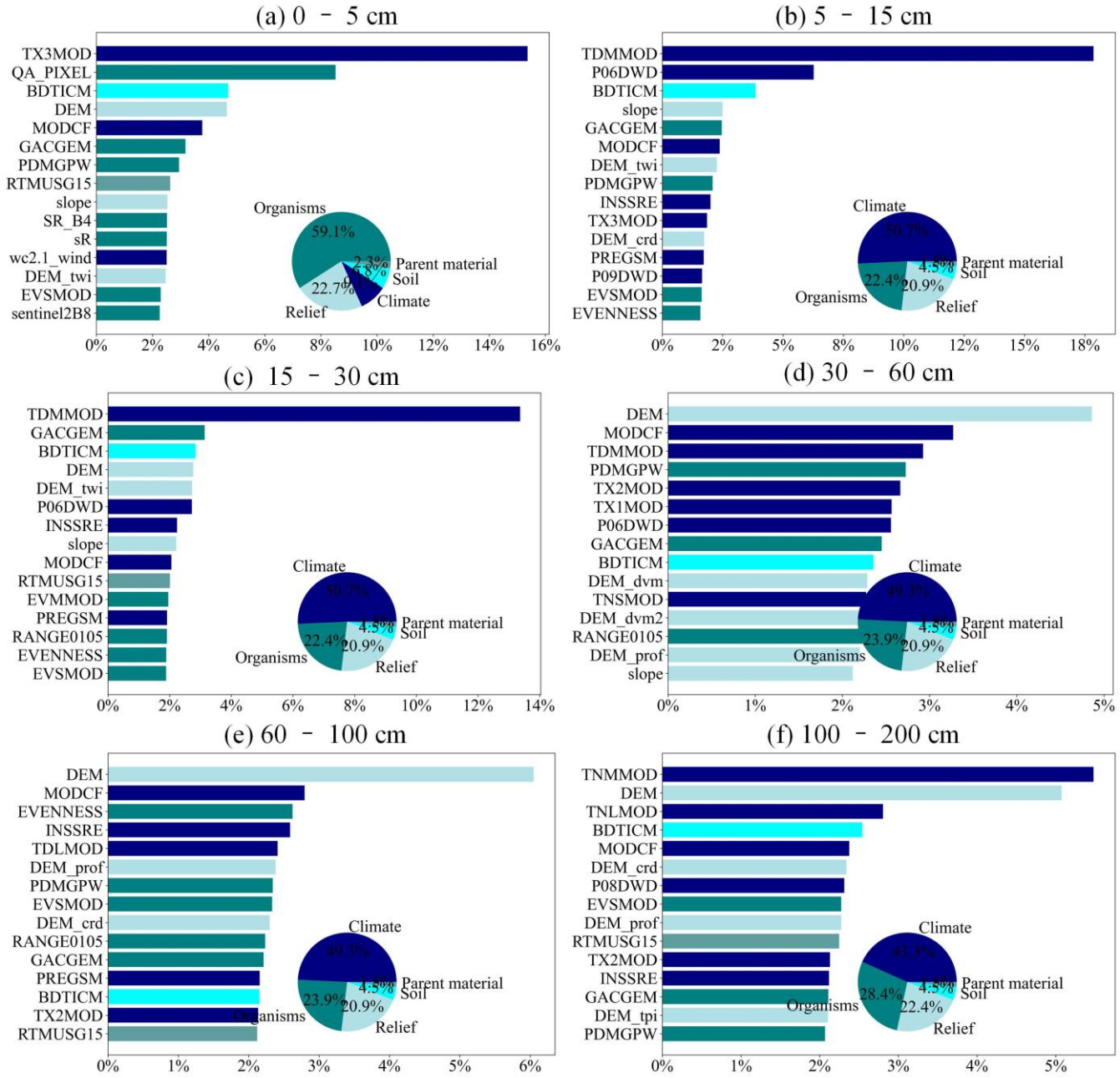


Figure S22. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the red (R) component of wet soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S9 Green (G) of wet soil color

S9.1 Prediction maps

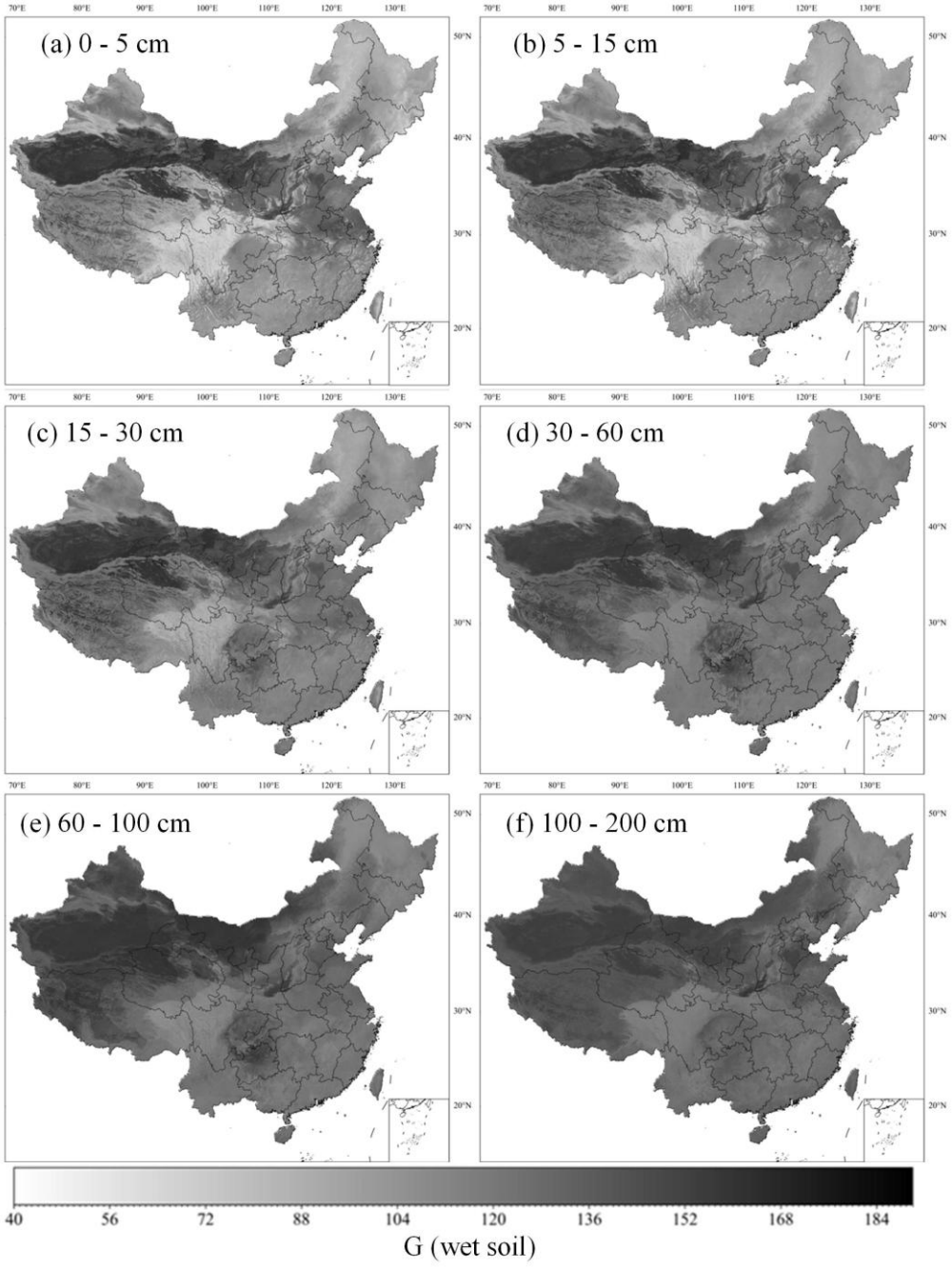


Figure S23. The predicted maps of the green (G) component of wet soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The G component represents the green channel in the RGB soil color system.

S9.2 Accuracy assessment

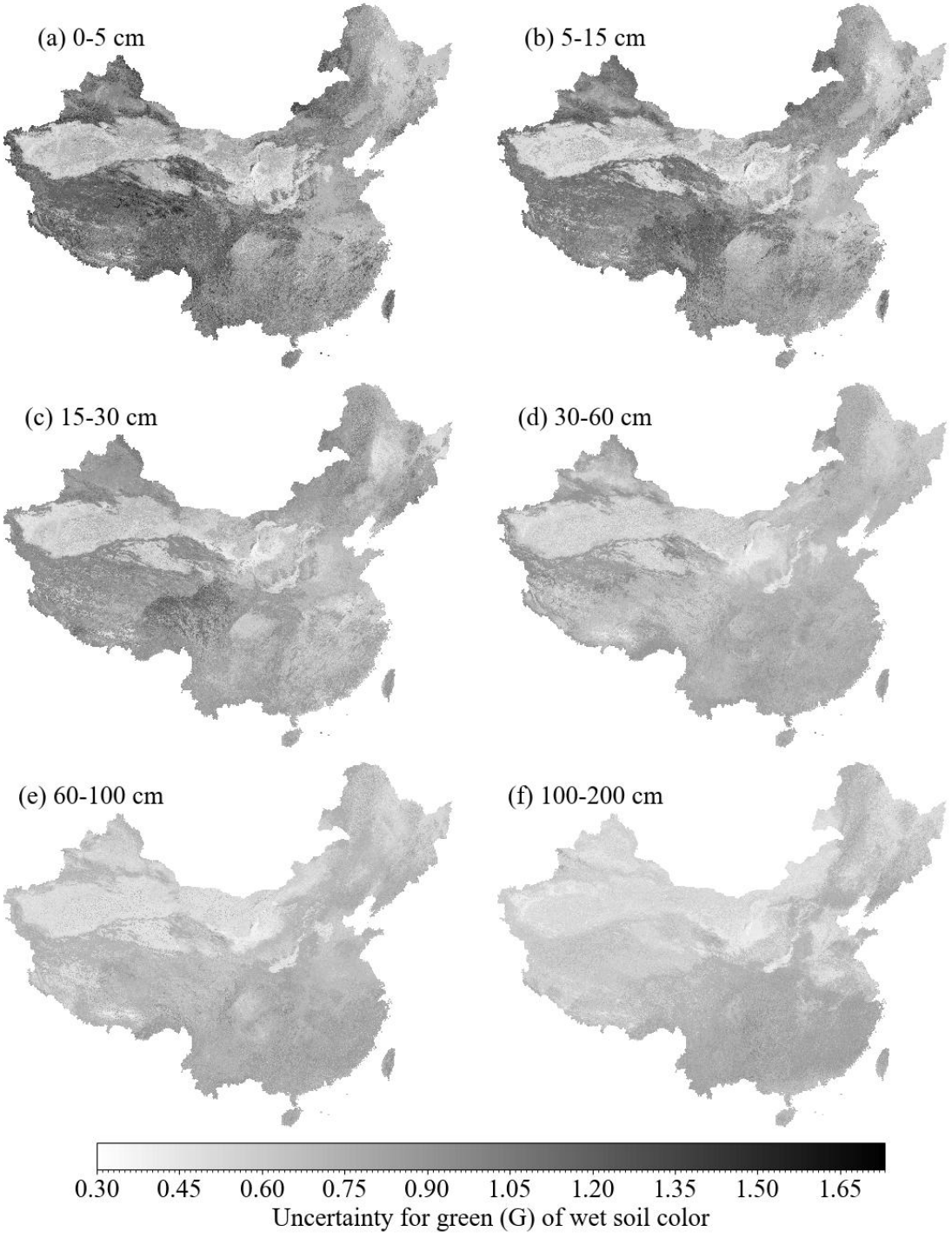


Figure S24. The maps of uncertainty of the green (G) component of wet soil color predictions at the six depth intervals.

S9.3 Variable importance

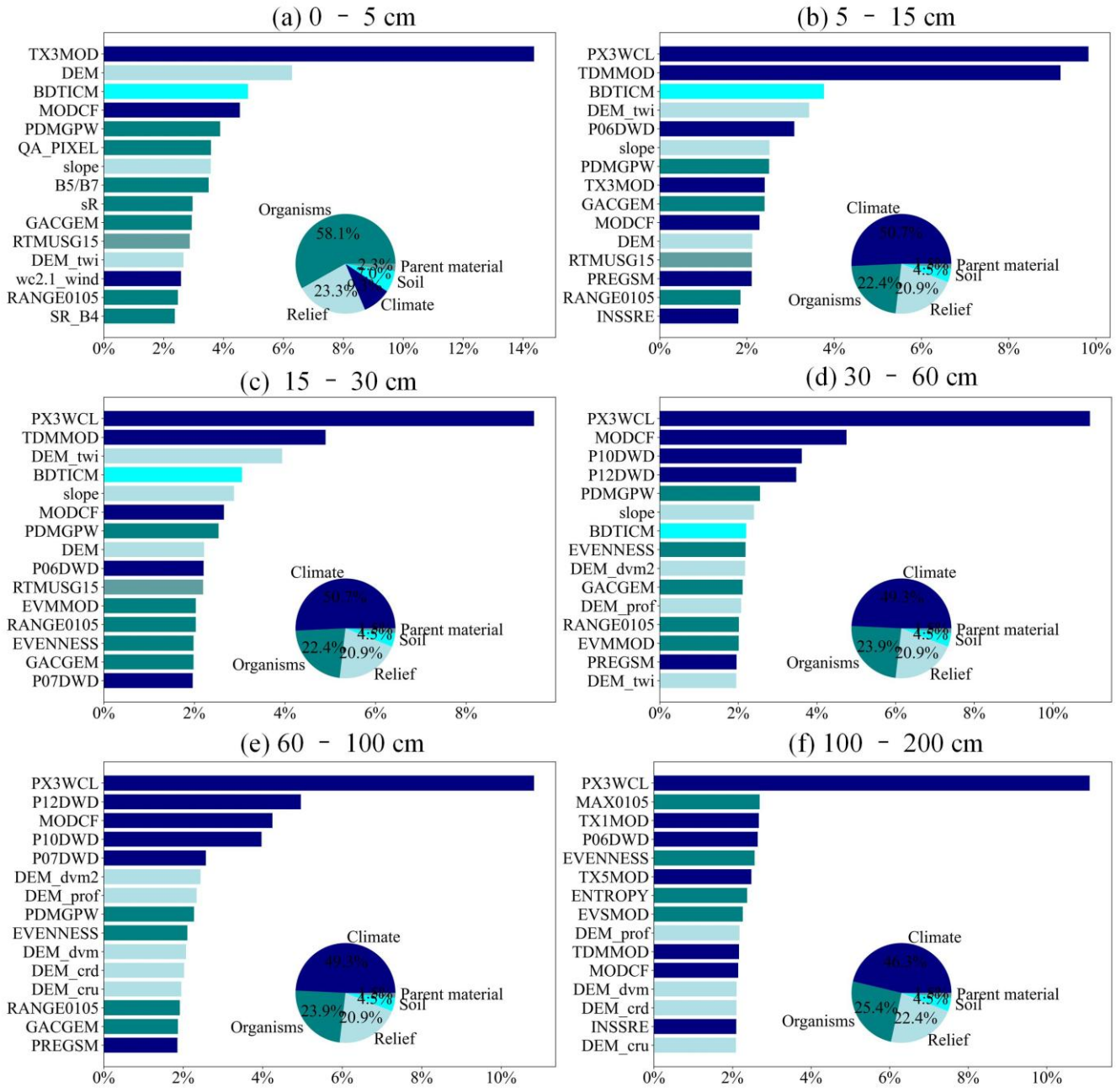


Figure S25. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the green (G) component of wet soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S10 Blue (B) of wet soil color

S10.1 Prediction maps

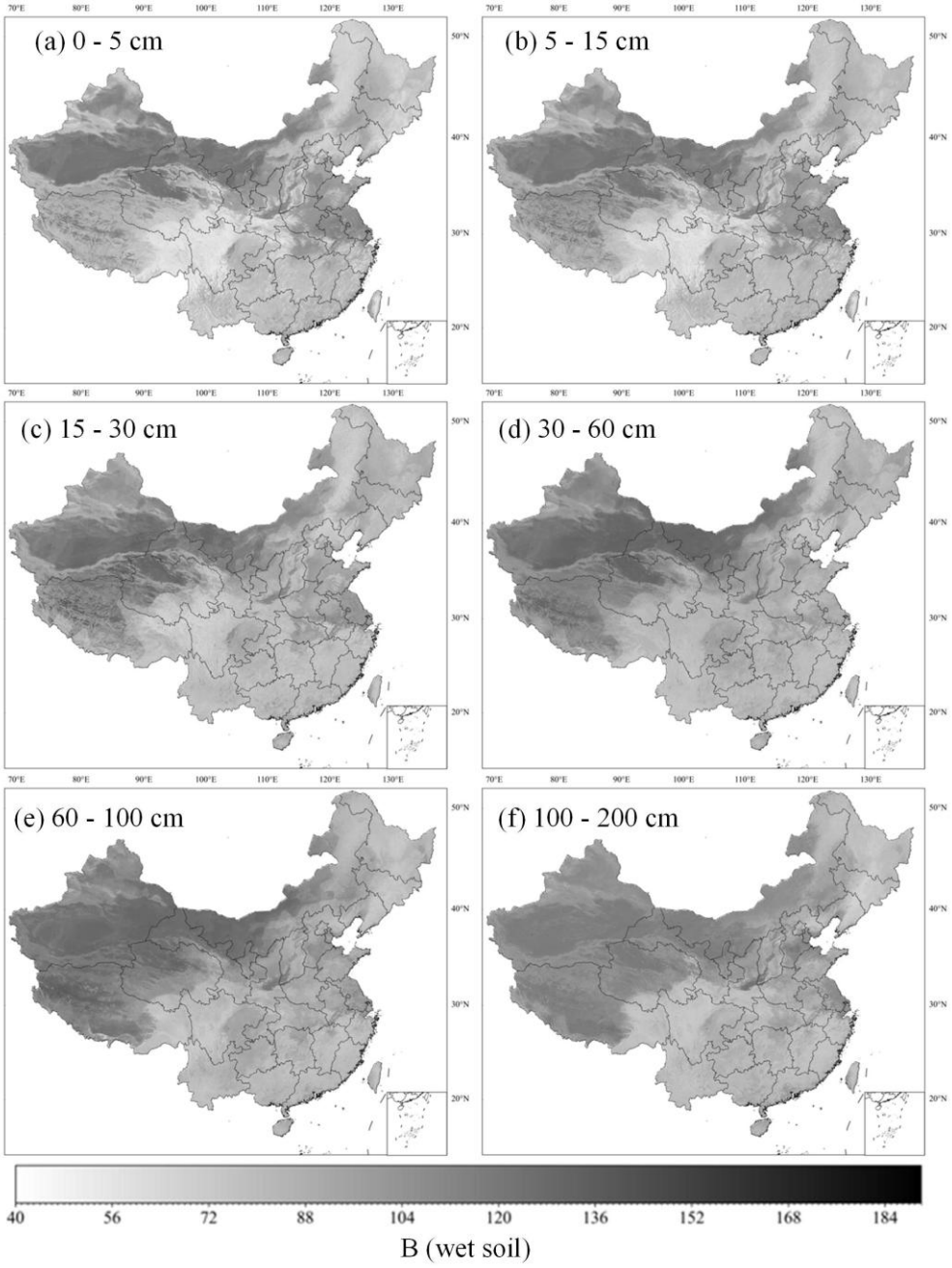


Figure S26. The predicted maps of the blue (B) component of wet soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The B component represents the blue channel in the RGB soil color system.

105 **S10.2 Accuracy assessment**

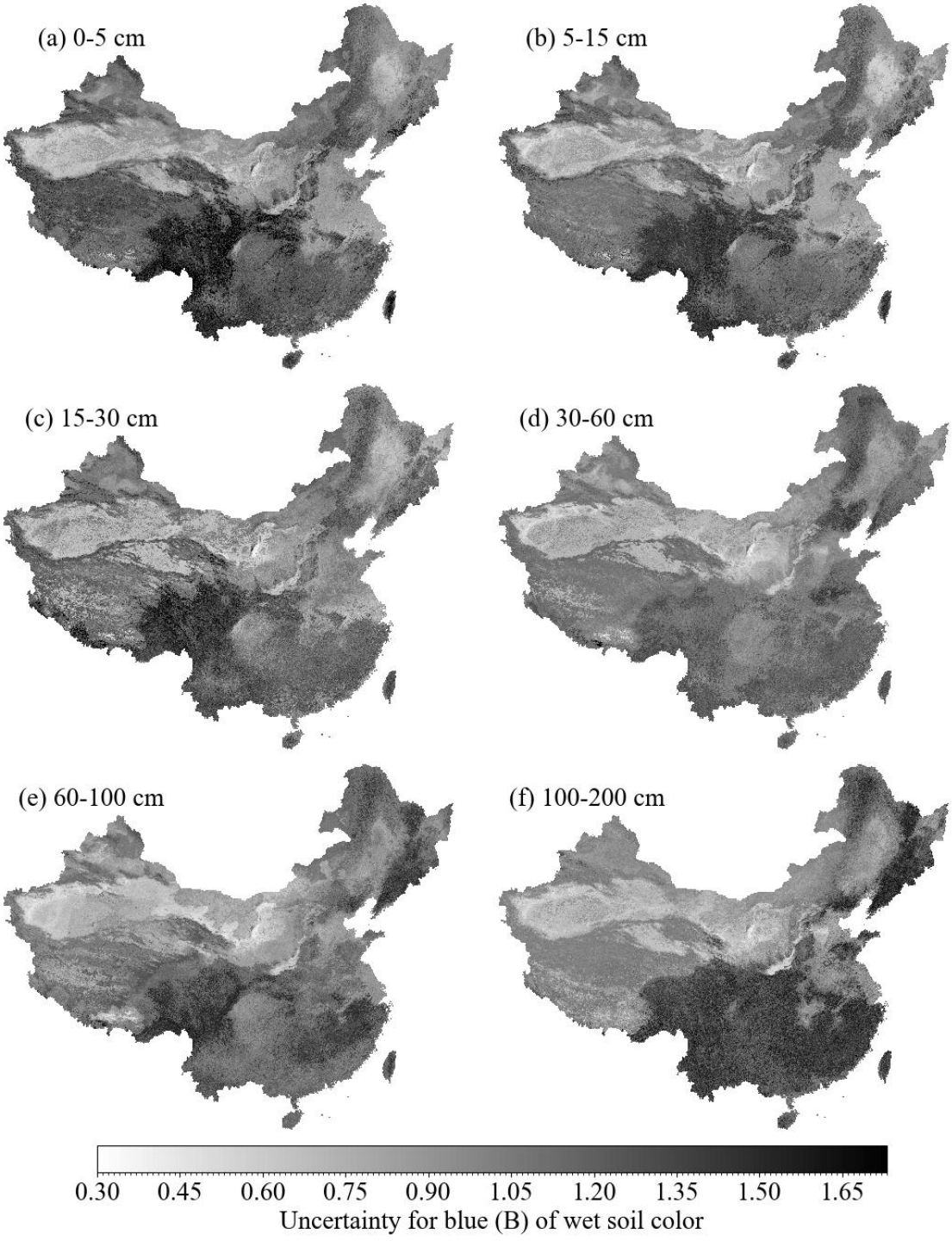


Figure S27. The maps of uncertainty of the blue (B) component of wet soil color predictions at the six depth intervals.

S10.3 Variable importance

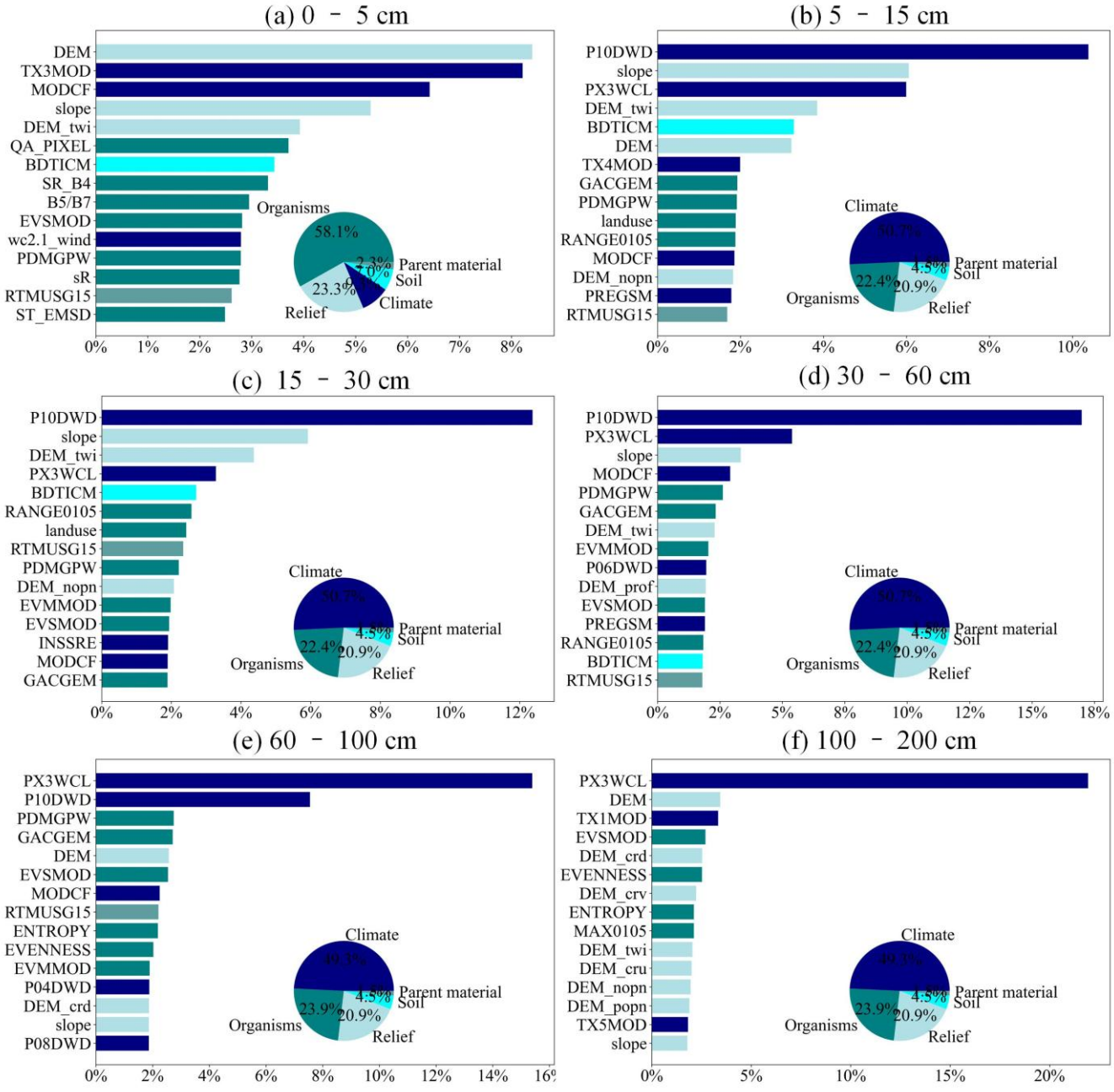
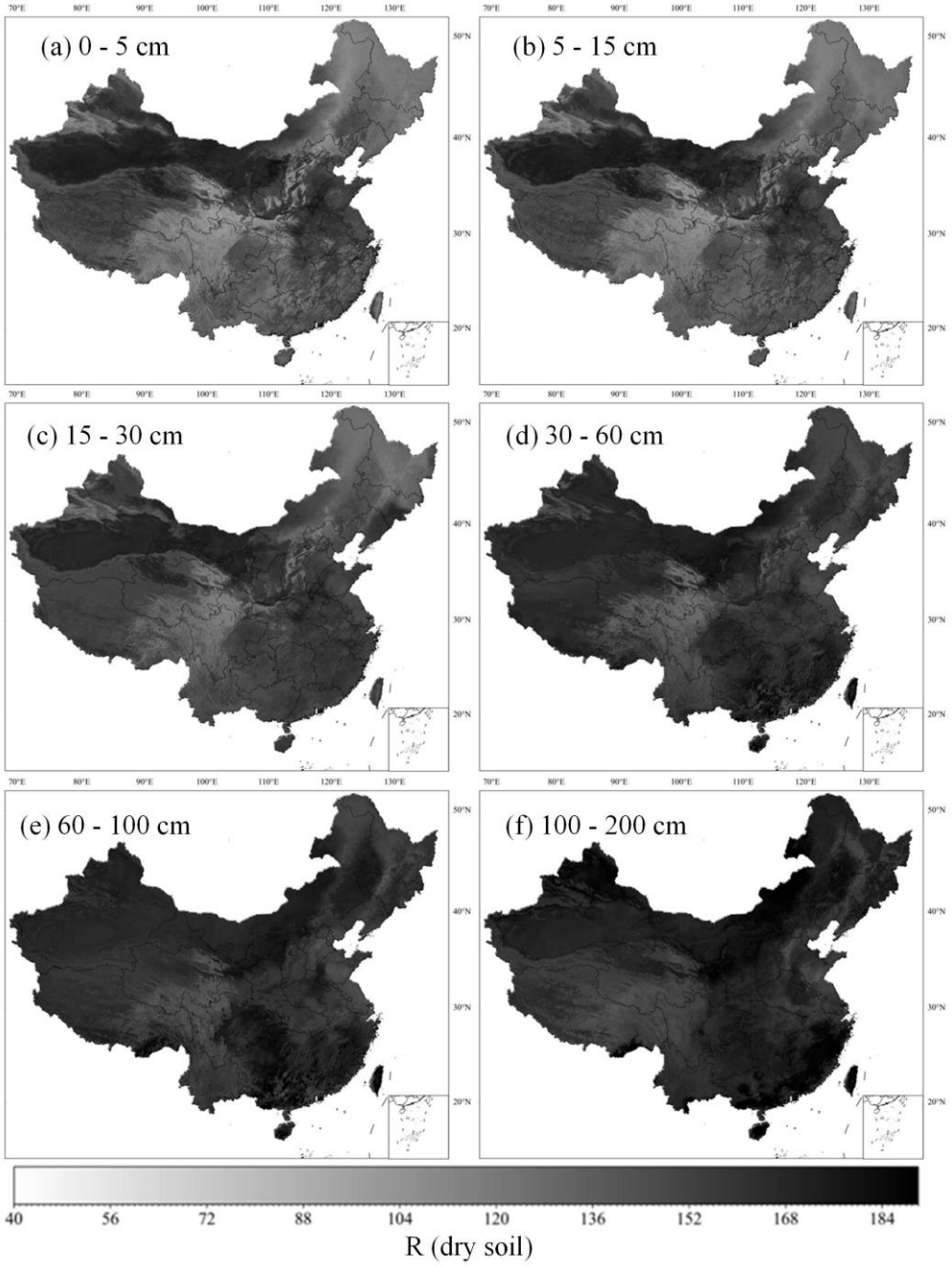


Figure S28. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the blue (B) component of wet soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S11 Red (R) of dry soil color

S11.1 Prediction maps



115 **Figure S29.** The predicted maps of the red (R) component of dry soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The R component represents the red channel in the RGB soil color system.

S11.2 Accuracy assessment

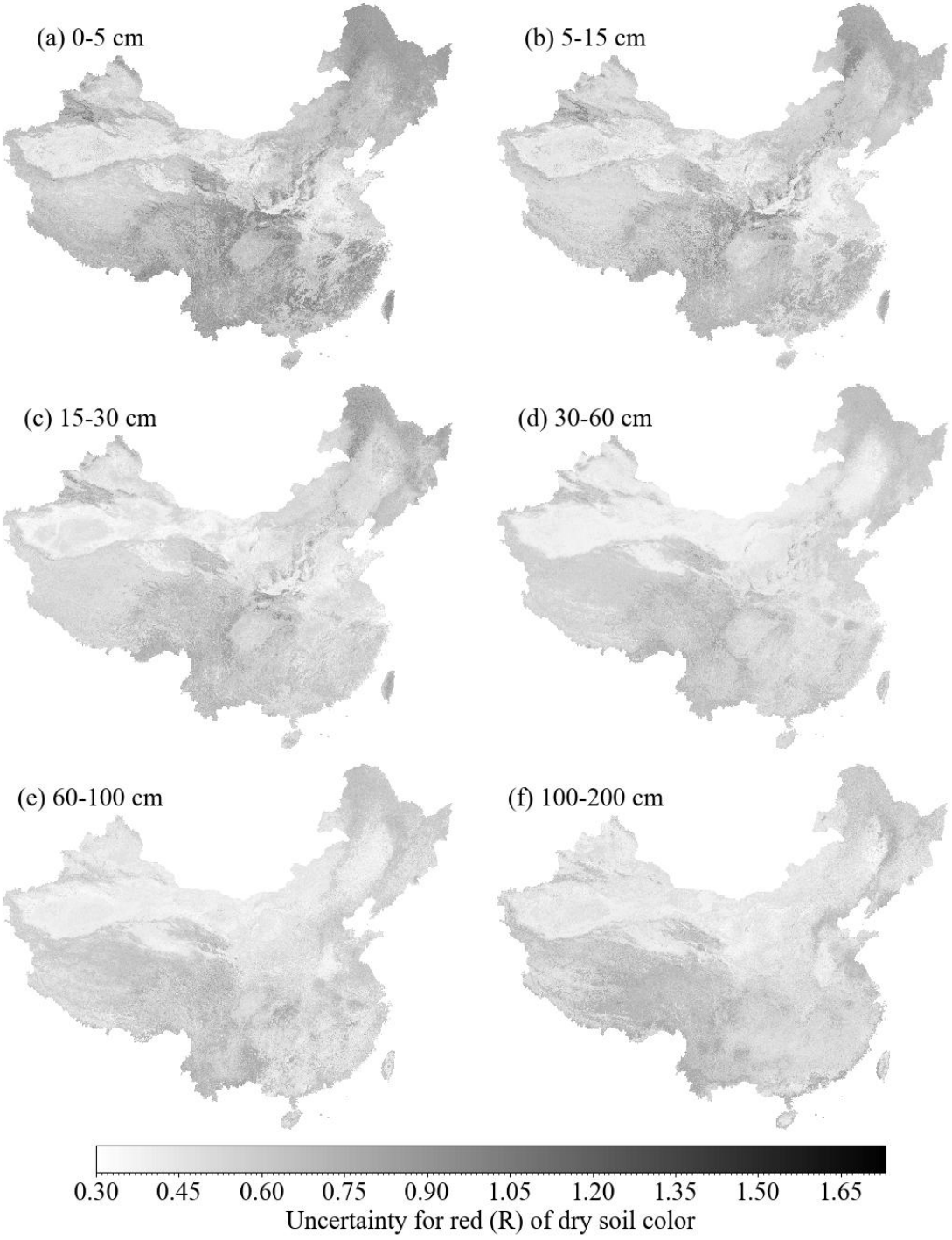


Figure S30. The maps of uncertainty of the red (R) component of dry soil color predictions at the six depth intervals.

S11.3 Variable importance

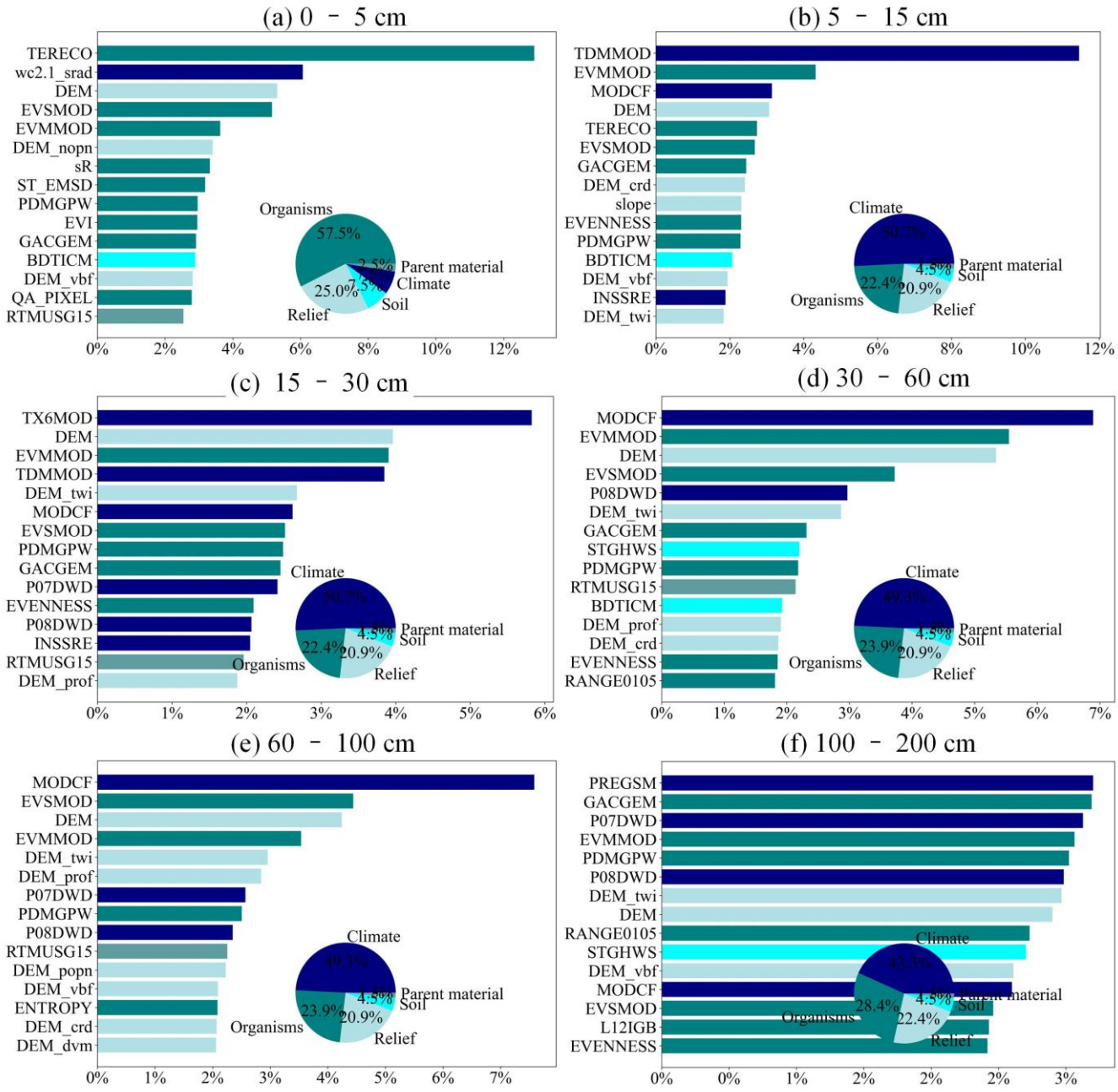


Figure S31. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the red (R) component of dry soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S12 Green (G) of dry soil color

S12.1 Prediction maps

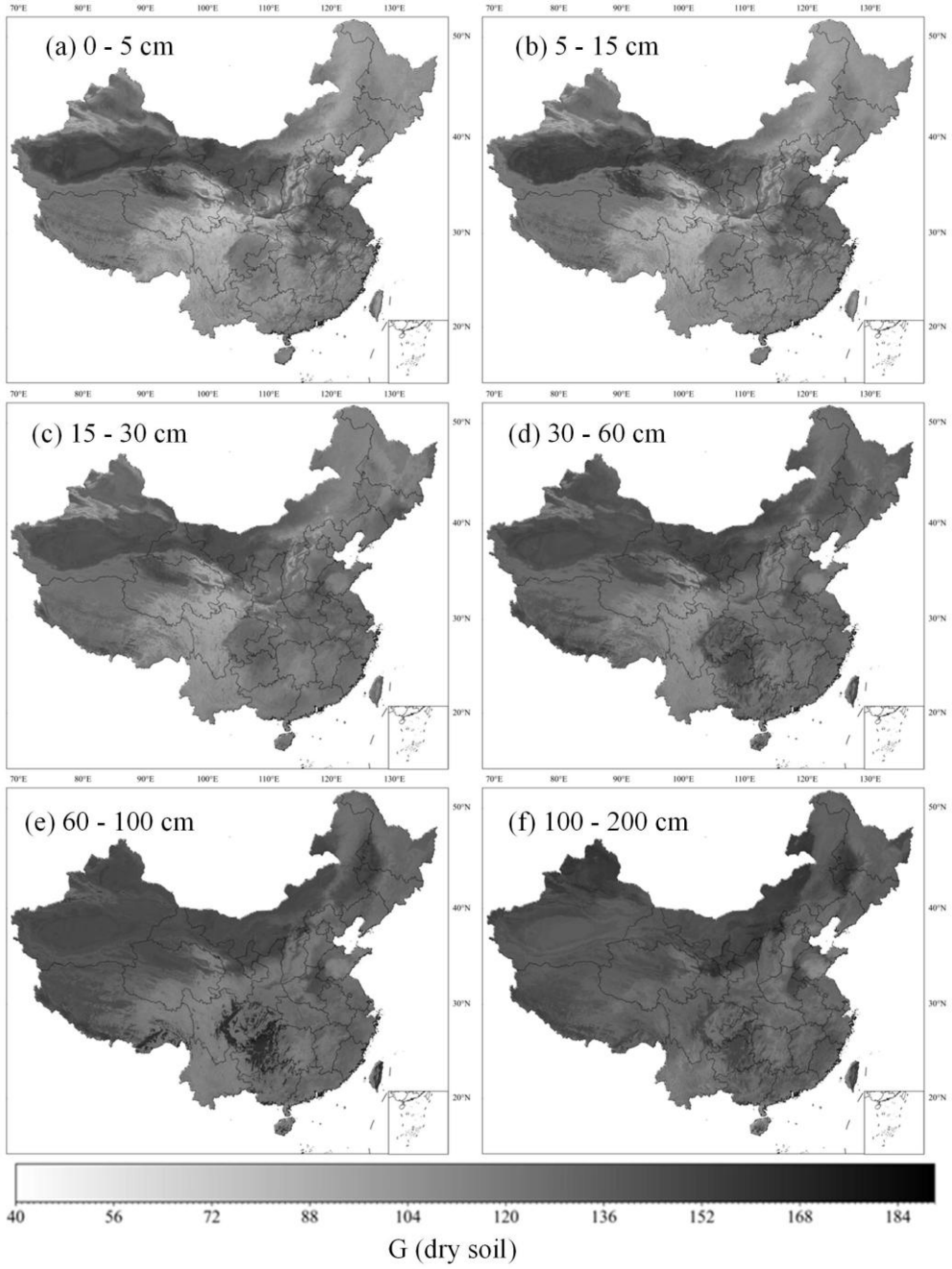


Figure S32. The predicted maps of the green (G) component of dry soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The G component represents the green channel in the RGB soil color system.

S12.2 Accuracy assessment

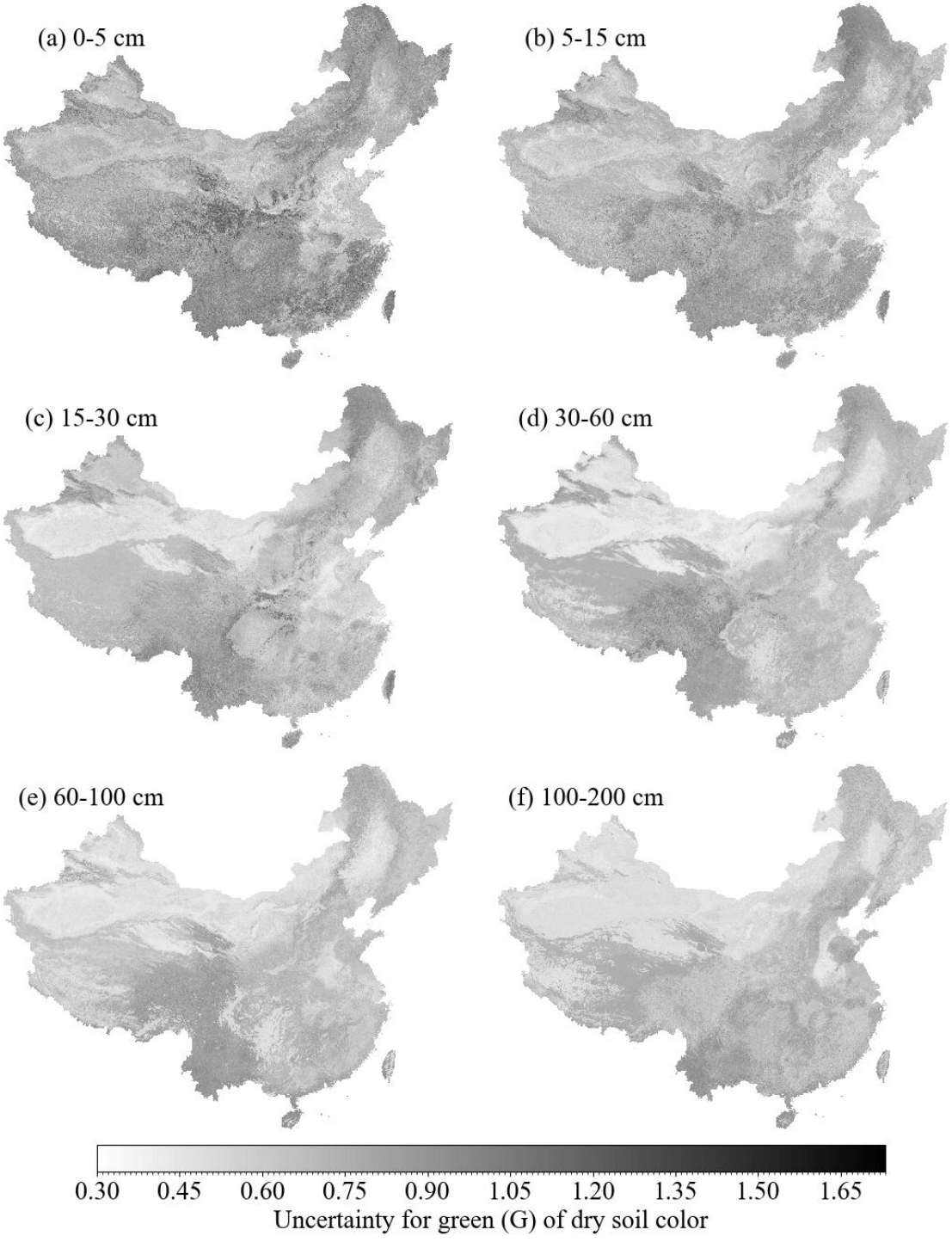


Figure S33. The maps of uncertainty of the green (G) component of dry soil color predictions at the six depth intervals.

S12.3 Variable importance

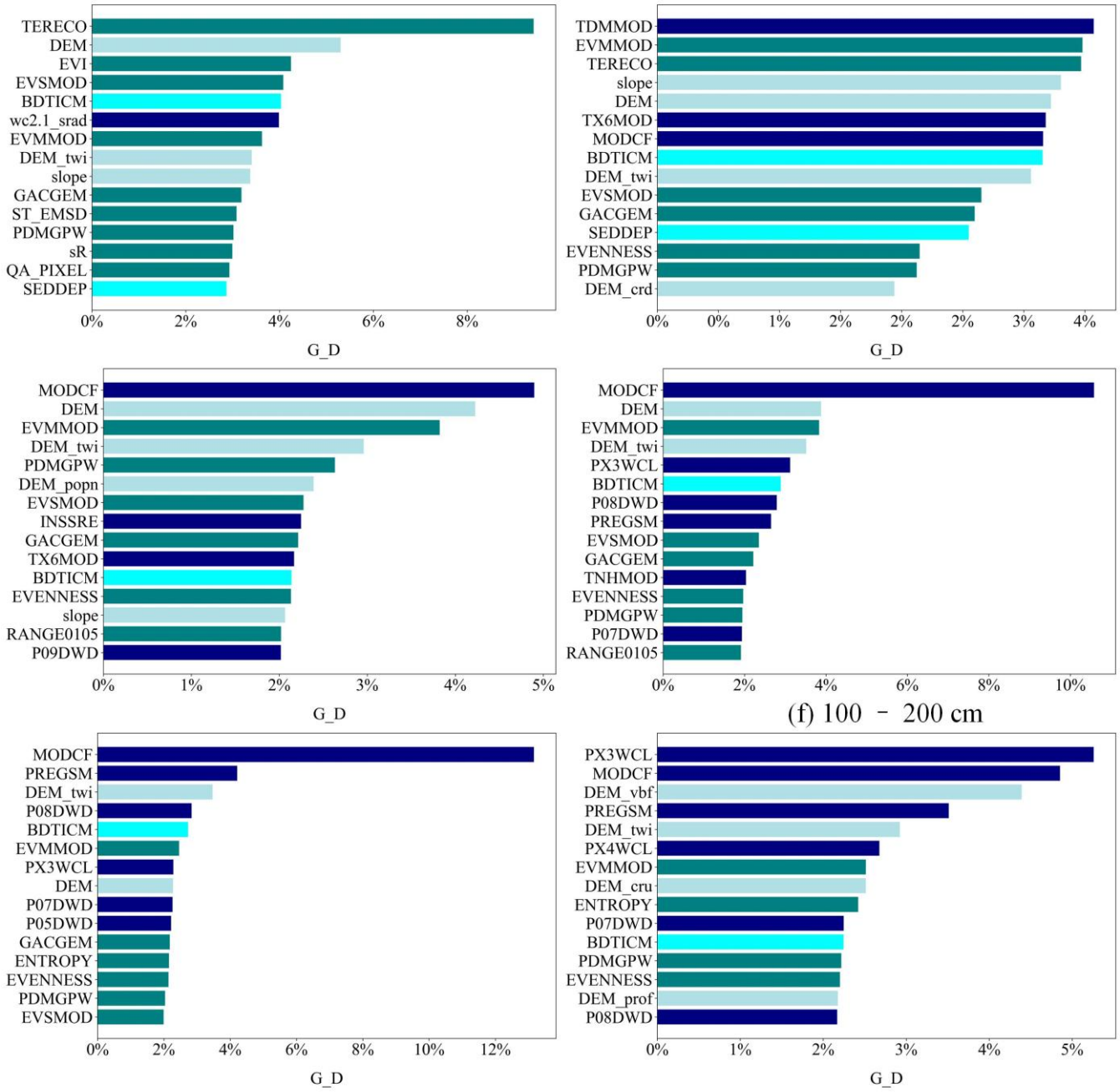


Figure S34. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the green (G) component of dry soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S13 Blue (B) of dry soil color

S13.1 Prediction maps

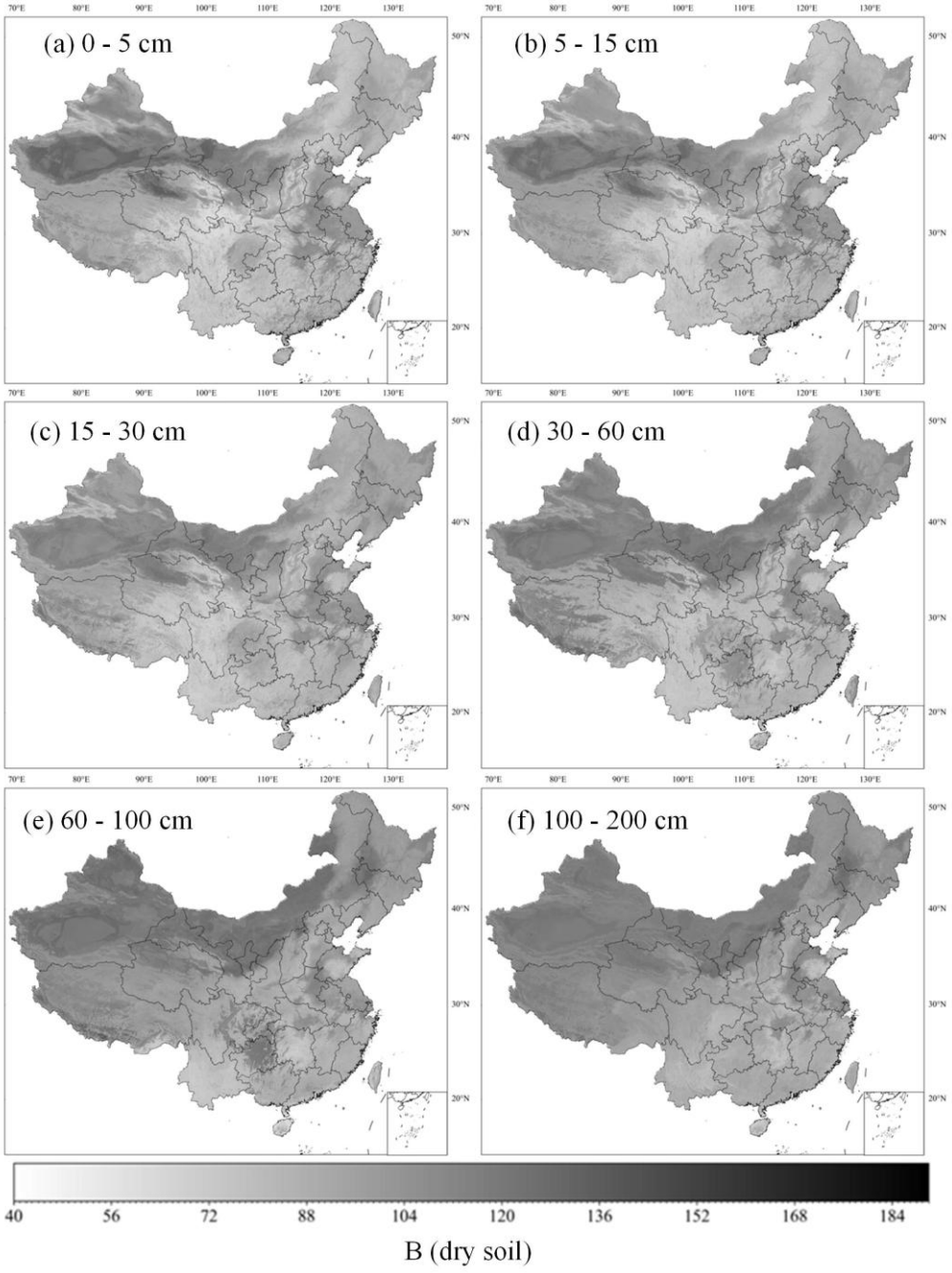


Figure S35. The predicted maps of the blue (B) component of dry soil color at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm; and (f) 100-200 cm depth interval. The B component represents the blue channel in the RGB soil color system.

S13.2 Accuracy assessment

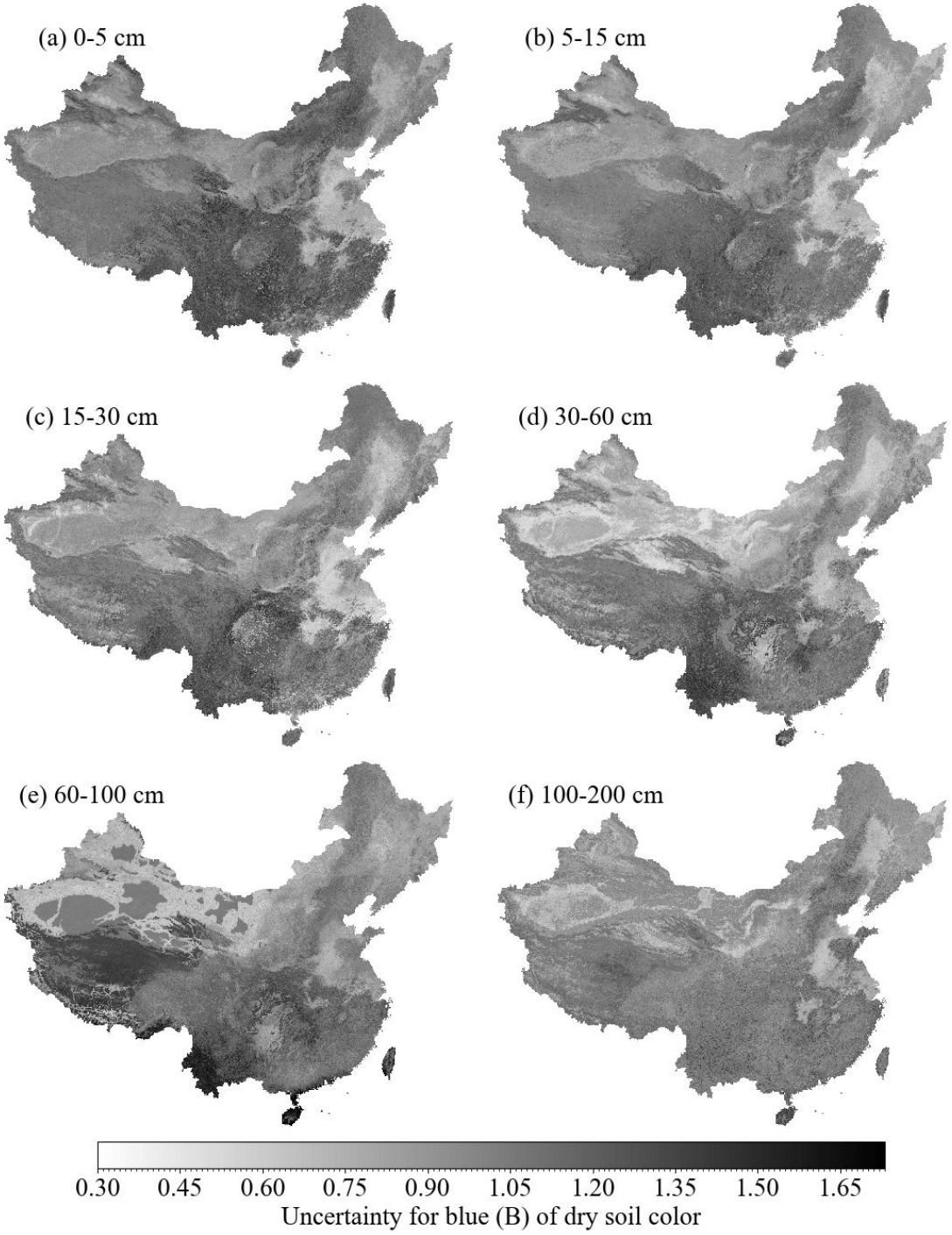
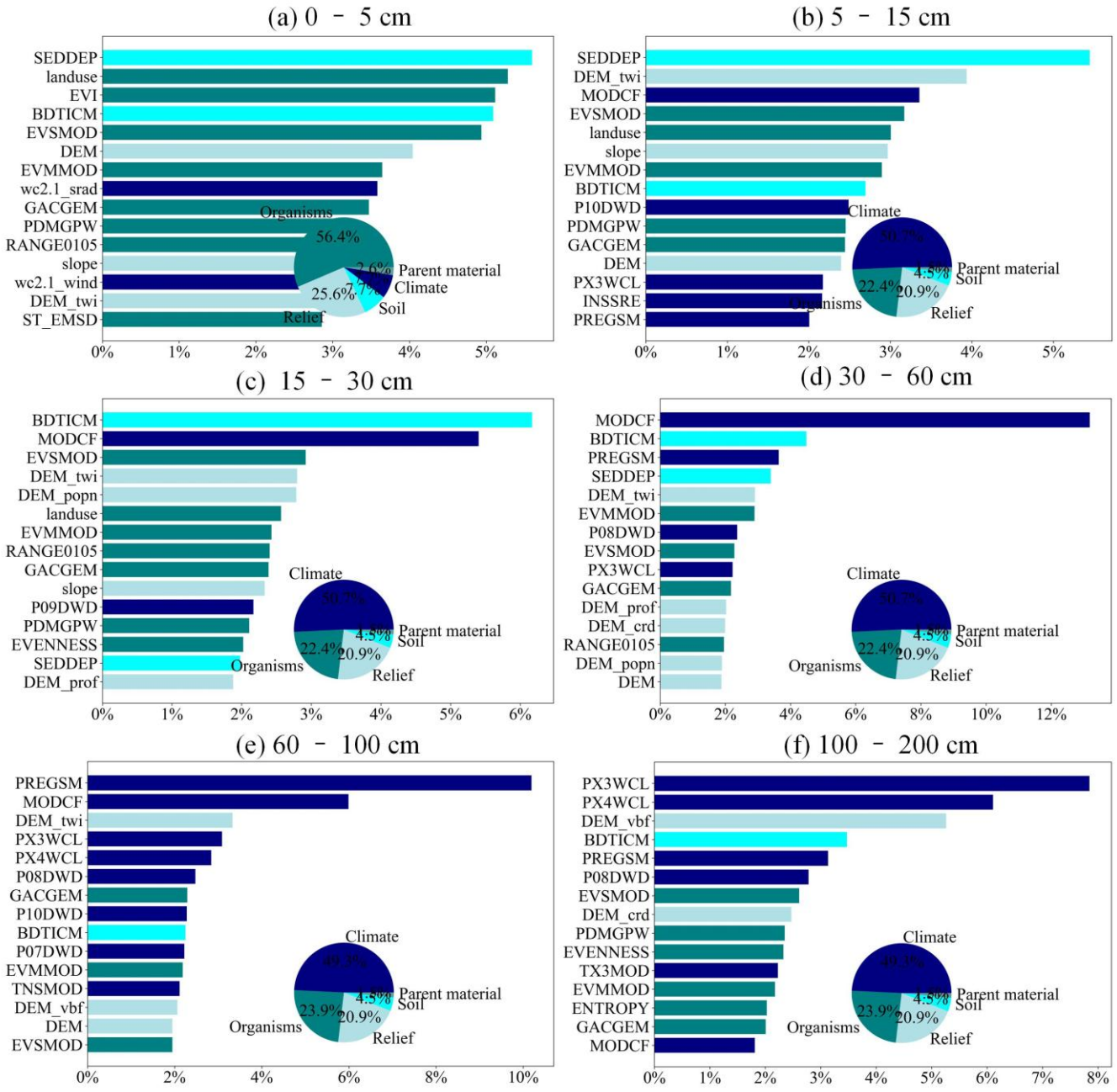


Figure S36. The maps of uncertainty of the blue (B) component of dry soil color predictions at the six depth intervals.

S13.3 Variable importance



145

Figure S37. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of the blue (B) component of dry soil color at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S14 Wet soil colours

S14.1 Prediction maps

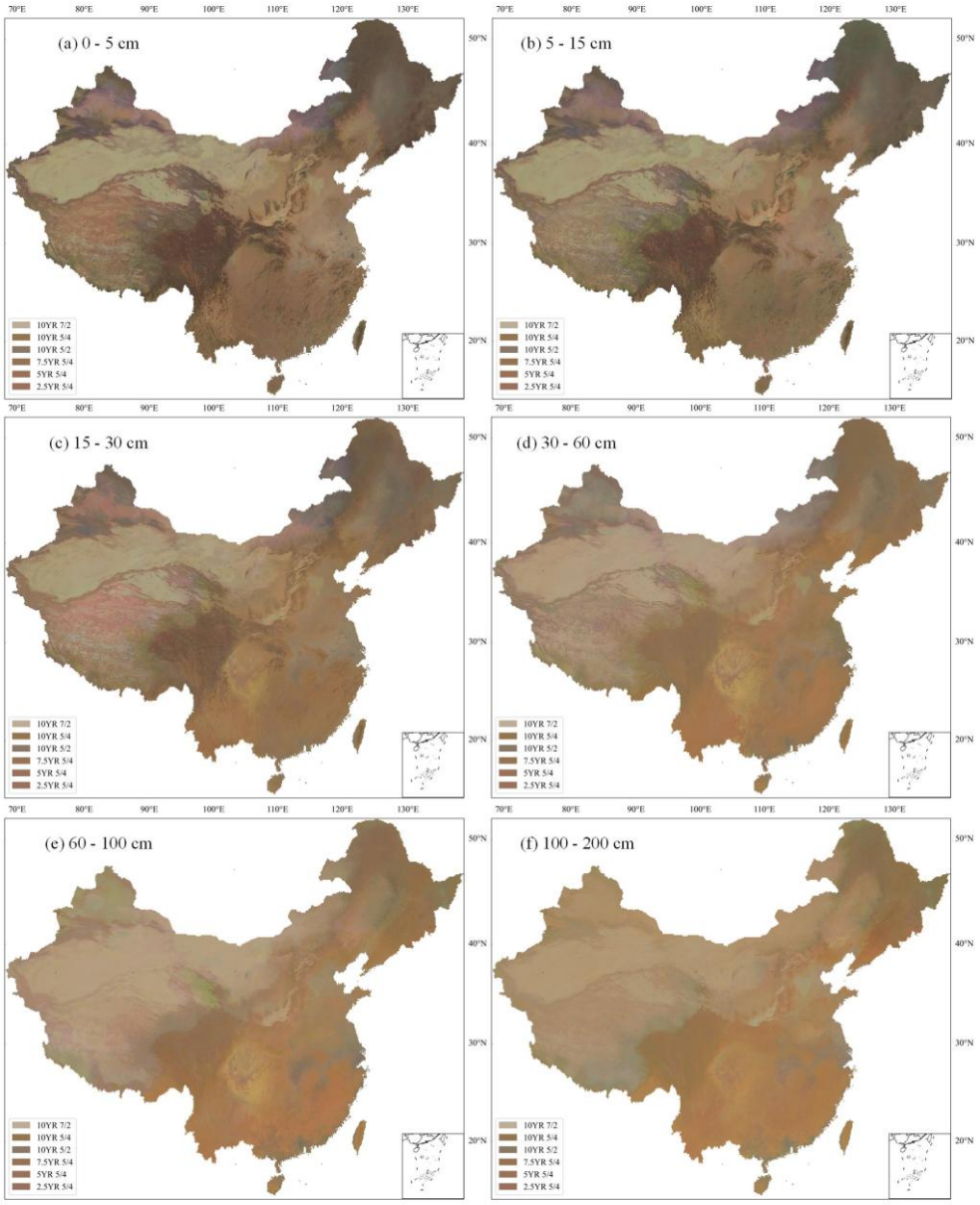


Figure S38. The predicted maps of wet soil colours at multiple depths. The colour bar only displays six representative colours, with some less distinctive colours aggregated for clarity. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S15 Dry soil colours

S15.1 Prediction maps

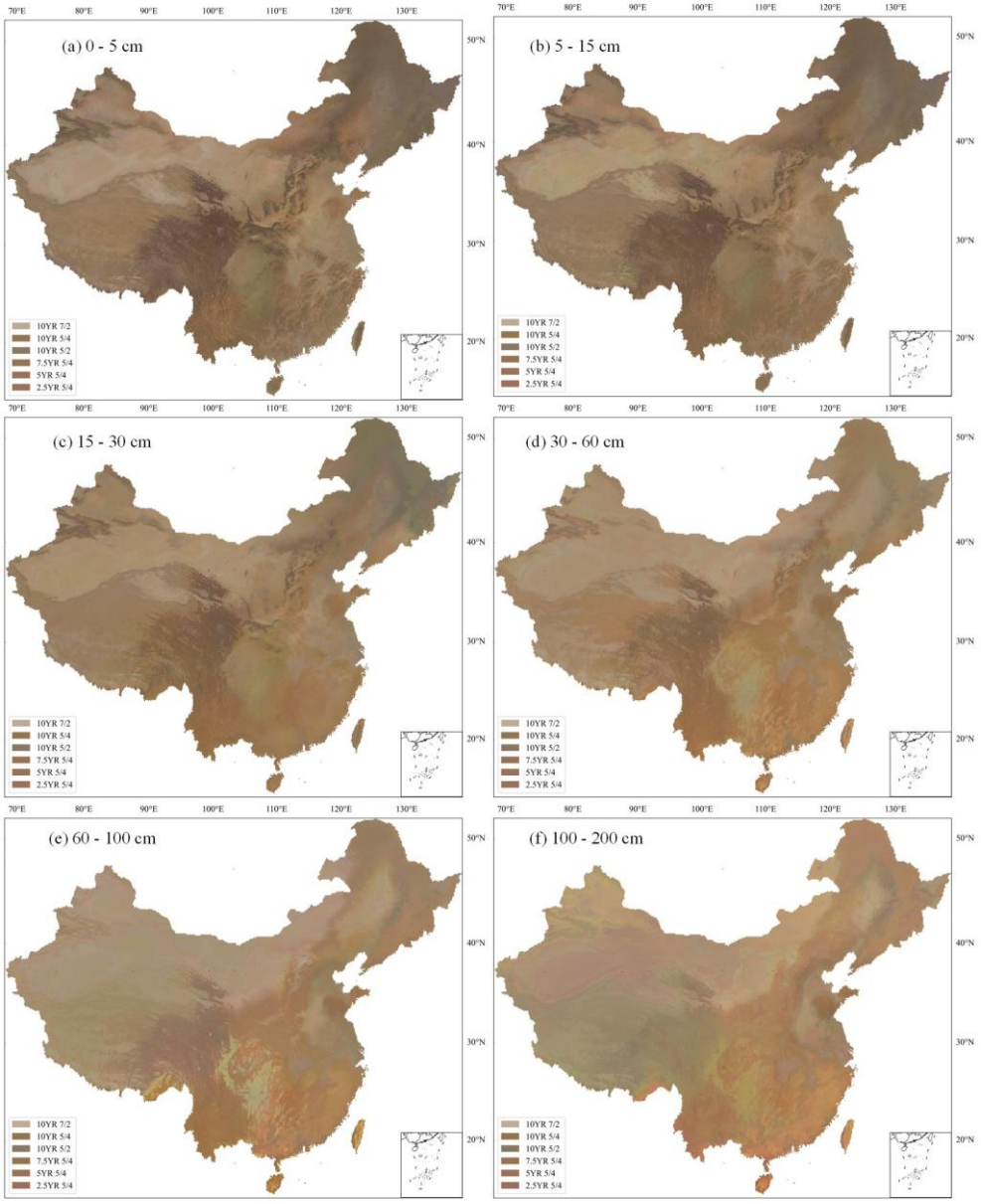


Figure S39. The predicted maps of dry soil colours at multiple depths. The colour bar only displays six representative colours, with some less distinctive colours aggregated for clarity. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S16 pH

S16.1 Prediction maps

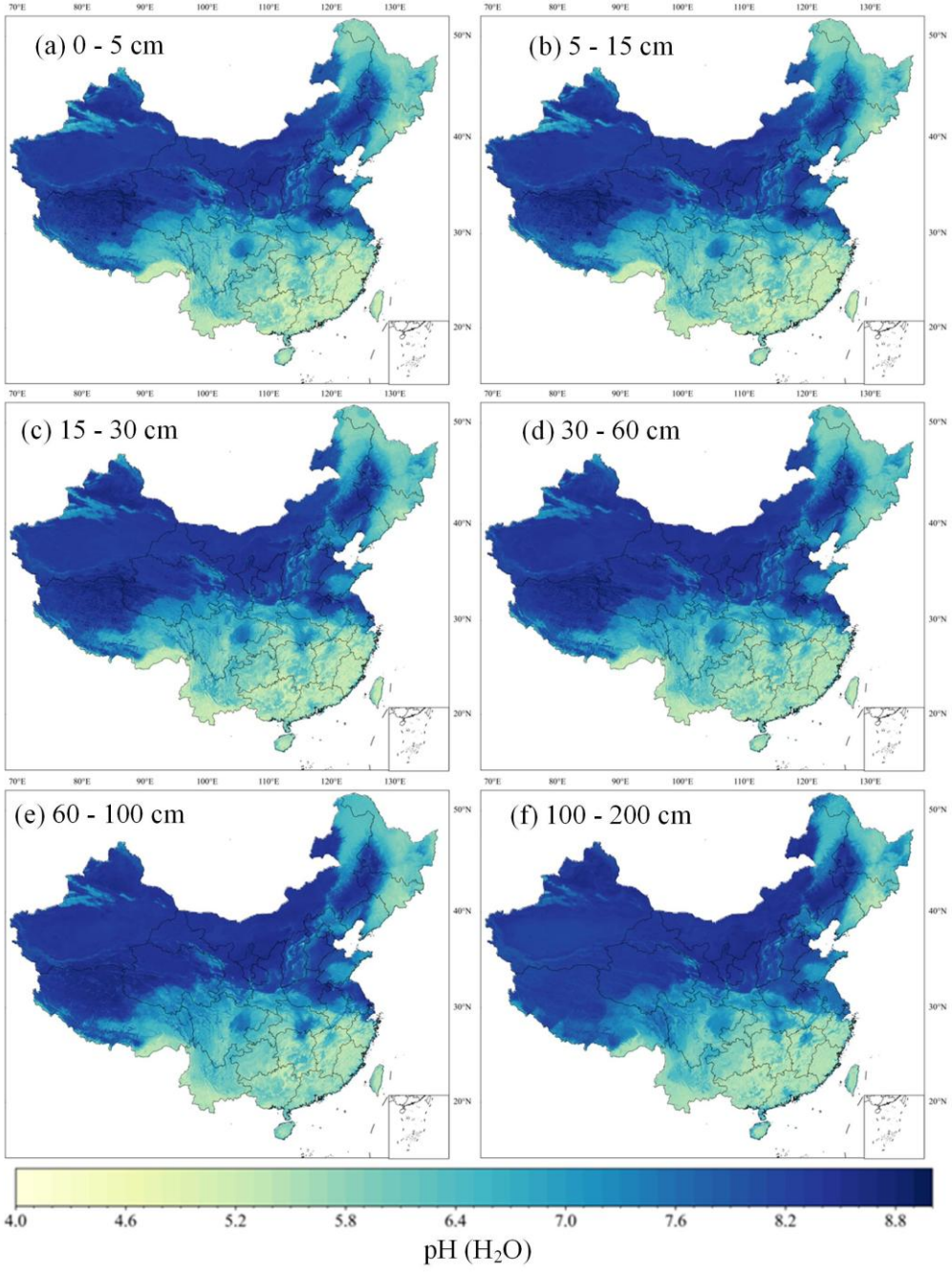


Figure S40. The predicted maps of soil pH at multiple depths. (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S16.2 Accuracy assessment

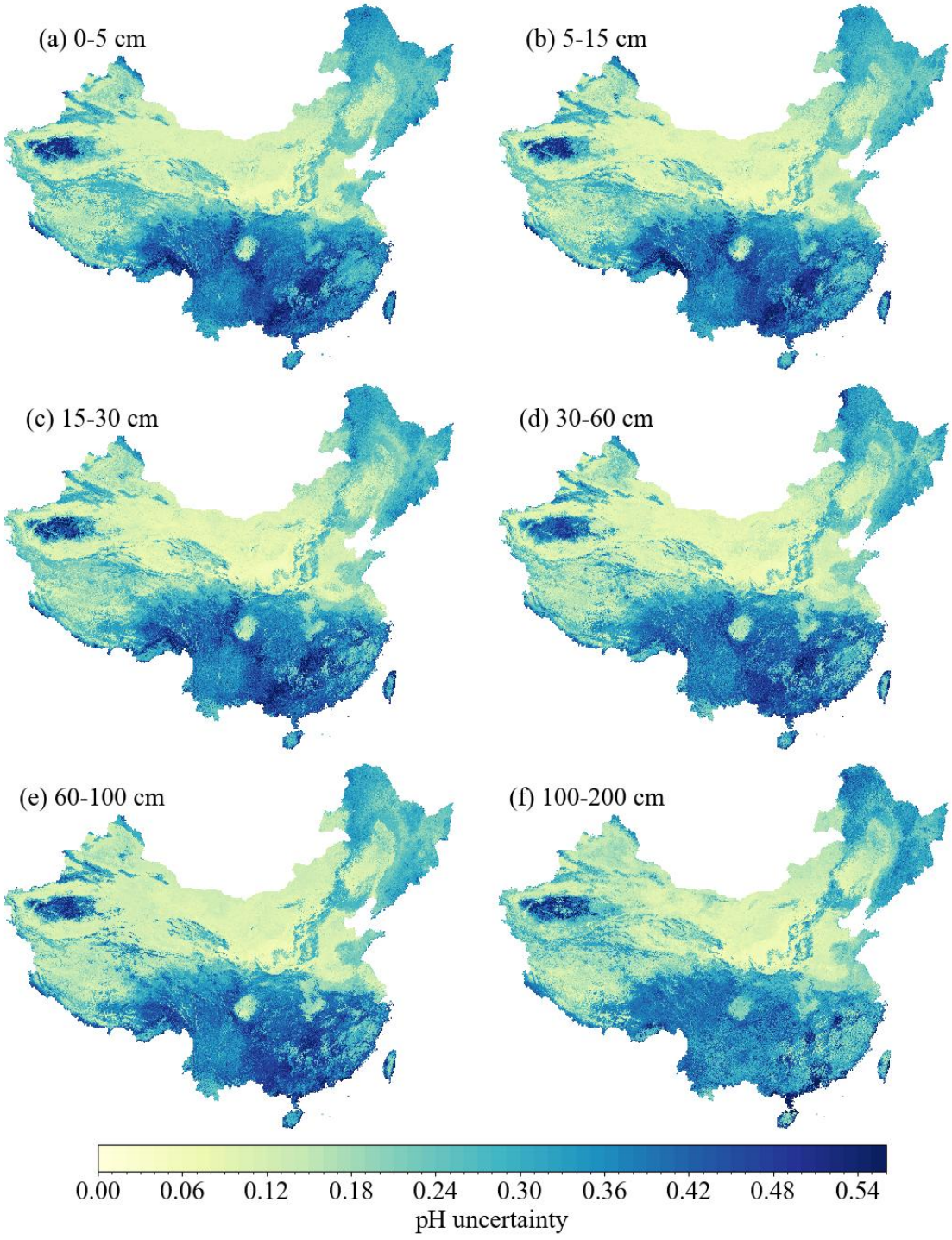


Figure S41. The maps of uncertainty of soil soil pH predictions at the six depth intervals.

S16.3 Variable importance

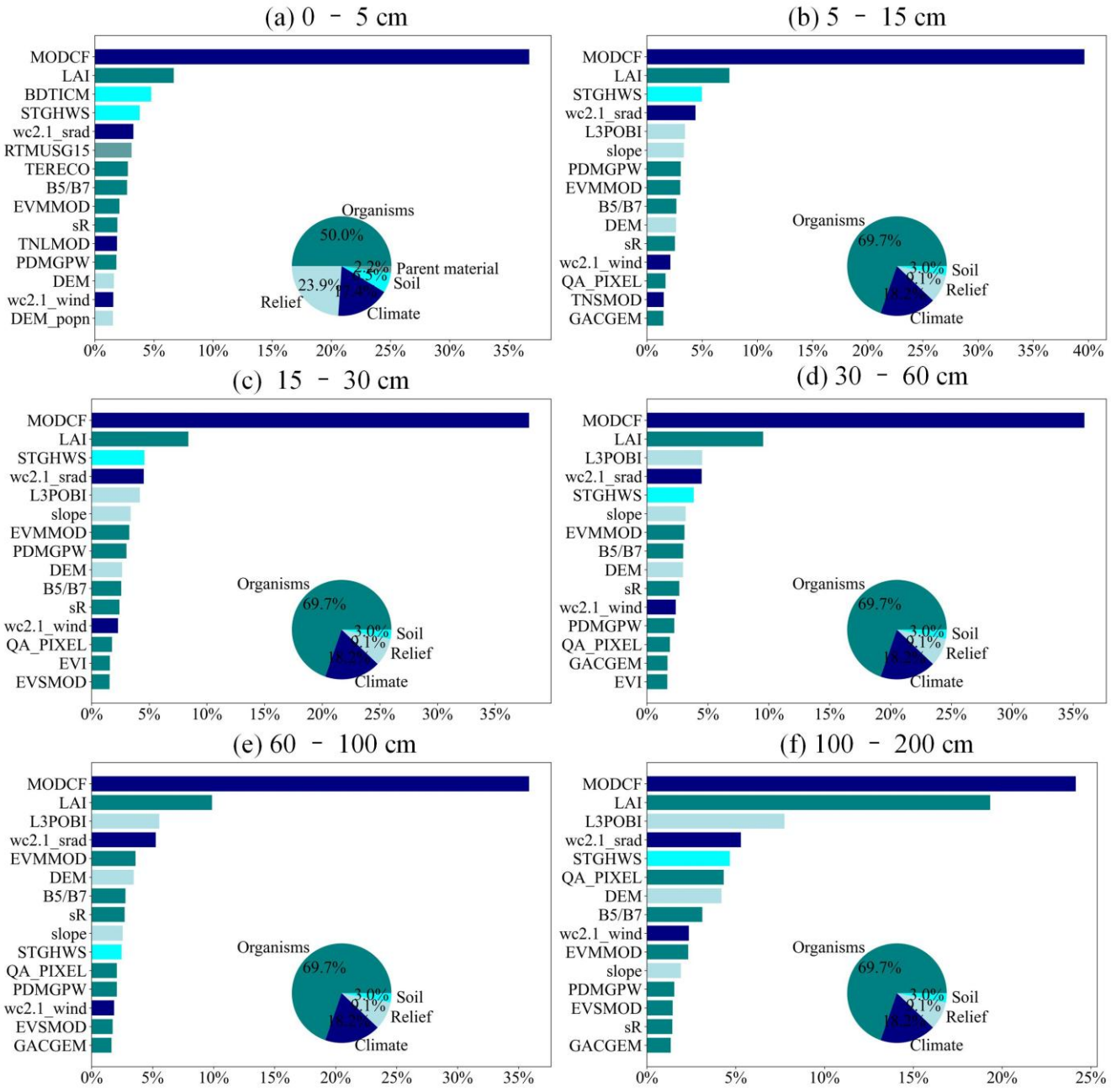
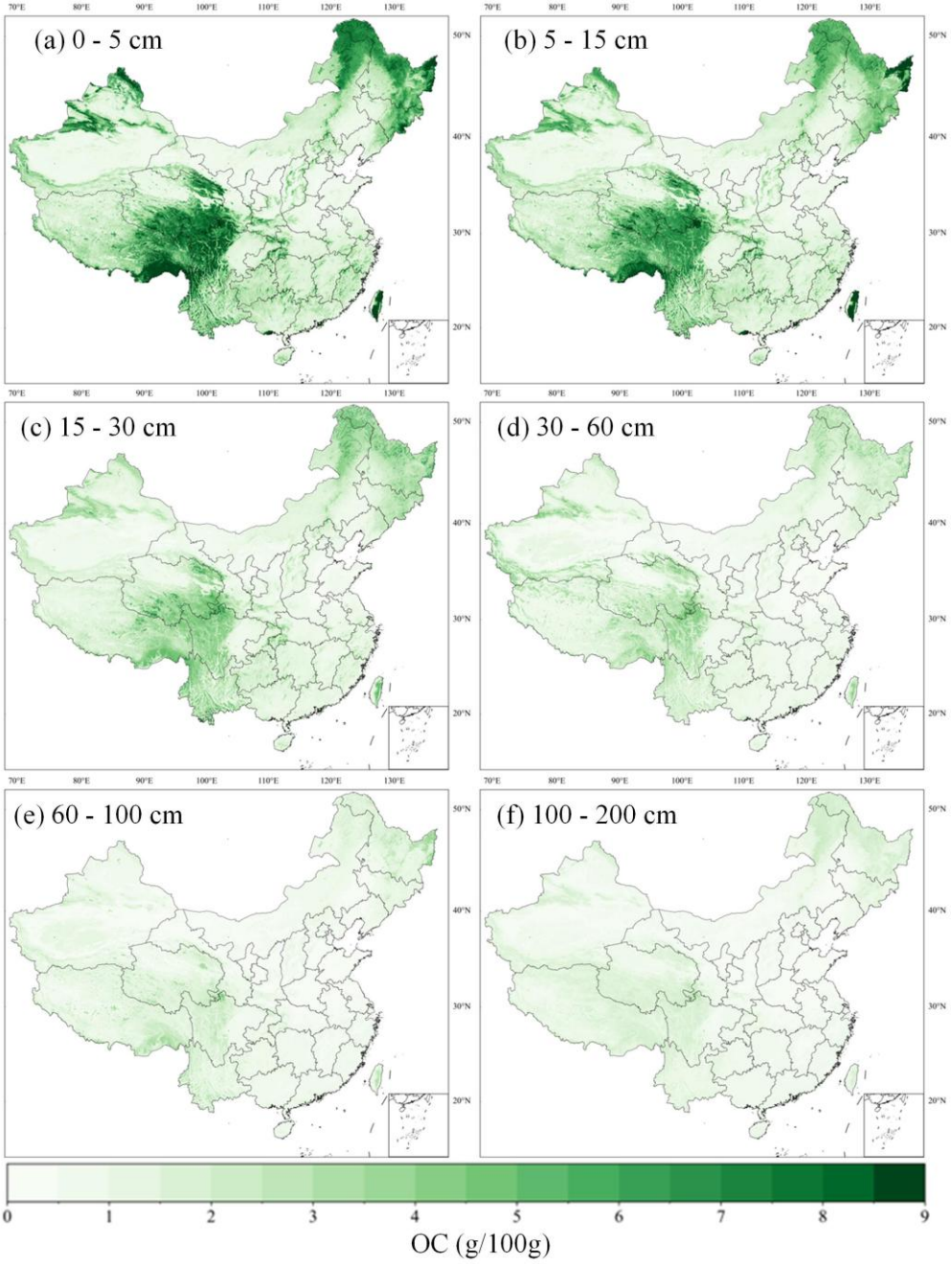


Figure S42. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of soil pH at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S17 Soil organic carbon (OC)

S17.1 Prediction maps



175 **Figure S43.** The predicted maps of soil organic carbon (OC) content at multiple depths (g/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S17.2 Accuracy assessment

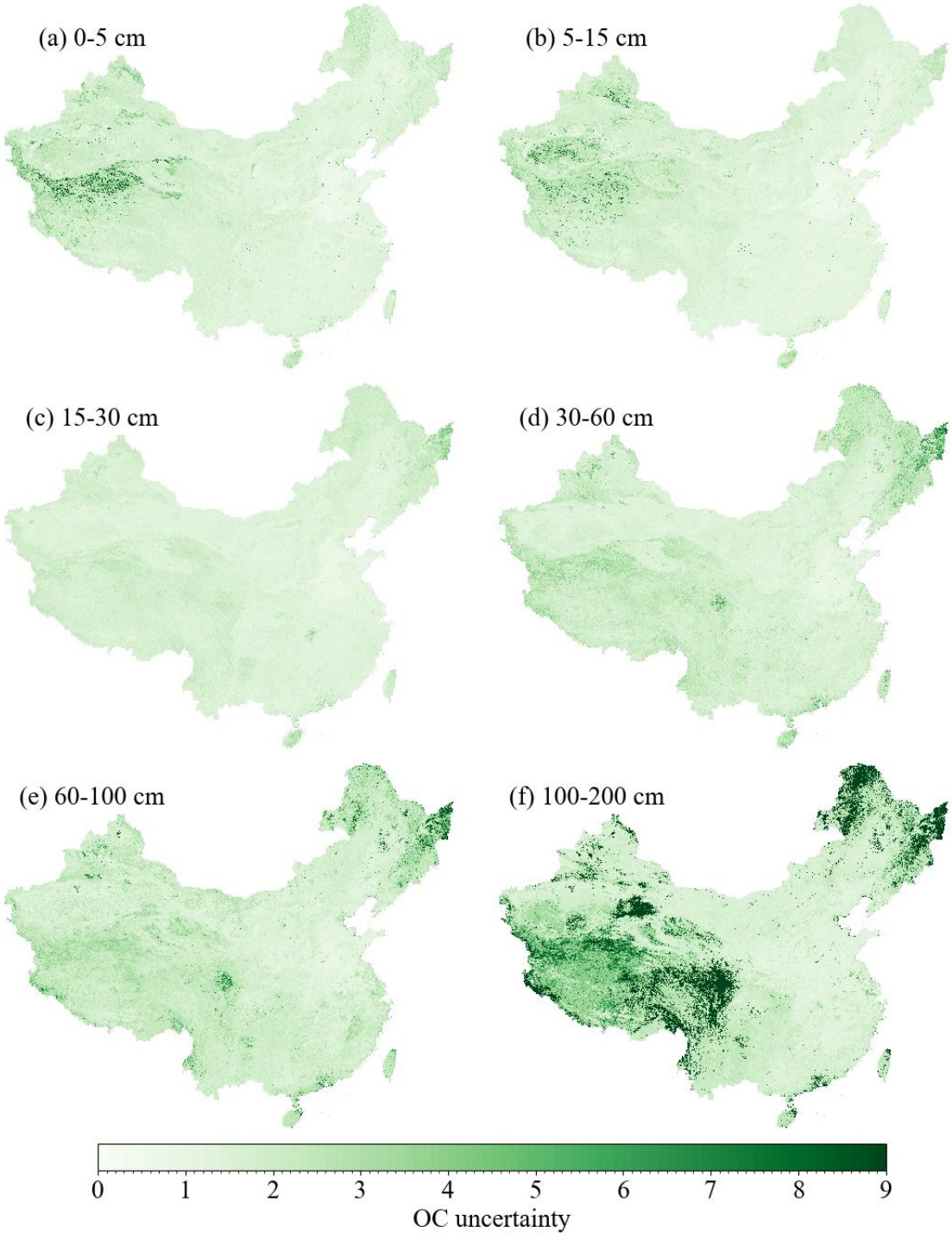


Figure S44. The maps of uncertainty of soil organic carbon (OC) content predictions at the six depth intervals.

S17.3 Variable importance

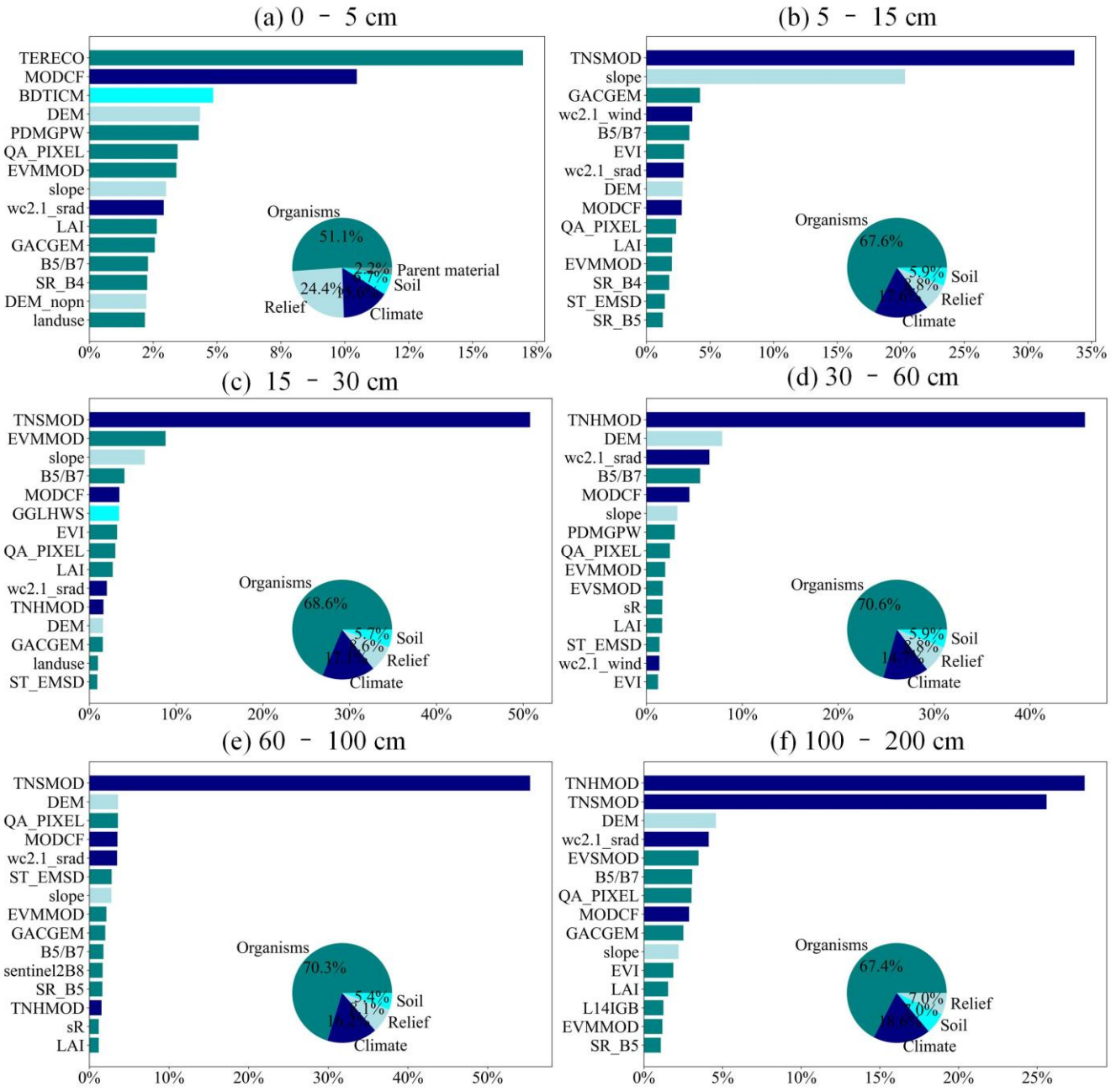


Figure S45. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of soil organic carbon content (OC) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S18 Cation exchange capacity (CEC)

S18.1 Prediction maps

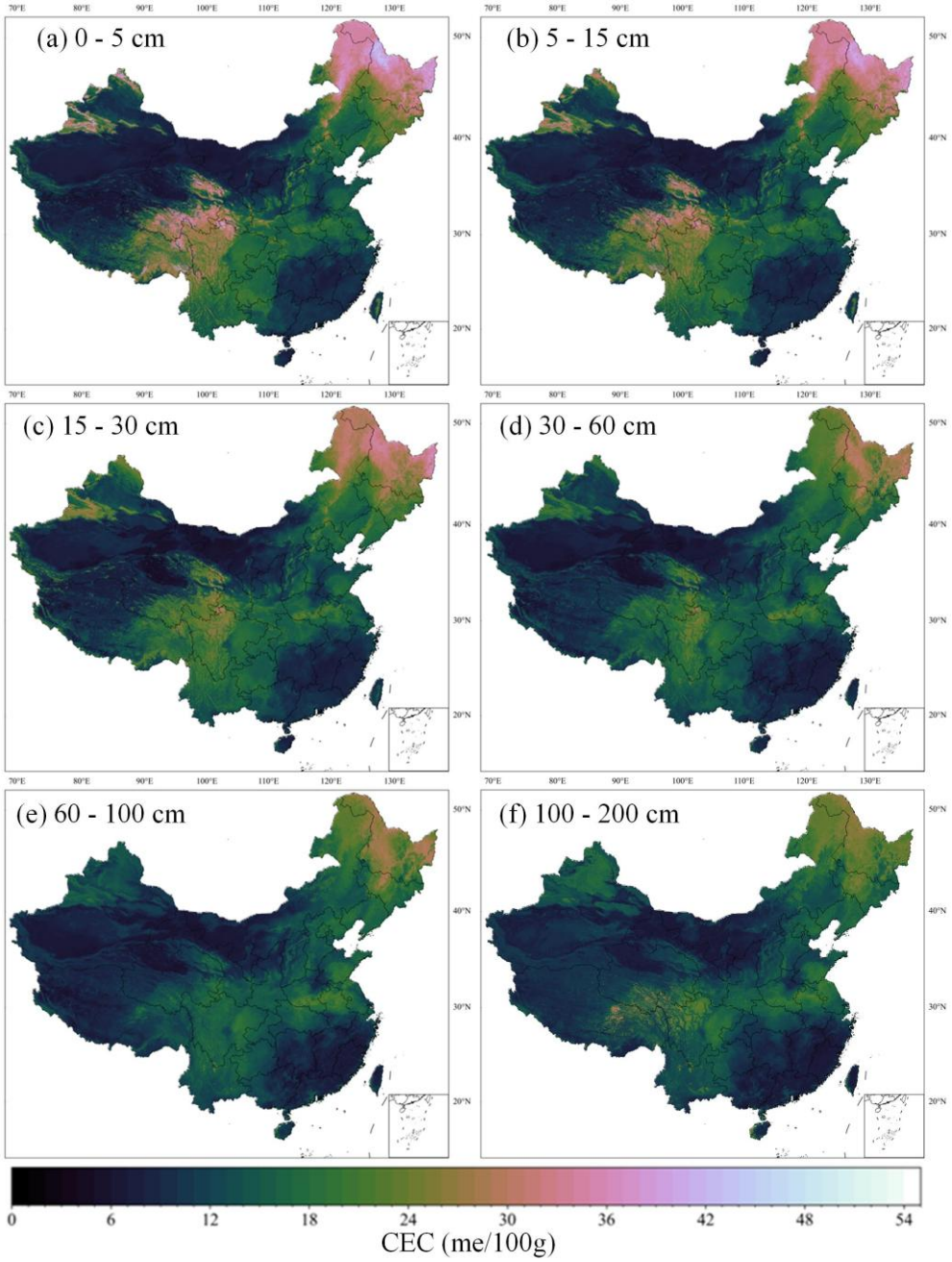
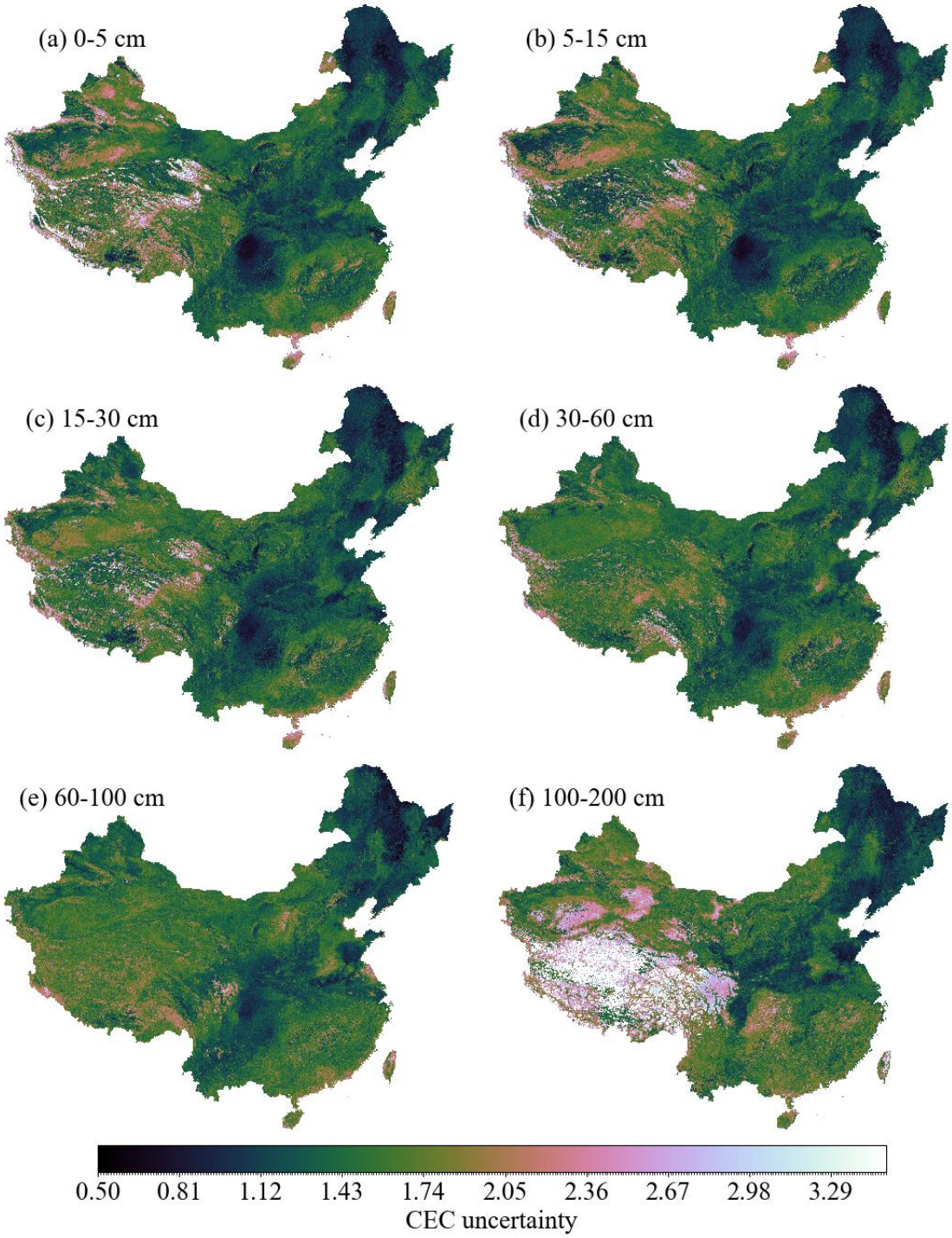


Figure S46. The predicted maps of cation exchange capacity (CEC) content at multiple depths (me/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S18.2 Accuracy assessment



190

Figure S47. The maps of uncertainty of cation exchange capacity (CEC) predictions at the six depth intervals.

S18.3 Variable importance

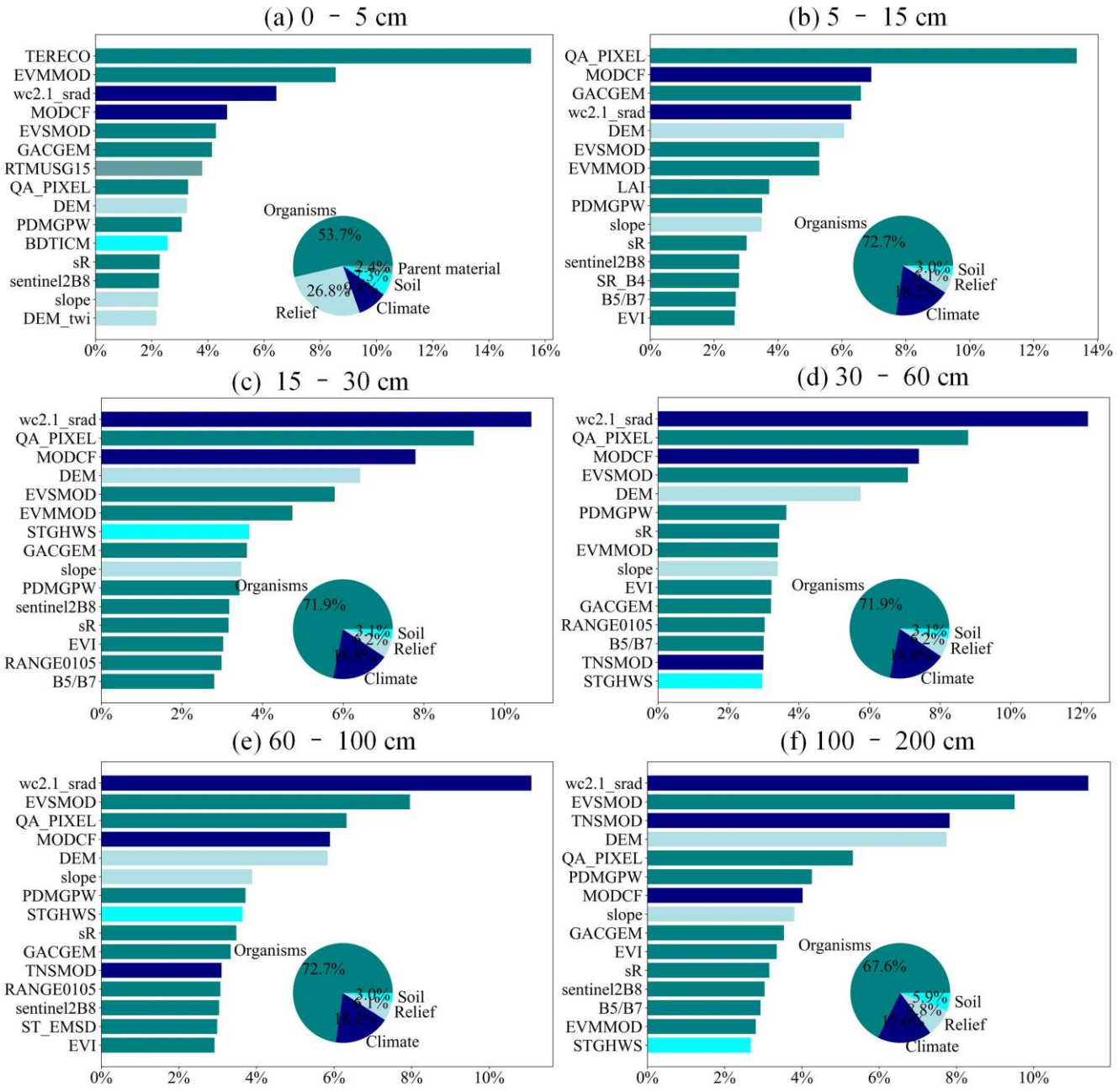


Figure S48. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of cation exchange capacity (CEC) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S19 Total nitrogen (TN)

S19.1 Prediction maps

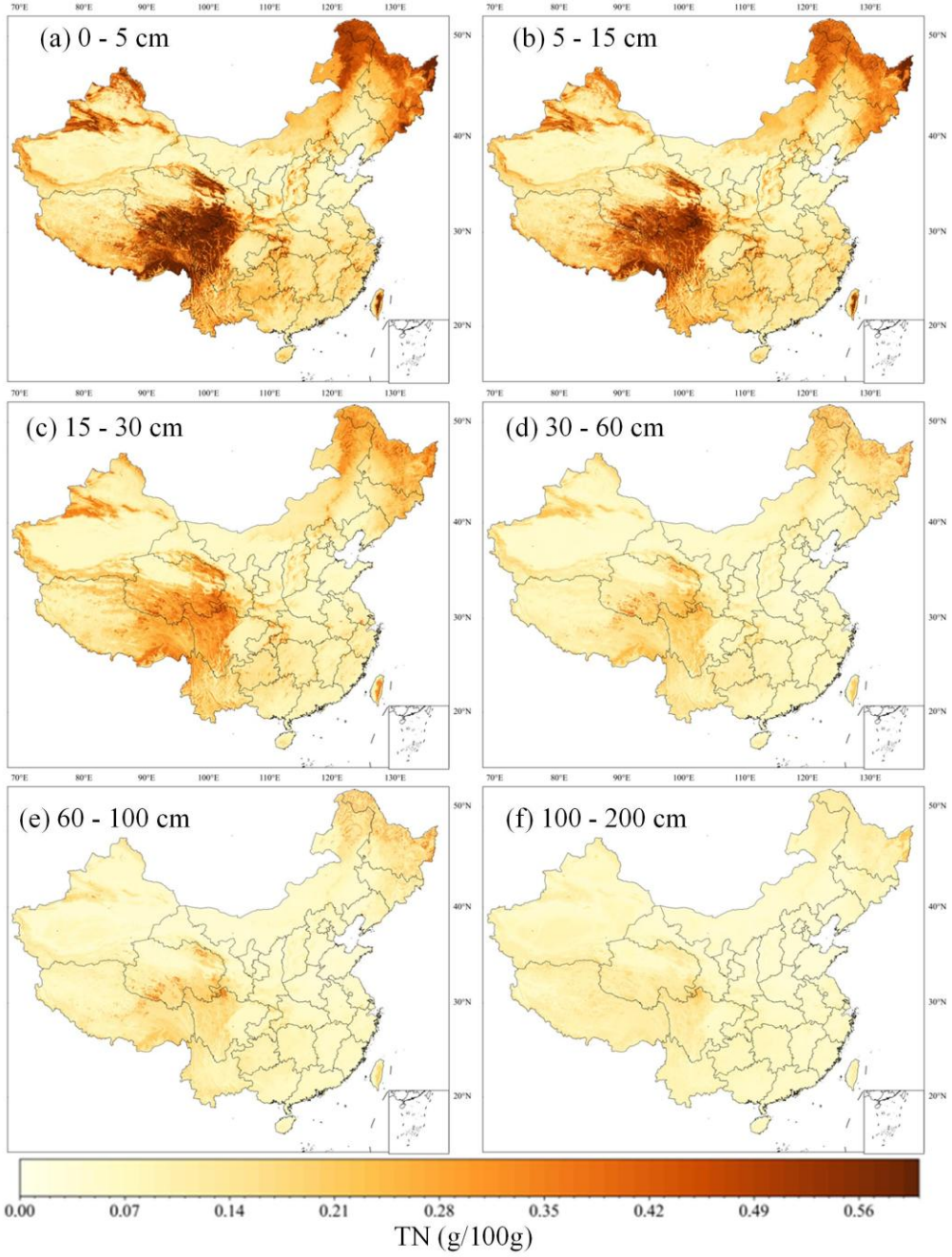


Figure S49. The predicted maps of total nitrogen (TN) content at multiple depths (g/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S19.2 Accuracy assessment

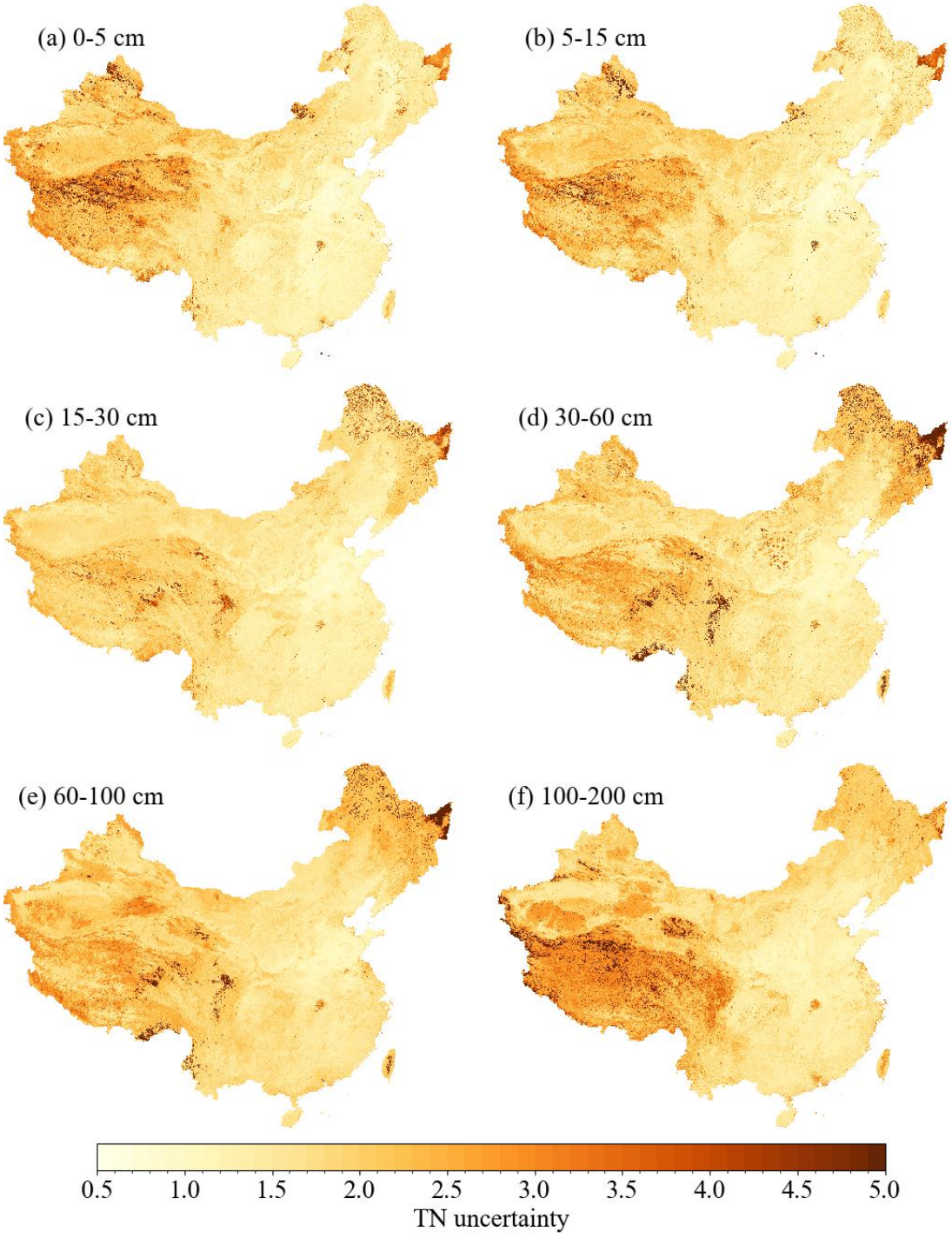
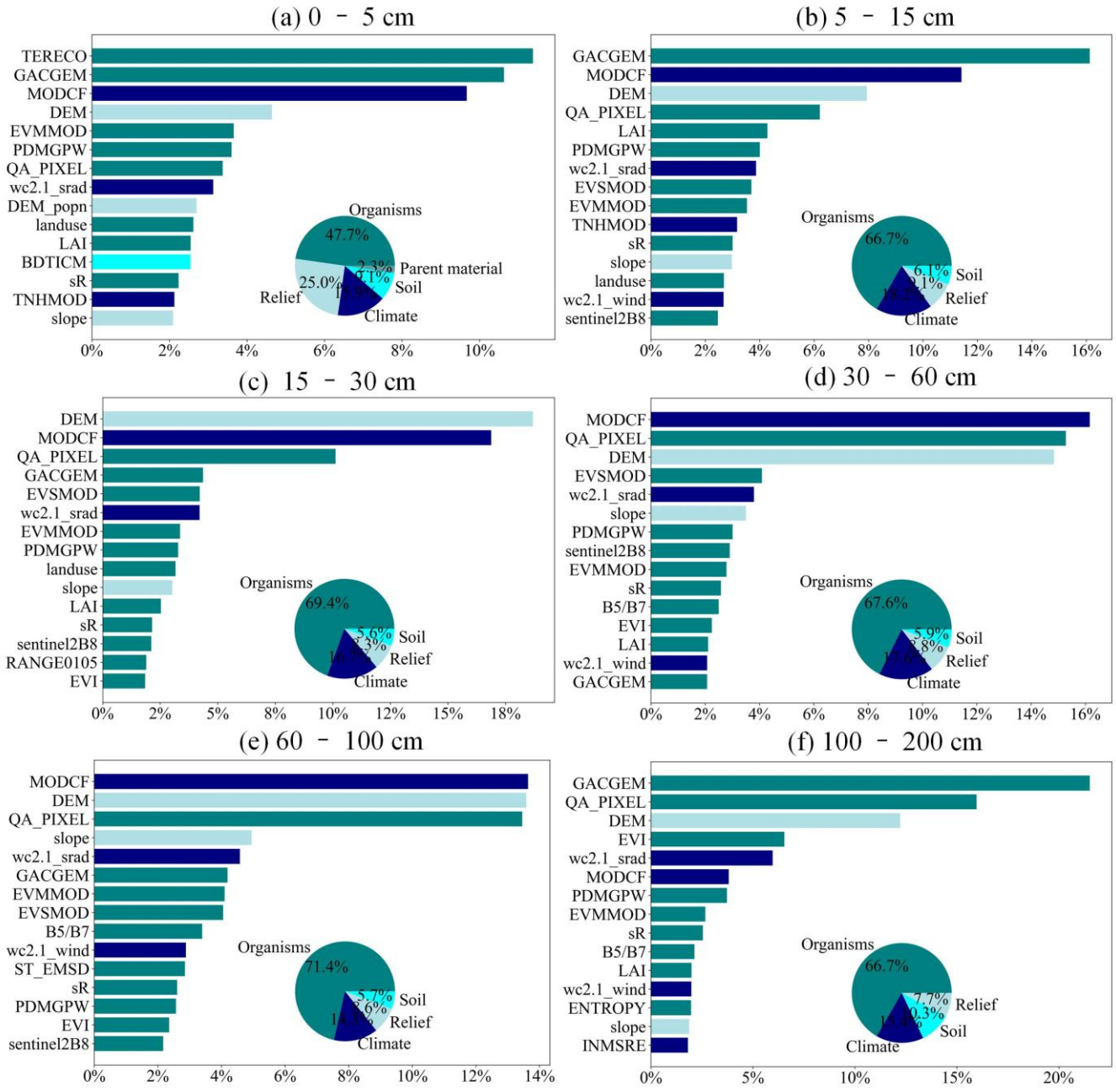


Figure S50. The maps of uncertainty of total nitrogen (TN) predictions at the six depth intervals.

S19.3 Variable importance



205

Figure S51. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of total nitrogen (TN) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S20 Total phosphorus (TP)

S20.1 Prediction maps

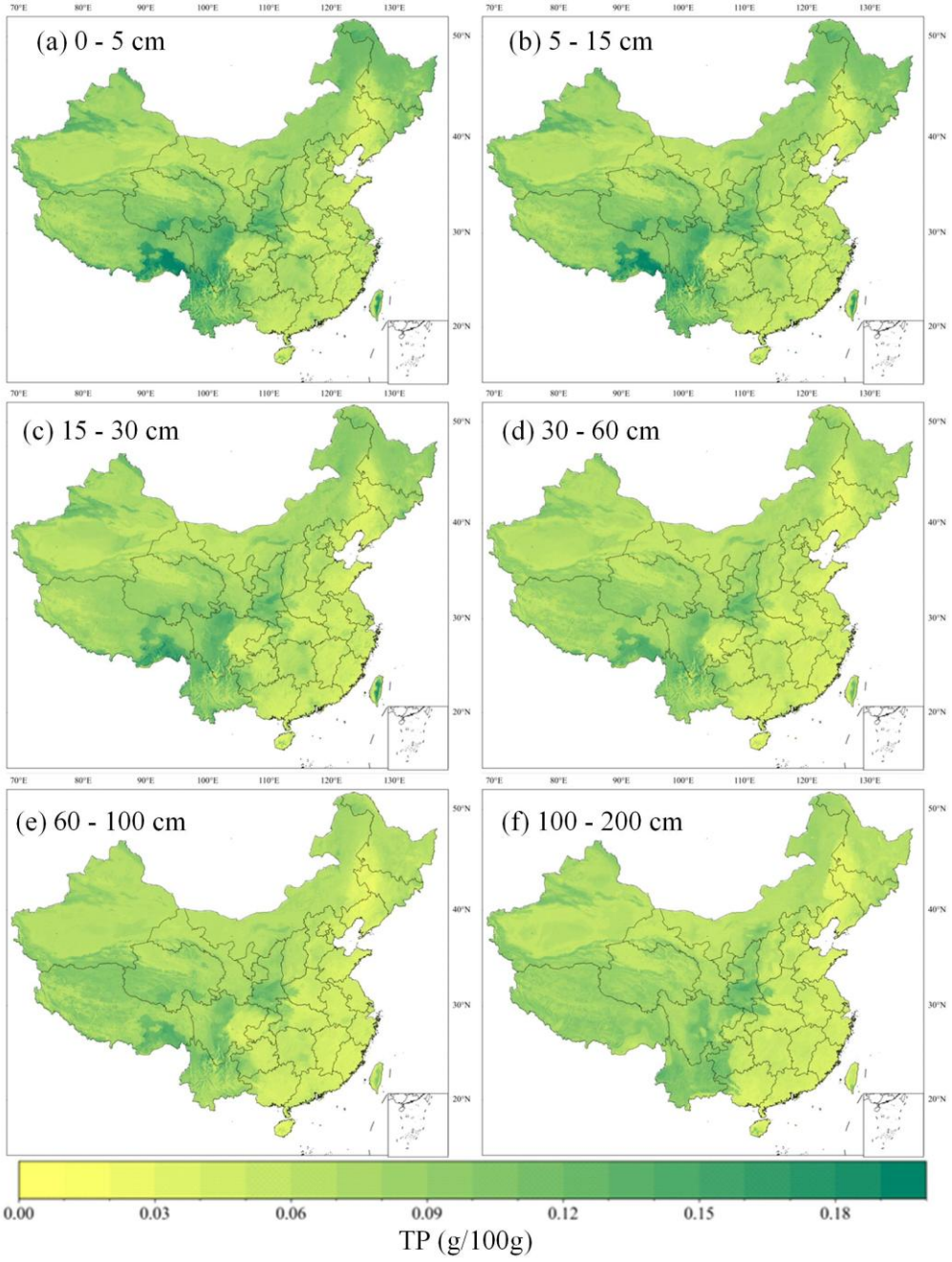


Figure S52. The predicted maps of total phosphorus (TP) content at multiple depths (g/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S20.2 Accuracy assessment

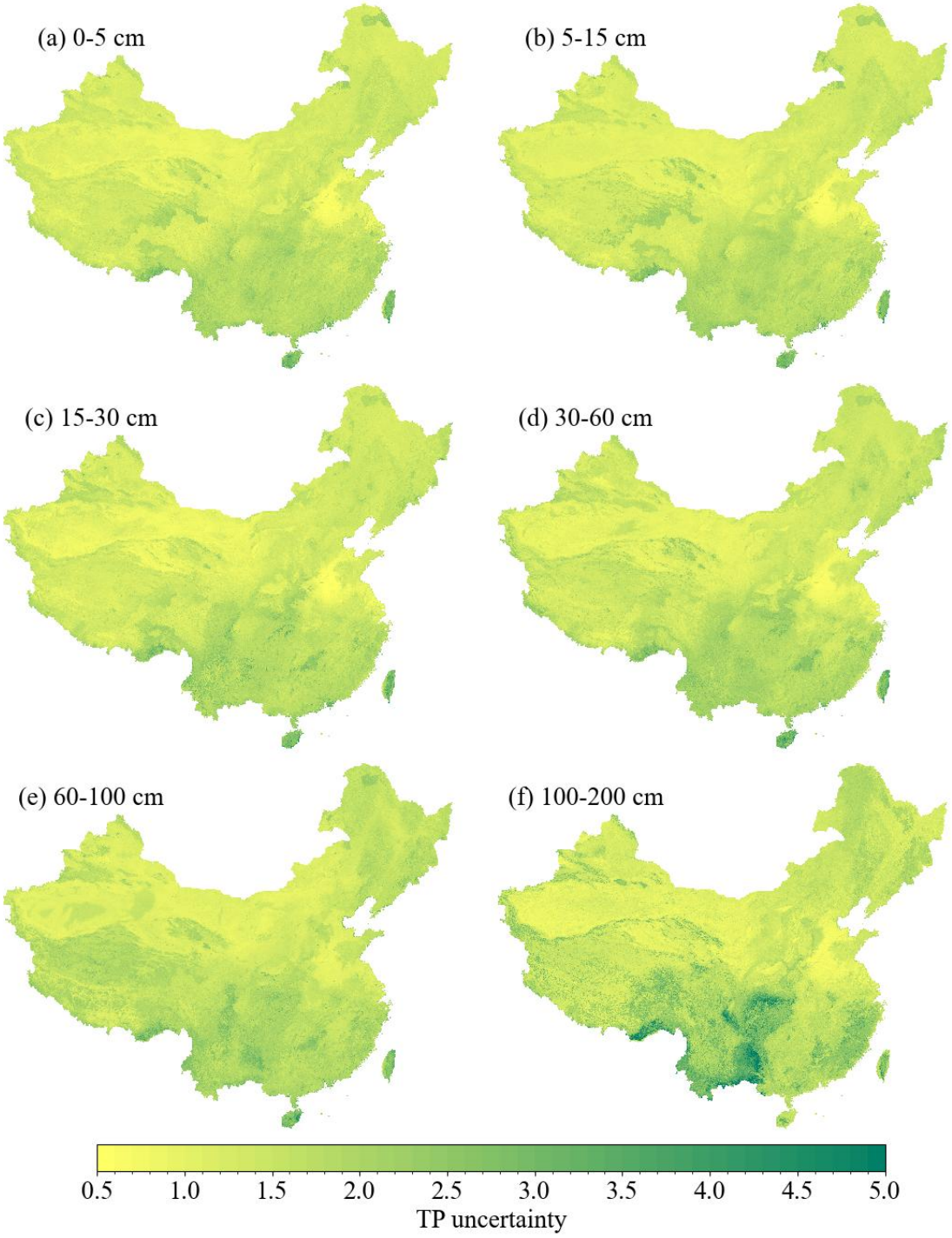


Figure S53. The maps of uncertainty of total phosphorus (TP) predictions at the six depth intervals.

S20.3 Variable importance

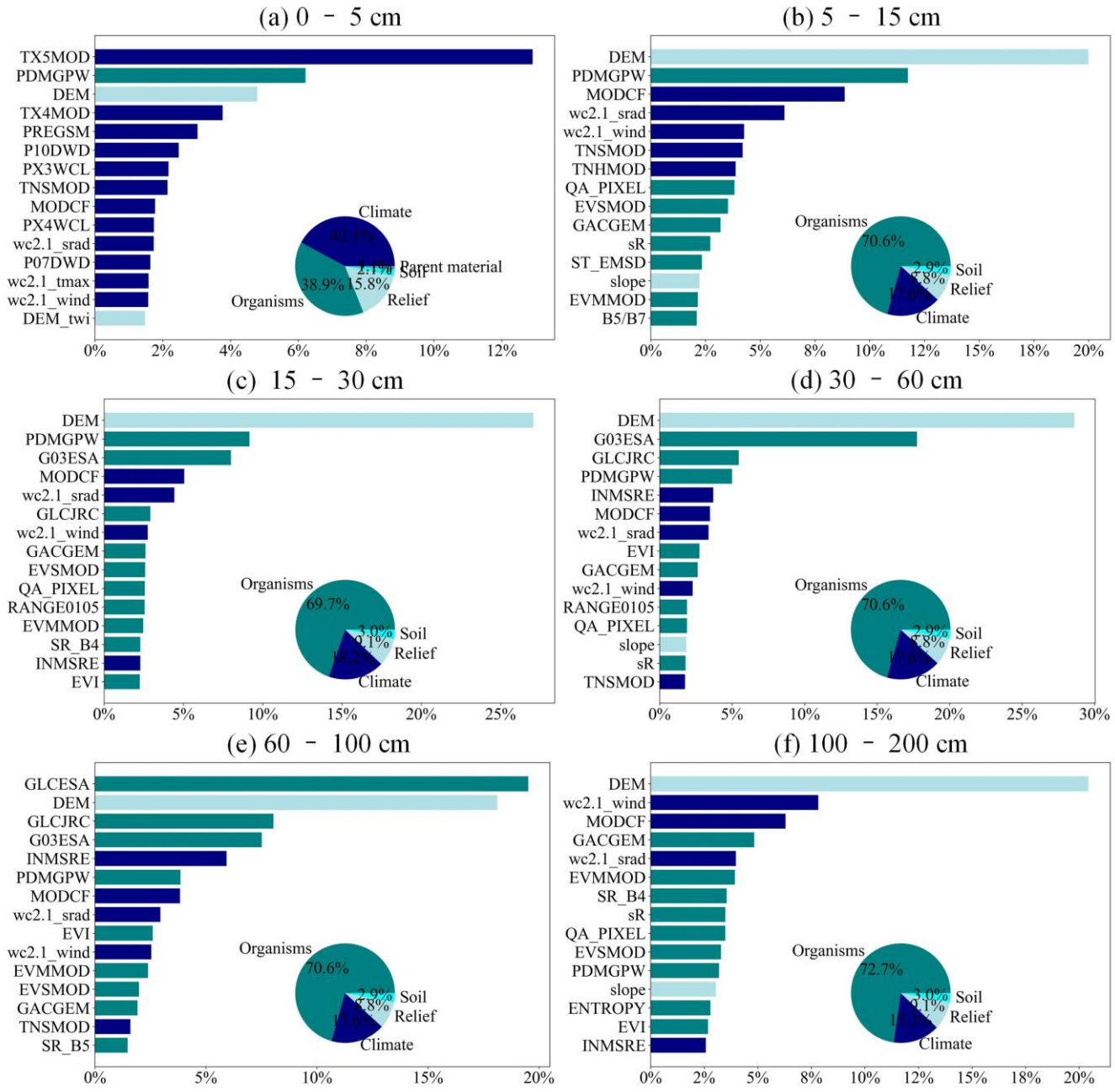


Figure S54. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of total phosphorus (TP) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S21 Total potassium (TK)

S21.1 Prediction maps

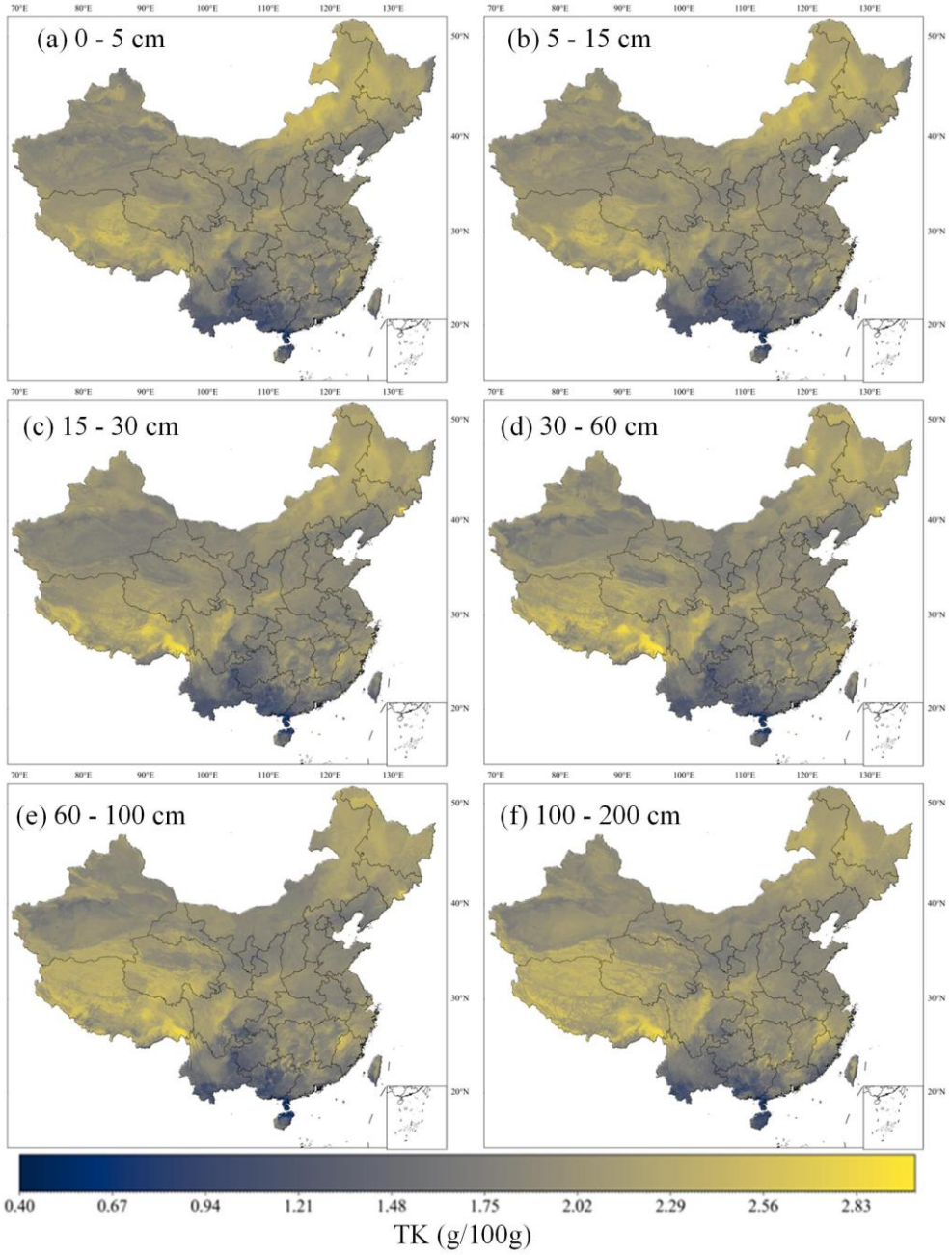


Figure S55. The predicted maps of total potassium (TK) content at multiple depths (g/100g). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

225 **S21.2 Accuracy assessment**

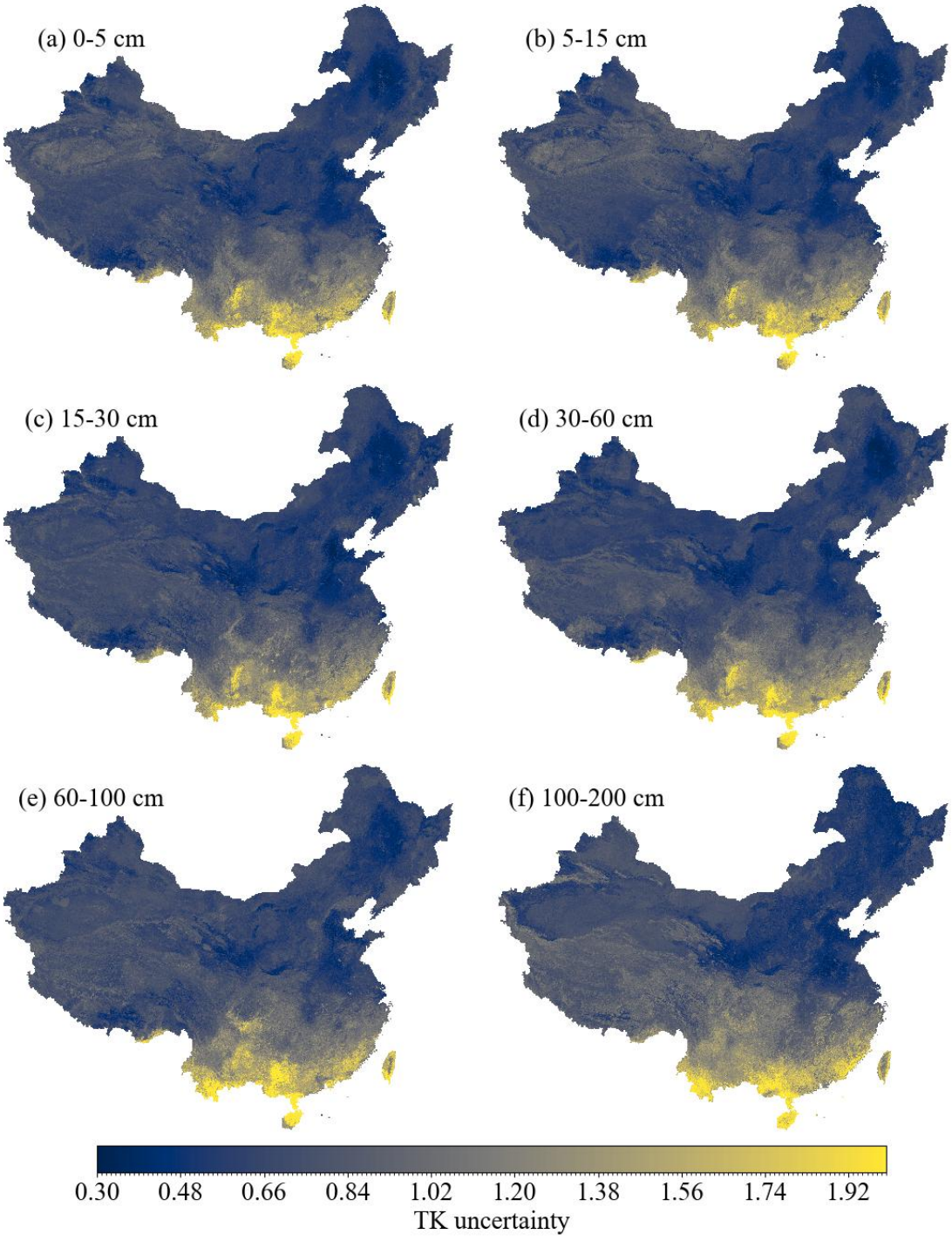


Figure S56. The maps of uncertainty of total potassium (TK) predictions at the six depth intervals.

S21.3 Variable importance

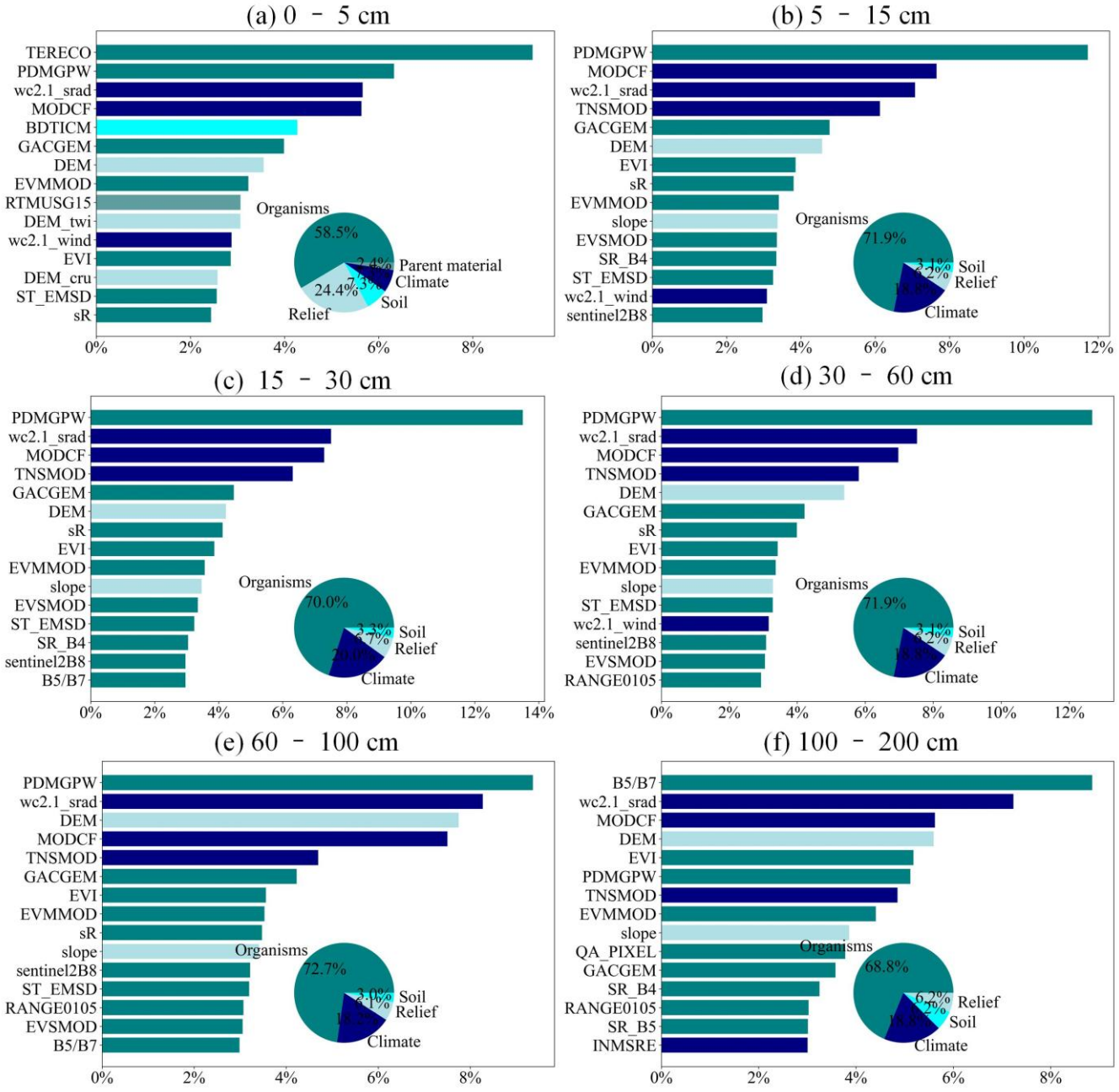


Figure S57. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of total potassium (TK) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S22 Alkali-hydrolysable nitrogen (AN)

S22.1 Prediction maps

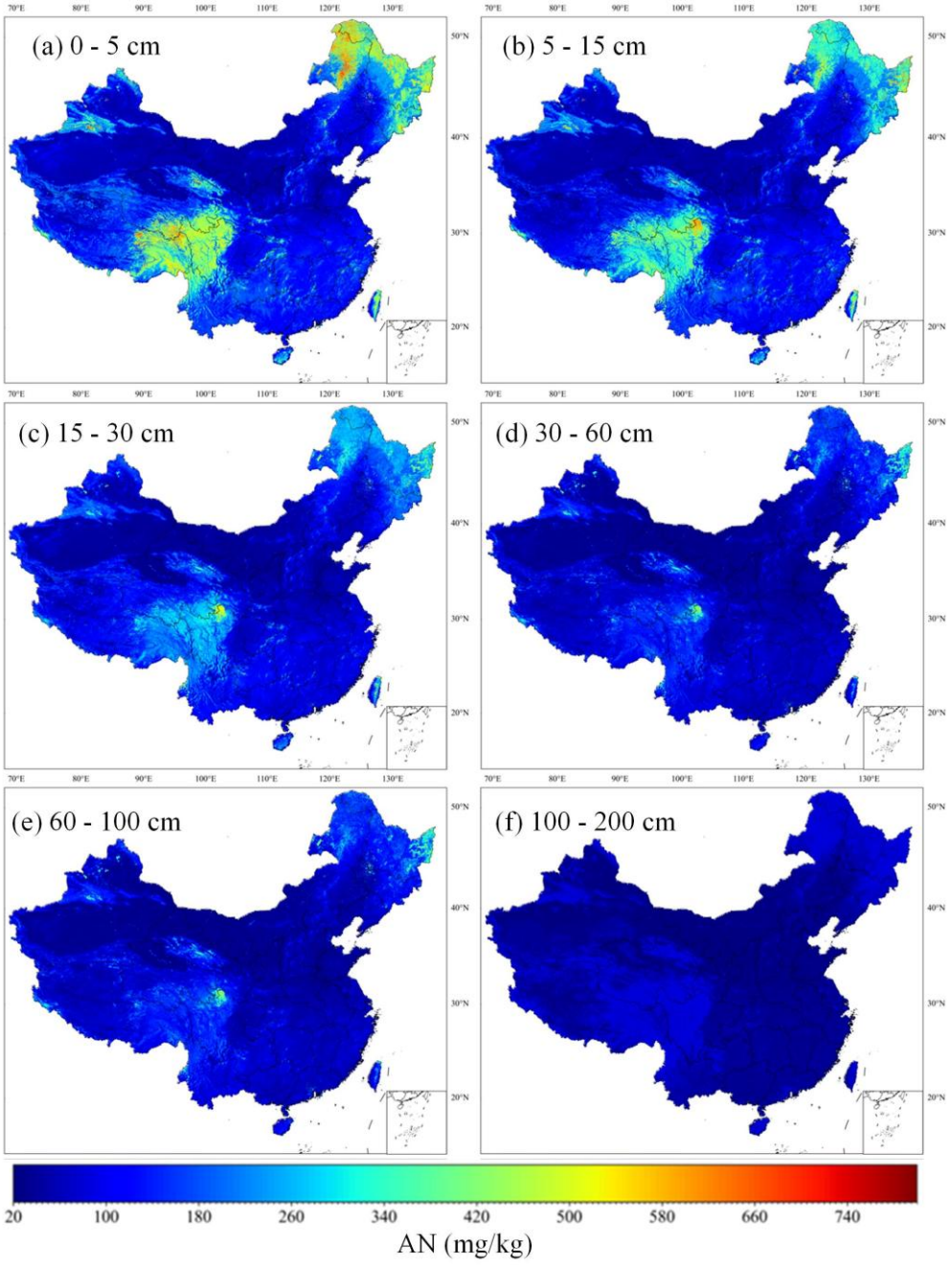


Figure S58. The predicted maps of alkali-hydrolysable nitrogen (AN) content at multiple depths (mg/kg). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S22.2 Accuracy assessment

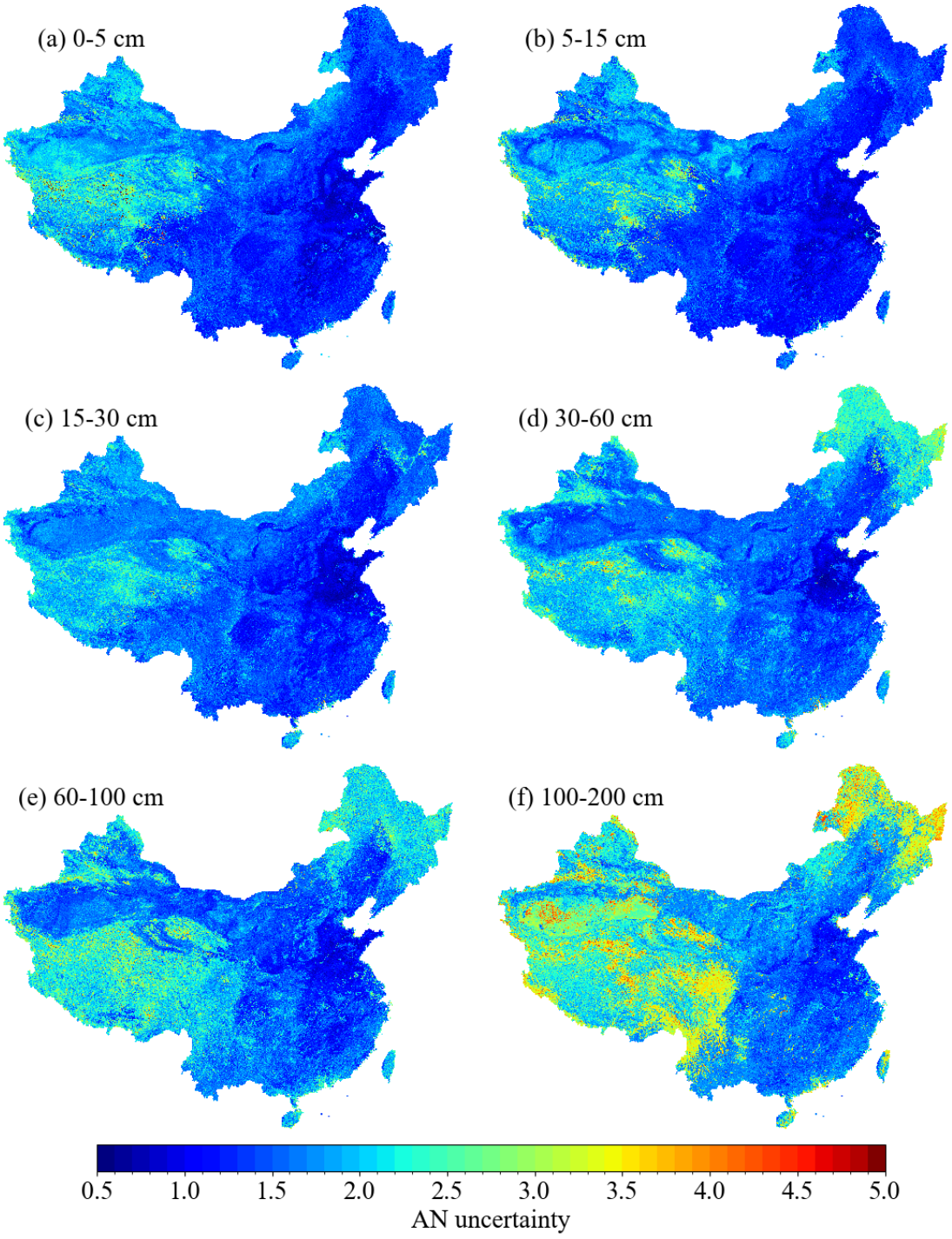


Figure S59. The maps of uncertainty of alkali-hydrolysable nitrogen (AN) predictions at the six depth intervals.

S22.3 Variable importance

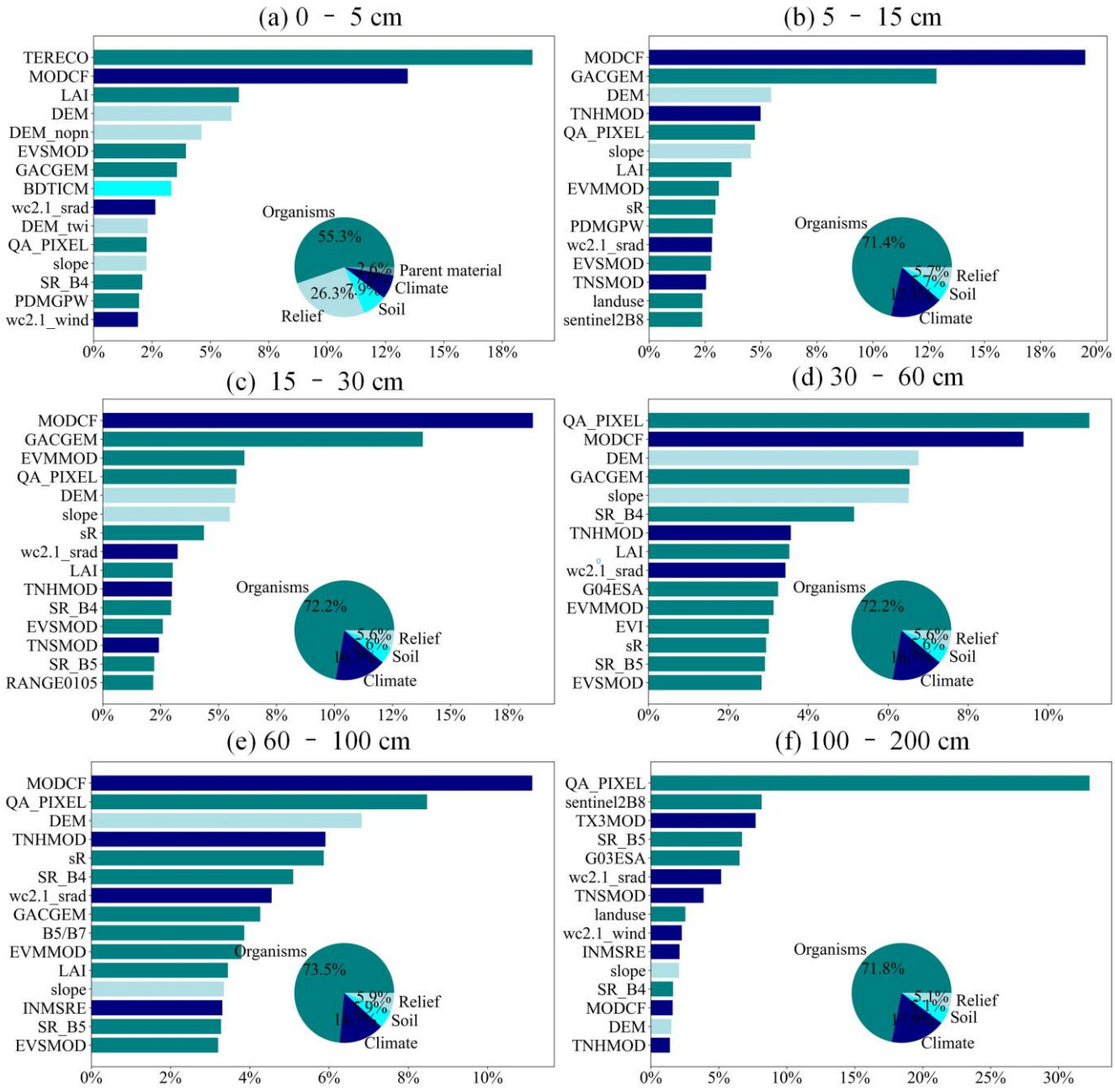


Figure S60. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of alkali-hydrolysable nitrogen (AN) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S23 Available potassium (AK)

S23.1 Prediction maps

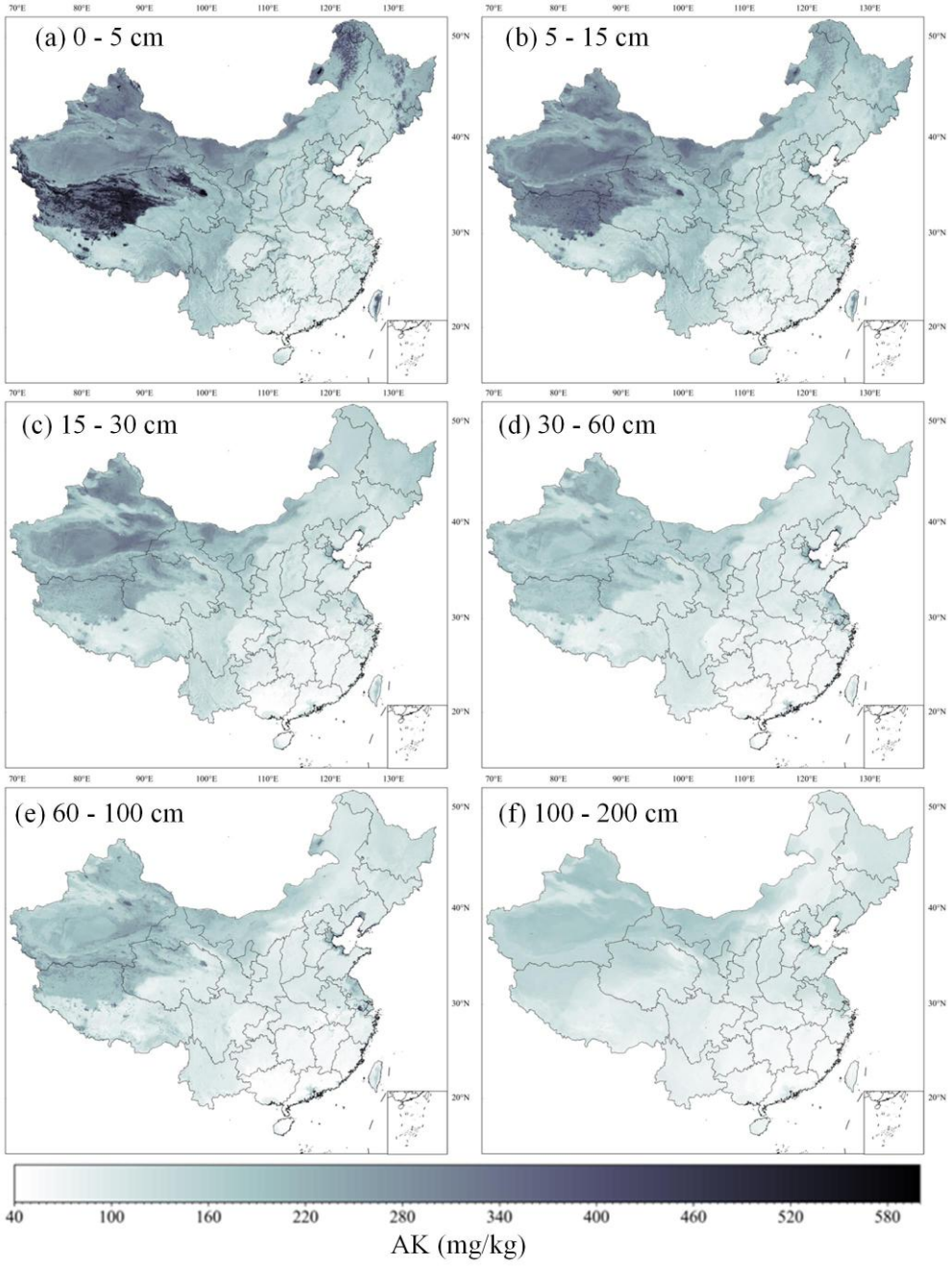


Figure S61. The predicted maps of available potassium (AK) content at multiple depths (mg/kg). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S23.2 Accuracy assessment

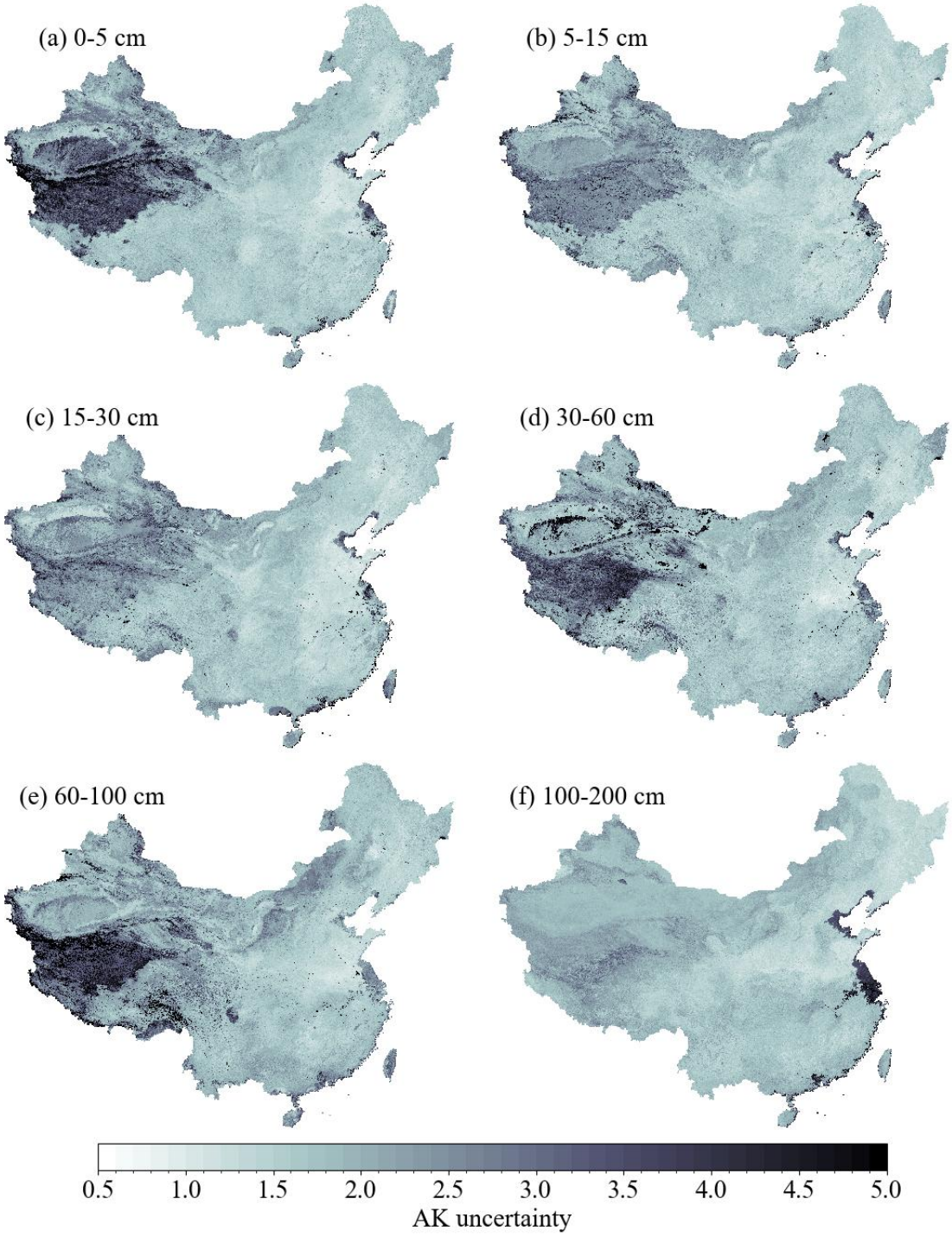


Figure S62. The maps of uncertainty of available potassium (AK) predictions at the six depth intervals.

S23.3 Variable importance

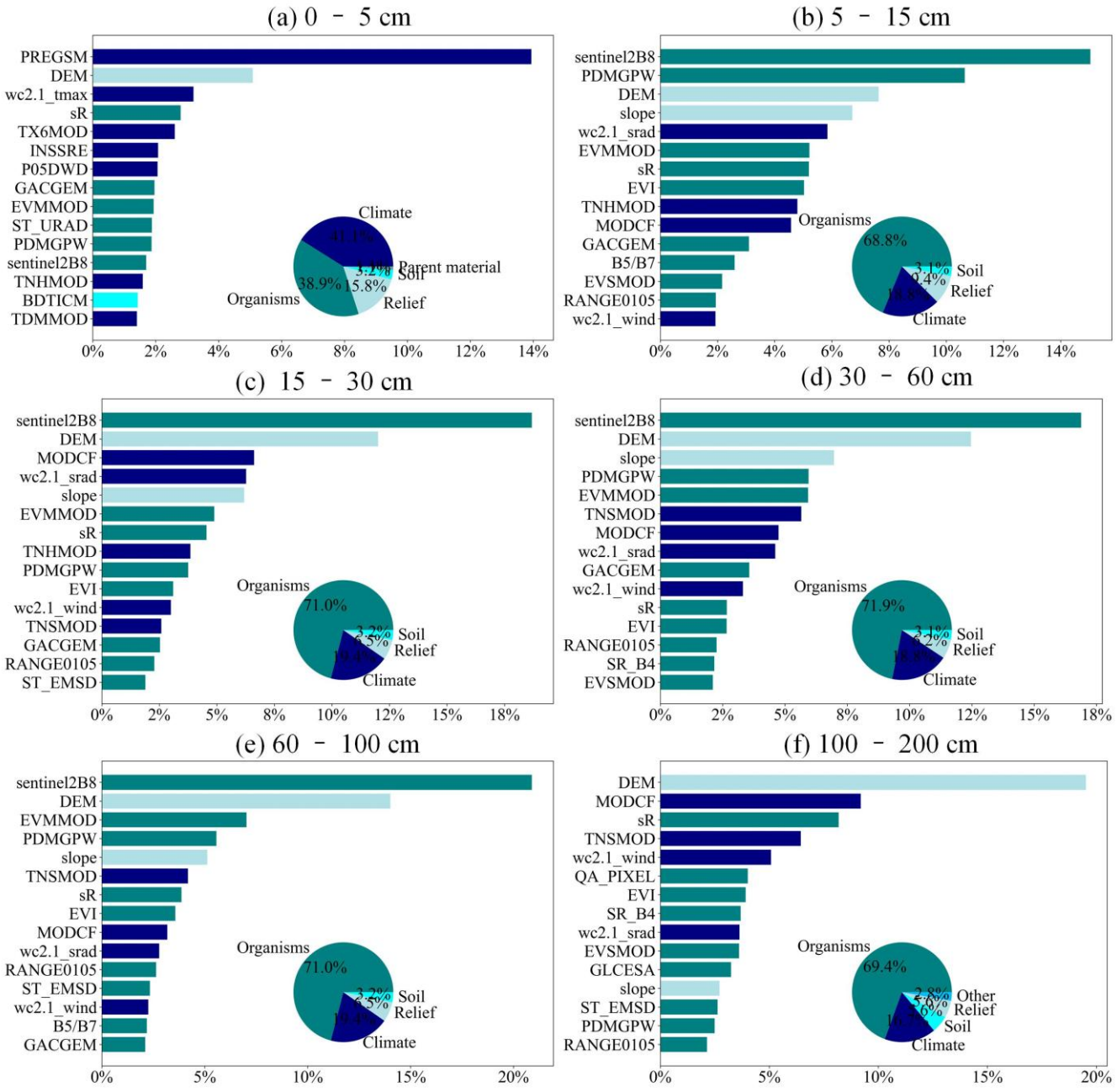


Figure S63. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of available potassium (AK) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S24 Available phosphorus (AP)

S24.1 Prediction maps

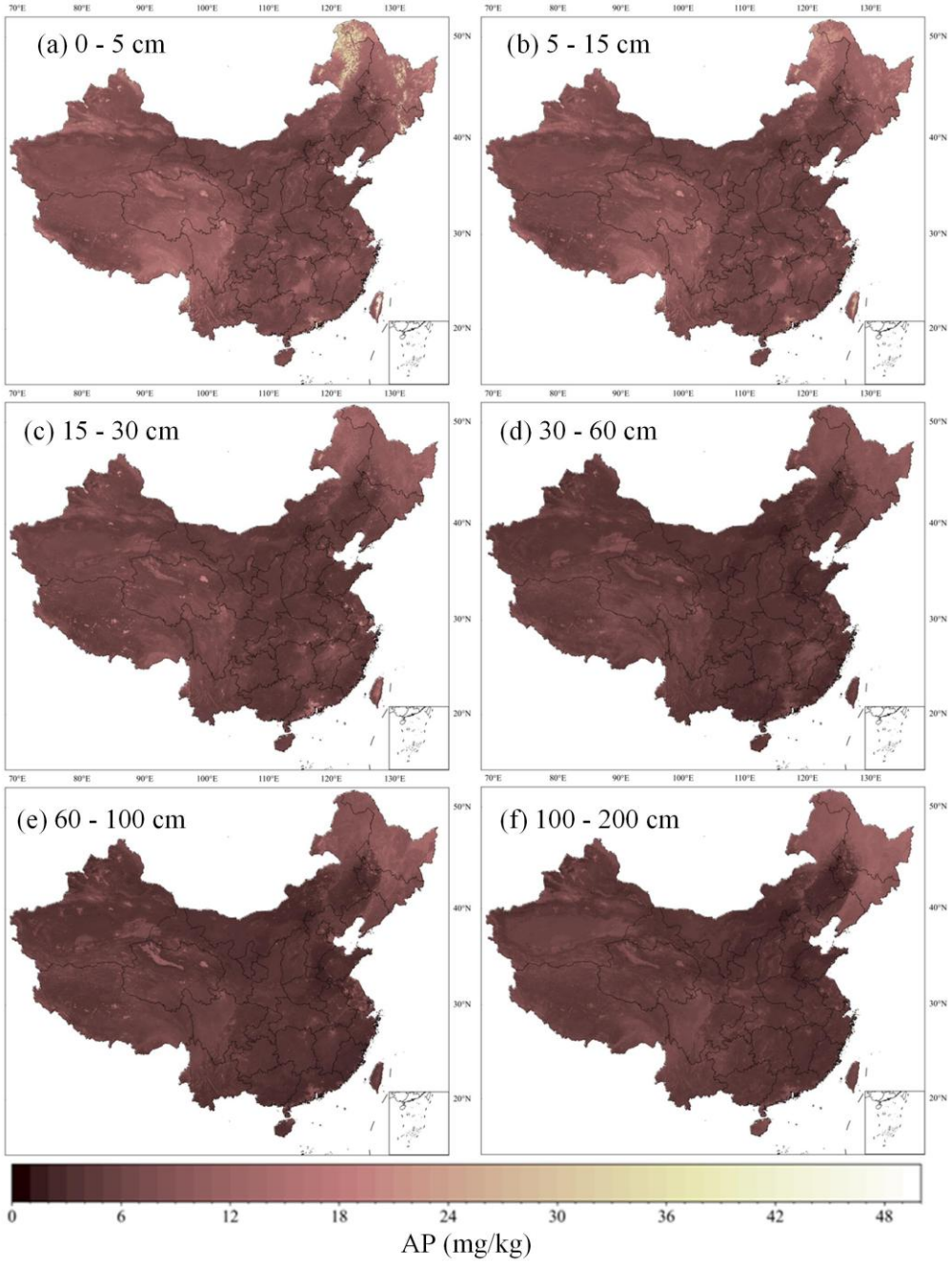


Figure S64. The predicted maps of available phosphorus (AP) content at multiple depths (mg/kg). (a) 0-5 cm; (b) 5-15 cm; (c) 15-30 cm; (d) 30-60 cm; (e) 60-100 cm and (f) 100-200 cm depth interval.

S24.2 Accuracy assessment

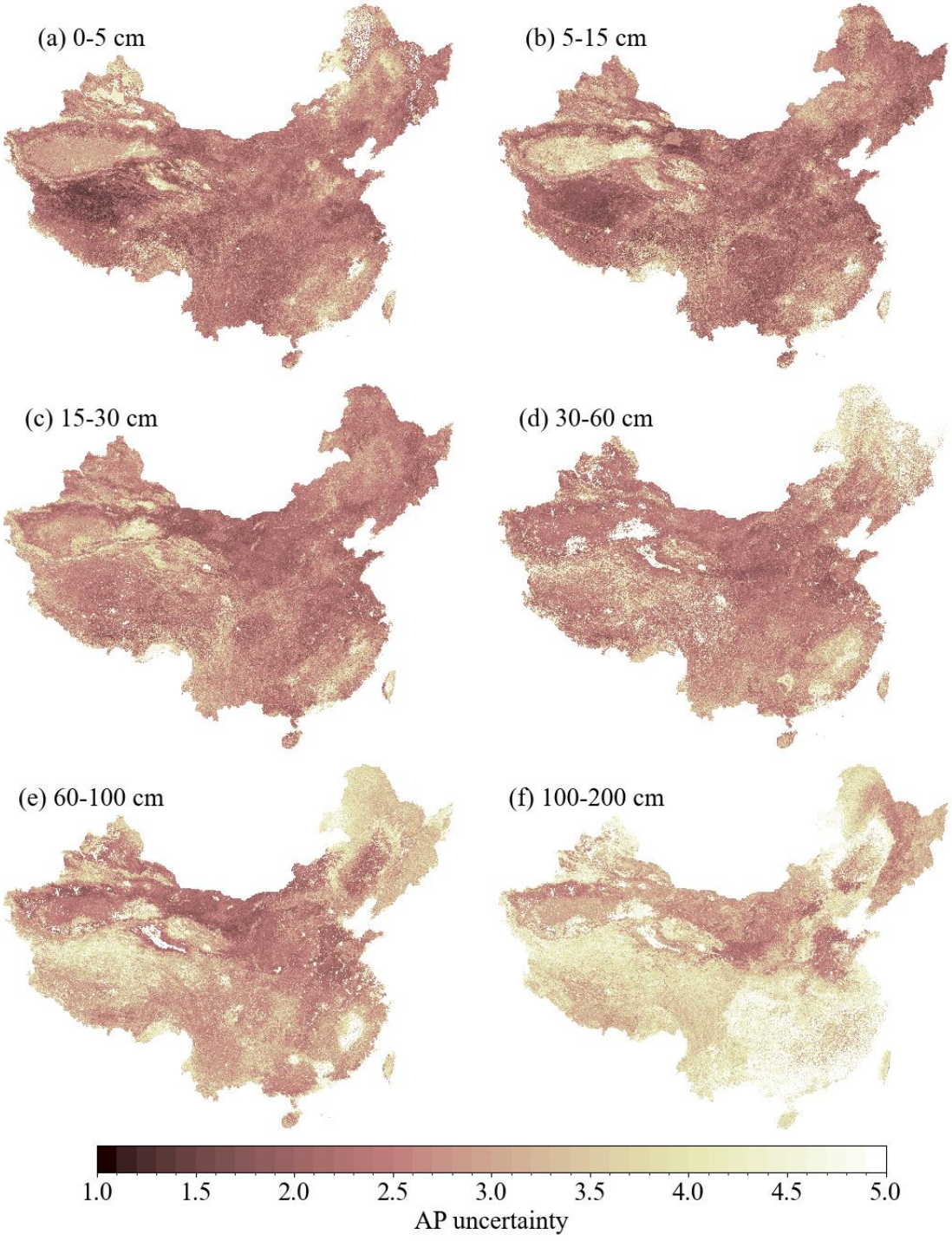


Figure S65. The maps of uncertainty of available phosphorus (AP) predictions at the six depth intervals.

S24.3 Variable importance

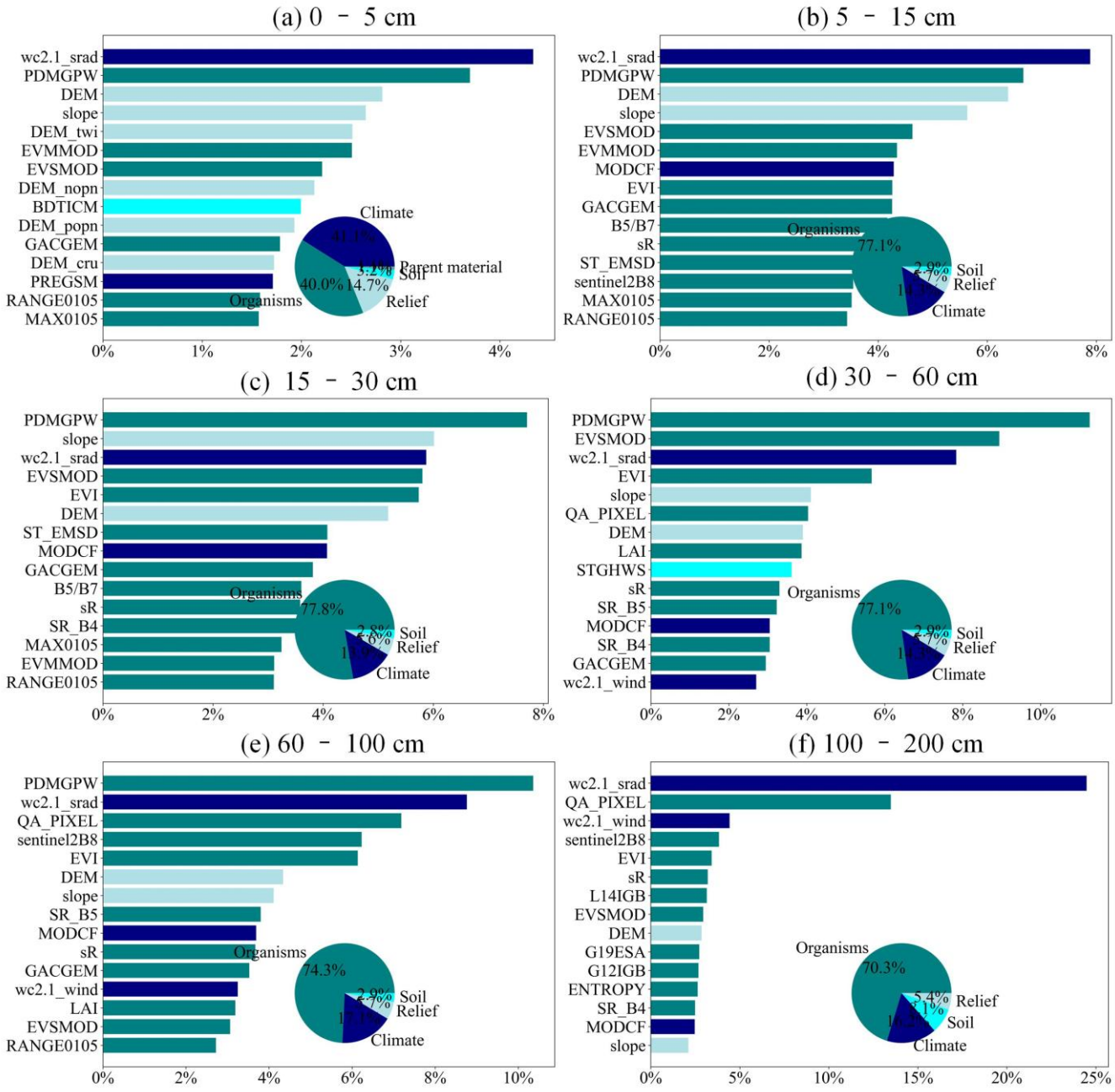


Figure S66. Relative importance of the top 15 predictors for the Quantile Regression Forest model in the spatial predictions of available phosphorus (AP) at the six depth intervals. See Table S6 for abbreviations of the environmental covariates.

S25 Spatial details of total nitrogen (TN)

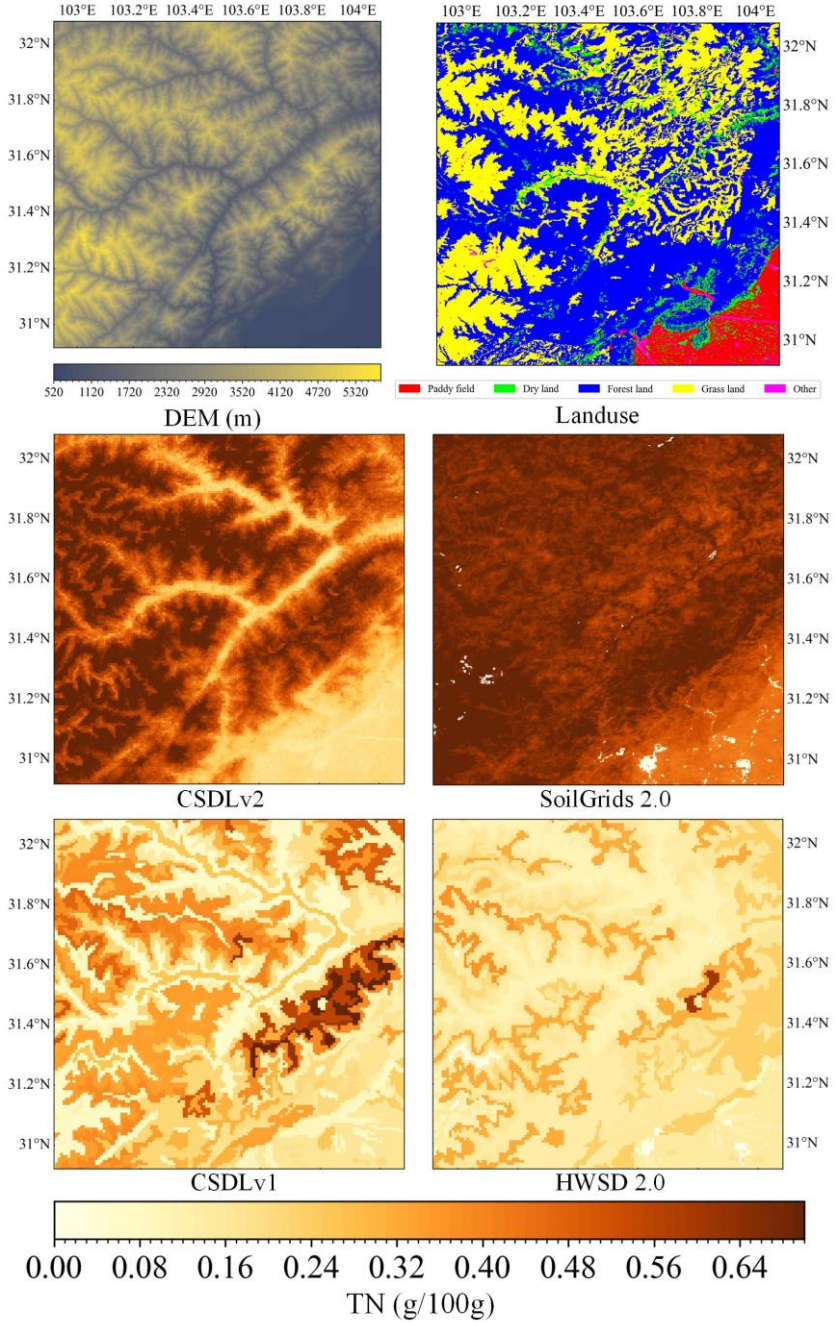


Figure S67. Surface layer (0-5cm) total nitrogen (TN) maps derived from our predictions (CSDLv2), SoilGrids 2.0, CSDLv1, and HWSD 2.0, respectively, in a selected area (102.92°-104.08°E and 30.92°-32.08°N) located in Sichuan Province. This selected area corresponds to the red window shown in Figure 1. DEM and landuse refer to the land surface elevation and land use type of the selected area, respectively.The spatial resolutions are 90 m for CSDLv2, 250 m for SoilGrids 2.0, and 1 km for both CSDLv1 and HWSD 2.0.

S26 Spatial details of rock fragment (gravel)

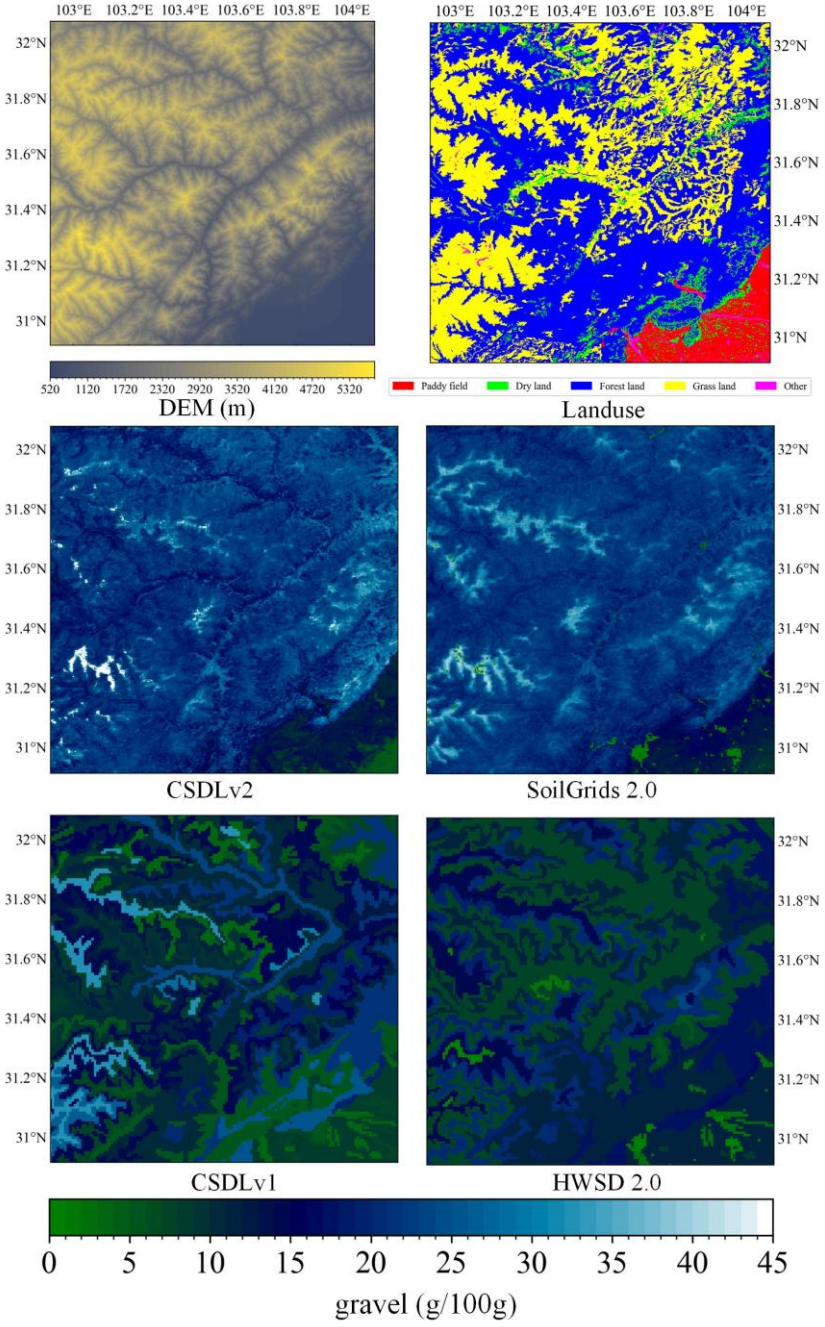


Figure S68. Surface layer (0-5cm) rock fragment (gravel) maps derived from our predictions (CSDLv2), SoilGrids 2.0, CSDLv1, and HWSD 2.0, respectively, in a selected area (102.92°-104.08°E and 30.92°-32.08°N) located in Sichuan province. This selected area corresponds to the red window shown in Figure 1. DEM and landuse refer to the land surface elevation and land use type of the selected area, respectively.The spatial resolutions are 90 m for CSDLv2, 250 m for SoilGrids 2.0, and 1 km for both CSDLv1 and HWSD 2.0.

S27 Spatial details of porosity

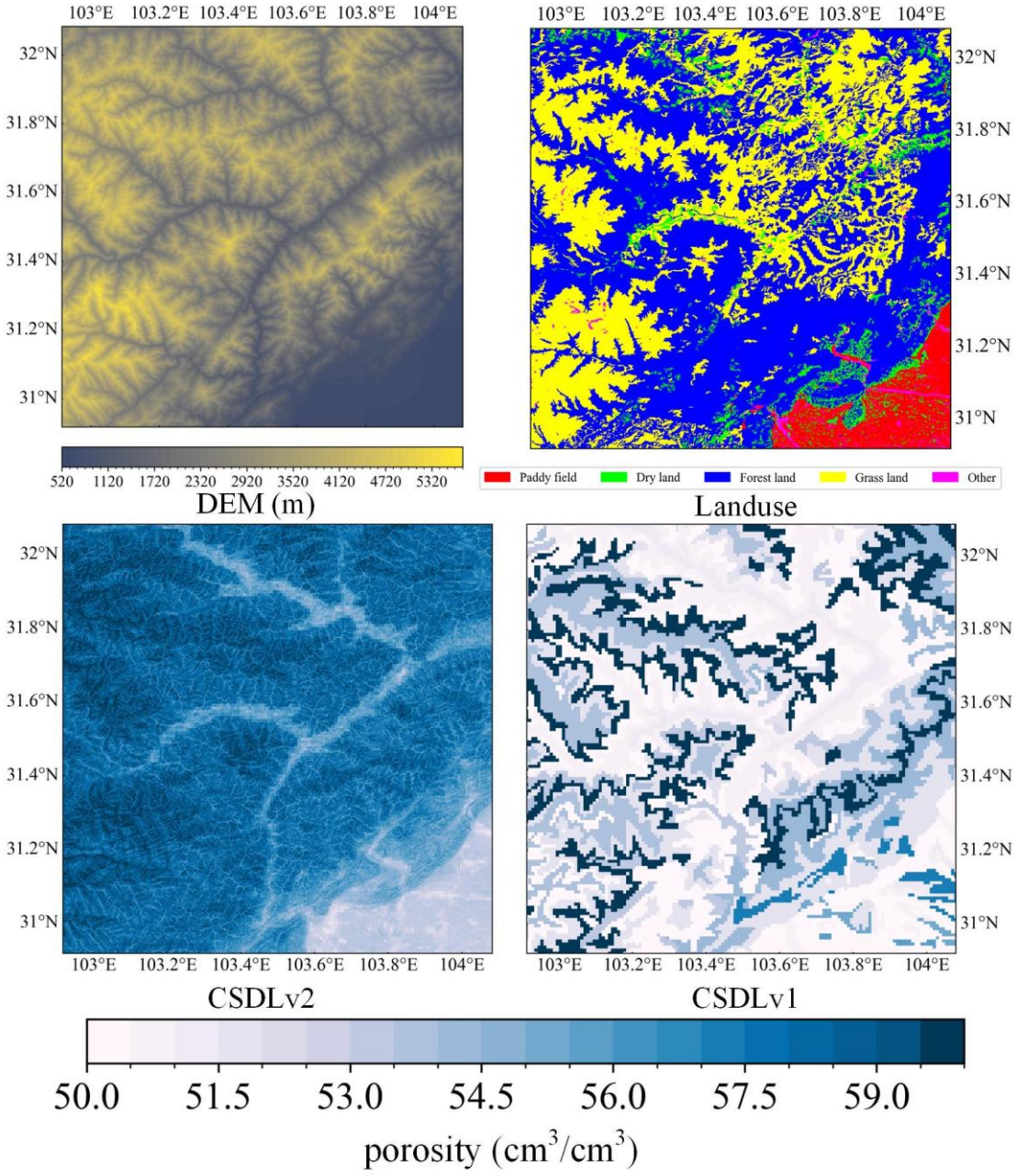


Figure S69. Surface layer (0-5 cm) porosity maps derived from our predictions (CSDLv2) and CSDLv1, respectively, in a selected area (102.92°-104.08°E and 30.92°-32.08°N) located in Sichuan province. This selected area corresponds to the red window shown in Figure 1. DEM and land use refer to the land surface elevation and land use type of the selected area, respectively. The spatial resolutions are 90 m for CSDLv2 and 1 km for CSDLv1. Note that porosity data is not available in SoilGrids 2.0 and HWSD 2.0, therefore no visualizations are provided for these datasets.

S28 Spatial details of alkali-hydrolysable nitrogen (AN)

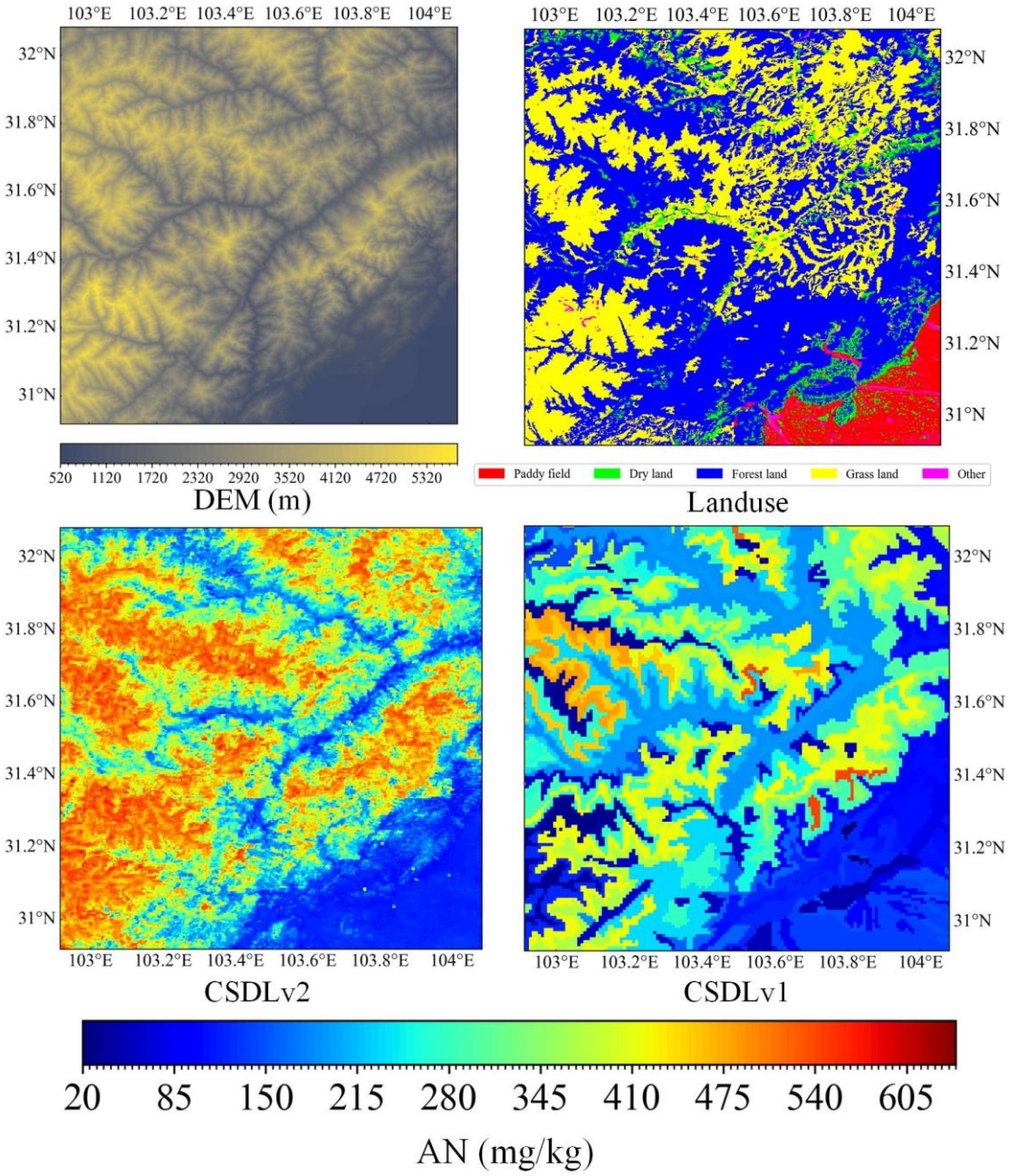


Figure S70. Surface layer (0-5 cm) alkali-hydrolysable nitrogen (AN) maps derived from our predictions (CSDLv2) and CSDLv1, respectively, in a selected area (102.92°-104.08°E and 30.92°-32.08°N) located in Sichuan province. This selected area corresponds to the red window shown in Figure 1. DEM and land use refer to the land surface elevation and land use type of the selected area, respectively. The spatial resolutions are 90 m for CSDLv2 and 1 km for CSDLv1. Note that AN data is not available in SoilGrids 2.0 and HWSD 2.0, therefore no visualizations are provided for these datasets.

S29 Spatial details of available phosphorus (AP)

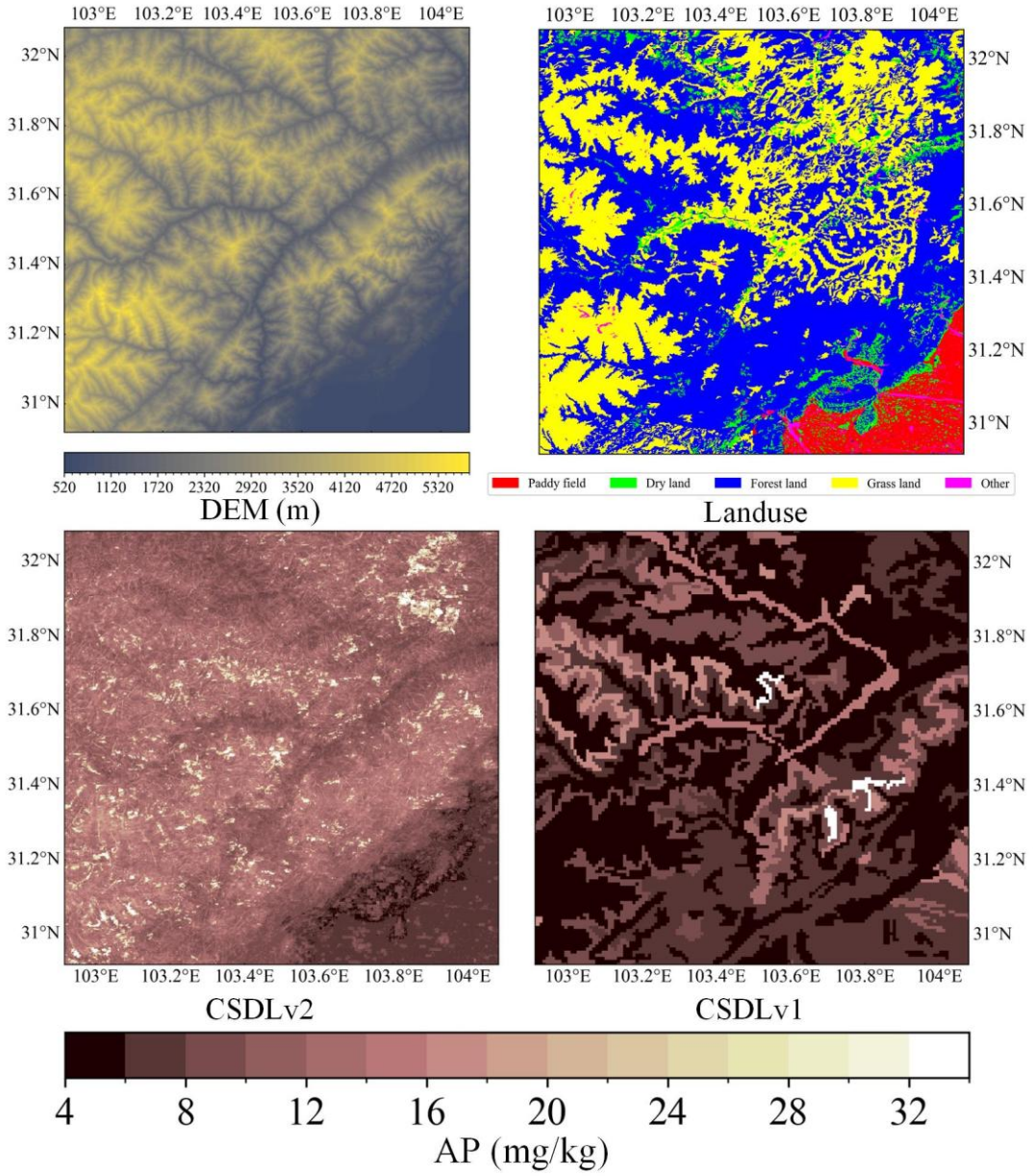


Figure S71. Surface layer (0-5 cm) available phosphorous (AP) maps derived from our predictions (CSDLv2) and CSDLv1, respectively, in a selected area (102.92°-104.08°E and 30.92°-32.08°N) located in Sichuan province. This selected area corresponds to the red window shown in Figure 1. DEM and land use refer to the land surface elevation and land use type of the selected area, respectively. The spatial resolutions are 90 m for CSDLv2 and 1 km for CSDLv1. Note that AP data is not available in SoilGrids 2.0 and HWSD 2.0, therefore no visualizations are provided for these datasets.

Table S1. List of environmental covariates used to characterize soil-forming environments.

Factors definitions	Description	Resolution (m)	Source data set
Soil (28)			
STGHWS[1]	Dominant soil group	5000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/
GVRHWS	Percent coverage Vertisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v34/en/
GUMHWS	Percent coverage Umbrisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v33/en/
GSTHWS	Percent coverage Stagnosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v37/en/
GSNHWS	Percent coverage Solonetz	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v32/en/
GSCHWS	Percent coverage Solonchaks	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v31/en/
GRGHWS	Percent coverage Regosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v30/en/
GPZHWS	Percent coverage Podzols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v29/en/
GPTHWS	Percent coverage Plinthosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v28/en/

Factors definitions	Description	Resolution (m)	Source data set
GPLHWS	Percent coverage Planosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v27/en/
GLPHWS[1]	Percent coverage Leptosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v26/en/
GKSHWS	Percent coverage Kastanozems	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v25/en/
GHSHWS	Percent coverage Histosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v24/en/
GGYHWS[1]	Percent coverage Gypsisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v23/en/
GGLHWS	Percent coverage Gleysols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v22/en/
GFRHWS	Percent coverage Ferralsols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v20/en/
GFLHWS	Percent coverage Fluvisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v21/en/
GCRHWS	Percent coverage Cryosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v19/en/
GCMHWS[1]	Percent coverage Cambisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v17/en/

Factors definitions	Description	Resolution (m)	Source data set
GCLHWS	Percent coverage Calcisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v16/en/
GCHHWS	Percent coverage Chernozems	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v18/en/
GATHWS	Percent coverage Anthrosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v36/en/
GARHWS	Percent coverage Arenosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v15/en/
GANHWS	Percent coverage Andosols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v14/en/
GALHWS	Percent coverage Alisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v35/en/
GACHWS	Percent coverage Acrisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/
GABHWS	Percent coverage Albeluvisols	1000	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v13/en/
BDTICM[1]	Depth to bedrock of China	90	http://globalchange.bnu.edu.cn/research/cdtb.jsp
Climate (36)			
TX6MOD[1]	Mean Long-term Surface Temperature Oct/Nov	1000	https://modis.gsfc.nasa.gov
TX5MOD	Mean Long-term Surface Temperature Aug/Sep	1000	https://modis.gsfc.nasa.gov

Factors definitions	Description	Resolution (m)	Source data set
TX4MOD	Mean Long-term Surface Temperature Jun/Jul	1000	https://modis.gsfc.nasa.gov
TX3MOD	Mean Long-term Surface Temperature Apr/May	1000	https://modis.gsfc.nasa.gov
TX2MOD	Mean Long-term Surface Temperature Feb/Mar	1000	https://modis.gsfc.nasa.gov
TX1MOD[1]	Mean value of the day-time LST	1000	https://modis.gsfc.nasa.gov
TNSMOD[1]	Standard deviation Long-term night surface temperature	1000	https://modis.gsfc.nasa.gov
TNMMOD	Mean value Long-term night surface temperature	1000	https://modis.gsfc.nasa.gov
TNLMOD	Minimum Long-term surface temperature	1000	https://modis.gsfc.nasa.gov
TNHMOD[1]	Maximum Long-term night surface temperature	1000	https://modis.gsfc.nasa.gov
TDSMOD	Standard deviation of day-time LST	1000	https://modis.gsfc.nasa.gov
TDMMOD	Mean Long-term day surface temperature	1000	https://modis.gsfc.nasa.gov
TDLMOD	Minimum Long-term day surface temperature	1000	https://modis.gsfc.nasa.gov
TDHMOD	Maximum Long-term day surface temperature	1000	https://modis.gsfc.nasa.gov
PX4WCL	Long-term Precipitation Aug/Sep/Oct	1000	https://www.worldclim.org/
PX3WCL	Long-term Precipitation of May/Jun/Jul	1000	https://www.worldclim.org/
PX2WCL	Long-term Precipitation of Feb/Mar/Apr	1000	https://www.worldclim.org/

Factors definitions	Description	Resolution (m)	Source data set
PX1WCL	Long-term precipitation of Nov/Dec/Jan	1000	https://www.worldclim.org/
PREGSM[1]	Mean monthly precipitation (annual)	1000	http://chelsa-climate.org/
P12DWD	Monthly precipitation for December	5000	http://chelsa-climate.org/
P11DWD	Mean precipitation of November	1000	http://chelsa-climate.org/
P10DWD	Mean precipitation of October	1000	http://chelsa-climate.org/
P09DWD	Mean precipitation of September	1000	http://chelsa-climate.org/
P08DWD	Mean precipitation of August	1000	http://chelsa-climate.org/
P07DWD	Mean precipitation of July	1000	http://chelsa-climate.org/
P06DWD	Mean precipitation of June	1000	http://chelsa-climate.org/
P05DWD	Mean precipitation of May	1000	http://chelsa-climate.org/
P04DWD	Mean precipitation of April	1000	http://chelsa-climate.org/
P03DWD	Mean precipitation of Mar	1000	http://chelsa-climate.org/
P02DWD	Monthly precipitation for February	1000	http://chelsa-climate.org/
P01DWD[1]	Monthly precipitation for January	1000	http://chelsa-climate.org/
MODCF[1]	EC	1000	http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002415
L15IGB	Snow and ice index	1000	https://modis.gsfc.nasa.gov
INSSRE[1]	Standard deviation Potential incoming solar radiation	1000	https://www.worldgrids.com
INMSRE[1]	Mean potential incoming solar radiation	1000	https://www.worldgrids.com
G22ESA	Permanent snow and ice	1000	http://due.esrin.esa.int/page_globcover.php
Organisms (50)			

Factors definitions	Description	Resolution (m)	Source data set
B5/B7[1]	The ratio of Band 5 (near-infrared) to Band 7 (shortwave infrared 2) surface reflectance	90	https://www.usgs.gov/landsat-missions/landsat-collection-2
NDVI[1]	Normalized Difference Vegetation Index	90	Calculated from Landsat 8 Collection 2 Level-2 (LC08C02) on the GEE platform
NDWI[1]	Normalized Difference Water Index	90	Calculated from Landsat 8 Collection 2 Level-2 (LC08C02) on the GEE platform
surR[1]	Surface Reflectance	250	https://modis.gsfc.nasa.gov/data/dataprod/mod09.php
EVI	Enhanced Vegetation Index	500	Calculated from LC08C02 on the GEE platform
SAI[1]	Snow Area Index	500	Calculated from LC08C02 on the GEE platform
LAI[1]	Leaf Area Index	90	Calculated from LC08C02 on the GEE platform
NPP	Net Primary Productivity	500	https://lpdaac.usgs.gov/products/mod17a3hgfv061/
landuse[1]	Land use type	30	https://www.resdc.cn/DOI/DOI.aspx?DOIID = 54
CanopyHeight[1]	Canopy Height	10	https://doi.org/10.3929/ethz-b-000609802
Sentinel2B2[1]	Band2 from Sentinel2	90	Derived from Sentinel2 on the GEE platform
Sentinel2B3	Band3 from Sentinel2	90	Derived from Sentinel2 on the GEE platform
Sentinel2B4	Band4 from Sentinel2	90	Derived from Sentinel2 on the GEE platform
Sentinel2B8	Band8 from Sentinel2	90	Derived from Sentinel2 on the GEE platform
Sentinel2B9	Band9 from Sentinel2	90	Derived from Sentinel2 on the GEE platform
QA_PIXEL[1]	Landsat 8 Collection 2 Level-2 Pixel Quality Band	90	Derived from LC08C02 on the GEE platform
QA_RADSAT	Radiometric Saturation Quality control	90	Derived from LC08C02 on the GEE platform
SR_B4[1]	Surface Reflectance of Band4	90	Derived from LC08C02 on the GEE platform
SR_B5	Surface Reflectance of Band5	90	Derived from LC08C02 on the GEE platform
SR_B6	Surface Reflectance of Band6	90	Derived from LC08C02 on the GEE platform
SR_B7	Surface Reflectance of Band7	90	Derived from LC08C02 on the GEE platform
ST_ATRAN	Atmospheric Transmittance	90	Derived from LC08C02 on the GEE platform
ST_B10	Band 10 Surface Temperature	90	Derived from LC08C02 on the GEE platform
ST_EMSD	Emissivity standard deviation	90	Derived from LC08C02 on the GEE platform

Factors definitions	Description	Resolution (m)	Source data set
ST_TRAD	Thermal Radiance	90	Derived from LC08C02 on the GEE platform
ST_URAD	Downwelled Radiance	90	Derived from LC08C02 on the GEE platform
wc2.1_prec		1000	
wc2.1_srad[1]	solar radiation (kJ m-2 day-1)	1000	https://worldclim.org/data/worldclim21.html
wc2.1_tavg	average temperature (°C)	1000	https://worldclim.org/data/worldclim21.html
wc2.1_tmax	maximum temperature (°C)	1000	https://worldclim.org/data/worldclim21.html
wc2.1_tmin	minimum temperature (°C)	1000	https://worldclim.org/data/worldclim21.html
wc2.1_prec	precipitation (mm)	1000	https://worldclim.org/data/worldclim21.html
wc2.1_wind[1]	wind speed (m s-1)	1000	https://worldclim.org/data/worldclim21.html
RANGE0105	Range of Enhanced Vegetation Index	1000	http://onlinelibrary.wiley.com/doi/10.1111/geb.12368/abstract
PDMGPW[1]	Average population density	5000	https://www.worldgrids.com
MAX0105	Maximum of Enhanced Vegetation Index	1000	http://onlinelibrary.wiley.com/doi/10.1111/geb.12367/abstract
LCEE10	ESA land cover	300	http://maps.elie.ucl.ac.be/CCI/viewer/download/ESACCI-LC-PUG-v2.5.pdf
L16IGB	Barren or sparsely vegetated	1000	https://modis.gsfc.nasa.gov
L14IGB	Cropland/natural vegetation mosaic	1000	https://modis.gsfc.nasa.gov
L13IGB	Urban and built-up	1000	https://modis.gsfc.nasa.gov
L12IGB	Croplands index	1000	https://modis.gsfc.nasa.gov
L11IGB	Permanent Wetlands	1000	https://modis.gsfc.nasa.gov
L10IGB	Grasslands	1000	https://modis.gsfc.nasa.gov
L09IGB	Savannas	1000	https://modis.gsfc.nasa.gov
L06IGB	Closed shrublands	1000	https://modis.gsfc.nasa.gov
L05IGB	Mixed forests index	1000	https://modis.gsfc.nasa.gov
L04IGB[1]	Deciduous broadleaf forest	1000	https://modis.gsfc.nasa.gov
L03IGB	Deciduous needleleaf forest	1000	https://modis.gsfc.nasa.gov
L02IGB	Evergreen broadleaf forest	1000	https://modis.gsfc.nasa.gov
L01IGB	Evergreen needleleaf forest	1000	https://modis.gsfc.nasa.gov

Factors definitions	Description	Resolution (m)	Source data set
GLCJRC	Global Land Cover map for the year 2000	1000	http://www.globallandcover.com/
GLCESA	Land Cover classes	1000	http://due.esrin.esa.int/page_globcover.php
GACGEM[1]	Global accessibility map	1000	http://globalaccessibilitymap.com/
G21ESA	Water bodies	1000	http://due.esrin.esa.int/page_globcover.php
G20ESA	Bare areas	1000	http://due.esrin.esa.int/page_globcover.php
G19ESA	Artificial surfaces and associated areas	1000	http://due.esrin.esa.int/page_globcover.php
G18ESA	Closed to open grassland or woody vegetation on regularly flooded or waterlogged soil - Fresh, brackish or saline water	1000	http://due.esrin.esa.int/page_globcover.php
G17ESA	Closed broadleaved forest or shrubland permanently flooded - Saline or brackish water	1000	http://due.esrin.esa.int/page_globcover.php
G16ESA	Closed to open broadleaved forest regularly flooded - Fresh or brackish water	1000	http://due.esrin.esa.int/page_globcover.php
G15ESA	Sparse (<15%) vegetation	1000	http://due.esrin.esa.int/page_globcover.php
G14ESA	Closed to open shrubland	1000	http://due.esrin.esa.int/page_globcover.php
G12IGB	Land cover types for 2012	1000	https://modis.gsfc.nasa.gov
G11IGB	Land cover types for 2011	1000	https://modis.gsfc.nasa.gov
G11ESA	Mosaic forest or shrubland / grassland	1000	http://due.esrin.esa.int/page_globcover.php
G10IGB	Land cover types for 2010	1000	https://modis.gsfc.nasa.gov
G10ESA	Closed to open mixed broadleaved and needleleaved forest	1000	http://due.esrin.esa.int/page_globcover.php
G09ESA	Open needleleaved deciduous or evergreen forest	1000	http://due.esrin.esa.int/page_globcover.php

Factors definitions	Description	Resolution (m)	Source data set
G08ESA	Closed needleleaved evergreen forest	1000	http://due.esrin.esa.int/page_globcover.php
G07ESA	Open broadleaved deciduous forest/woodland	1000	http://due.esrin.esa.int/page_globcover.php
G05ESA	Closed to open broadleaved evergreen or semi-deciduous forest	1000	http://due.esrin.esa.int/page_globcover.php
G04IGB	Land cover types for 2004	1000	https://modis.gsfc.nasa.gov
G04ESA	Mosaic vegetation / cropland	1000	http://due.esrin.esa.int/page_globcover.php
G03ESA	Mosaic cropland / vegetation	1000	http://due.esrin.esa.int/page_globcover.php
G02IGB	Land cover types for 2002	1000	https://modis.gsfc.nasa.gov
G02ESA	Rainfed croplands	1000	http://due.esrin.esa.int/page_globcover.php
G01IGB	Land cover types for 2001	1000	https://modis.gsfc.nasa.gov
G01ESA	Post-flooding or irrigated croplands (or aquatic)	1000	http://due.esrin.esa.int/page_globcover.php
EVSMOD	Standard deviation MODIS Enhanced Vegetation Index	1000	https://modis.gsfc.nasa.gov
EVMMOD[1]	Mean MODIS Enhanced Vegetation Index	1000	https://modis.gsfc.nasa.gov
EVENNESS	Evenness of Enhanced Vegetation Index	1000	http://onlinelibrary.wiley.com/doi/10.1111/geb.12366/abstract
ENTROPY	Disorderliness of Enhanced Vegetation Index	1000	http://onlinelibrary.wiley.com/doi/10.1111/geb.12365/abstract
COVER	Land cover of 2010	300	http://www.sciencemag.org/content/342/6160/850
TERECO[1]	Terrestrial Ecosystems	250	https://landscape12.arcgis.com/arcgis/rest/services/World_Terrestrial_Ecosystems/ImageServer
Relief (13)			
L3POBI	Physiographic landform units (SCALA project)	1000	https://www.worldgrids.com
DEM[1]	Land surface elevation	90	https://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/

Factors definitions	Description	Resolution (m)	Source data set
slope[1]	Terrain slope	90	Derived from DEM
DEM_crd	Local downslope Curvature	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_cru	Local upslope Curvature	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_crv	Downslope Curvature	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_dvm	Deviation from Mean Value (surface roughness) x9	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_dvm2	Deviation from Mean Value (surface roughness) x13	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_mrn	Melton Ruggedness Number	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_nopn[1]	Negative Topographic Openness	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_popn	Positive Topographic Openness	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_prof	Profile Curvature	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_tpi	Topographic Position Index	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_twi[1]	Topographic Wetness Index	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
DEM_vbf	Multiresolution Index of Valley Bottom Flatness	90	http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/
Parent material (2)			
RTMUSG15[1]	Rock type	250	USGS Geosciences and Environmental Change Science Center (GECSC) based on the Global Lithological Map database v1.1 (GLiM, Hartmann and Moosdorf, 2012).

Factors definitions	Description	Resolution (m)	Source data set
SEDDEP	Average soil and sedimentary deposit thickness	1000	https://www.ornl.gov/
Other (2)			
SMKMOD	MODIS LAI based soil productive area mask of the world	5000	https://modis.gsfc.nasa.gov
LMTGSH[1]	Land mask based on GSHHS	1000	https://www.worldgrids.com

[1]variables used in the modeling of soil organic carbon content at 0-5 cm depth interval.

Table S2. Tuned model parameters for each soil property considered at 0-5 cm depth interval. See Table 1 for abbreviations and units of the soil properties considered.

Property	Number of covariates	mtry	nodesize
pH	32	9	10
Sand	27	10	8
Silt	27	10	8
Clay	27	10	9
BD	25	11	10
OC	26	9	10
Gravel	25	12	8
AN	29	17	13
TN	26	16	10
CEC	25	9	10
Porosity	29	11	15
TK	41	17	12
TP	38	11	15
AK	43	17	11
AP	42	19	12
R (Wet)	36	12	13
G (Wet)	35	11	12
B (Wet)	35	11	13
R (Dry)	33	12	13
G (Dry)	33	12	12
B (Dry)	33	10	13

Table S3. Statistical description of soil properties at six depth intervals. Refer to Table 1 for the abbreviations and units of the soil properties interested.

Depth interval (cm)	Number	Max	Min	Mean	SD	CV	Skewness	Kurtosis
pH								
0-5	9623	10.59	2.64	7.12	1.28	0.18	-0.48	-0.71
5-15	9632	10.53	2.66	7.14	1.27	0.18	-0.49	-0.71
15-30	9596	10.61	2.76	7.21	1.25	0.17	-0.54	-0.64
30-60	9288	10.50	2.99	7.28	1.25	0.17	-0.61	-0.56
60-100	7711	10.36	2.97	7.33	1.26	0.17	-0.66	-0.56
100-200	2584	10.28	2.94	7.61	1.23	0.16	-1.02	0.15
sand								
0-5	8743	102.63	0.00	40.26	21.18	0.53	0.36	-0.51
5-15	8152	99.99	0.00	40.12	21.01	0.52	0.30	-0.56
15-30	8122	99.99	0.02	39.23	21.13	0.54	0.36	-0.51
30-60	7844	101.84	0.02	38.70	22.03	0.57	0.40	-0.57
60-100	6389	101.33	0.00	37.93	22.88	0.60	0.47	-0.56
100-200	2127	101.82	0.22	37.01	23.18	0.63	0.62	-0.33
silt								
0-5	8926	96.45	0.00	40.60	15.88	0.39	-0.07	-0.20
5-15	8324	95.23	0.00	40.18	15.34	0.38	-0.02	-0.13
15-30	8300	92.53	0.00	39.90	15.29	0.38	-0.05	-0.19
30-60	8018	97.19	0.00	39.36	15.73	0.40	-0.01	-0.21
60-100	6562	102.40	0.00	39.52	16.38	0.41	0.01	-0.16
100-200	2207	100.57	0.00	41.14	17.74	0.43	-0.08	-0.27
clay								
0-5	9142	100.00	0.04	19.23	11.01	0.57	1.06	1.70
5-15	8539	100.00	0.08	19.70	11.20	0.57	1.02	1.44
15-30	8509	100.00	0.03	20.91	11.95	0.57	1.01	1.35
30-60	8225	100.00	0.00	22.02	13.02	0.59	0.96	1.20
60-100	6748	100.00	0.00	22.79	13.78	0.60	0.90	0.92
100-200	2302	84.67	0.04	22.16	13.35	0.60	0.96	1.22

Depth interval (cm)	Number	Max	Min	Mean	SD	CV	Skewness	Kurtosis
BD								
0-5	1531	2.21	0.14	1.24	0.20	0.16	-0.69	2.84
5-15	1556	2.18	0.18	1.26	0.19	0.15	-0.80	2.97
15-30	1551	2.12	0.18	1.34	0.19	0.14	-1.10	3.47
30-60	1362	2.10	0.34	1.40	0.19	0.13	-1.05	3.52
60-100	955	2.60	0.26	1.43	0.19	0.13	-0.94	4.27
100-200	331	2.13	0.54	1.44	0.19	0.13	-0.72	4.48
OC								
0-5	9758	41.99	0.00	2.26	3.13	1.39	4.67	30.98
5-15	9164	61.83	0.00	2.03	2.78	1.37	5.67	55.93
15-30	9147	52.10	0.00	1.45	2.12	1.47	7.93	105.75
30-60	8811	43.07	0.00	0.97	1.72	1.77	10.57	165.14
60-100	7156	47.56	0.00	0.70	1.55	2.20	13.90	266.53
100-200	2306	45.22	0.00	0.54	1.83	3.35	15.04	271.28
gravel								
0-5	1994	97.42	0.00	20.10	18.25	0.91	1.14	0.69
5-15	2041	95.00	0.00	20.42	18.27	0.89	1.10	0.60
15-30	2016	95.00	0.00	22.99	19.86	0.86	0.95	0.18
30-60	1911	95.33	0.00	25.64	21.19	0.83	0.78	-0.25
60-100	1288	94.11	0.00	26.15	21.25	0.81	0.73	-0.36
100-200	163	87.90	0.02	22.68	21.21	0.93	1.10	0.53
AN								
0-5	3447	1295.31	0.90	145.04	142.00	0.98	2.71	9.75
5-15	3447	1279.89	0.95	132.51	124.07	0.94	2.82	11.79
15-30	3410	1326.79	1.12	99.77	96.81	0.97	4.04	28.29
30-60	3151	1425.23	0.65	68.43	77.99	1.14	6.36	67.66
60-100	2270	1010.77	0.62	51.85	58.11	1.12	6.48	73.97
100-200	516	1043.52	0.62	41.87	64.90	1.55	9.69	127.43
TN								
0-5	9446	2.46	0.00	0.19	0.20	1.09	3.67	19.26
5-15	9239	2.46	0.00	0.17	0.18	1.06	4.01	24.93

Depth interval (cm)	Number	Max	Min	Mean	SD	CV	Skewness	Kurtosis
15-30	9219	2.46	0.00	0.13	0.14	1.09	5.58	53.87
30-60	8816	2.49	0.00	0.09	0.11	1.24	8.26	111.67
60-100	7037	2.46	0.00	0.07	0.10	1.38	9.57	142.33
100-200	2219	1.79	0.00	0.05	0.09	1.69	11.89	179.87
CEC								
0-5	6624	123.89	0.16	14.94	10.65	0.71	2.57	11.74
5-15	6627	124.86	0.52	14.53	9.86	0.68	2.47	11.76
15-30	6595	125.40	0.29	13.59	8.96	0.66	2.62	14.92
30-60	6213	116.03	0.22	12.71	8.35	0.66	2.27	11.12
60-100	4809	105.11	0.34	12.21	8.29	0.68	2.54	14.79
100-200	1539	102.90	0.28	12.36	8.00	0.65	2.14	13.08
TP								
0-5	8229	12.43	0.00	0.08	0.17	1.98	54.57	3808.42
5-15	8229	12.61	0.00	0.08	0.17	2.00	56.58	4081.97
15-30	8193	14.58	0.00	0.08	0.18	2.34	68.24	5468.62
30-60	7822	15.93	0.00	0.07	0.19	2.73	75.01	6237.73
60-100	6160	16.12	0.00	0.07	0.21	3.21	68.67	5123.50
100-200	1882	0.66	0.00	0.06	0.05	0.79	3.55	24.01
porosity								
0-5	734	74.86	32.11	52.14	6.49	0.12	0.35	0.76
5-15	734	74.15	30.57	51.41	6.15	0.12	0.41	0.80
15-30	732	78.23	28.42	49.01	6.07	0.12	0.81	1.89
30-60	659	77.09	22.44	47.40	6.14	0.13	0.83	2.61
60-100	469	78.85	22.91	46.60	6.02	0.13	0.69	2.87
100-200	196	79.42	23.72	45.92	6.64	0.14	0.52	4.08
TK								
0-5	6729	5.24	0.02	1.95	0.67	0.34	0.05	1.17
5-15	6728	5.24	0.03	1.95	0.66	0.34	0.04	1.16
15-30	6698	5.23	0.03	1.95	0.66	0.34	0.03	1.11
30-60	6360	5.02	0.02	1.95	0.68	0.35	0.03	1.02
60-100	4978	6.16	0.00	1.93	0.70	0.36	0.09	1.06

Depth interval (cm)	Number	Max	Min	Mean	SD	CV	Skewness	Kurtosis
100-200	1344	5.13	0.00	1.93	0.63	0.32	0.18	1.99
AK								
0-5	4984	6405.52	1.00	153.36	183.92	1.20	16.29	490.56
5-15	4990	7440.15	0.92	143.03	170.30	1.19	19.89	747.11
15-30	4951	7803.84	1.00	116.92	151.66	1.30	28.23	1350.57
30-60	4605	6986.45	1.00	99.69	139.19	1.40	28.28	1318.20
60-100	3494	6047.12	0.98	94.69	140.06	1.48	24.32	954.11
100-200	937	861.81	1.75	99.71	84.75	84.75	0.85	3.43
AP								
0-5	4932	398.99	0.10	9.41	13.48	1.43	10.02	208.71
5-15	4934	443.53	0.10	8.76	13.16	1.50	12.68	323.74
15-30	4889	587.27	0.10	6.39	11.85	1.85	26.22	1193.62
30-60	4485	185.08	0.02	4.87	7.74	1.59	8.59	125.29
60-100	3351	235.83	0.03	4.73	8.80	1.86	11.63	227.95
100-200	882	74.62	0.06	4.53	7.11	1.57	4.89	33.14
R (wet)								
0-5	2889	265.92	40.00	139.34	38.89	0.28	-0.06	-0.14
5-15	2940	259.30	23.80	140.47	37.19	0.26	-0.08	-0.16
15-30	2929	256.22	26.33	147.65	34.28	0.23	-0.16	0.07
30-60	2808	256.67	15.27	156.04	34.23	0.22	-0.23	0.39
60-100	2365	261.15	161.39	34.83	34.83	0.22	-0.20	0.28
100-200	801	261.06	53.26	167.02	34.08	0.20	-0.19	0.04
G (wet)								
0-5	2889	266.35	21.00	117.25	37.87	0.32	0.07	-0.12
5-15	2940	255.00	21.00	117.78	36.20	0.31	0.05	-0.23
15-30	2929	255.00	21.00	122.59	33.20	0.27	0.02	-0.17
30-60	2809	255.00	18.09	128.73	33.25	0.26	0.03	-0.06
60-100	2365	257.89	19.81	133.05	33.87	0.25	0.01	-0.29
100-200	801	206.33	40.92	135.84	32.06	0.24	-0.14	-0.41
B (wet)								
0-5	2887	269.35	0.05	92.40	37.61	0.41	0.10	0.02

Depth interval (cm)	Number	Max	Min	Mean	SD	CV	Skewness	Kurtosis
5-15	2939	255.00	0.02	92.17	36.03	0.39	0.06	-0.20
15-30	2828	255.00	7.84	93.58	34.48	0.39	-0.02	-0.49
30-60	2808	255.00	0.51	96.13	36.14	0.38	-0.00	-0.32
60-100	2364	258.83	4.36	98.33	38.14	0.39	-0.06	-0.45
100-200	800	198.68	10.25	98.26	36.66	0.37	-0.21	-0.58
R (dry)								
0-5	1738	265.58	8.00	145.12	36.70	0.25	-0.14	0.05
5-15	1769	256.63	8.00	145.90	34.62	0.24	-0.16	0.07
15-30	1757	236.48	8.00	151.26	32.21	0.21	-0.17	0.19
30-60	1714	251.16	8.00	158.01	33.28	0.21	-0.20	0.38
60-100	1502	257.89	8.00	163.92	33.97	0.21	-0.34	0.57
100-200	665	263.26	8.00	170.09	33.48	0.20	-0.38	0.80
G (dry)								
0-5	1738	267.41	8.00	120.71	36.16	0.30	0.12	0.11
5-15	1769	256.95	8.00	121.01	34.17	0.28	0.10	0.03
15-30	1757	219.37	8.00	124.52	31.78	0.26	0.09	-0.17
30-60	1714	250.37	8.00	128.70	32.81	0.25	0.06	-0.22
60-100	1502	258.48	8.00	133.33	34.06	0.26	-0.03	-0.31
100-200	665	267.38	8.00	133.33	34.06	0.26	-0.03	-0.31
B (dry)								
0-5	1732	269.53	8.00	94.91	37.06	0.39	0.24	0.34
5-15	1768	257.30	5.61	94.34	35.32	0.37	0.17	0.08
15-30	1756	213.47	8.00	95.35	33.29	0.35	0.06	-0.42
30-60	1713	249.42	8.00	96.26	34.41	0.37	0.05	-0.42
60-100	1502	259.21	8.00	99.22	38.33	0.39	0.04	-0.39
100-200	668	268.45	8.00	103.70	38.75	0.37	-0.07	-0.26

CV: coefficient of variation; SD: standard deviation;

310

Table S4. Accuracy evaluation of the soil properties prediction with CSDLv2, CSDLv1, SoilGrids 2.0, and HWSD 2.0, based on the randomly held-back soil profiles. The "Number" column indicates the number of samples used during testing. See Table 1 for the abbreviations and units of the soil properties interested.

Property	Depth interval	Number	CSDLv2			CSDLv1			SoilGrids 2.0			HWSD 2.0		
			MEC	RMSE	ME	MEC	RMSE	ME	MEC	RMSE	ME	MEC	RMSE	ME
OC	0-5	848	0.57	2.04	0.03	0.16	2.86	-0.51	0.24	2.72	1.11	0.04	3.38	-0.50
	5-15	848	0.56	1.82	0.02	0.13	2.60	-0.46	0.46	2.05	0.08	0.03	3.05	-1.15
	15-30	842	0.45	1.51	0.01	0.12	2.11	-0.36	0.40	1.64	0.03	0.04	2.29	-0.82
	30-60	810	0.40	1.28	0.01	0.10	1.76	-0.26	0.34	1.38	0.01	0.02	1.83	-0.51
	60-100	653	0.25	1.30	0.01	0.08	1.64	-0.23	0.20	0.54	-0.01	0.03	1.61	-0.36
	100-200	205	0.23	0.41	0.03	0.07	1.82	-0.32	0.13	1.70	0.04	0.03	1.58	-0.21
gravel	0-5	199	0.49	12.97	0.06	0.13	19.43	-6.31	0.45	13.46	0.36	0.04	21.12	-7.27
	5-15	204	0.51	12.72	0.11	0.06	18.82	-5.63	0.48	13.07	0.55	0.03	21.63	-6.47
	15-30	202	0.52	13.68	0.09	0.09	20.77	-5.23	0.49	14.18	-0.13	0.03	23.17	-9.60
	30-60	191	0.50	14.85	0.09	0.06	21.83	5.35	0.47	15.37	-0.06	0.03	23.99	-10.69
	60-100	129	0.47	15.25	0.14	0.05	22.45	2.91	0.43	15.86	-0.07	0.03	24.47	-8.93
	100-200	16	0.35	14.84	0.03	0.04	23.34	-3.97	0.30	16.60	2.66	0.05	23.43	-8.13
AN	0-5	341	0.53	96.32	1.48	0.14	131.81	-11.55	-	-	-	-	-	-
	5-15	340	0.52	84.08	1.28	0.14	114.91	-10.35	-	-	-	-	-	-
	15-30	337	0.37	73.85	0.71	0.09	92.90	-6.05	-	-	-	-	-	-
	30-60	311	0.33	62.78	0.96	0.02	78.46	-3.38	-	-	-	-	-	-
	60-100	223	0.25	48.92	0.74	0.02	59.46	-6.55	-	-	-	-	-	-
	100-200	50	0.24	20.41	-0.11	0.01	98.61	-8.46	-	-	-	-	-	-
TN	0-5	664	0.44	0.15	0.00	0.19	0.18	-0.03	0.14	0.23	0.13	0.04	2.46	-0.79
	5-15	664	0.40	0.14	0.00	0.17	0.17	-0.03	0.31	0.15	0.01	0.02	2.50	-1.46
	15-30	661	0.28	0.12	0.00	0.08	0.14	-0.03	0.21	0.13	0.01	0.02	2.27	-1.48
	30-60	623	0.18	0.06	0.00	0.01	0.02	-0.02	0.13	0.11	0.00	0.02	2.33	-1.44
	60-100	491	0.25	0.04	0.00	0.01	0.10	-0.02	0.08	0.09	-0.00	0.03	2.45	-1.48
	100-200	133	0.20	0.02	0.00	0.01	0.09	-0.03	0.02	0.09	0.00	0.02	2.92	-1.56
CEC	0-5	637	0.34	8.49	0.16	0.07	10.23	-1.27	0.17	11.55	5.58	0.02	12.37	1.73
	5-15	637	0.33	7.90	0.15	0.06	9.51	-1.22	0.16	10.27	4.01	0.02	11.02	0.69
	15-30	633	0.28	7.44	0.13	0.04	9.10	-1.17	0.14	9.91	4.50	0.03	9.23	0.52

	30-60	597	0.27	7.01	0.12	0.03	8.47	-1.23	0.13	9.69	4.80	0.03	8.87	0.58
	60-100	459	0.24	7.05	0.14	0.05	8.79	1.30	0.10	9.73	4.97	0.02	8.86	0.73
	100-200	144	0.25	6.86	0.06	0.08	8.91	1.42	0.11	9.70	4.86	0.02	8.45	1.09
TP	0-5	814	0.29	0.05	0.00	0.01	0.17	-0.02	-	-	-	-	-	-
	5-15	814	0.30	0.05	0.00	0.01	0.15	-0.01	-	-	-	-	-	-
	15-30	809	0.29	0.05	0.00	0.02	0.15	-0.02	-	-	-	-	-	-
	30-60	774	0.25	0.05	0.00	0.01	0.19	-0.02	-	-	-	-	-	-
	60-100	608	0.23	0.05	0.00	0.02	0.12	-0.02	-	-	-	-	-	-
	100-200	186	0.23	0.04	0.00	0.01	0.07	-0.04	-	-	-	-	-	-
porosity	0-5	73	0.28	5.47	-0.02	0.03	6.48	-0.03	-	-	-	-	-	-
	5-15	73	0.27	5.22	-0.03	0.01	6.11	-0.36	-	-	-	-	-	-
	15-30	73	0.23	5.02	-0.00	0.02	6.01	-0.31	-	-	-	-	-	-
	30-60	64	0.20	3.95	0.01	0.01	6.28	-0.07	-	-	-	-	-	-
	60-100	47	0.21	2.70	-0.00	0.01	6.58	0.08	-	-	-	-	-	-
	100-200	20	0.15	3.94	0.14	0.01	7.02	0.12	-	-	-	-	-	-
TK	0-5	664	0.25	0.56	0.00	0.01	0.67	-0.07	-	-	-	-	-	-
	5-15	663	0.26	0.55	0.00	0.01	0.67	-0.07	-	-	-	-	-	-
	15-30	661	0.27	0.55	0.00	0.00	0.66	-0.05	-	-	-	-	-	-
	30-60	627	0.25	0.57	0.00	0.00	0.67	-0.04	-	-	-	-	-	-
	60-100	490	0.22	0.61	0.00	0.00	0.71	-0.06	-	-	-	-	-	-
	100-200	133	0.16	0.50	-0.00	0.00	2.12	-0.08	-	-	-	-	-	-
AK	0-5	491	0.27	110.72	1.22	0.03	181.65	-24.17	-	-	-	-	-	-
	5-15	492	0.24	102.74	1.27	0.02	168.75	-23.75	-	-	-	-	-	-
	15-30	488	0.24	83.50	1.10	0.02	150.73	-20.54	-	-	-	-	-	-
	30-60	454	0.21	76.76	0.98	0.01	140.83	-17.93	-	-	-	-	-	-
	60-100	344	0.16	79.33	1.46	0.01	142.55	-20.97	-	-	-	-	-	-
	100-200	92	0.12	70.70	0.61	0.00	182.79	-42.54	-	-	-	-	-	-
AP	0-5	486	0.14	9.58	0.26	0.09	11.86	-3.37	-	-	-	-	-	-
	5-15	486	0.13	8.84	0.23	0.07	11.03	-3.21	-	-	-	-	-	-
	15-30	482	0.12	6.77	0.19	0.07	8.57	-2.18	-	-	-	-	-	-
	30-60	442	0.10	5.81	0.08	0.09	7.74	-1.84	-	-	-	-	-	-
	60-100	330	0.12	6.20	0.08	0.06	9.04	-1.93	-	-	-	-	-	-
	100-200	87	0.12	6.16	0.07	0.00	20.47	-5.64	-	-	-	-	-	-

"-" indicates that the soil property was not mapped or not included in the dataset.

315 **Table S5. Predictive performance of CSDLv2, SoilGrids 2.0, CSDLv2, and HWSD 2.0 based on validation with testing profiles from WoSIS. Refer to Table 1 for the abbreviations and units of the soil properties interested.**

Property	Depth interval	CSDLv2			CSDLv1			SoilGrids 2.0			HWSD 2.0		
		MEC	RMSE	ME	MEC	RMSE	ME	MEC	RMSE	ME	MEC	RMSE	ME
pH	0-5	0.84	0.57	0.15	0.64	0.84	0.08	0.87	0.51	0.14	0.51	0.99	-0.17
	5-15	0.85	0.54	0.14	0.66	0.81	0.08	0.88	0.49	0.14	0.52	0.97	-0.02
	15-30	0.84	0.56	0.10	0.29	1.16	-0.37	0.87	0.49	0.13	0.57	0.93	-0.04
	30-60	0.85	0.52	0.11	0.66	0.80	0.05	0.87	0.50	0.10	0.58	0.91	-0.06
	60-100	0.85	0.53	0.12	0.67	0.80	0.46	0.87	0.51	0.10	0.58	0.91	-0.07
	100-200	0.84	0.38	-0.03	0.61	0.90	0.10	0.86	0.53	0.13	0.61	0.92	0.04
sand	0-5	0.79	9.81	-2.36	0.03	24.10	-9.98	0.75	10.71	-5.46	0.01	21.44	-2.76
	5-15	0.82	9.21	-2.02	0.05	23.63	-9.69	0.78	10.05	-5.03	0.06	21.44	-3.81
	15-30	0.83	9.11	-1.33	0.04	23.59	-8.92	0.81	9.39	-4.26	0.06	21.03	-2.96
	30-60	0.83	9.24	-1.22	0.03	23.90	-9.01	0.82	9.41	-4.16	0.12	20.80	-2.11
	60-100	0.84	9.36	-1.57	0.04	23.91	-8.83	0.79	10.47	-4.51	0.10	21.50	-1.83
	100-200	0.79	10.77	-3.16	0.01	26.70	-9.99	0.75	11.99	-5.98	0.01	23.16	-3.37
silt	0-5	0.72	7.56	3.47	0.03	19.25	11.27	0.68	8.24	3.53	0.05	15.45	2.78
	5-15	0.74	7.23	3.17	0.04	18.93	11.02	0.73	7.65	3.05	0.06	15.19	1.46
	15-30	0.78	6.66	2.89	0.03	19.00	11.08	0.76	7.13	2.85	0.07	14.93	0.94
	30-60	0.76	6.95	3.09	0.04	18.75	10.88	0.73	7.50	3.05	0.07	14.75	1.30
	60-100	0.73	7.42	3.18	0.05	18.37	10.04	0.71	7.91	3.17	0.07	14.95	1.27
	100-200	0.74	7.75	3.14	0.04	18.53	9.23	0.72	8.10	3.62	0.05	16.67	2.16
clay	0-5	0.74	5.51	0.15	0.07	11.84	-1.48	0.71	6.66	2.33	0.05	12.01	0.54
	5-15	0.78	5.10	0.12	0.11	11.74	-1.75	0.75	6.24	2.11	0.04	12.19	2.86
	15-30	0.78	5.21	-0.35	0.12	12.62	-2.81	0.79	6.21	1.66	0.14	12.33	2.65
	30-60	0.82	5.36	-0.69	0.17	13.14	-2.45	0.83	5.98	1.22	0.20	12.71	1.08
	60-100	0.85	5.74	-0.61	0.20	13.34	-2.16	0.82	6.31	1.21	0.21	13.18	0.31
	100-200	0.83	6.21	0.07	0.18	13.61	0.48	0.79	7.01	2.42	0.14	13.71	0.72
OC	0-5	0.63	19.88	1.43	0.08	31.19	-5.26	0.58	22.34	9.97	0.04	35.46	-3.31
	5-15	0.53	24.48	0.55	0.03	35.18	-5.42	0.35	30.79	-0.17	0.04	38.59	-10.02
	15-30	0.46	19.08	0.08	0.02	25.87	-3.24	0.58	17.71	0.31	0.05	28.69	-6.77
	30-60	0.36	9.37	1.24	0.11	7.40	-0.87	0.33	6.09	1.15	0.10	8.14	-2.39
	60-100	0.22	6.62	1.26	0.04	4.26	-0.46	0.20	4.71	0.93	0.11	5.35	-1.12

	100-200	0.16	9.01	1.37	0.10	10.09	-2.09	0.15	7.64	1.15	0.11	5.38	-0.20
CEC	0-5	0.23	7.03	4.85	0.09	9.28	4.86	0.24	6.08	5.12	0.07	10.30	3.25
	5-15	0.25	5.80	3.98	0.07	9.20	3.21	0.22	6.10	4.56	0.05	11.22	4.37
	15-30	0.25	5.89	4.16	0.07	9.19	3.02	0.23	5.89	5.22	0.04	11.56	4.82
	30-60	0.28	5.34	4.05	0.12	8.10	2.51	0.25	5.92	5.11	0.07	9.89	2.89
	60-100	0.25	5.62	4.13	0.09	9.25	4.82	0.21	6.01	4.72	0.06	11.02	3.22
	100-200	0.24	6.42	4.72	0.06	9.32	4.20	0.22	6.13	4.89	0.03	12.68	4.93
TN	0-5	0.50	1.53	-0.14	0.21	1.93	-0.42	0.44	2.23	0.06	0.26	1.93	-0.34
	5-15	0.53	1.37	-0.11	0.22	1.77	-0.37	0.52	1.46	-0.05	0.17	1.89	-0.77
	15-30	0.49	1.05	-0.03	0.33	1.20	-0.25	0.61	0.95	0.01	0.44	1.13	-0.49
	30-60	0.34	1.05	0.02	0.33	1.05	-0.14	0.58	0.87	0.01	0.70	0.74	-0.22
	60-100	0.30	0.91	0.05	0.26	0.94	-0.13	0.40	0.88	0.02	0.67	0.66	-0.08
	100-200	0.13	0.54	0.03	0.19	0.64	-0.28	0.21	0.52	0.05	0.26	0.61	-0.02
BD	0-5	0.68	0.14	-0.01	0.20	0.28	0.05	0.63	0.14	-0.01	0.26	0.34	0.15
	5-15	0.73	0.13	-0.01	0.12	0.27	0.04	0.67	0.12	-0.00	0.21	0.32	0.17
	15-30	0.70	0.13	-0.02	0.01	0.24	0.08	0.72	0.10	0.02	0.23	0.32	0.16
	30-60	0.57	0.15	-0.02	0.01	0.22	0.04	0.55	0.16	0.02	0.15	0.29	0.15
	60-100	0.56	0.14	-0.05	0.02	0.20	-0.01	0.55	0.15	0.01	0.05	0.26	0.09
	100-200	0.61	0.11	-0.04	0.11	0.19	-0.02	0.59	0.11	-0.01	0.11	0.23	0.05

Table S6. Prediction interval coverage probability (PICP) for each soil property at multiple depths. Refer to Table 1 for the abbreviations and units of the soil properties interested.

property	Depth interval (cm)					
	0-5	5-15	15-30	30-60	60-100	100-200
pH	0.90	0.91	0.91	0.91	0.91	0.91
sand	0.90	0.90	0.90	0.90	0.90	0.91
silt	0.91	0.90	0.90	0.90	0.90	0.90
clay	0.90	0.90	0.90	0.90	0.90	0.90
BD	0.90	0.90	0.91	0.89	0.89	0.89
OC	0.90	0.90	0.90	0.90	0.90	0.90
Gravel	0.91	0.90	0.90	0.89	0.90	0.90
AN	0.90	0.90	0.91	0.90	0.90	0.90
TN	0.90	0.91	0.90	0.90	0.90	0.90
CEC	0.90	0.90	0.90	0.90	0.90	0.89
Porosity	0.90	0.89	0.90	0.90	0.90	0.88
TK	0.90	0.90	0.90	0.90	0.90	0.90
TP	0.90	0.91	0.90	0.90	0.90	0.90
AK	0.90	0.90	0.90	0.90	0.90	0.90
AP	0.90	0.88	0.90	0.91	0.90	0.90
R(wet)	0.90	0.89	0.90	0.90	0.90	0.92
G(wet)	0.90	0.90	0.90	0.91	0.90	0.90
B(wet)	0.90	0.90	0.90	0.90	0.91	0.90
R(dry)	0.90	0.90	0.89	0.90	0.90	0.90
G(dry)	0.90	0.90	0.89	0.90	0.92	0.90
B(dry)	0.90	0.90	0.90	0.91	0.90	0.90

Table S7. Comparison of predictive performance for mean predictions using random forest model and median predictions using quantile regression Forest model across different soil properties under 'All Data,' 'High Values,' and 'Low Values' conditions based on 10-fold cross-validation. The 'All Data' condition evaluates performance on the full training set, while 'High Values' and 'Low Values' assess prediction accuracy for the top 10% highest and bottom 10% lowest values, respectively. The 'Prediction method' column documents the models constructed for generating final national-scale predictions at a 90-meter resolution for various soil properties.

property	Statistic Validation	All Data			High Values			Low Values			Prediction method
		MEC	RMSE	ME	MEC	RMSE	ME	MEC	RMSE	ME	
pH	Mean	**0.693**	**0.706**	**0.001**	-2.923	0.786	-0.564	-7.196	1.023	0.830	**Median**
	Median	0.690	0.709	-0.012	**-2.871**	**0.781**	**-0.557**	**-5.958**	**0.943**	**0.730**	**(QRF)**
sand	Mean	**0.670**	**12.161**	**0.056**	**-8.000**	**22.178**	**-16.260**	-9.543	12.961	8.400	Mean
	Median	0.667	12.231	-0.734	-8.612	22.919	-16.560	**-9.070**	**12.021**	**7.299**	(RF)
silt	Mean	0.615	9.825	0.023	-4.324	15.014	-10.967	-8.659	15.652	11.526	**Median**
	Median	0.614	9.840	0.003	**-4.240**	**14.895**	**-10.789**	**-8.838**	**15.796**	**11.139**	**(QRF)**
clay	Mean	**0.629**	**6.749**	**0.019**	-1.328	12.197	-8.221	-23.577	8.543	6.279	**Median**
	Median	0.626	6.771	0.018	**-1.281**	**12.071**	**-7.919**	**-23.416**	**8.515**	**6.088**	**(QRF)**
BD	Mean	**0.623**	**0.119**	**0.001**	**-2.230**	**0.188**	**-0.129**	**-0.561**	**0.208**	**0.133**	Mean
	Median	0.619	0.120	-0.000	-2.351	0.192	-0.133	-0.619	0.212	0.140	(RF)
OC	Mean	**0.570**	**2.043**	**0.028**	**0.089**	**5.382**	**-2.647**	-98.229	1.056	0.559	Mean
	Median	0.556	2.075	-0.225	-0.071	5.836	-3.455	**-69.297**	**0.889**	**0.464**	(RF)
gravel	Mean	**0.494**	**13.010**	**0.066**	**-5.133**	**24.486**	**-19.554**	-150.920	10.572	8.463	Mean
	Median	0.483	13.152	-1.542	-5.427	25.067	-19.771	**-103.985**	**8.789**	**6.430**	(RF)
AN	Mean	**0.535**	**96.580**	**1.489**	**-0.671**	**224.419**	**-155.231**	-91.610	89.083	58.083	Mean
	Median	0.528	97.276	-8.873	-0.882	238.166	-171.510	**-80.097**	**83.362**	**51.067**	(RF)
TN	Mean	**0.437**	**0.153**	**0.003**	**-0.602**	**0.403**	**-0.249**	-63.525	0.090	0.066	Mean

	Median	0.411	0.157	-0.024	-0.950	0.445	-0.310	**-37.921**	**0.069**	**0.050**	(RF)
CEC	Mean	**0.342**	**8.516**	**0.168**	**-1.280**	**20.586**	**-15.277**	-47.768	7.887	6.714	Mean
	Median	0.322	8.644	-1.273	-1.706	22.427	-17.579	**-31.976**	**6.486**	**5.280**	(RF)
porosity	Mean	**0.286**	**5.496**	**-0.028**	**-6.014**	**9.548**	**-8.380**	**-10.608**	**10.167**	**9.167**	Mean
	Median	0.283	5.507	0.064	-6.041	9.566	-8.436	-10.728	10.219	9.236	(RF)
TK	Mean	**0.254**	**0.569**	**0.004**	**-6.439**	**1.133**	**-0.985**	-7.496	-0.921	0.842	Mean
	Median	0.251	0.570	-0.022	-6.856	1.164	-1.007	**-6.626**	**0.873**	**0.772**	(RF)
TP	Mean	0.039	0.153	**0.001**	**-0.073**	**0.471**	**-0.114**	-45.798	0.047	0.040	**Median**
	Median	**0.042**	**0.153**	-0.012	-0.092	0.475	-0.136	**-23.025**	**0.034**	**0.029**	**(QRF)**
AK	Mean	**0.161**	**169.589**	**1.120**	**-0.250**	**484.127**	**-235.202**	-74.502	91.844	77.809	Mean
	Median	0.130	172.666	-24.174	-0.413	514.801	-285.971	**-46.213**	**72.628**	**61.121**	(RF)
AP	Mean	**0.137**	**10.600**	**0.284**	**-1.000**	**29.102**	**-21.562**	-217.302	6.999	6.334	Mean
	Median	0.075	10.976	-2.468	-1.470	32.340	-25.594	**-90.100**	**4.521**	**4.074**	(RF)
R (Wet)	Mean	**0.275**	**33.108**	**0.032**	-10.615	56.055	-50.741	-10.427	54.593	49.311	**Median**
	Median	0.271	33.212	0.081	**-10.481**	**55.730**	**-50.198**	**-10.363**	**54.441**	**48.539**	**(QRF)**
G (Wet)	Mean	**0.258**	**32.333**	**0.076**	**-12.180**	**55.557**	**-51.001**	-24.998	52.446	48.498	Mean
	Median	0.244	32.639	-0.777	-12.543	56.317	-51.137	**-24.089**	**45.522**	**46.730**	(RF)
B (Wet)	Mean	**0.205**	**34.046**	**0.021**	-9.174	57.428	-52.629	-75.942	54.758	50.755	**Median**
	Median	0.193	34.305	0.934	**-8.686**	**56.034**	**-50.974**	**-74.629**	**54.168**	**49.383**	**(QRF)**
R (Dry)	Mean	**0.256**	**34.204**	**0.041**	-11.524	58.243	-51.861	-11.524	56.236	50.954	**Median**
	Median	0.249	34.331	0.095	**-11.142**	**57.531**	**-51.256**	**-11.321**	**56.112**	**50.364**	**(QRF)**
G (Dry)	Mean	**0.269**	**31.238**	**0.067**	**-11.173**	**54.248**	**-50.843**	-23.128	50.571	46.368	Mean
	Median	0.254	31.854	0.421	-11.534	55.658	-50.994	**-22.451**	**46.358**	**43.589**	(RF)
B (Dry)	Mean	**0.213**	**33.224**	**0.020**	-9.854	56.552	-52.223	-74.642	53.775	49.228	**Median**
	Median	0.204	33.612	0.635	**-9.347**	**55.012**	**-50.128**	**-73.734**	**53.127**	**48.581**	**(QRF)**