

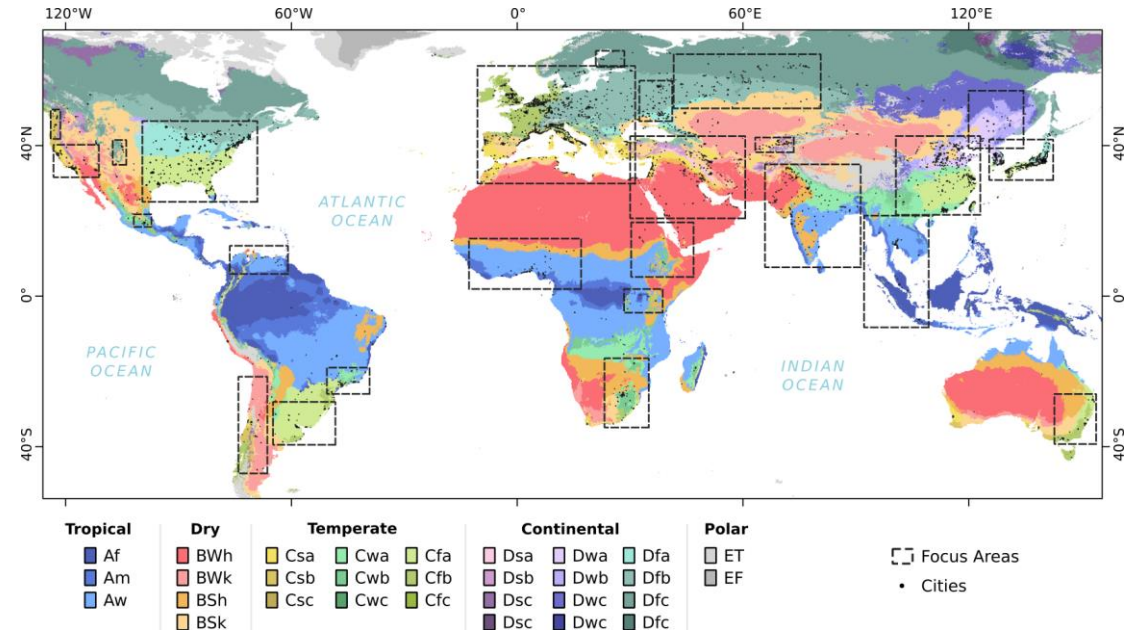
BUCSS

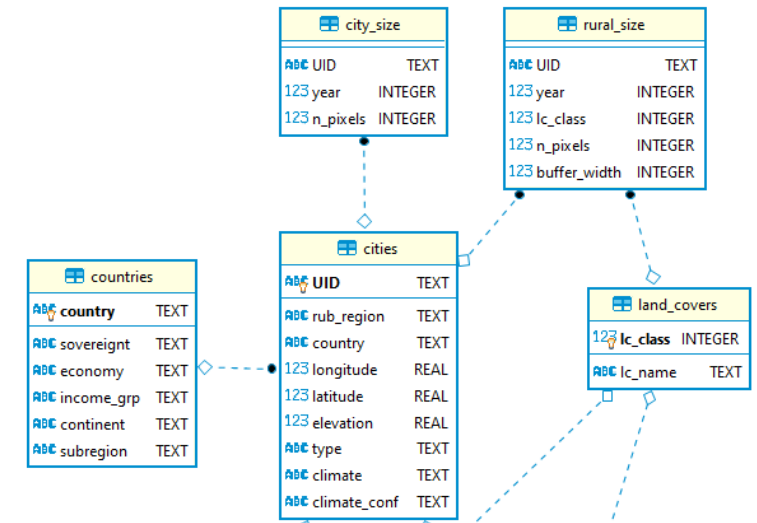
Thermal RS - Exercise

Panagiotis Sismanidis, Benjamin Bechtel

Our Aim

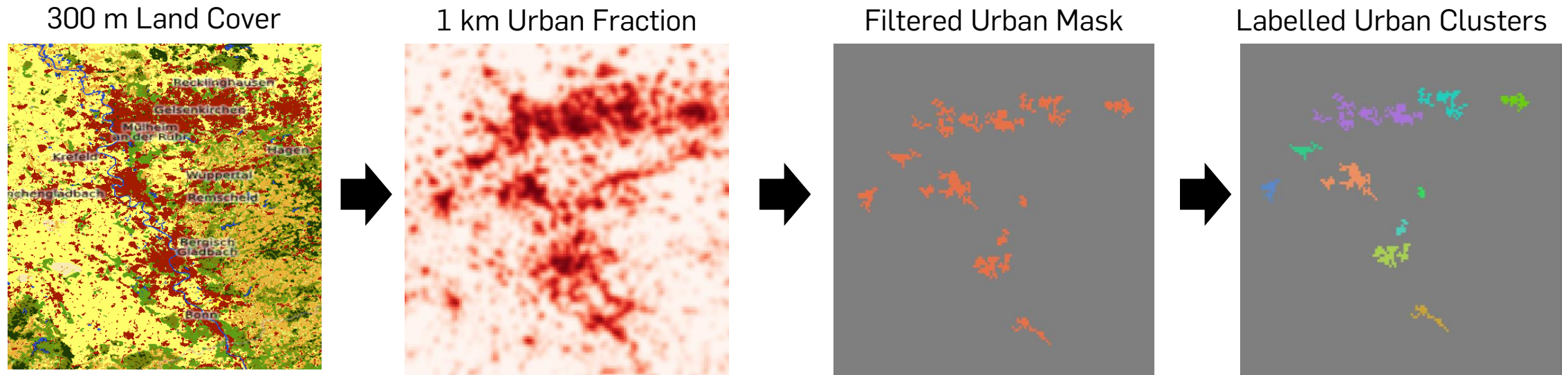
- Global SUHI Dataset
- Analysis-ready data
- Consistent SUHI definition
- Long time-series of data (>20 years)
- Daytime / Nighttime data
- Documented Uncertainties
- Ancillary data to facilitate data analysis
- Make it publicly available in 2022.



[illegible]

City Delineation (1/3)

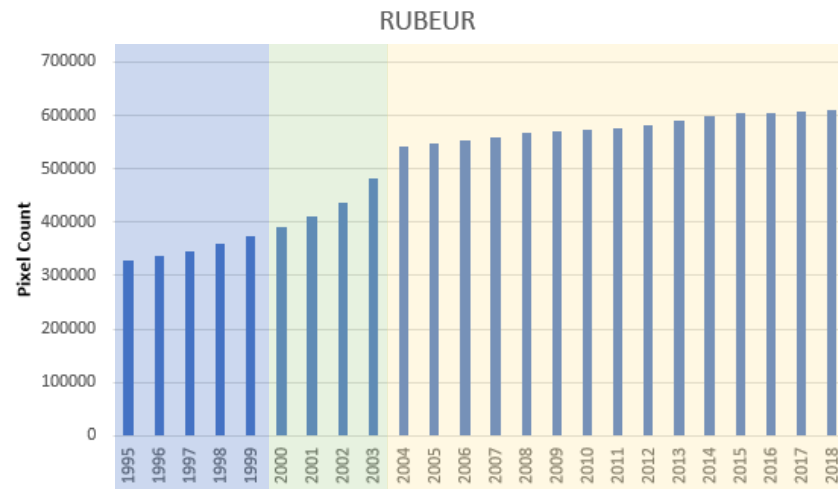
- We use a custom implementation of the **City Clustering Algorithm**.



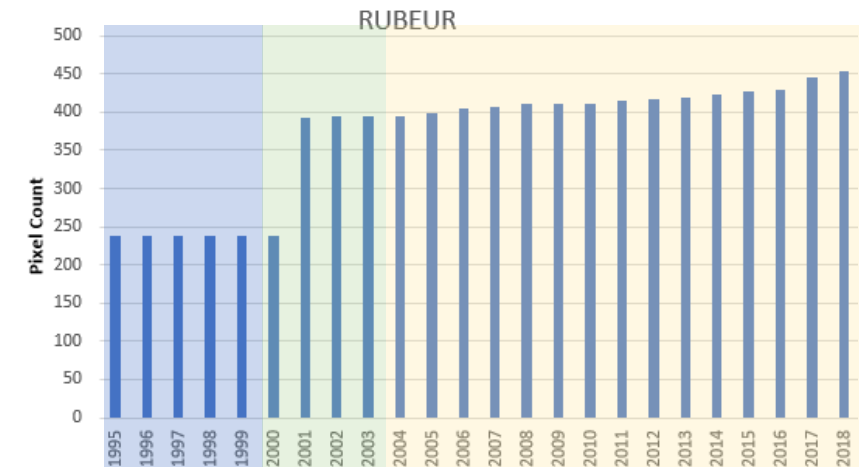
- Urban Fraction >95%
- Water fraction 0%
- Distance from coastline > ~2 km
- 9 or more connected pixels

City Delineation (2/3)

Total number of urban pixels (> 0%)

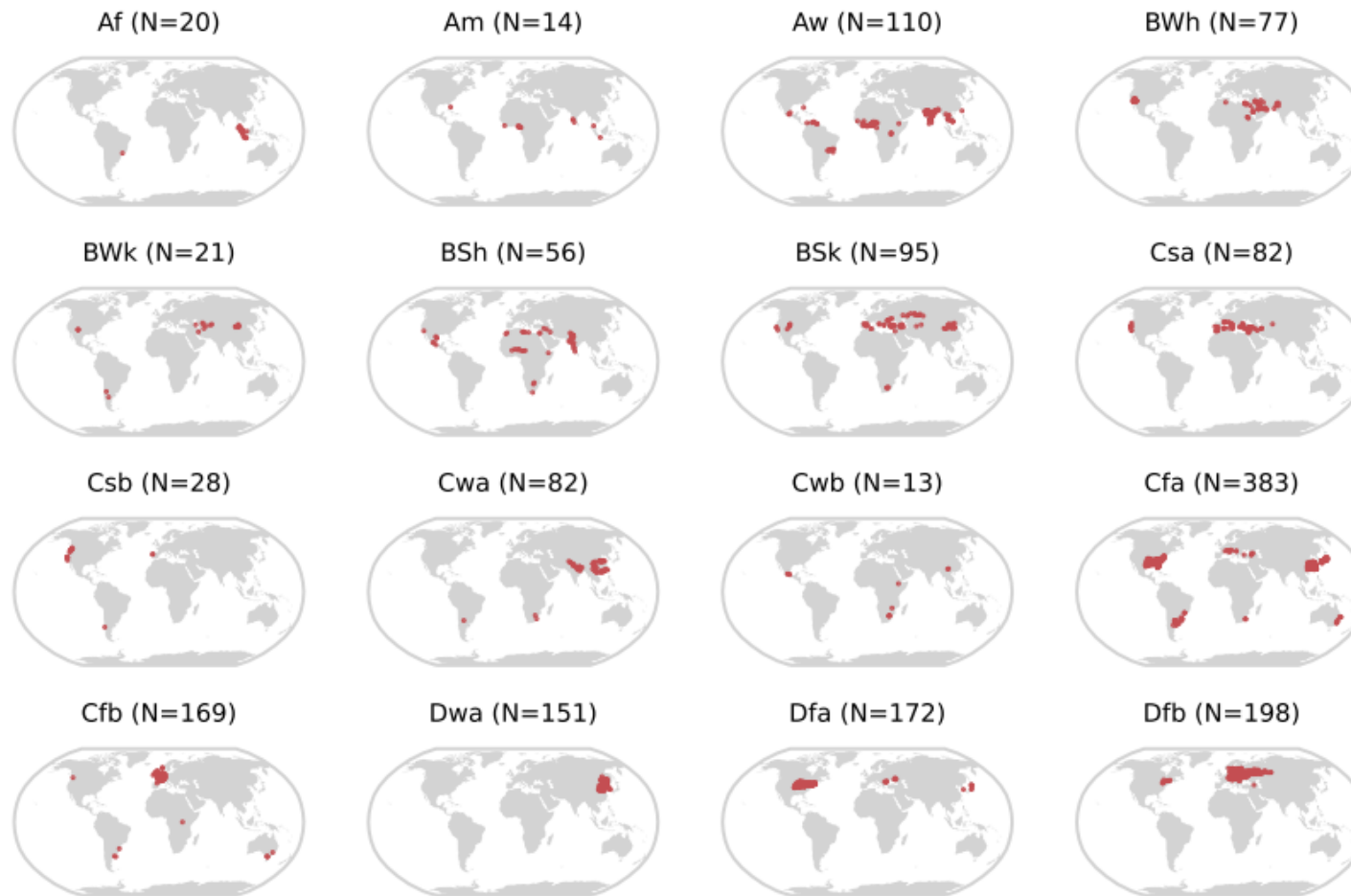


Total number of cities



- 1992 - 1999: GHSL 1990 + 1 km changes
- 2000 - 2003: GHSL 2000 + 1 km changes
- 2004 - Present: GHSL 2000 + 2014 [+GUF] + 300 m changes

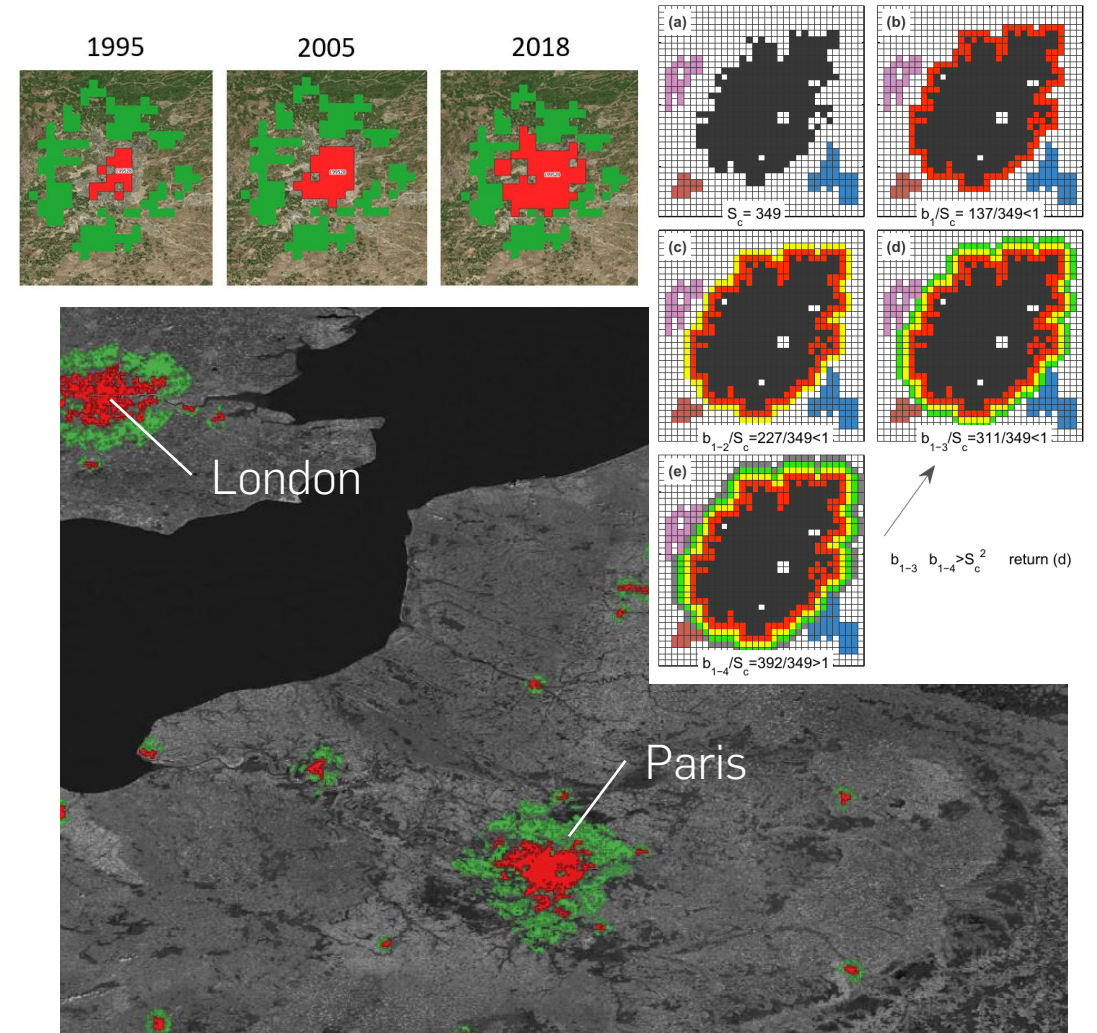
City Delineation (3/3)



2085 Cities
in 20 Köppen-Geiger classes

Natural Buffer (1/2)

- We iteratively expand a buffer around each city until they have approx. the same city.
- One per city
- Same for all years
- Natural LC fraction is $\geq 95\%$ for each year.
- Urban & water fractions are 0%.
- The elevation must not differ by more than ± 200 m from the median elevation of the urban area.
- Maximum width is 30 pixels

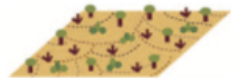


Natural Buffer (2/2)

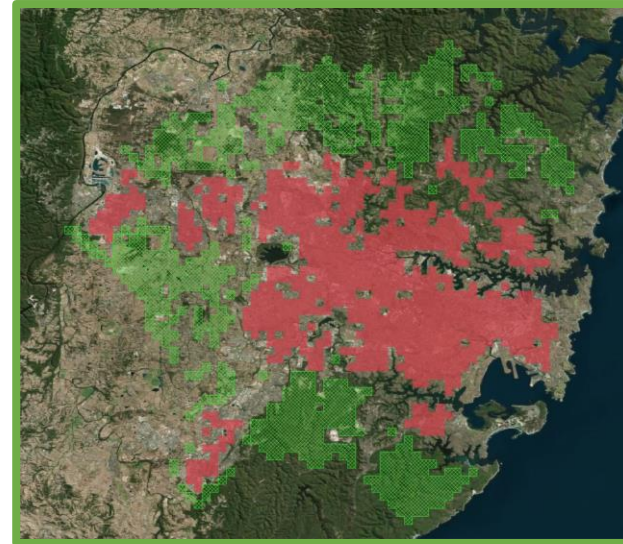
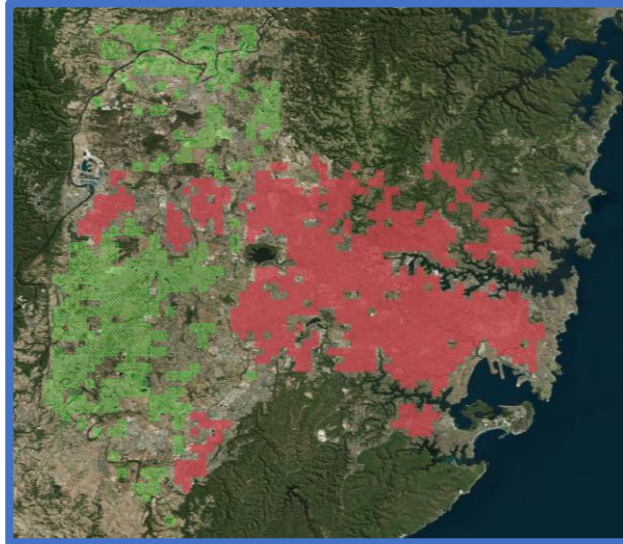
B. Scattered trees



C. Bush, scrub



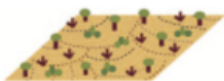
D. Low plants



B. Scattered trees



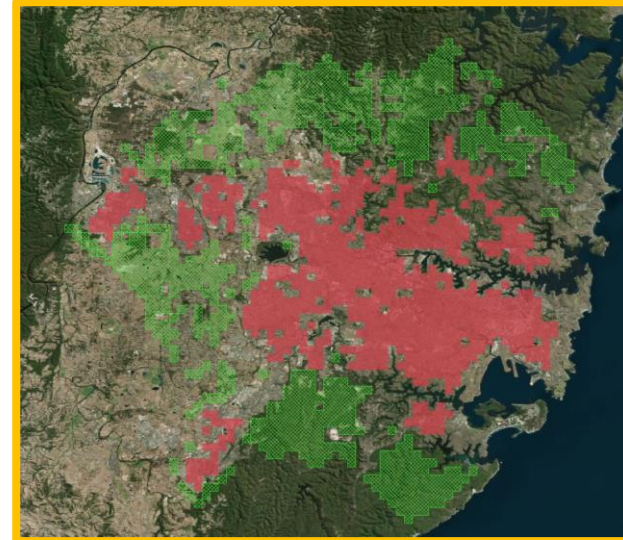
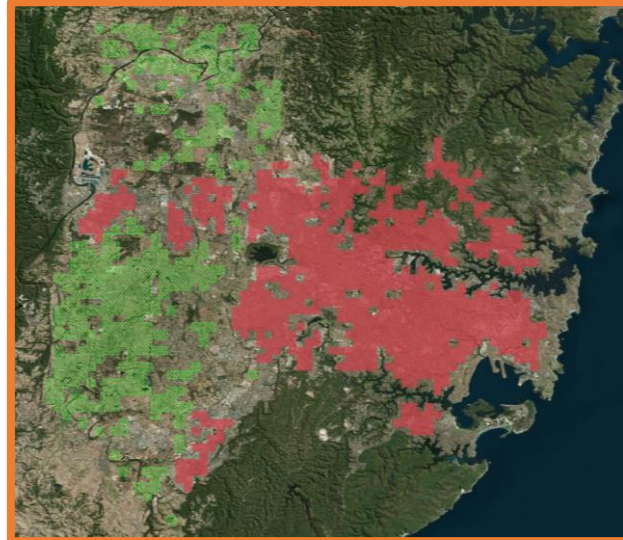
C. Bush, scrub



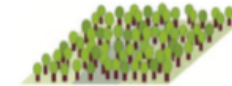
D. Low plants



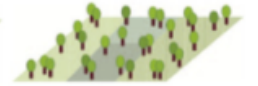
F. Bare soil or sand



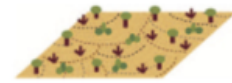
A. Dense trees



B. Scattered trees



C. Bush, scrub



D. Low plants



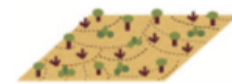
A. Dense trees



B. Scattered trees



C. Bush, scrub



D. Low plants

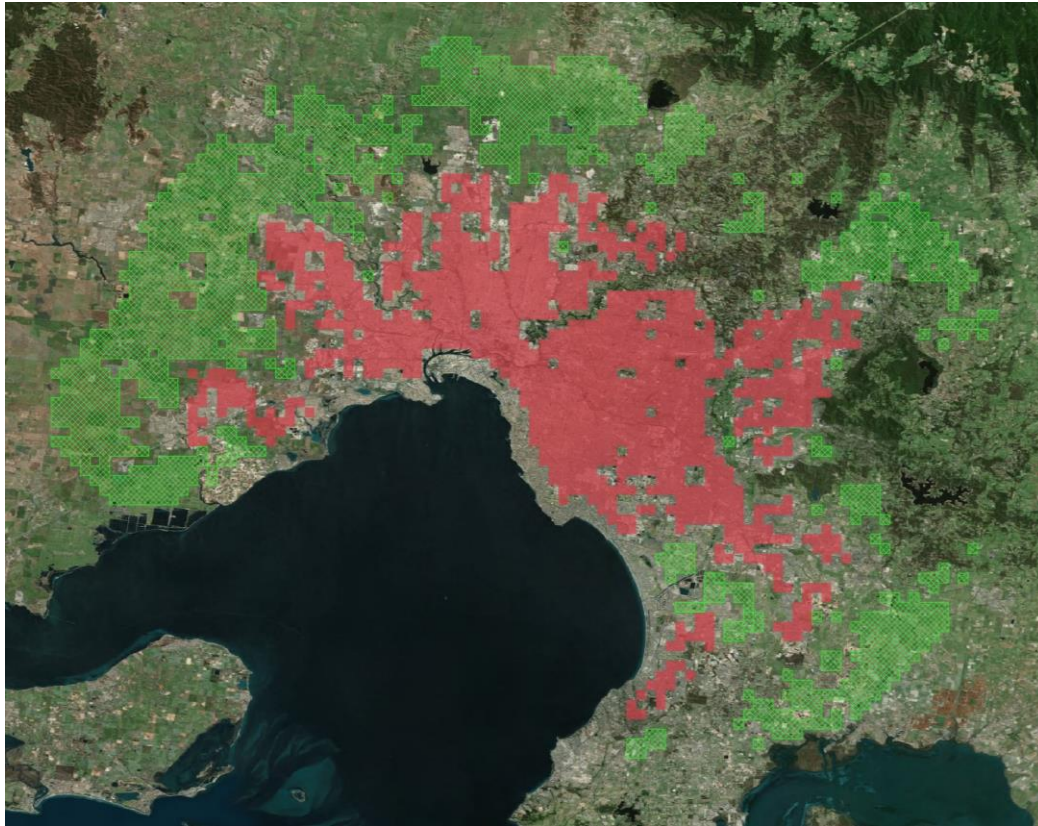


F. Bare soil or sand

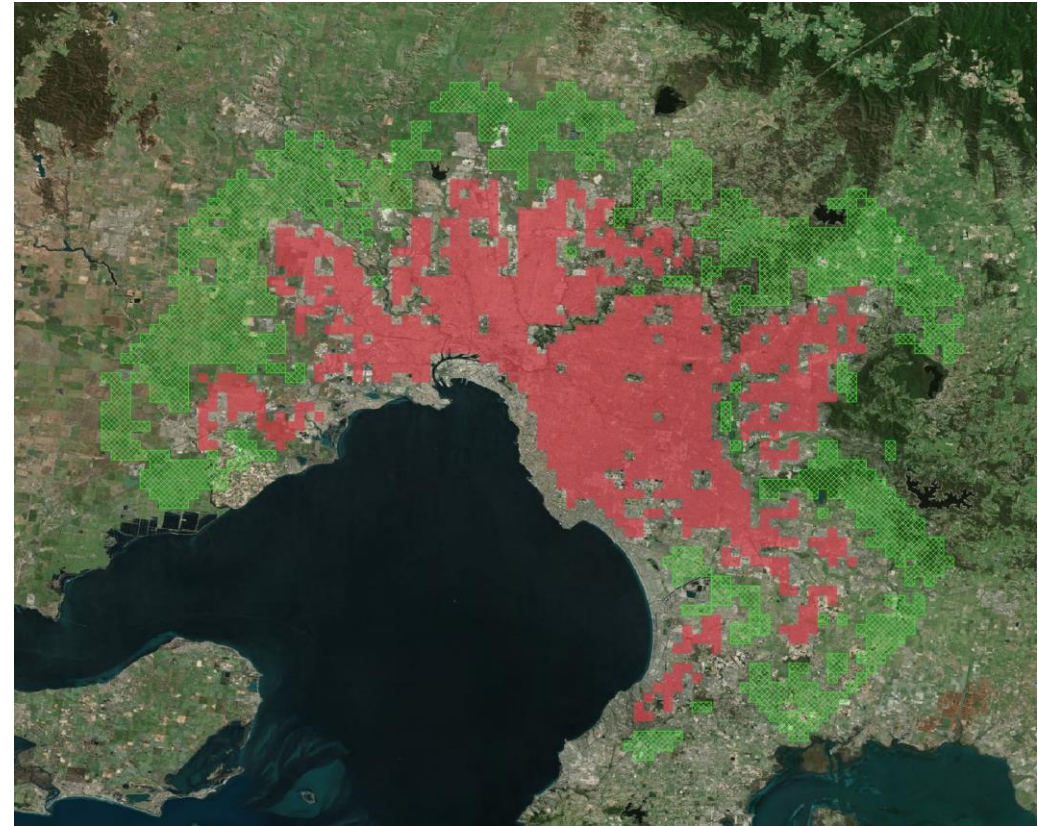


Natural Buffer - Examples

Rural (LCZ B + C + D)

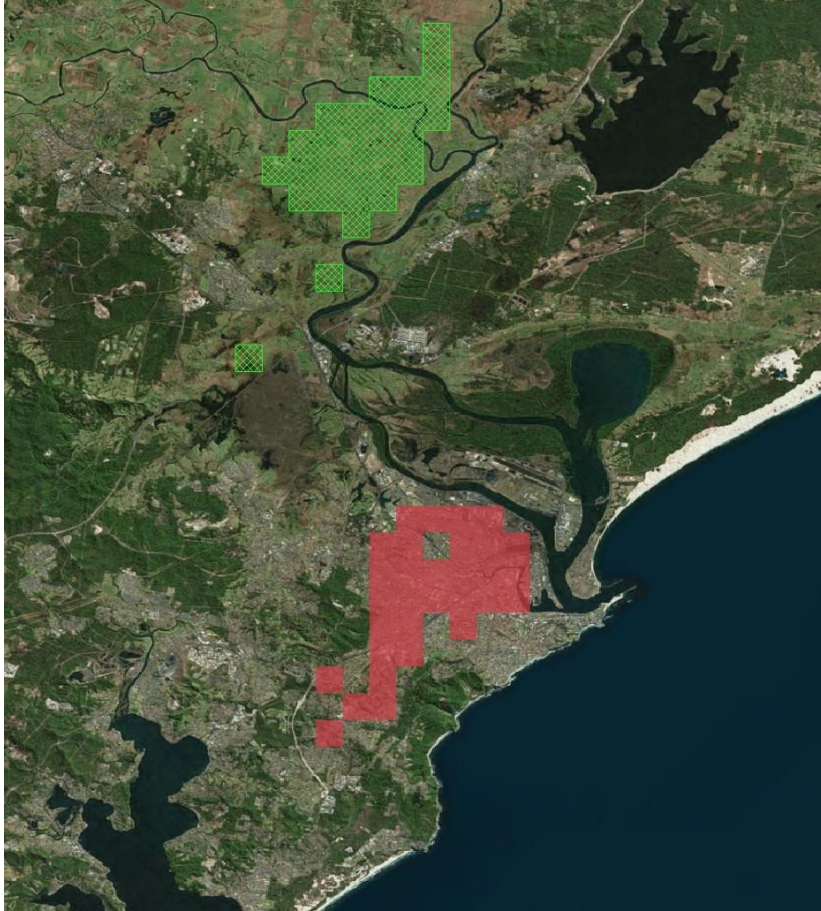


Rural + Forest (LCZ A + B + C + D)

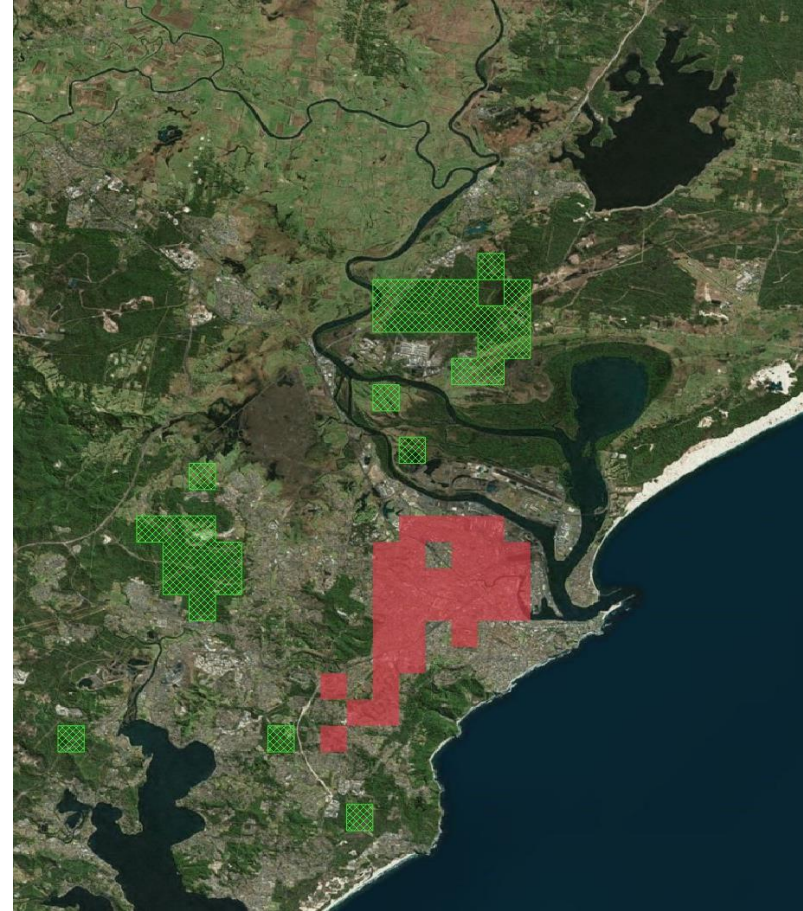


Natural Buffer - Examples

Rural (LCZ B + C + D)

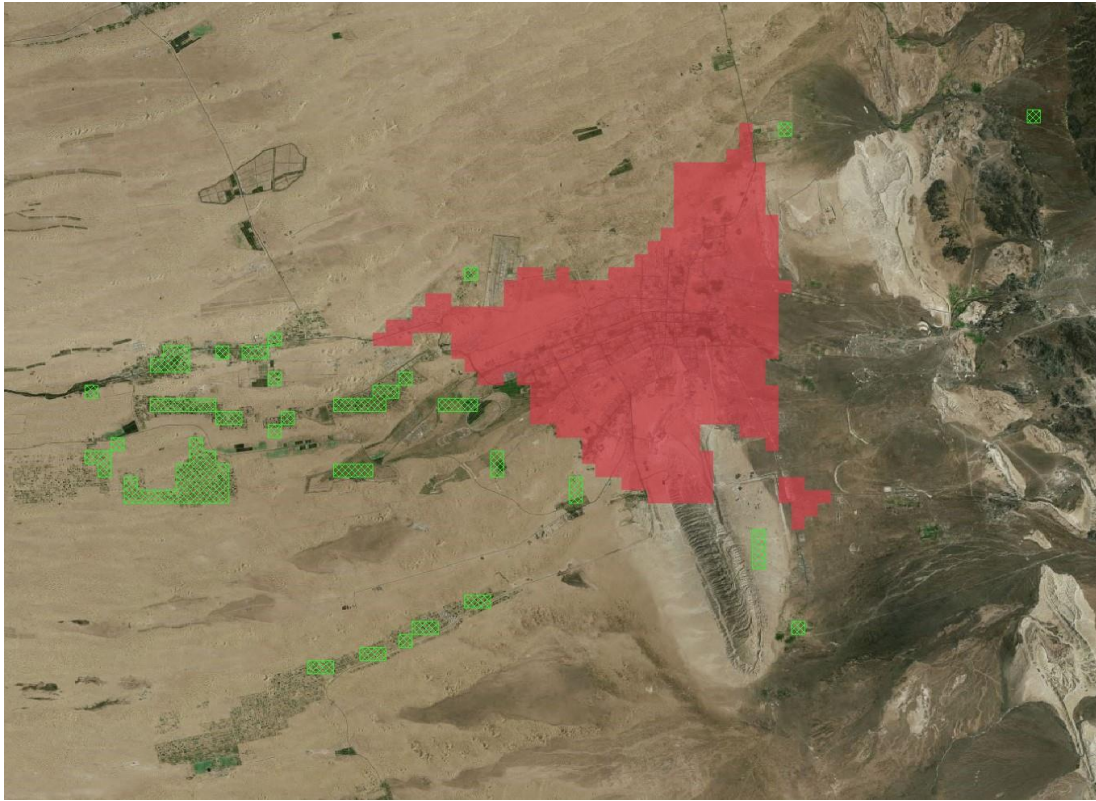


Rural + Forest (LCZ A + B + C + D)

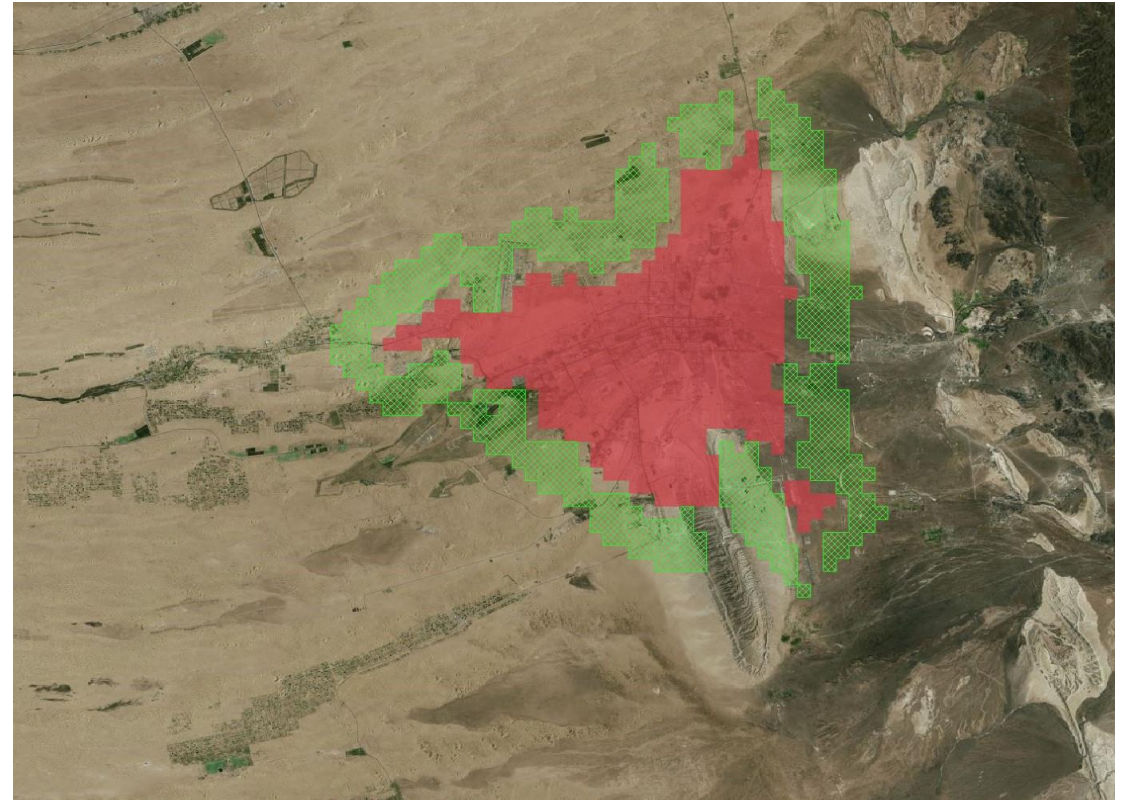


Natural Buffer - Examples

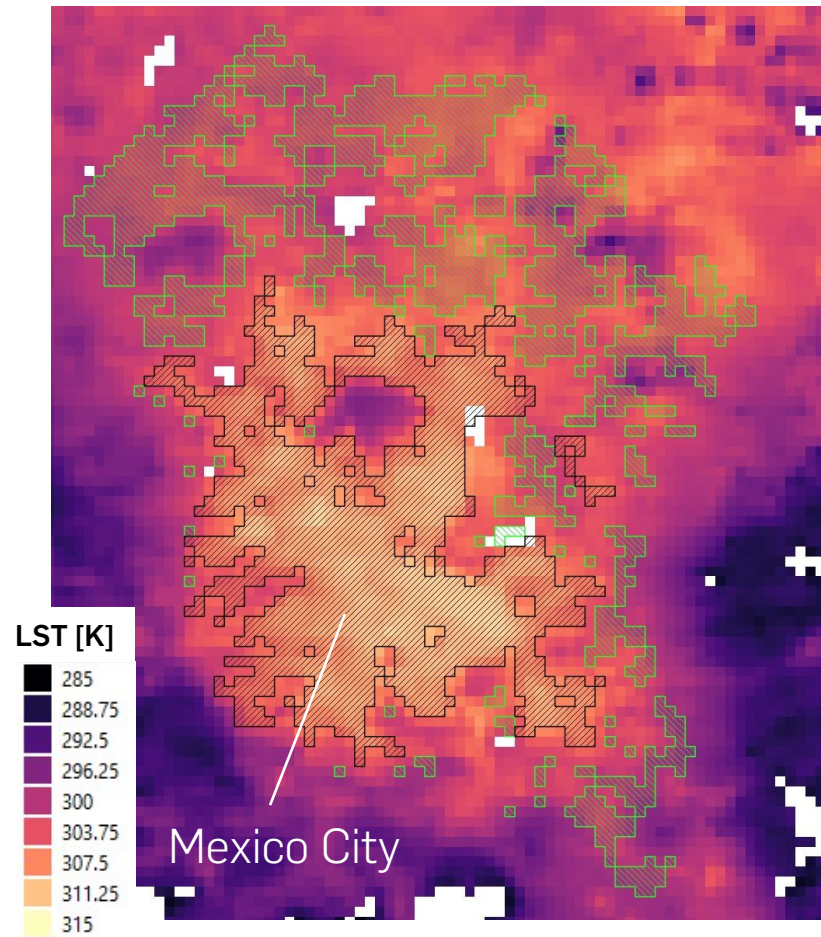
Rural (LCZ B + C + D)



Rural + Bare Soil (LCZ B + C + D + F)



LST Means & SUHI Intensity



Spatial means per day:

$$\overline{\text{LST}}_{\text{u}} = \frac{1}{n} \sum_{i=1}^n \text{LST}_{\text{u},i}$$

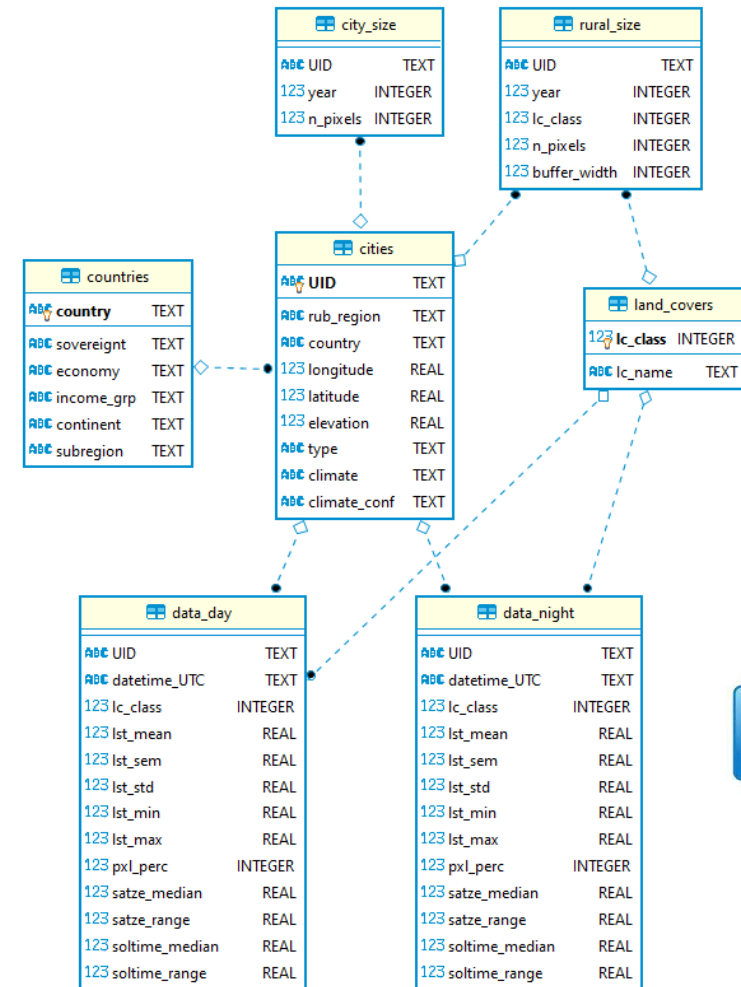
$$\overline{\text{LST}}_{\text{n}} = \frac{1}{n} \sum_{i=1}^n \text{LST}_{\text{n},i}$$

$$\text{SUHI} = \overline{\text{LST}}_{\text{u}} - \overline{\text{LST}}_{\text{n}}$$

- LST min, max, std
- % missing pixels
- Median VZA
- Median Local Solar Time

Analysis-ready Data

- File Format:
 - SQLite is a self-contained, file-based SQL database.
 - Stable, cross-platform, and backwards compatible.
 - Well-supported by both Python and R.
- Ancillary data
 - Timestamp (UTC & Local Solar Time)
 - Satellite VZA, %-missing pixels, urban/natural LST min/max
 - City properties (area, polygon geometry, Köppen-Geiger climate class, lat/lon, elevation, coastal/inland etc.)
 - Socioeconomic data (country, economy, etc.)
 - *We are also working to add: NDVI, daily precipitation, daily snowfall, population data.*



Outputs

	abc UID	abc datetime UTC	123 lc_class	123 lst_mean	123 lst_sem	123 lst_std	123 lst_min	123 lst_max	123 pxL_perc	123 satze_median	123 satze_range	123 soltime_median	123 soltime_range
1	BRA199518	2018-12-30 13:07:12	0	315.6814	0.2468	1.1312	313.15	317.77	100	22.01	0.35	10.1	0.01
2	BRA199518	2018-12-28 13:20:00	0	314.7046	0.129	0.4651	313.49	315.63	61.9	-4.72	0.31	10.3	0
3	BRA199518	2018-12-14 13:07:12	0	320.0141	0.326	1.3442	317.12	321.62	80.95	22	0.36	10.1	0.01
4	BRA199518	2018-12-14 13:07:12	2	312.9933	0.1853	0.321	312.54	313.24	20	22.16	0.45	10.1	0.01
5	BRA199518	2018-12-12 13:20:00	0	319.8812	0.2283	0.9413	317.46	321.37	80.95	-4.75	0.45	10.3	0.01
6	BRA199518	2018-12-10 13:32:48	0	315.6266	0.2886	1.3223	312.72	317.78	100	-29.98	0.33	10.52	0
7	BRA199518	2018-12-10 13:32:48	2	311.048	0.3531	1.3676	309.19	313.26	100	-29.89	0.73	10.52	0
8	BRA199518	2018-12-09 12:50:08	0	309.6176	0.2286	1.0476	307.41	310.9	100	50.01	0.18	9.8	0
9	BRA199518	2018-12-09 12:50:08	2	306.15	0.4843	1.7463	303.6	309.52	86.67	50.04	0.41	9.8	0
10	BRA199518	2018-12-05 13:12:32	0	316.9709	0.2626	0.8711	315.45	318.56	52.38	9.06	0.46	10.22	0.01
11	BRA199518	2018-11-28 13:07:12	0	311.6623	0.3514	1.2669	309.35	314.14	61.9	21.66	0.29	10.11	0.01
12	BRA199518	2018-11-28 13:07:12	2	309.145	0.1662	0.235	308.91	309.38	13.33	21.335	0.05	10.11	0
13	BRA199518	2018-11-12 13:07:12	0	314.5895	0.1821	0.8144	313.13	315.79	95.24	20.985	0.41	10.1	0.01
14	BRA199518	2018-11-12 13:07:12	2	311.8233	0.2668	0.4621	311.24	312.37	20	21.39	0.46	10.09	0
15	BRA199518	2018-11-03 13:15:44	0	316.3635	0.1303	0.5829	314.61	317.19	95.24	7.55	0.39	10.23	0
16	BRA199518	2018-10-23 13:32:48	0	314.21	0.1558	0.6231	312.98	315.33	76.19	-31.375	0.3	10.53	0.01
17	BRA199518	2018-10-22 12:50:08	0	309.1316	0.203	0.8847	307.03	310.52	90.48	49.14	0.23	9.81	0
18	BRA199518	2018-10-22 12:50:08	2	307.89	0	0	307.89	307.89	6.67	49.11	0	9.81	0
19	BRA199518	2018-10-21 13:45:36	0	306.115	0.251	0.355	305.76	306.47	9.52	-49.06	0.02	10.73	0
20	BRA199518	2018-10-21 13:45:36	2	304.5	0	0	304.5	304.5	6.67	-48.87	0	10.73	0
21	BRA199518	2018-10-20 13:02:56	0	304.4431	0.6266	2.2591	299.53	306.62	61.9	31.81	0.28	10.02	0.01
22	BRA199518	2018-10-20 13:02:56	2	301.7375	0.2468	0.4936	301.24	302.5	26.67	32.12	0.1	10.02	0
23	BRA199518	2018-09-25 13:07:12	0	310.3507	0.1876	0.702	308.78	311.36	66.67	19.995	0.35	10.11	0
24	BRA199518	2018-09-25 13:07:12	2	309.204	0.3305	0.739	308.47	310.56	33.33	20.11	0.58	10.11	0.01
25	BRA199518	2018-09-24 13:29:57	0	308.6747	0.0978	0.4481	307.6	309.18	100	-65.4	0.12	11.04	0.01
26	BRA199518	2018-09-24 13:29:57	2	308.621	0.1565	0.495							
27	BRA199518	2018-09-23 13:20:00	0	311.0829	0.1997	0.9153							
28	BRA199518	2018-09-23 13:20:00	2	309.3587	0.2487	0.9633							
29	BRA199518	2018-09-12 13:39:12	0	305.3495	0.1436	0.6092							
30	BRA199518	2018-09-12 13:39:12	2	304.0558	0.2445	0.8469							
31	BRA199518	2018-09-09 13:07:12	0	304.0976	0.134	0.6139							
32	BRA199518	2018-09-09 13:07:12	2	302.8393	0.3689	1.3802							
33	BRA199518	2018-09-08 13:29:57	0	300.5965	0.0812	0.363							
34	BRA199518	2018-09-08 13:29:57	2	300.1061	0.1823	0.6573							
35	BRA199518	2018-09-07 13:20:00	0	303.3881	0.1674	0.7672							
36	BRA199518	2018-09-07 13:20:00	2	302.9493	0.2199	0.8517							
37	BRA199518	2018-09-06 13:10:02	0	298.4	0	0							
38	BRA199518	2018-09-06 13:10:02	2	297.8467	0.1711	0.2963							
39	BRA199518	2018-09-05 13:32:48	2	293.42	0	0							
40	BRA199518	2018-09-03 13:45:36	0	308.9433	0.1124	0.4355							
41	BRA199518	2018-09-03 13:45:36	2	308.4983	0.1411	0.3457							
42	BRA199518	2018-09-02 13:02:56	0	308.1072	0.2125	0.9739							
43	BRA199518	2018-09-02 13:02:56	2	307.18	0.2454	0.9182							
44	BRA199518	2018-09-01 13:24:58	0	309.338	0.0611	0.2366							
45	BRA199518	2018-09-01 13:24:58	2	309.4363	0.1124	0.3178							

- Date
- LST mean, min, max, std, sem
- % missing pixels
- Median VZA
- Median Local Solar Time
- Quality Control
- Solar time

