

Table S1. Construction land equivalent conversion coefficient for different land use types

land use type	Conversion coefficient	land use type	Conversion coefficient
Cropland	0.20	Ice and snow	0
Forest	0.13	Bare land	0.1
Shrubland	0.13	Impervious surface	0.1
Grassland	0.13	Wetland	0
Water body	0		

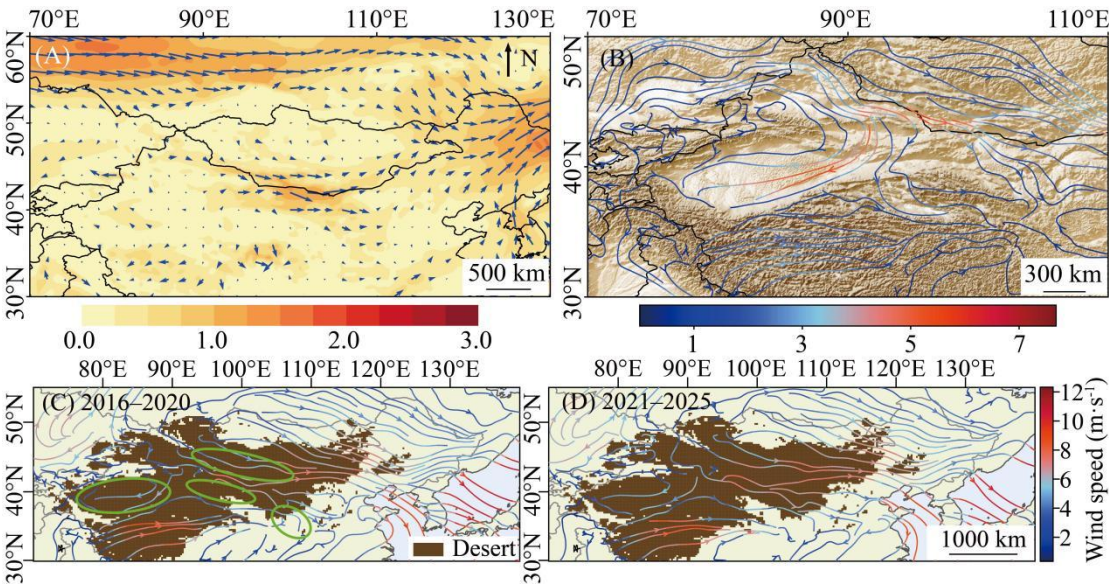


Fig. S1. (A) Wine speed anomalies from 2021–2025 compared to 1981–2020; (B) Topographic modulation of the mean wind field during 1981–2025 (C, D) Wind field maps for the periods 2016–2020 and 2021–2025, with the base map being the distribution of deserts.

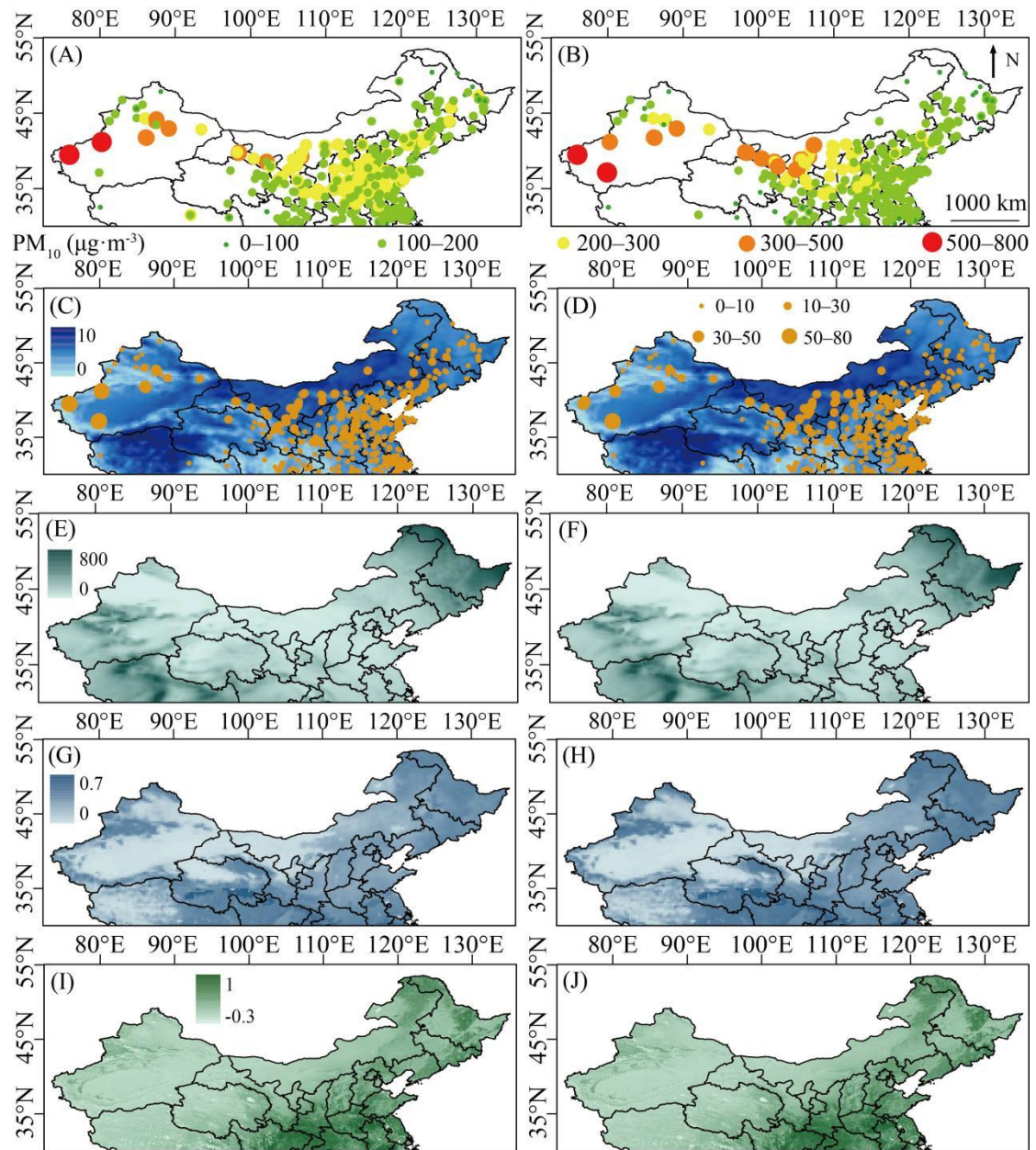


Fig. S2. (A–B) Daily mean PM_{10} concentration for 2016–2020 and 2021–2025. (C–D) Average annual wind speed distribution and DSD for 2016–2020 and 2021–2025. (E–F) Average annual precipitation distribution for 2016–2020 and 2021–2025. (G–H) Average annual soil moisture distribution for 2016–2020 and 2021–2025. (I–J) Average annual NDVI distribution for 2016–2020 and 2021–2025.

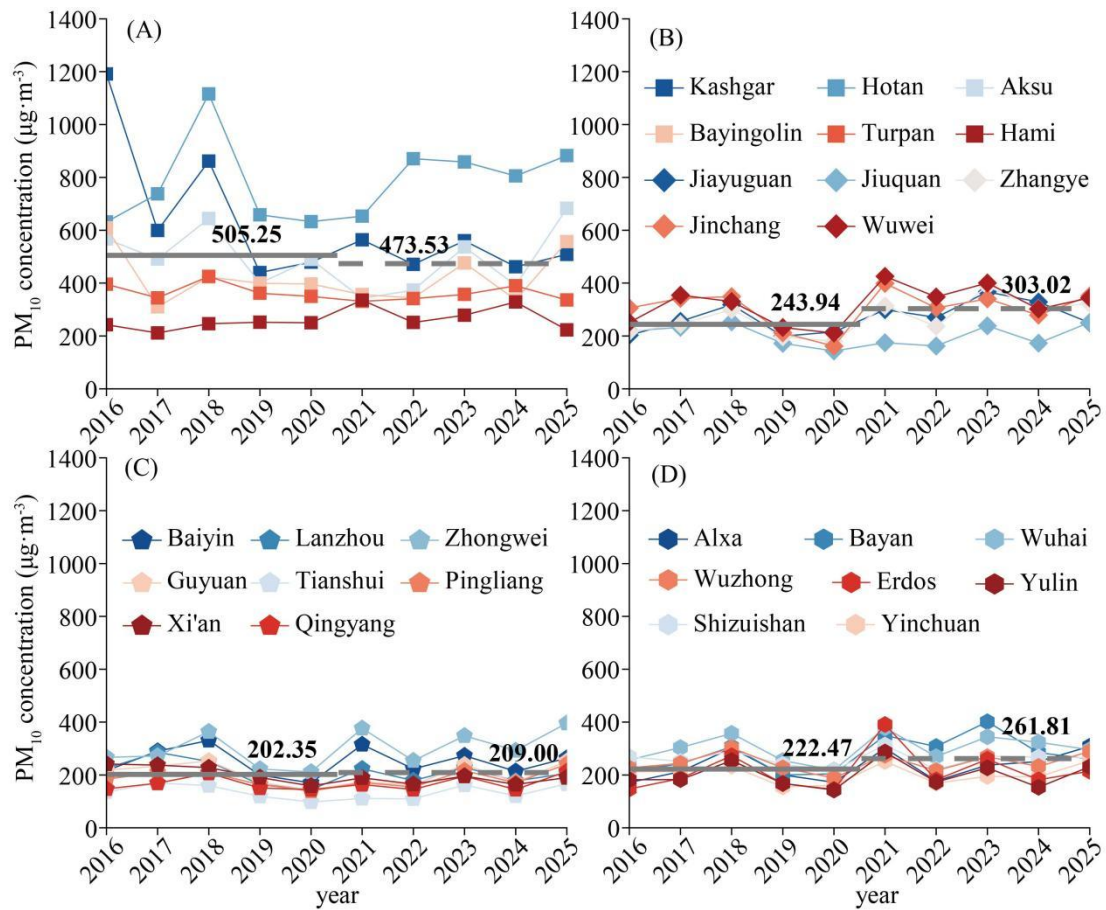


Fig. S3. The PM₁₀ concentration in Northwest China from 2015 to 2025. (A) Source 1; (B) Pathway; (C) Downwind cities; (D) Source 2. (The solid grey line represents the average DSD from 2016 to 2025, while the dashed grey line represents the period from 2020 to 2025).

Table S2. The changing slopes of each factor during the period from 2000 to 2025. * $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.

Variable	Source 1		Source 2		Pathway		Downwind city	
	2001-2019	2019-2025	2001-2019	2019-2025	2001-2019	2019-2025	2001-2019	2019-2025
DUCM ASS	0.006*	-0.013	- 0.005**	0.007	-0.004*	0.002	- 0.005**	0.003
DSD	-0.373	4.064*	- 0.406**	0.838	-0.287*	0.411	-0.465	1.509*
Wind speed	-0.010	0.060	-0.059*	0.106	-0.031	0.076	-0.034*	0.093
Soil moisture	-0.0009**		-0.0005		-0.0008**		-0.0003	
NDVI	0.0004***		0.0007***		0.0004***		0.0013***	

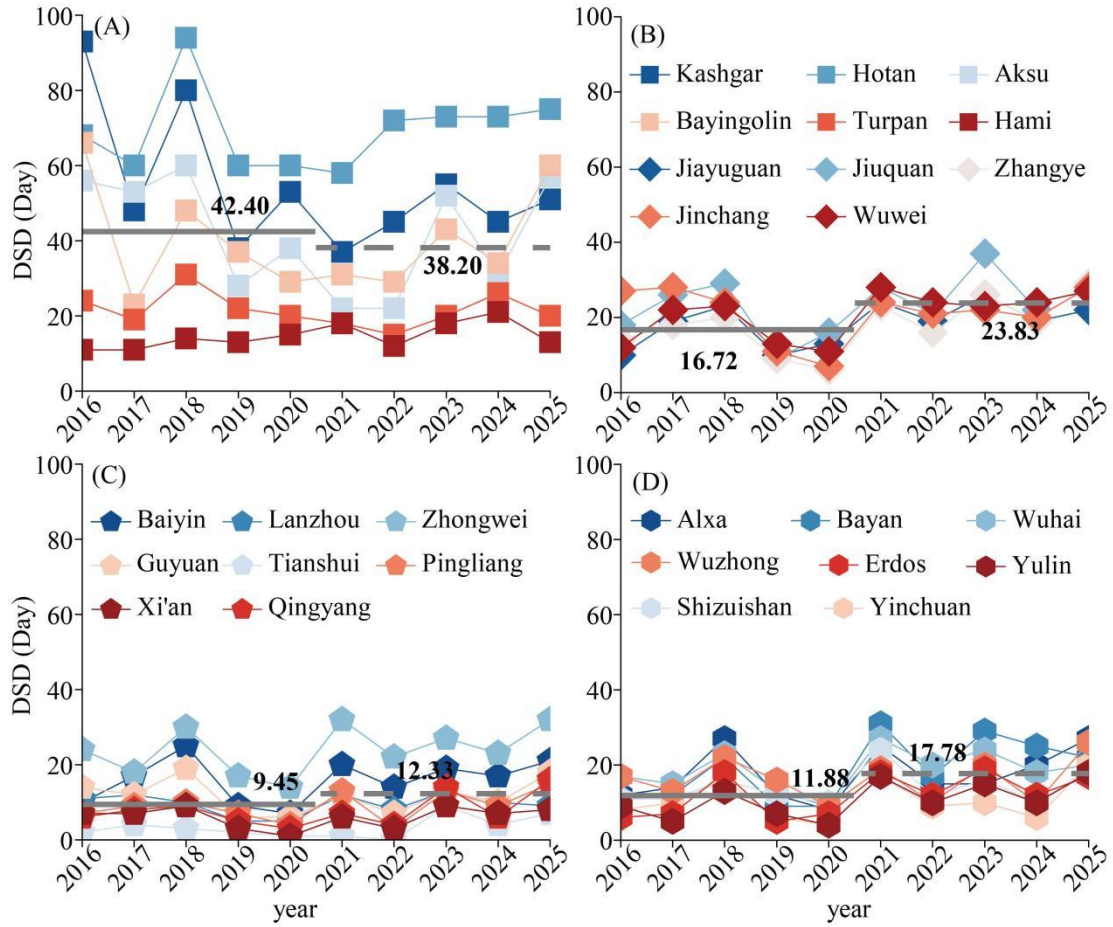


Fig. S4. The DSD in northwest China from 2015 to 2025. (A) Source 1; (B) Pathway; (C) Downwind cities; (D) Source 2. (The solid grey line represents the average DSD from 2016 to 2025, while the dashed grey line represents the period from 2020 to 2025).

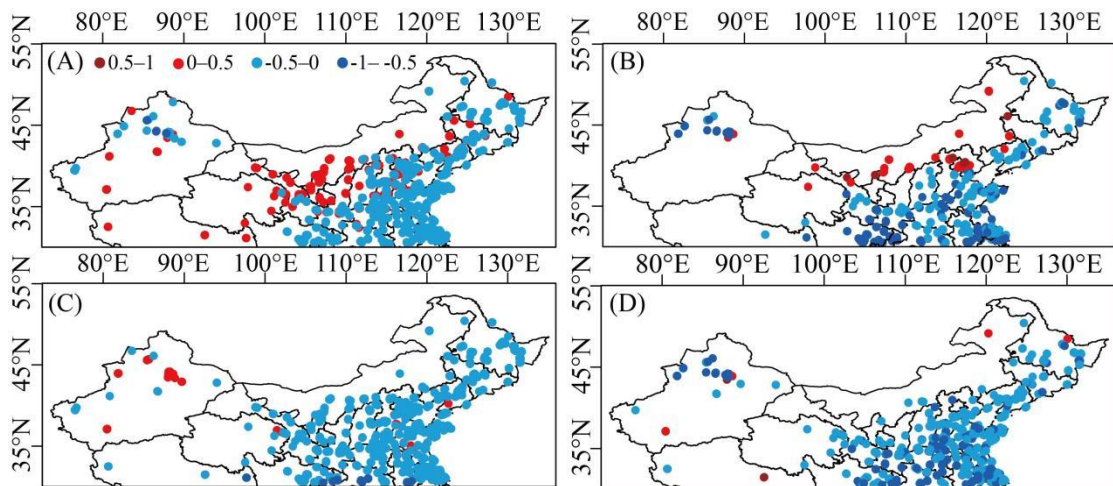


Fig. S5. (A) The correlation coefficient between wind speed and PM_{10} concentration. (B) The correlation coefficient between precipitation and PM_{10} concentration. (C) The correlation coefficient between soil moisture and PM_{10} concentration. (D) The correlation coefficient between NDVI and PM_{10} concentration (only the stations with data).

$P \leq 0.05$ were displayed).

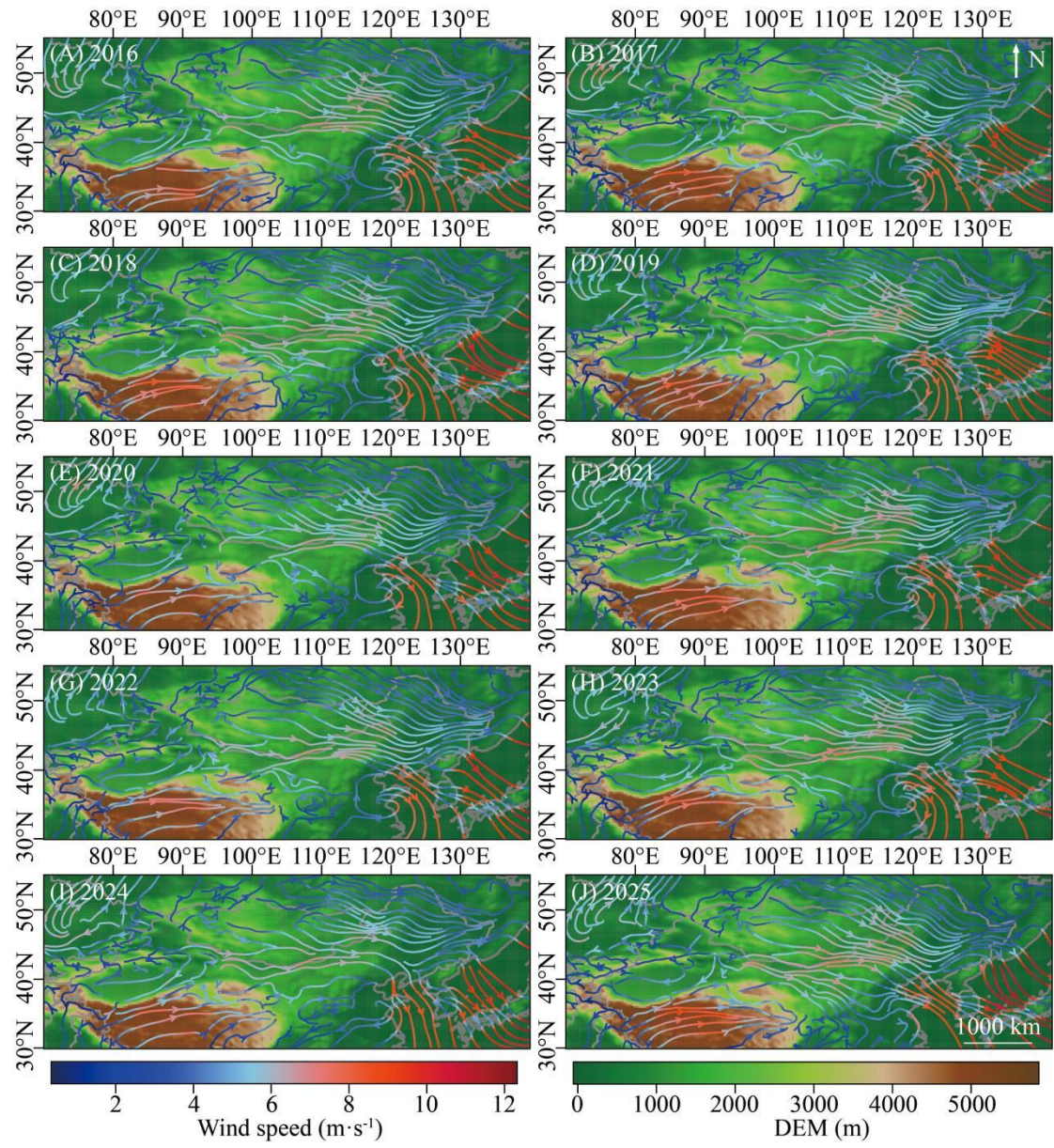


Fig. S6. (A-J) Wind field of 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025.

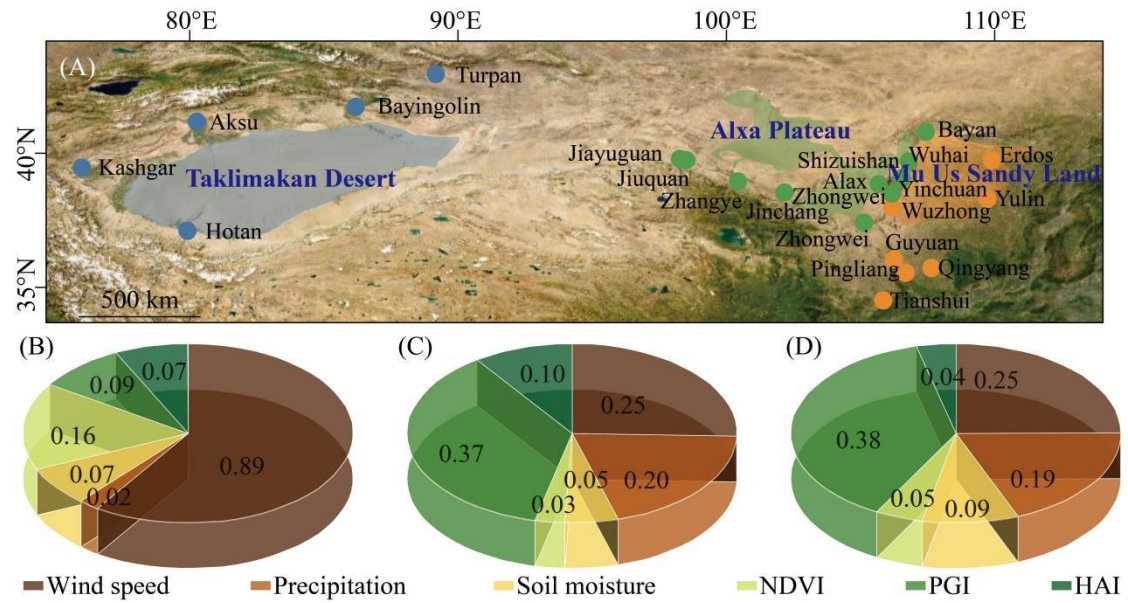


Fig. S7. (A) The extent of the Taklimakan Desert, Alxa Plateau, and Mu Us Sandy Land and the distribution of surrounding cities. (B–D) Relative contributions of various factors to PM₁₀ concentrations in cities surrounding the Taklimakan Desert, Alxa Plateau, and Mu Us Sandy Land, respectively.