Supplement of manuscript on

A global seamless 1 km resolution daily land surface temperature dataset (2003-2020)

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S1 Spatial patterns of gap-filled LST between neighboring regions

There are no significant boundary effects between neighboring regions as shown in the example data of gap-filled LST (Fig. S1), indicating that the division of regions with overlapped areas is useful (Sect. 3.2.2). For example, the spatial pattern of gap-filled LST based on the proposed gap-filling method has no sudden changes on the boundary of region 1 and region 3 (subregion A in Fig. S1), and region 2 and region 3 (subregion B in Fig. S1) (Fig. 4). This is because when interpolating the residual of center blocks near the boundary (Sect. 3.2.2), the valid residual values from the two neighboring regions were used, mitigating boundary effects in the finally gap-filled LST data.

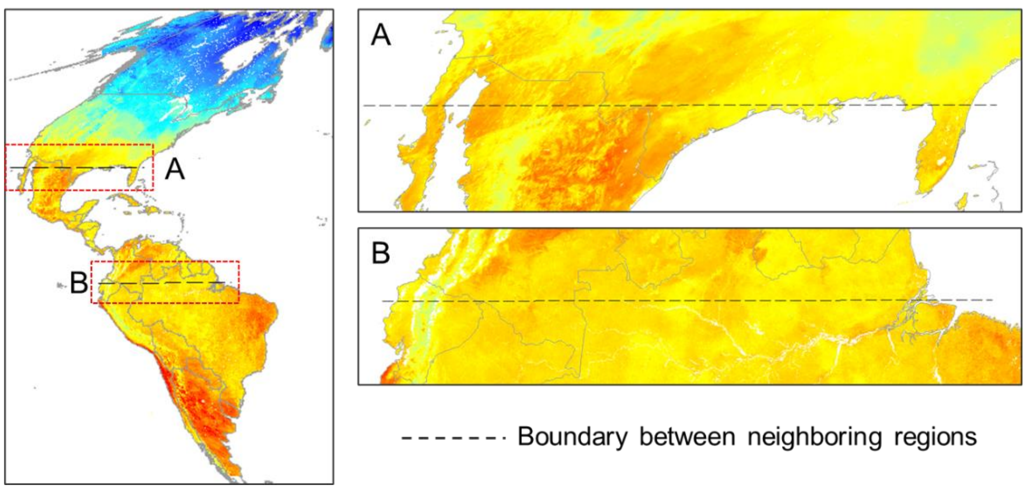

Figure S1: Spatial pattern of gap-filled daytime LST around the boundary of two neighboring regions in America.

S2 Spatial patterns of the gap-filled LST between neighboring tiles

There are no significant boundary effects between neighboring tiles as shown in the example data of gap-filled LST (Fig. S2), indicating the interpolation of residuals for block center pixels in a region with multiple tiles is useful (Sect. 3.2.2). There are obvious boundary effects between tiles h10v04, h11v04, h10v05, and h11v05 (Fig. S2(a)) with these tiles gap-filled independently; on the contrary, there are no boundary effects when the residuals of the whole region were interpolated at the same time (Fig. S2(b)). When the residuals for block center pixels were calculated independently for each tile, systematic differences may occur near the boundary of the two neighboring tiles especially when there are a lot of missing values, leading to boundary effects in the interpolated residuals and gap-filled LST data.

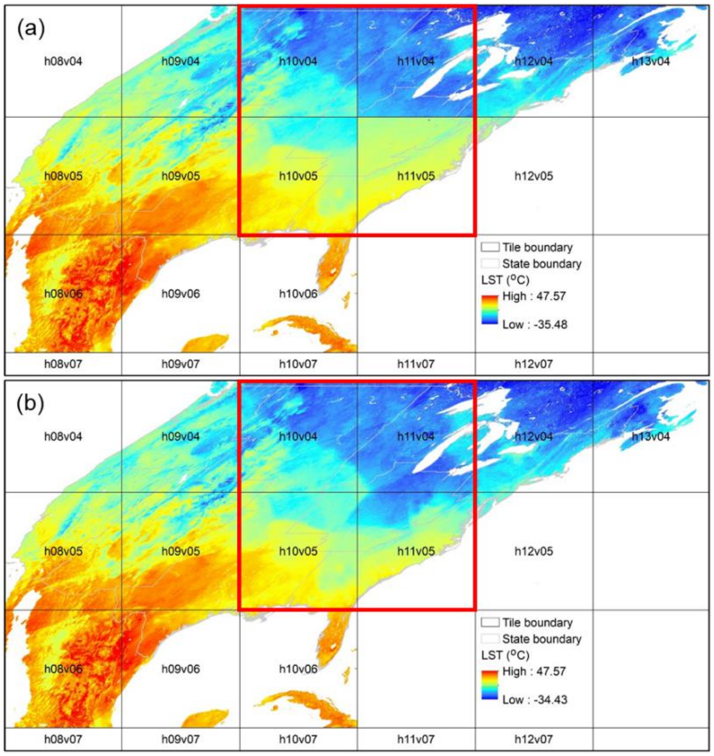

Figure S2: Spatial patterns of gap-filled daytime LST without (a) and with (b) interpolating center pixels of multiple tiles on 20th day of 2012.

Table S1. Average root mean square error (RMSE) (Unit: ℃) in excluded area in climate zones

Time	Climate zone	Landforms	Original missing rate (%)	RMSE (±standard deviation)		
				25%	50%	75%
Daytime	Equatorial climate	Plain, Plateau, Mountain	24.1	1.97 (±0.47)	1.96 (±0.42)	2.03 (±0.43)
	Arid climate	Desert, Plateau, Basin	1.3	1.40 (±0.51)	1.42 (±0.48)	1.64 (±0.53)
	Warm temperate climate	Plain, Plateau	13.7	1.81 (±0.50)	1.79 (±0.46)	2.05 (±0.59)
	Snow climate	Plain, Mountain	16.2	2.17 (±0.66)	2.25 (±0.68)	2.50 (±0.74)
	Polar climate	Plateau of Tibet	10.7	2.71 (±0.77)	2.73 (±0.77)	2.87 (±0.72)
Nighttime	Equatorial climate	Plain, Plateau, Mountain	23.0	1.24 (±0.35)	1.21 (±0.30)	1.33 (±0.33)
	Arid climate	Desert, Plateau, Basin	2.0	1.03 (±0.30)	1.19 (±0.35)	1.30 (±0.41)
	Warm temperate climate	Plain, Plateau	10.5	1.11 (±0.27)	1.23 (±0.32)	1.40 (±0.42)
	Snow climate	Plain, Mountain	13.1	1.80 (±0.57)	1.81 (±0.64)	1.97 (±0.64)
	Polar climate	Plateau of Tibet	2.2	1.50 (±0.28)	1.60 (±0.29)	1.62 (±0.24)

Note: Each root mean square error (RMSE) is the mean of RMSEs from all selected days in selected MODIS tiles of a specific climate zone (from 15 MODIS tiles).

Table S2. Summary of existing seamless LST dataset at large spatial extent

Literature	Spatial extent	Spatial resolution	Temporal frequency	Coverage time	Accuracy (default: RMSE)
Metz et al. (2017)	Global	3 arc-min (~5.6 km at the equator)	Monthly	2003 – 2016	0.5K
Li et al. (2018)	United States, urban and surrounding areas	1 km	Daily (mid-daytime and mid-nighttime)	2010	3.29℃ (day), 2.68℃ (night)
Zhao et al. (2020)	China	1 km	Monthly	2003 – 2017	1.59℃
Cheng et al. (2021)	China	1 km	Daily (mid-daytime and mid-nighttime)	2002 – 2020	3K
Zhang et al. (2021b)	China and surrounding areas	1 km	Daily, all weather	2000 – 2020	2.03K to 3.98K
Zhan et al. (2021)	Global	1 km	Daily, Average	2003 – 2019	Mean absolute error is 1.0K
Shiff et al. (2021)	Global (need to run code on GEE)	1 km	Daily (mean, mid-daytime and mid-nighttime)	2002 – 2020	2.7℃ (mean)
This study (Zhang et al., 2021a)	Global	1 km	Daily (mid-daytime and mid-nighttime)	2003 – 2020	1.83℃ (day), 1.28℃ (night)

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