A study on the diurnal land surface temperature cycle during a warmer and a cooler year using high spatial resolution land surface temperature data.

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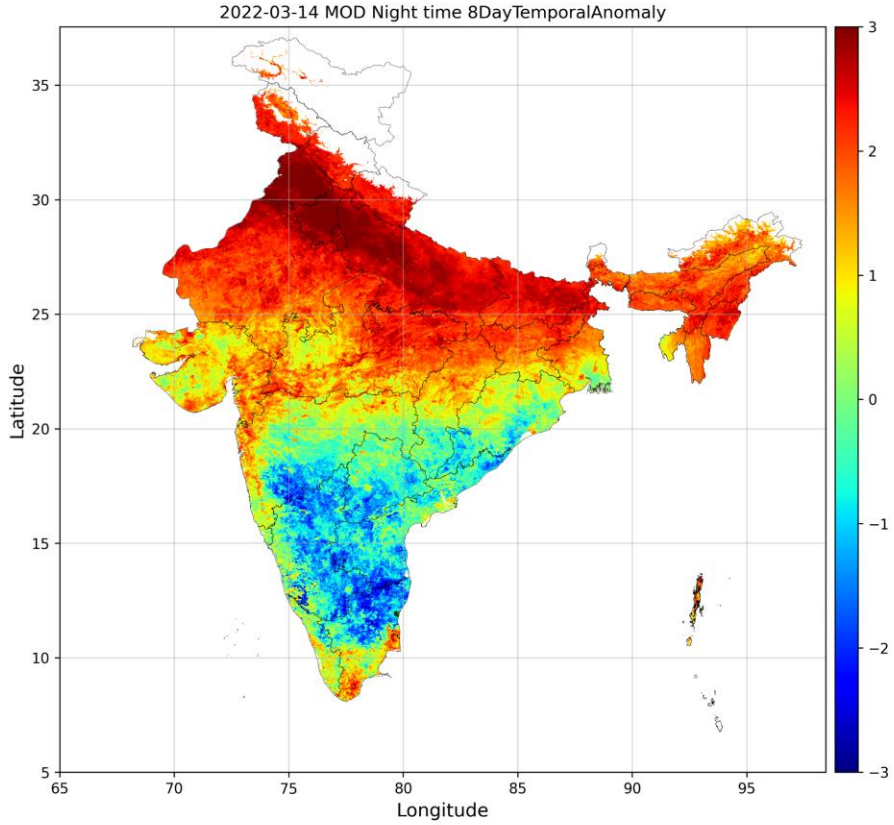
Extreme temperature patterns & its Diurnal Temperature Cycle (DTC)

- Climate change -Prolonged extreme heat events
- Air temperature - limited weather stations in India.
- Land surface temperature (LST) - better proxy for air temperature.
- Diurnal temperature parameters summarize thermal characteristics of land surface
- Geostationary satellites has relatively coarser resolution
- Combining data downscaling with a DTC model can be a suitable option to obtain field scale LST and its diurnal cycle.

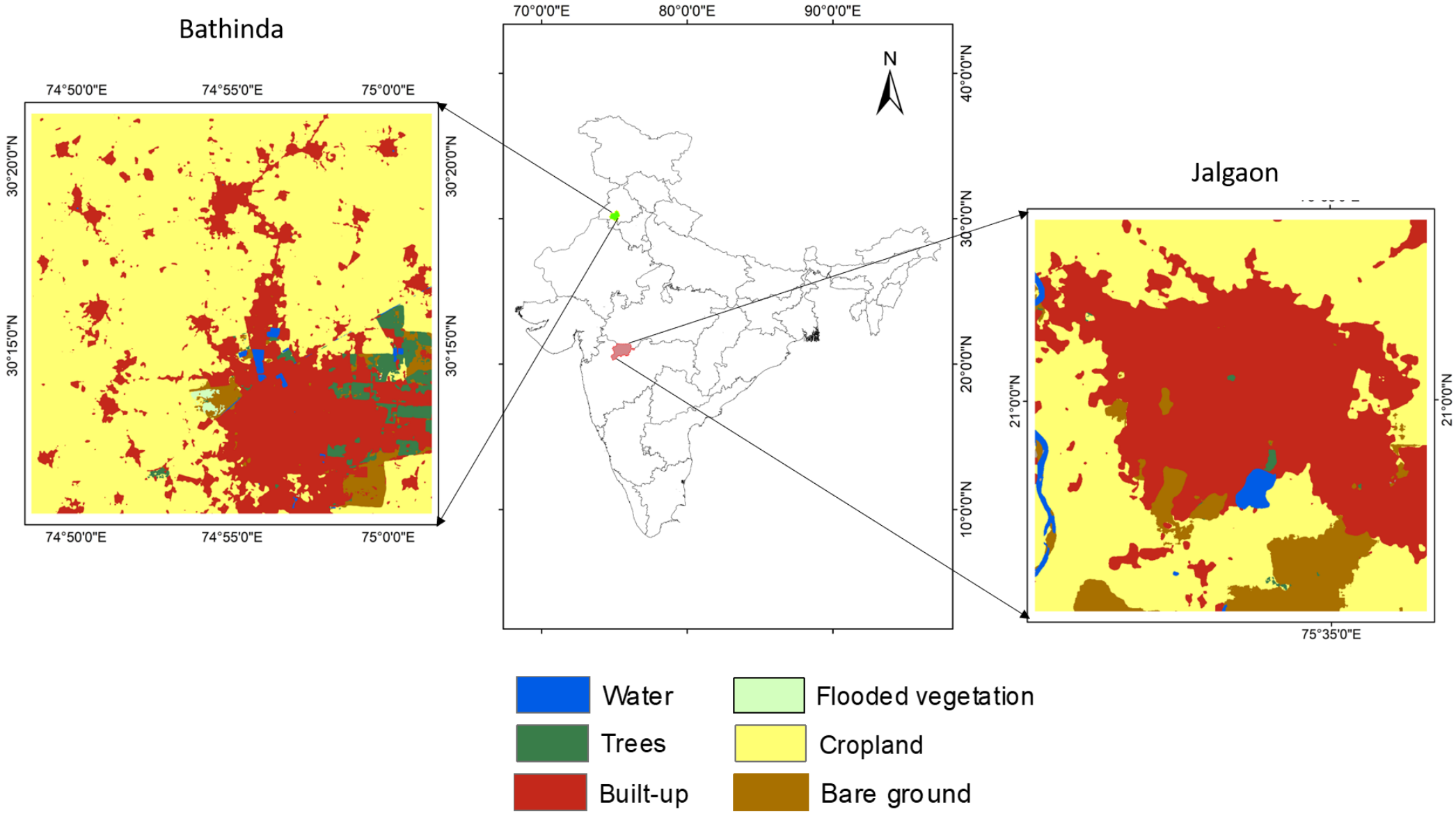


MODIS –Terra Night time 8 day thermal anomaly map for the year 2022

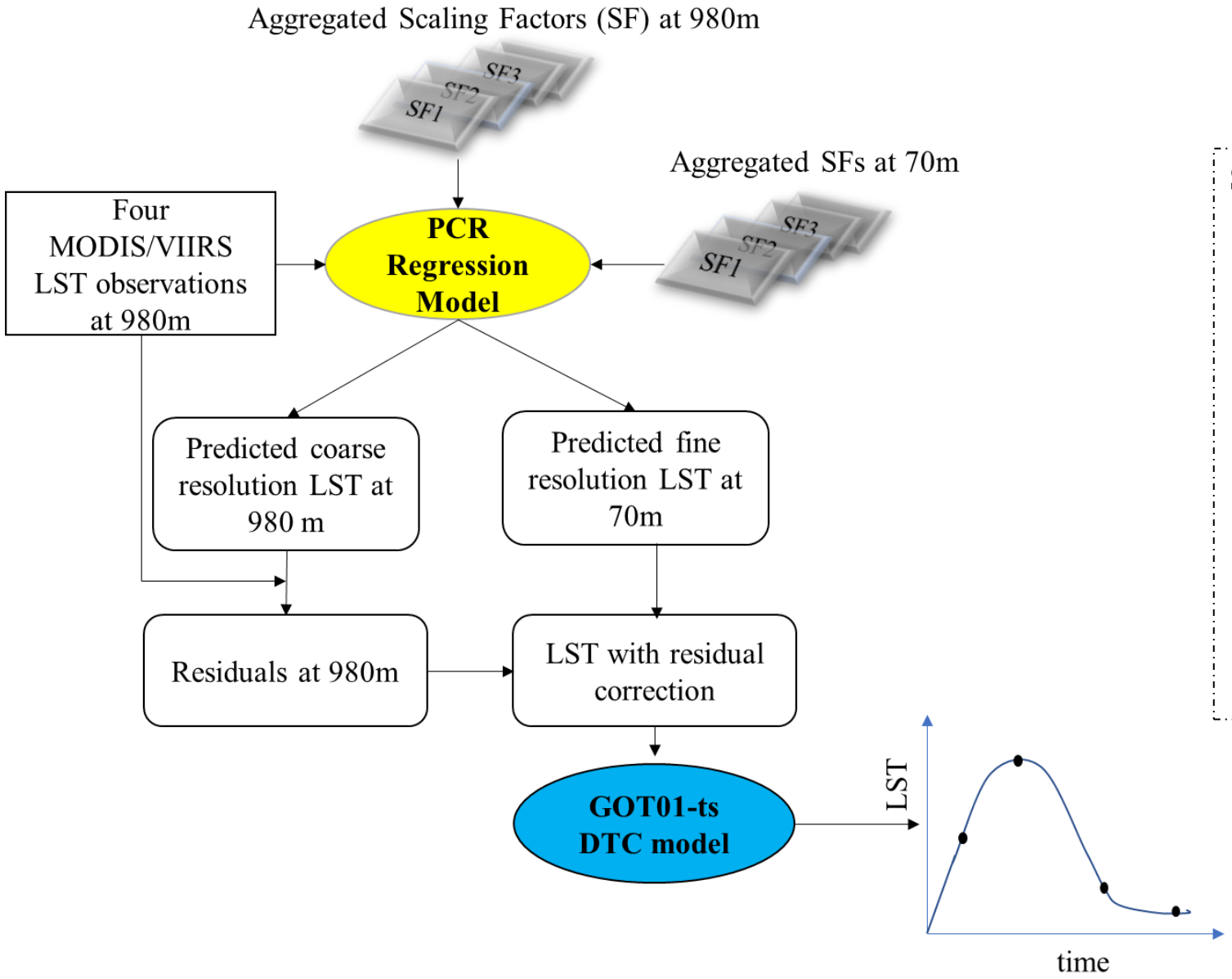
Objective

- To study the variation of diurnal land surface temperature parameters for different land cover types during a warmer and a cooler year.

Study Area


Bathinda
74°50'0"E
74°55'0"E
75°0'0"E
30°20'0"N
30°15'0"N
70°0'0"E
80°0'0"E
90°0'0"E
N
40°0'0"N
30°0'0"N
20°0'0"N
10°0'0"N
Jalgaon
21°0'0"N
75°35'0"E
Water
Trees
Built-up
Flooded vegetation
Cropland
Bare ground

Methodology



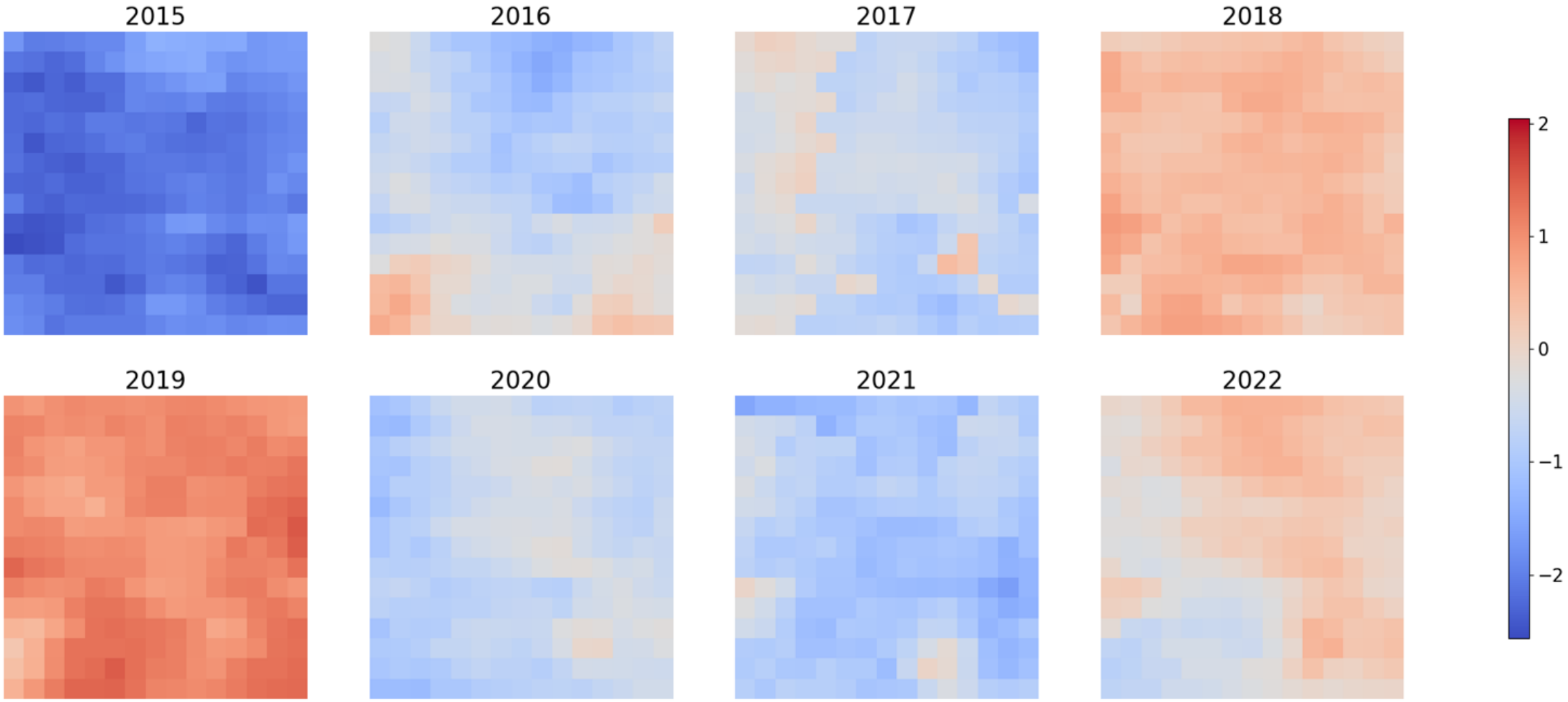
Scale Factors used

- ❑ NDVI
- ❑ EVI
- ❑ NDBI
- ❑ NDMI
- ❑ MSAVI
- ❑ BI
- ❑ UI
- ❑ Emissivity
- ❑ DEM
- ❑ Backscattering coefficient (VV polarisation)

Datasets Used

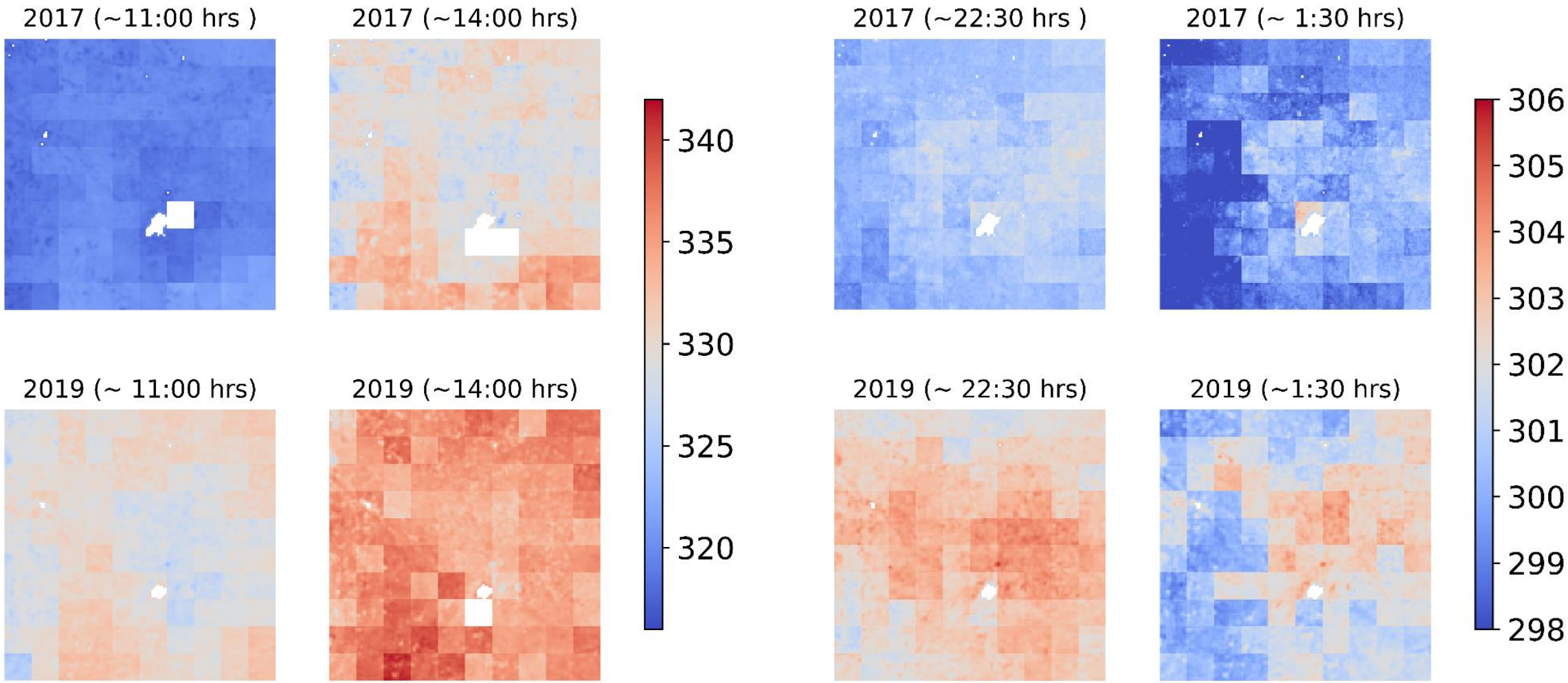
Dataset	Date	No of Images	Spatial Resolution	Temporal Resolution
MODIS Terra/Aqua LST VIIRS	18-03-2022 17-03-2020 28-04-2019 28-04-2017	4 4 4	1000 m 1000 m	1 day
Landsat 7/8/9 Reflectance bands LST	17-03-2022 19-03-2020 28-04-2019 22-04-2017	1 1	30 m 60m-100 m	16 days
Sentinel 1	17-03-2022 14-03-2020 28-04-2019 28-04-2017	1 1 1	10 m	6 days
SRTM	23-09-2014	1	30 m	-

Results and Discussion

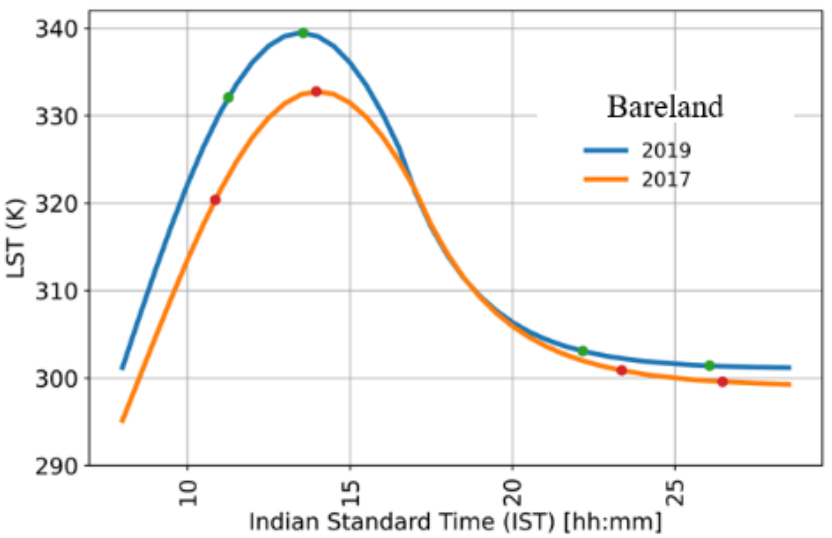


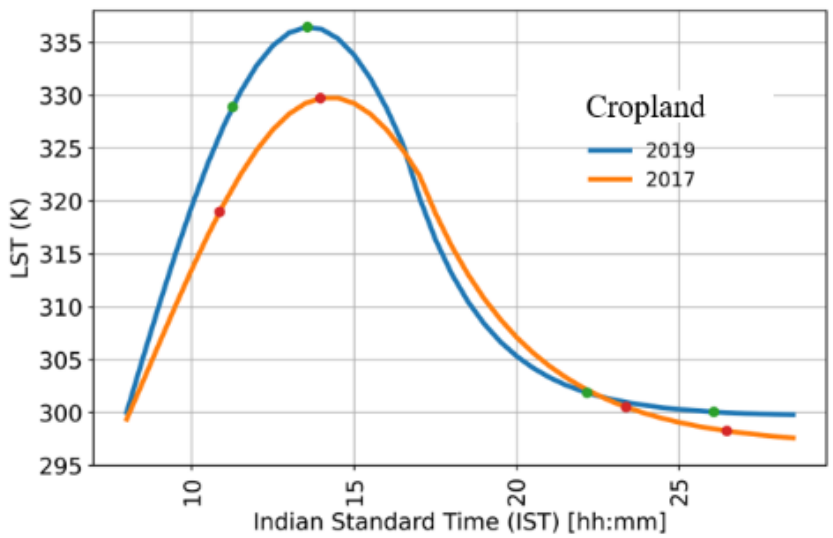
Thermal anomalies calculated using MODIS Terra Day time LST data for the month of April at Jalgaon, Maharashtra.

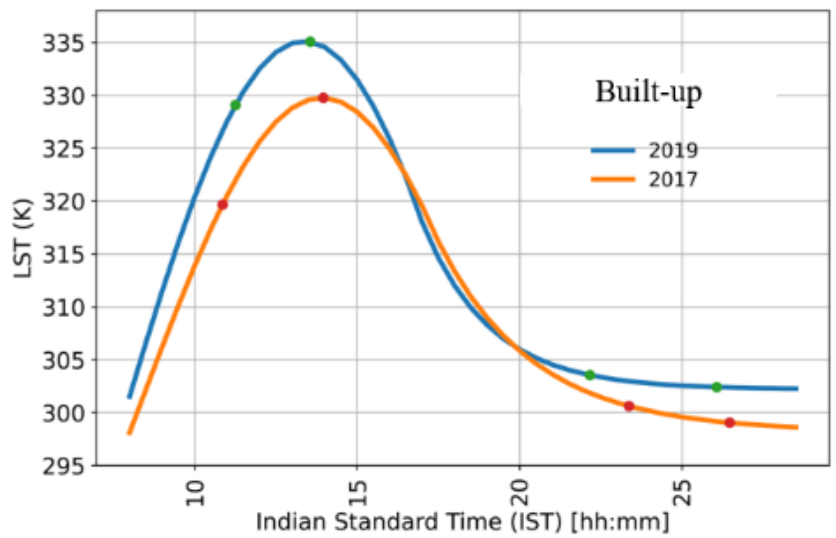
- MOD11A1 , VNP21A1D & VNP21A1N



Predicted LST at 70m using PCR disaggregation over Jalgaon region



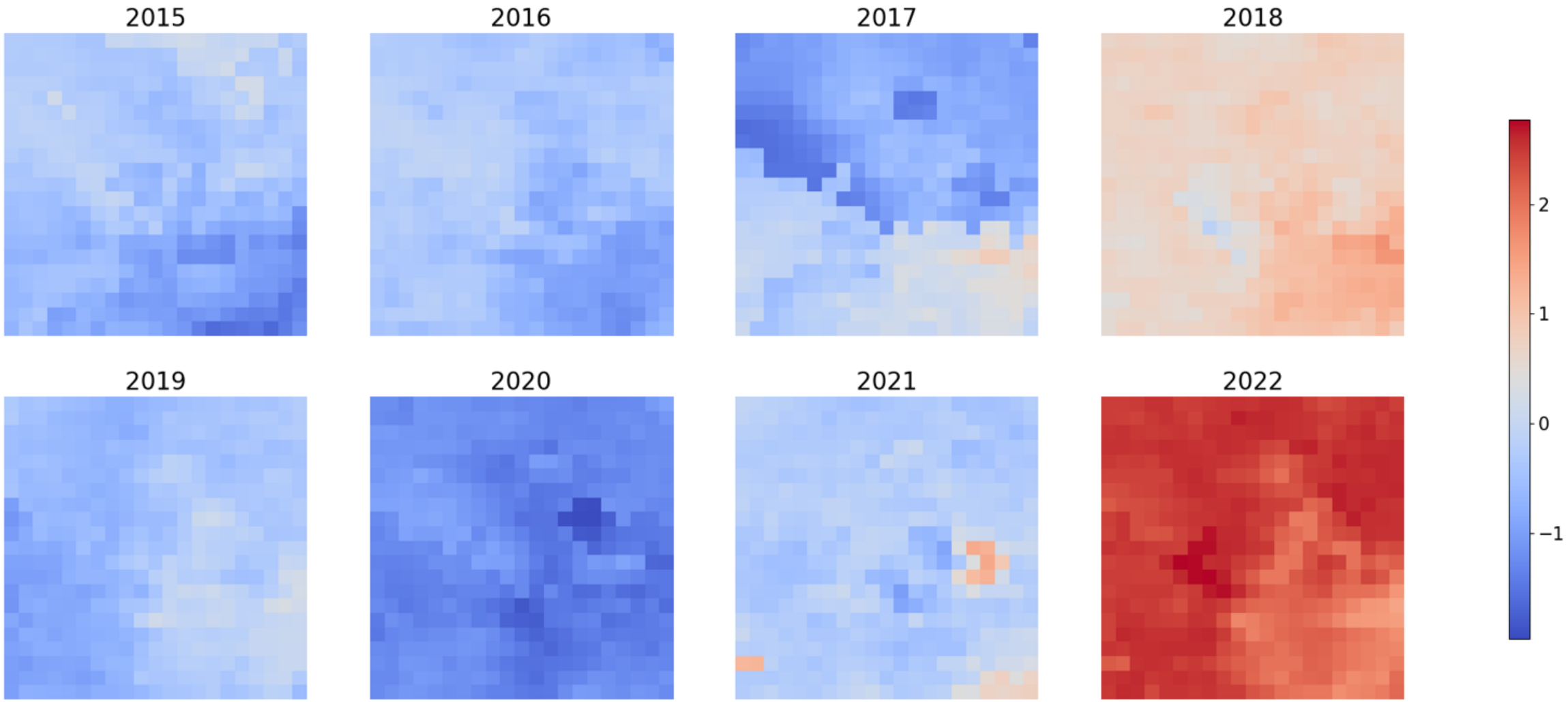




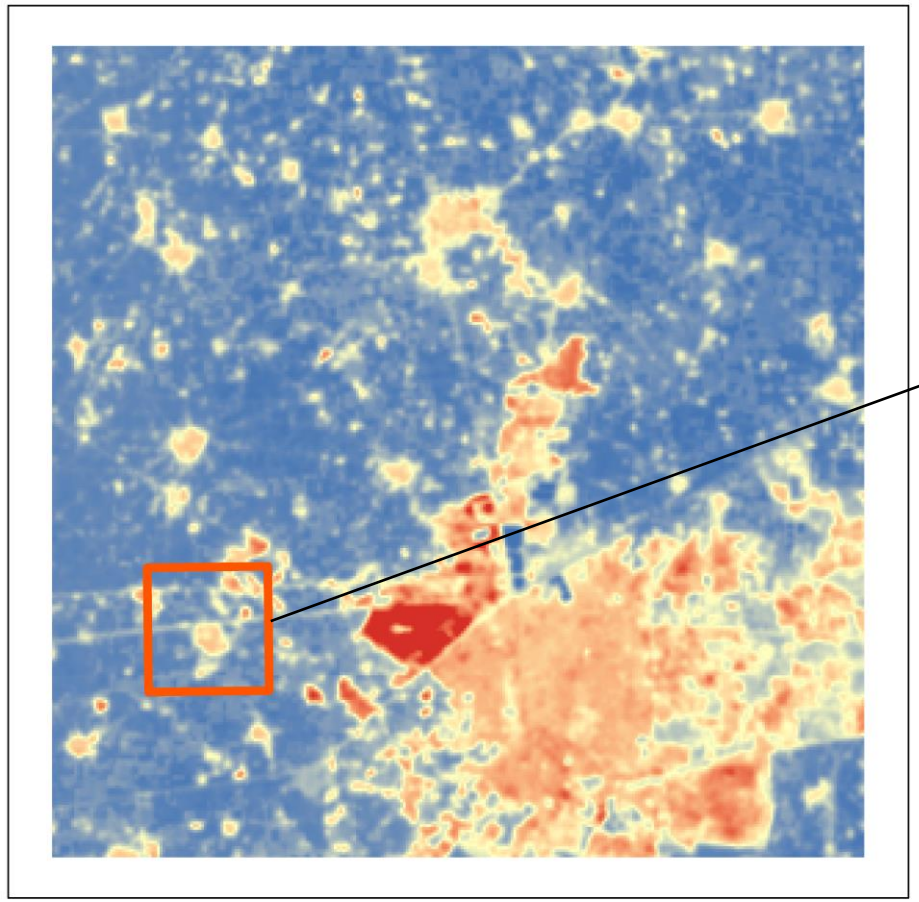
DTC derived for a single day in April, 2017 & 2019 using PCR & GOT01-ts model at Jalgaon

Diurnal parameters derived for different land cover types at Jalgaon

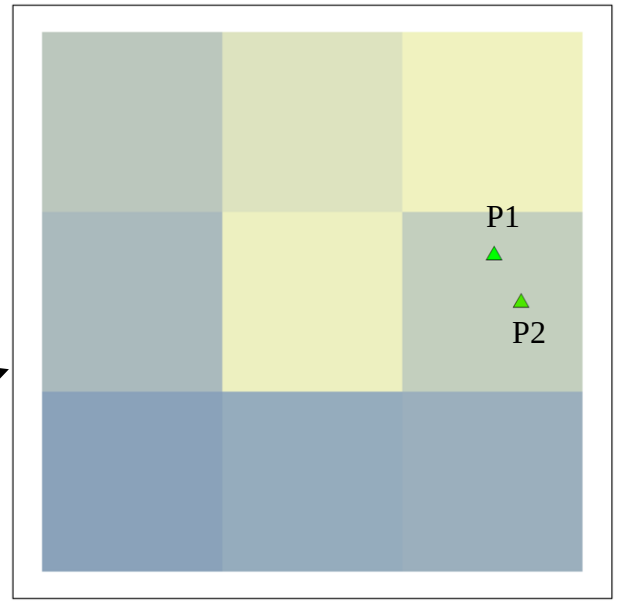
	Min Temp		Max Temp		Ta		tm	
	2017	2019	2017	2019	2017	2019	2017	2019
Bareland	290.53	295.53	332.77	339.48	42.24	43.95	14.00	13.5
Cropland	293.64	294.31	320.59	336.23	26.95	41.92	14.00	13.5
Urban Built up	294.45	296.39	329.56	334.96	35.11	38.57	14.00	13.5



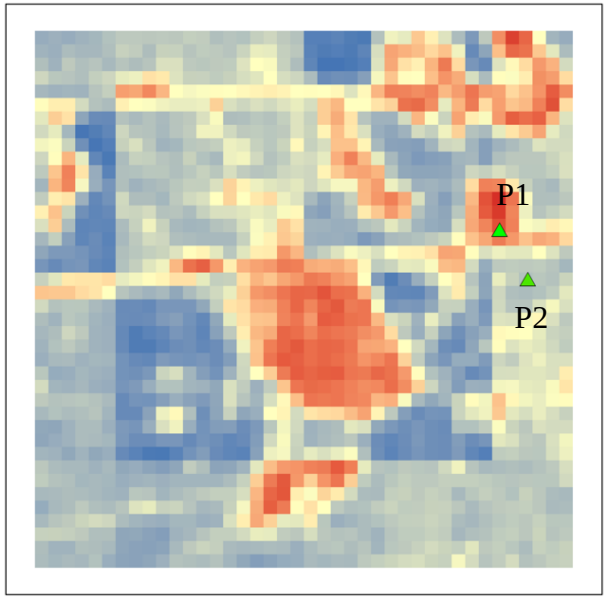
Thermal anomalies calculated using MODIS Terra Day time LST data for the month of March at Bathinda, Punjab.



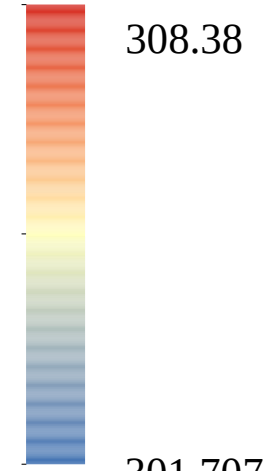
a) Landsat 8 LST (70 m) at Bathinda, Punjab

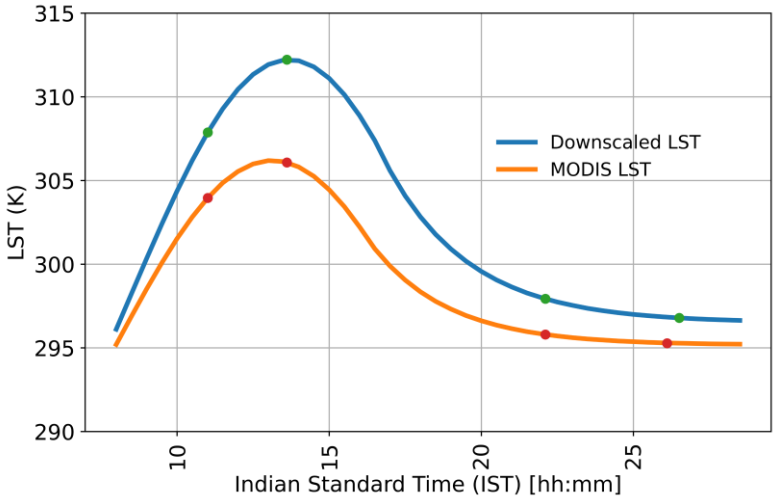


b) MODIS Terra LST (980 m)

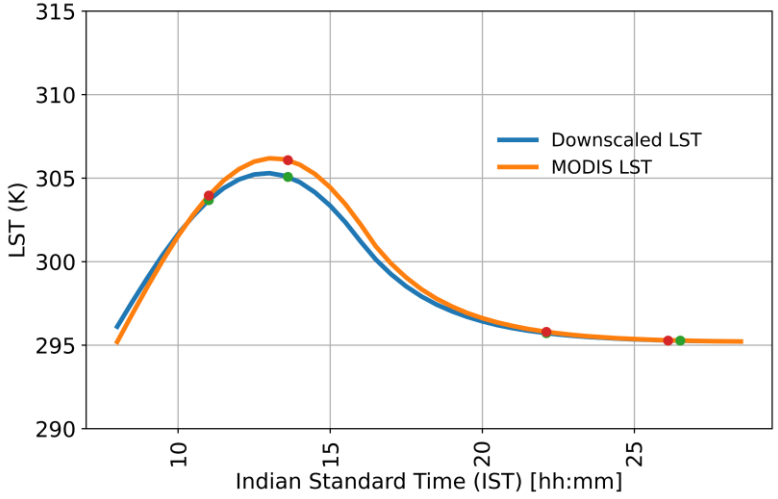


c) Downscaled LST (70 m)

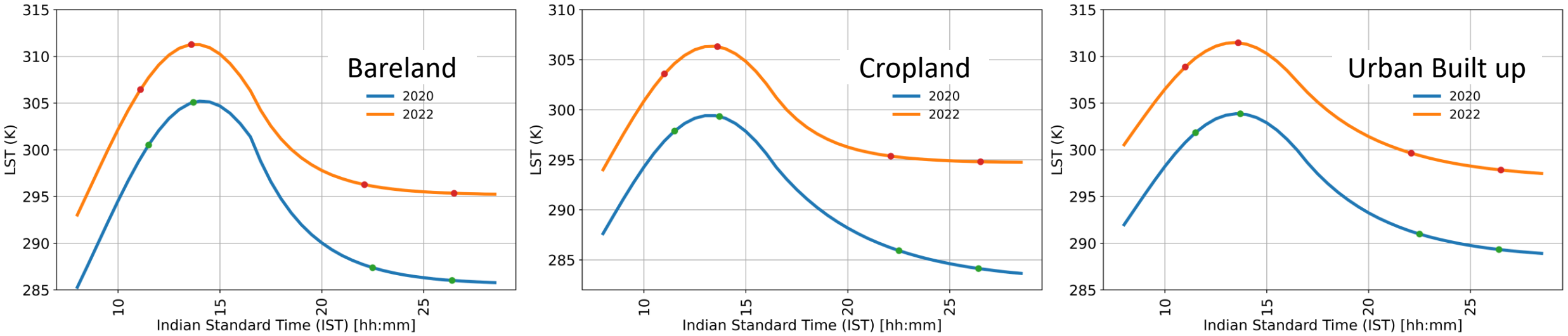




d) DTC at P1



e) DTC at P2



DTC derived for a single day in March, 2020 & 2022 at Bathinda using PCR & GOT01-ts model

Diurnal parameters derived for different land cover types at Bathinda

	Min Temp		Max Temp		Ta		tm	
	2020	2022	2020	2022	2020	2022	2020	2022
Bareland	285.28	293.02	305.2	311.26	15.45	15.407	14.135	13.780
Cropland	287.40	294.37	299.60	305.41	11.409	10.69	13.35	13.25
Urban Built up	291.98	300.54	303.86	311.47	10.571	10.182	13.576	13.410

Conclusion

- The temperature and duration of heat anomalies can vary for different land cover types in the same region.
- LST can be used as proxy along with heat stress index to monitor and mitigate the heat events at a finer scale.
- Identifying hotspots and time at which temperature peaks can help in mitigating the impact of heatwaves.

Thank you