Table S1. Performance evaluation of classical random forest and quantum feature enhanced random forest during the normal season under different numbers of virtual samples.

Sample size	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
66 (origin)	0.6727	20.62	13.83	0.6602	21.00	14.64
66 (origin) + 66 (virtual)	0.8437	13.50	7.86	0.8459	13.41	8.10
66 (origin) + 132 (virtual)	0.8912	10.64	5.99	0.8797	11.18	6.28
66 (origin) + 198 (virtual)	0.9182	9.18	4.77	0.9134	9.44	5.12
66 (origin) + 264 (virtual)	0.9249	8.62	4.42	0.9276	8.47	4.42
66 (origin) + 330 (virtual)	0.9357	7.88	3.94	0.9397	7.63	3.83
66 (origin) + 396 (virtual)	0.9436	7.26	3.66	0.9456	7.13	3.50
66 (origin) + 462 (virtual)	0.9505	6.83	3.35	0.9499	6.87	3.18
66 (origin) + 528 (virtual)	0.9524	6.49	3.17	0.9552	6.30	2.96
66 (origin) + 594 (virtual)	0.9560	6.15	2.99	0.9575	6.04	2.78
66 (origin) + 660 (virtual)	0.9583	6.02	2.96	0.9622	5.73	2.56

Table S2. Performance evaluation of classical random forest and quantum feature enhanced random forest during the dry season under different numbers of virtual samples.

Sample size	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
65 (origin)	0.2841	47.68	24.04	0.2883	47.54	25.26
65 (origin) + 65 (virtual)	0.5269	31.92	14.72	0.4726	33.71	16.44
65 (origin) + 130 (virtual)	0.6116	26.25	11.83	0.5712	27.58	12.98
65 (origin) + 195 (virtual)	0.6090	22.52	8.71	0.5953	22.91	9.03
65 (origin) + 260 (virtual)	0.7392	19.70	8.02	0.7196	20.42	8.63
65 (origin) + 325 (virtual)	0.7331	18.30	7.27	0.7227	18.65	7.63
65 (origin) + 390 (virtual)	0.7873	17.31	6.90	0.7847	17.41	7.05
65 (origin) + 455 (virtual)	0.8251	15.81	6.43	0.8197	16.05	6.21
65 (origin) + 520 (virtual)	0.8280	15.25	6.35	0.8292	15.20	6.27

65 (origin) + 585 (virtual)	0.8542	14.36	6.10	0.8422	14.94	5.89
65 (origin) + 650 (virtual)	0.8478	13.99	5.87	0.8440	14.17	5.44

Table S3. Performance evaluation of classical random forest and quantum feature enhanced random forest during the wet season under different numbers of virtual samples.

Sample size	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
50 (origin)	0.7331	12.19	7.95	0.7166	12.56	8.61
50 (origin) + 50 (virtual)	0.8402	8.13	4.44	0.8290	8.41	4.88
50 (origin) + 100 (virtual)	0.9209	6.14	3.04	0.9168	6.30	3.38
50 (origin) + 150 (virtual)	0.9409	5.25	2.50	0.9362	5.45	2.81
50 (origin) + 200 (virtual)	0.9575	4.55	1.99	0.9566	4.60	2.05
50 (origin) + 250 (virtual)	0.9615	4.14	1.81	0.9594	4.25	1.88
50 (origin) + 300 (virtual)	0.9691	3.78	1.53	0.9672	3.90	1.61
50 (origin) + 350 (virtual)	0.9739	3.45	1.44	0.9730	3.51	1.44
50 (origin) + 400 (virtual)	0.9759	3.28	1.35	0.9744	3.39	1.32
50 (origin) + 450 (virtual)	0.9762	3.25	1.27	0.9756	3.293	1.23
50 (origin) + 500 (virtual)	0.9774	3.03	1.18	0.9739	3.26	1.20

Table S4. Performance evaluation of classical random forest and quantum feature-enhanced random forest under different virtual sample numbers in the normal season based on AlphaEarth Foundation as the input variable.

	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
66 (origin)	0.1672	32.89	25.40	0.1193	33.82	26.41
66 (origin) + 66 (virtual)	0.3772	25.24	17.53	0.3315	26.15	18.39
66 (origin) + 132 (virtual)	0.5832	21.21	13.63	0.5626	21.73	14.54
66 (origin) + 198 (virtual)	0.6040	20.00	11.90	0.5829	20.53	12.78
66 (origin) + 264 (virtual)	0.7184	17.33	9.31	0.7118	17.53	9.95

66 (origin) + 330 (virtual)	0.7609	15.46	8.08	0.7446	15.98	8.82
66 (origin) + 396 (virtual)	0.7825	14.53	7.29	0.7689	14.97	7.96
66 (origin) + 462 (virtual)	0.8232	12.99	6.04	0.8176	13.19	6.42
66 (origin) + 528 (virtual)	0.8327	11.84	5.26	0.8045	12.80	6.29
66 (origin) + 594 (virtual)	0.8524	10.87	4.63	0.8326	11.58	5.57
66 (origin) + 660 (virtual)	0.8595	10.73	4.46	0.8438	11.32	5.42

Table S5. Performance evaluation of classical random forest and quantum feature-enhanced random forest under different virtual sample numbers in the dry season based on AlphaEarth Foundation as the input variable.

Sample size	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
65 (origin)	-0.0737	58.96	35.78	-0.0613	58.62	35.73
65 (origin) + 65 (virtual)	0.0391	42.02	22.64	0.0021	42.89	23.30
65 (origin) + 130 (virtual)	0.3521	37.36	19.52	0.3096	38.56	21.35
65 (origin) + 195 (virtual)	0.4229	34.52	16.36	0.4029	35.11	17.38
65 (origin) + 260 (virtual)	0.5655	30.59	13.51	0.5567	30.90	14.89
65 (origin) + 325 (virtual)	0.5979	27.10	11.10	0.5743	28.71	12.60
65 (origin) + 390 (virtual)	0.6345	26.57	10.67	0.6273	26.83	11.20
65 (origin) + 455 (virtual)	0.6705	23.57	8.59	0.6607	23.91	9.64
65 (origin) + 520 (virtual)	0.5911	22.55	8.11	0.5892	22.60	8.97
65 (origin) + 585 (virtual)	0.6410	21.05	7.42	0.6306	21.58	8.32
65 (origin) + 650 (virtual)	0.6741	19.86	6.41	0.6762	19.69	7.03

Table S6. Performance evaluation of classical random forest and quantum feature-enhanced random forest under different virtual sample numbers in the wet season based on AlphaEarth Foundation as the input variable.

Sample size	RF			Quantum-enhanced RF		
	R^2	RMSE	MAE	R^2	RMSE	MAE
50 (origin)	-0.2089	25.16	19.80	-0.1938	25.00	19.83

50 (origin) + 50 (virtual)	0.3662	15.79	11.07	0.3643	15.82	11.33
50 (origin) + 100 (virtual)	0.5157	13.47	8.70	0.4945	13.77	9.32
50 (origin) + 150 (virtual)	0.5677	12.44	7.68	0.5577	12.62	8.19
50 (origin) + 200 (virtual)	0.6162	11.35	6.39	0.5965	11.64	6.98
50 (origin) + 250 (virtual)	0.6388	11.10	6.07	0.6142	11.47	6.84
50 (origin) + 300 (virtual)	0.6847	10.44	5.33	0.6805	10.51	5.78
50 (origin) + 350 (virtual)	0.7175	9.69	4.86	0.7040	9.92	5.34
50 (origin) + 400 (virtual)	0.7478	8.96	4.31	0.7349	9.18	4.77
50 (origin) + 450 (virtual)	0.7800	8.39	3.93	0.7631	8.71	4.39
50 (origin) + 500 (virtual)	0.7841	8.27	3.80	0.7810	8.33	4.15