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## Supporting Information for

### **Simulating a long-range transported extreme dust storm over East Asia using a global variable-resolution model (iAMAS v2.6.3): model configuration and impacts of mesh refinement**

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20 **Table S1.** Daily dust emissions (Tg) over selected regions during 13–17 March 2021.

Mesh	Day	EA	TKD	MGD	HC–WIM	LP
U50 km (Tg)	13	82.587	33.757	22.301	8.582	0.494
	14	118.788	22.510	69.978	8.755	0.020
	15	35.000	8.212	13.102	6.111	0.124
	16	38.051	4.404	14.747	1.125	0.051
	17	48.399	3.518	20.713	9.187	0.936
V16 km (Tg)	13	109.180	39.681	30.186	7.994	0.527
	14	134.261	21.192	84.454	14.076	0.146
	15	57.832	16.747	17.309	7.327	0.480
	16	58.400	8.413	26.916	2.532	0.118
	17	76.930	15.988	35.250	12.568	0.640
V4 km (Tg)	13	102.692	31.067	32.622	7.625	0.626
	14	163.987	20.202	102.158	17.442	0.337
	15	72.098	16.133	26.706	7.810	0.497
	16	63.529	13.848	27.044	2.453	0.131
	17	97.995	24.162	44.390	16.842	1.051

22 **Table S2.** Regional mean surface PM<sub>10</sub> concentrations over the YRD during 13–17 March  
23 2021 for different mesh configurations.

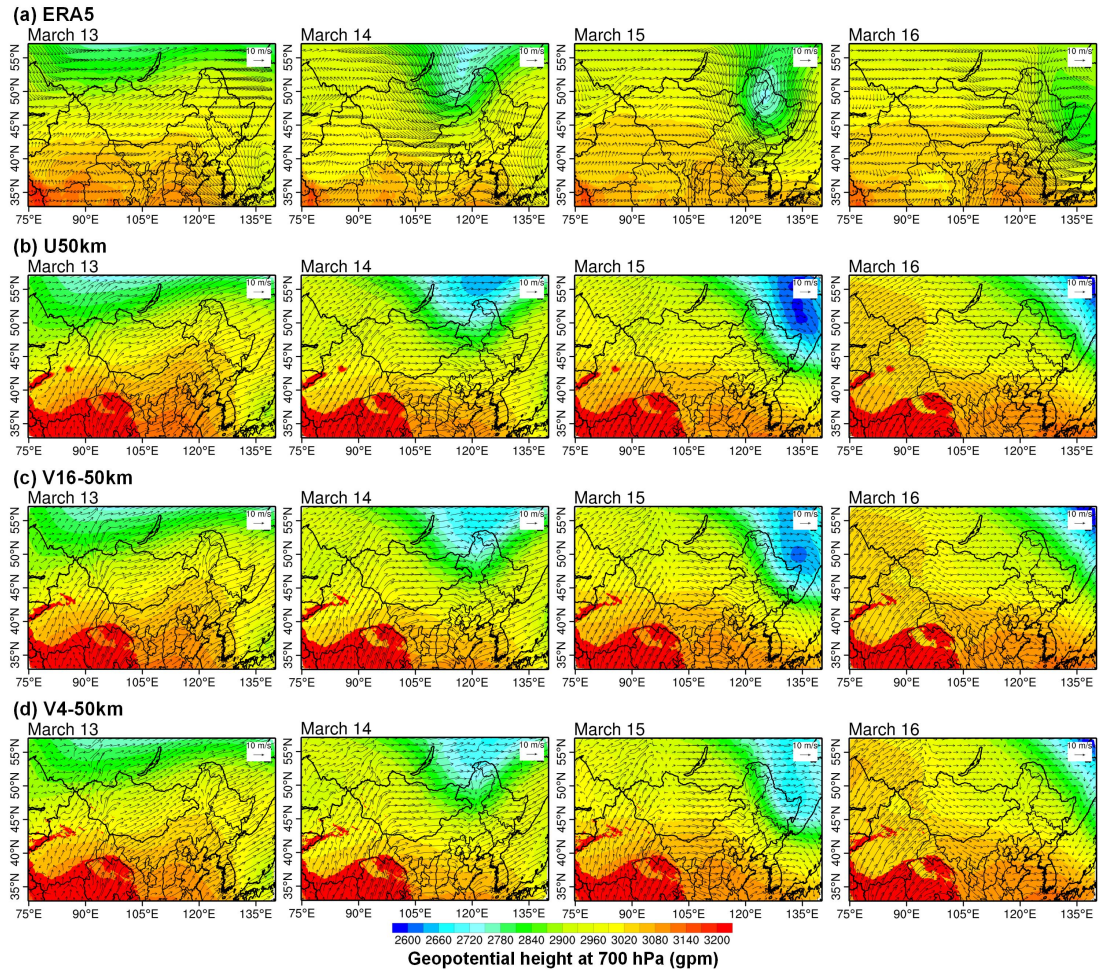
Experiment	Surface PM <sub>10</sub> (μg m <sup>-3</sup> )	Relative change relative to U50 km (%)
U50 km	18.667	-
V16 km	43.437	+132.70
V4 km	13.481	-27.78

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25 **Table S3.** Regional mean dust wet scavenging rate and total dust wet scavenging during  
26 13–17 March 2021 in the V16 km simulation.

Region	V16 km dust wet scavenging rate (mg m <sup>-2</sup> day <sup>-1</sup> )	V16 km total dust wet scavenging (Tg)
TKD	149.594	0.689
MGD	2.597	0.011
HC–WIM	54.389	0.164
LP	0.412	0.001
NCP	10.567	0.022
YRD	10.865	0.015

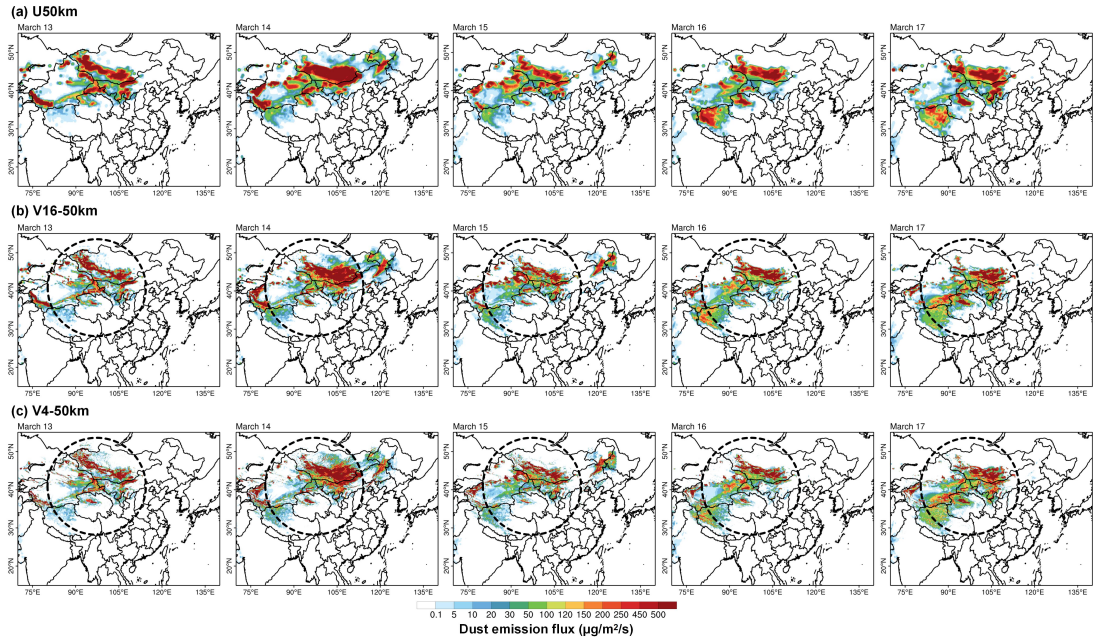
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29 **Fig. S1.** Daily mean geopotential height at 700 hPa (shading, gpm) and 700 hPa wind vectors  
 30 for ERA5 and iAMAS simulations (U50 km, V16 km, and V4 km) during 13–16 March 2021.

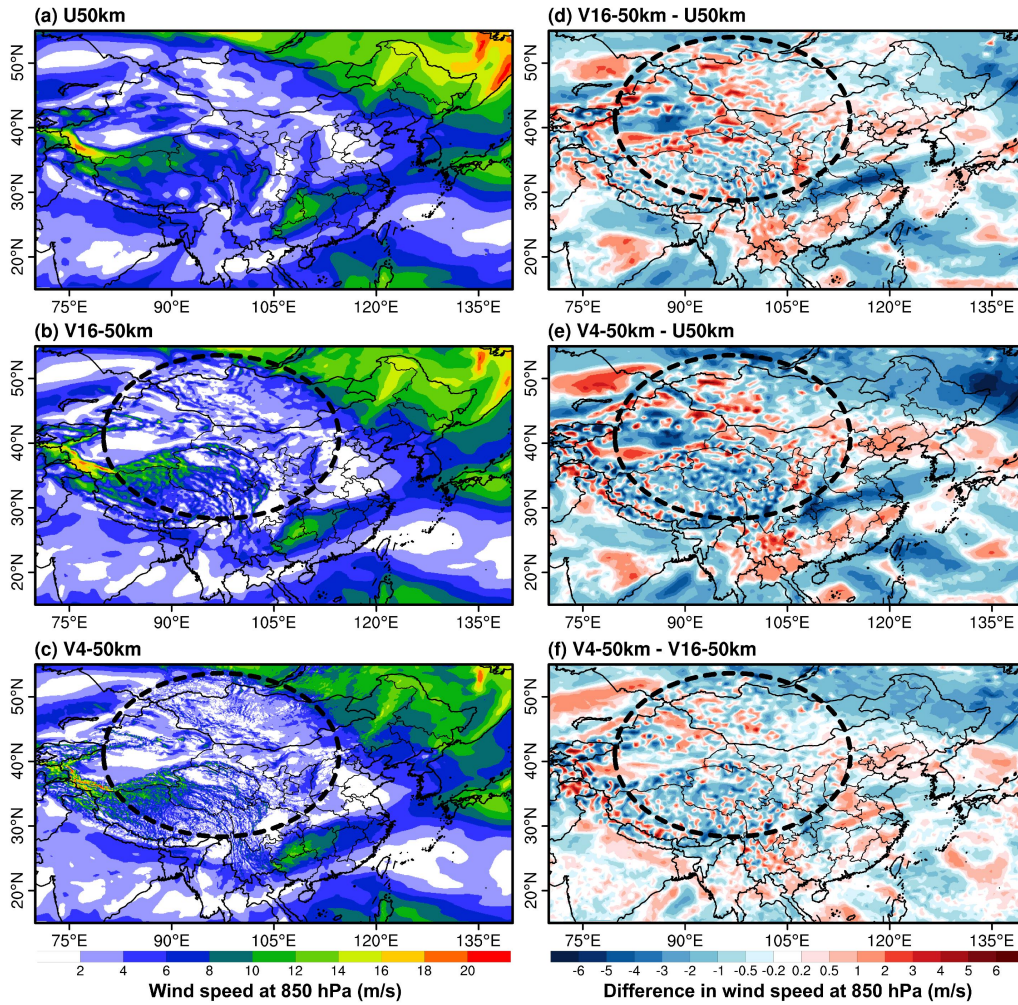
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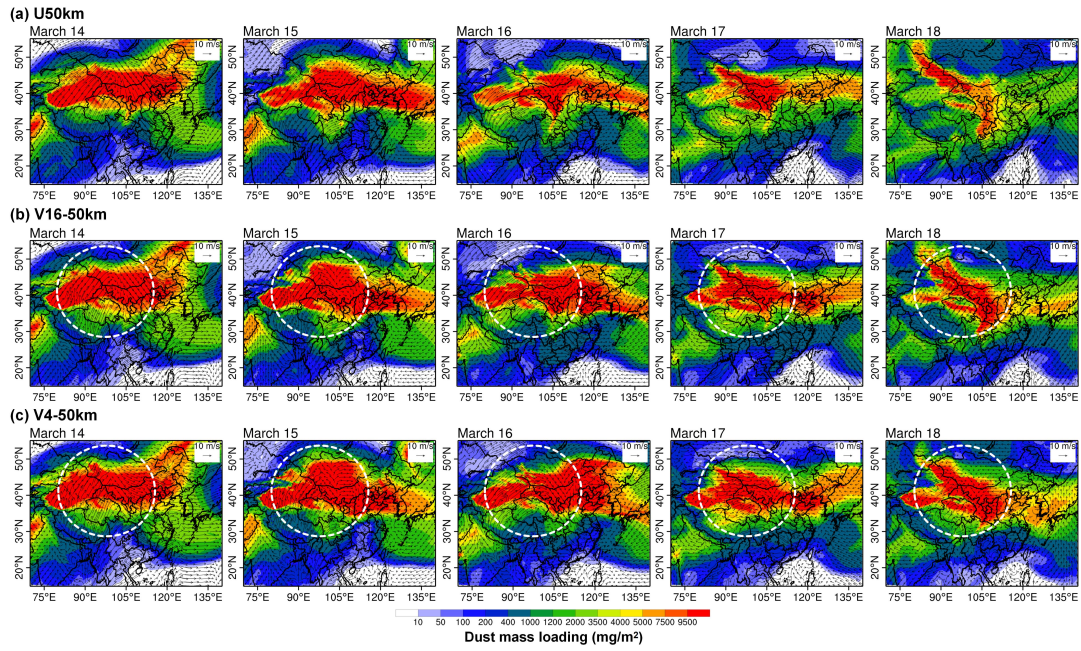
33 **Fig. S2.** Daily dust emission flux ( $\mu\text{g m}^{-2} \text{s}^{-1}$ ) from the U50 km, V16 km, and V4 km  
 34 simulations in iAMAS during 13–17 March 2021. The dashed outline denotes the refinement  
 35 region.

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38 **Fig. S3.** (a–c) Spatial distribution of period-mean wind speed at 850 hPa ( $\text{m s}^{-1}$ ) from the U50  
 39 km, V16 km, and V4 km simulations during 13–17 March 2021. (d) Differences in 850 hPa  
 40 wind speed between V16 km and U50 km. (e) Differences between V4 km and U50 km. (f)  
 41 Differences between V4 km and V16 km. The dashed outline denotes the refinement region.  
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**Fig. S4.** Daily dust mass loading ( $\text{mg m}^{-2}$ ) simulated by iAMAS for 14–18 March 2021 using the U50 km, V16 km, and V4 km mesh configurations, with 850 hPa wind vectors overlaid. The dashed outline denotes the refinement region.