

Urban Heat Islands:

Importance of temporal dimension and rural
land cover

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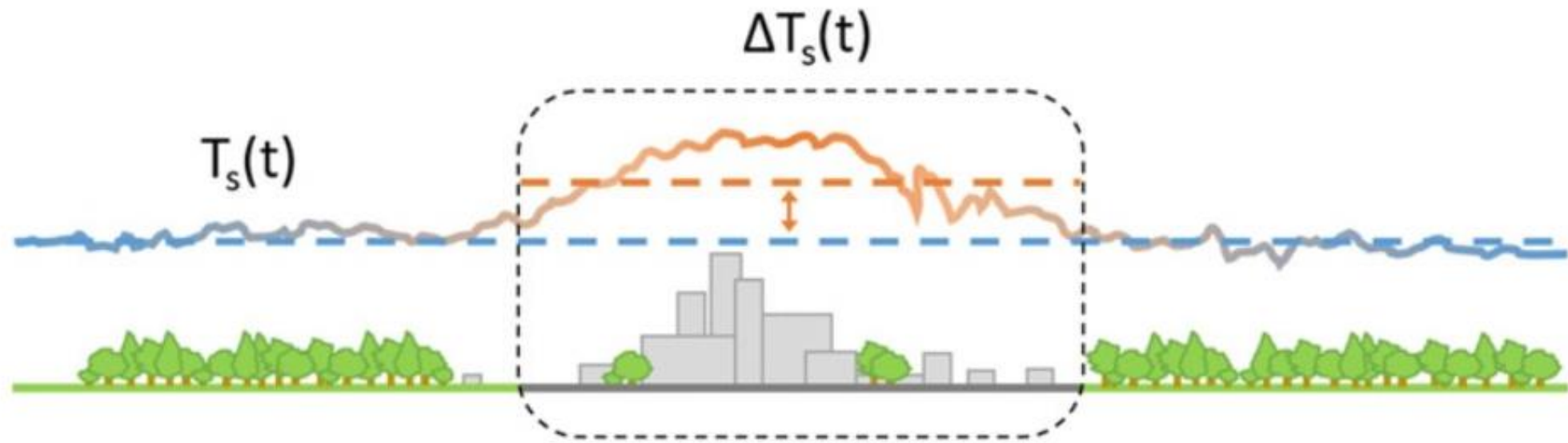


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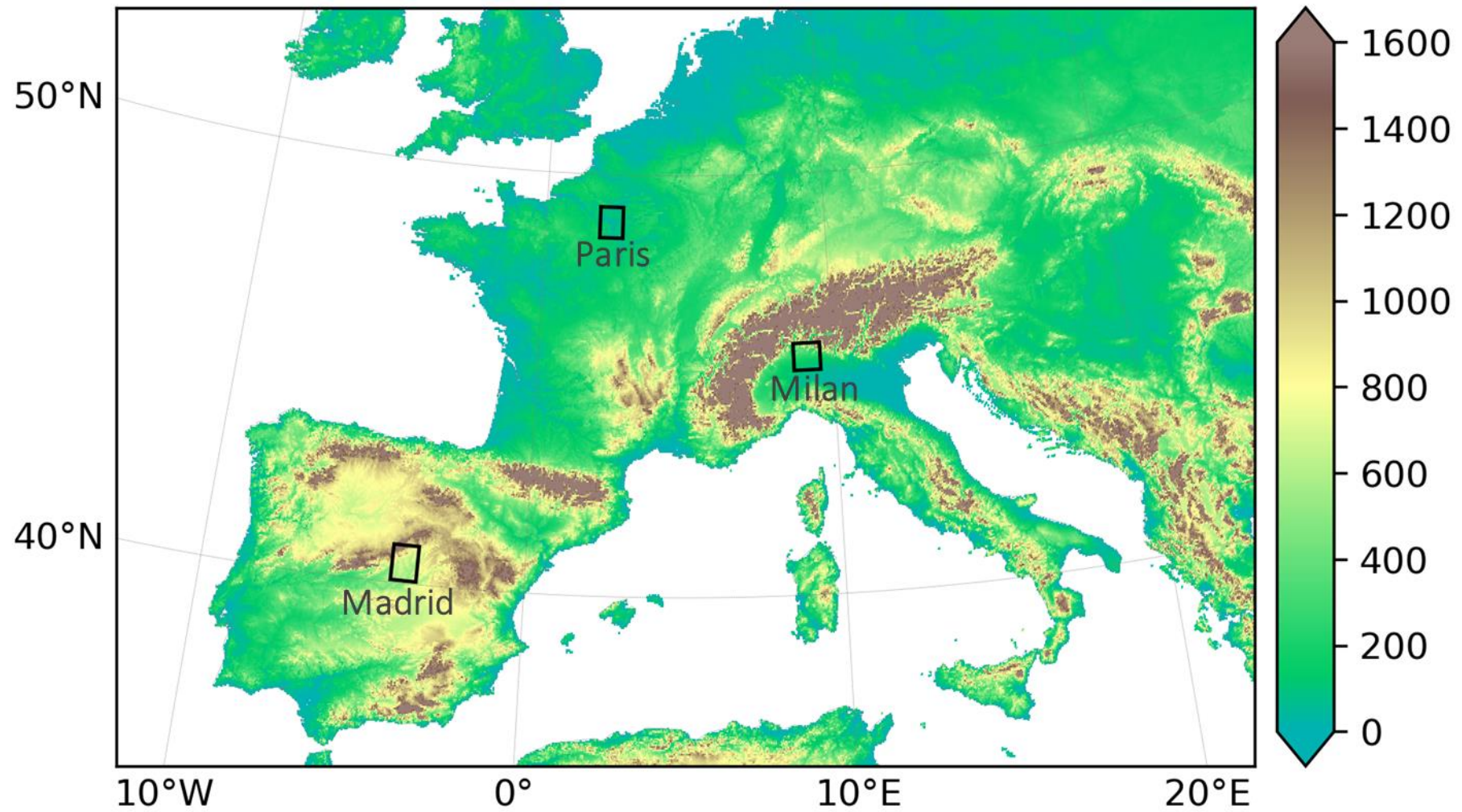


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Urban Heat Island



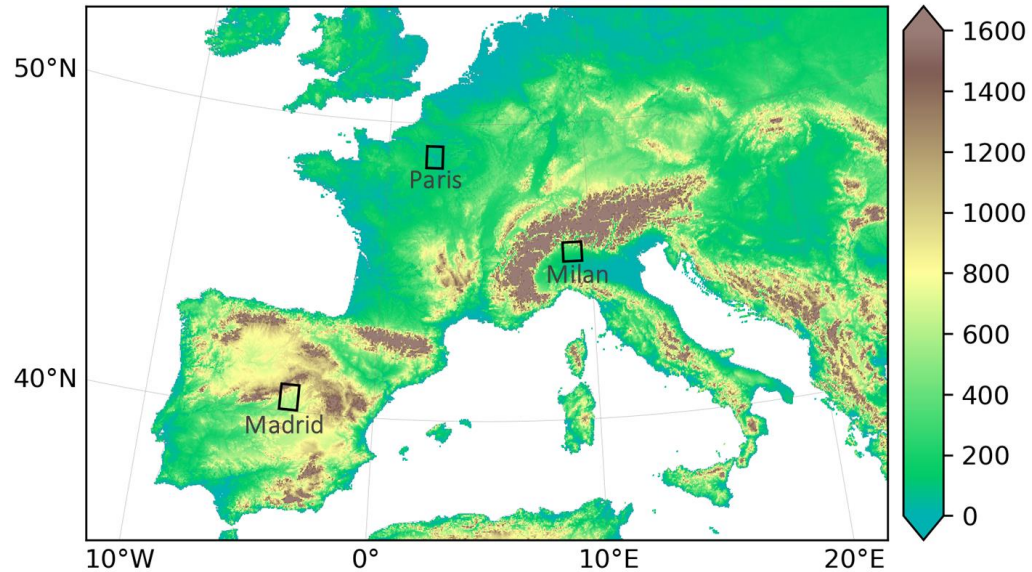
A tale of three cities...



A tale of three cities...

Data:

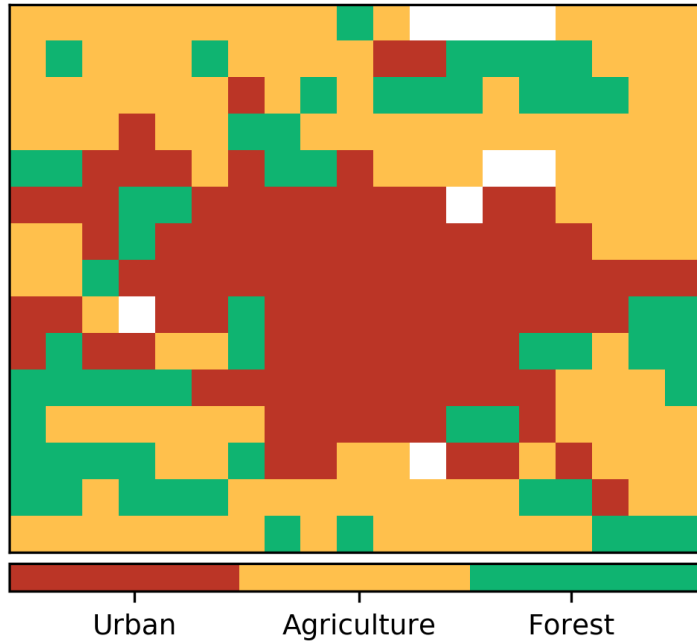
- Meteosat Second Generation – Land Surface Temperature (LST)
- CORINE Land Cover 2012 – reprojected to the MSG grid.
- Study period: 2004 - 2020



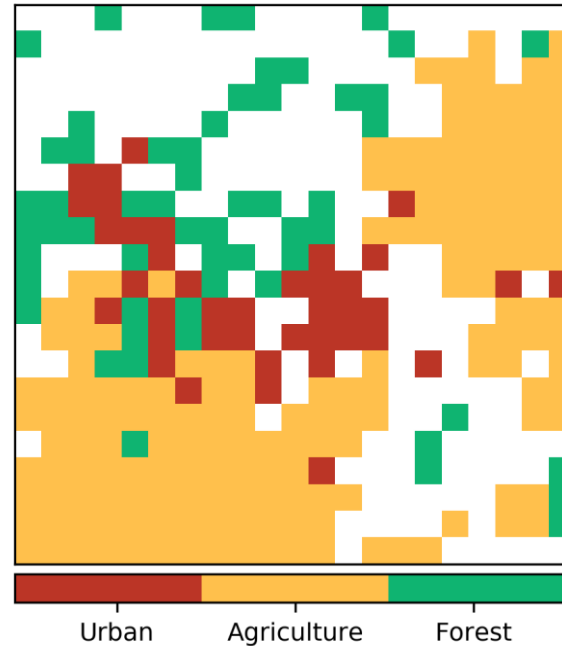
Why a geostationary satellite?

- High temporal resolution;
- Big cities - lower spatial resolution may not be a problem.

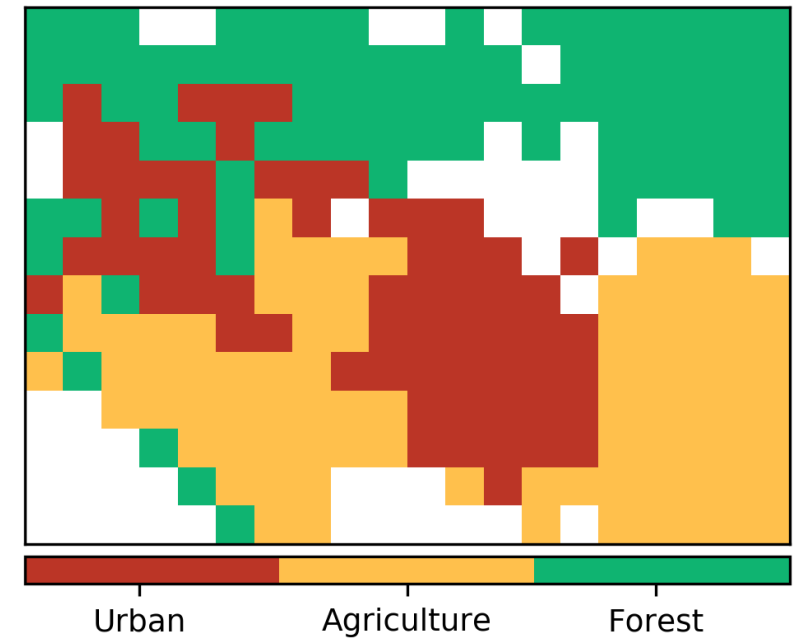
Paris



Madrid

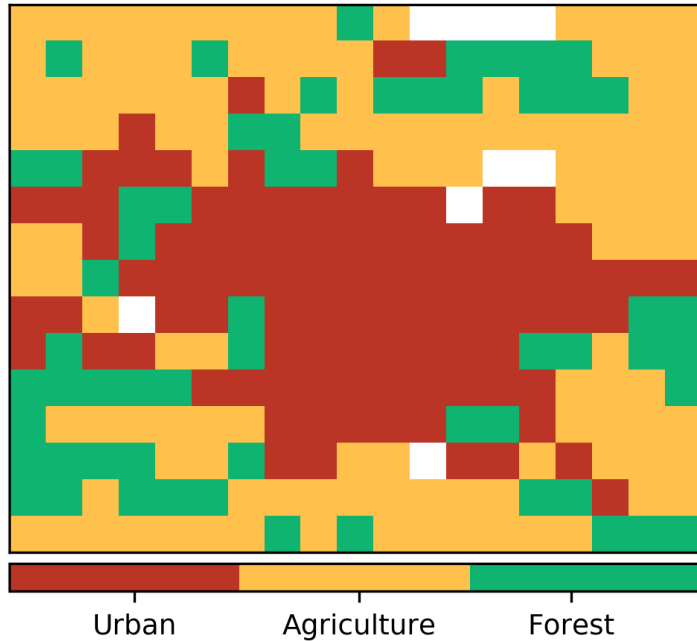


Milan

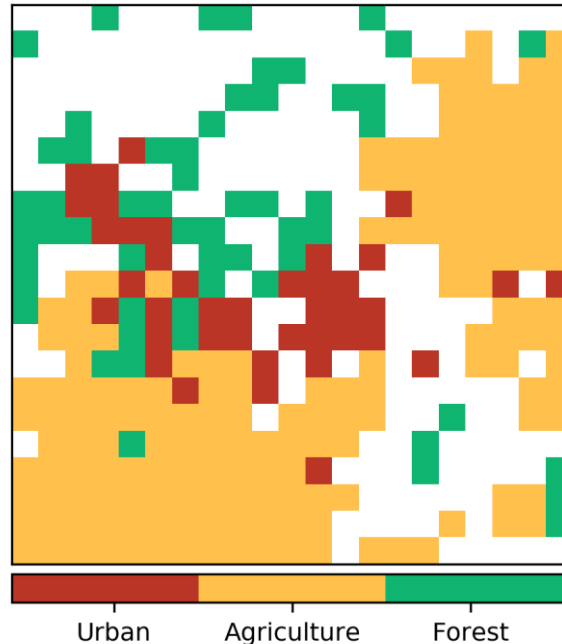


Land cover	Paris	Madrid	Milan
Urban fabric	96	40	63
Non-irrigated arable land	121	172	83
Broad-leaved forest	59	57	86
Total nr. of pixels	276	269	232

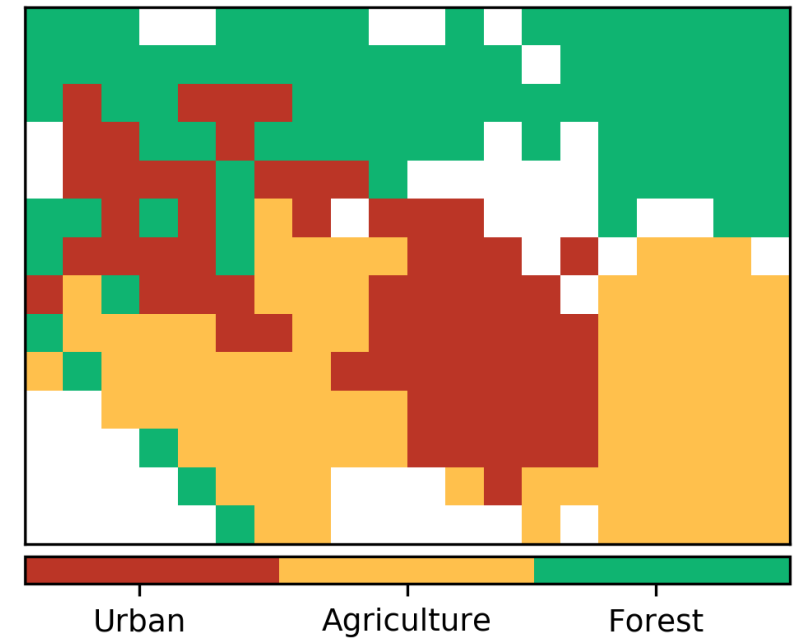
Paris



Madrid



Milan



Land cover	Paris	Madrid	Milan
Urban fabric	96 (71 m)	40 (686 m)	63 (220 m)
Non-irrigated arable land	121 (102 m)	172 (642 m)	83 (140 m)
Broad-leaved forest	59 (104 m)	57 (816 m)	86 (657 m)
Total nr. of pixels	276 (92 m)	269 (685 m)	232 (353 m)

1

Is there any
diurnal
variability?

2

Are there
differences when
computing the
UHI based on
different LCs?

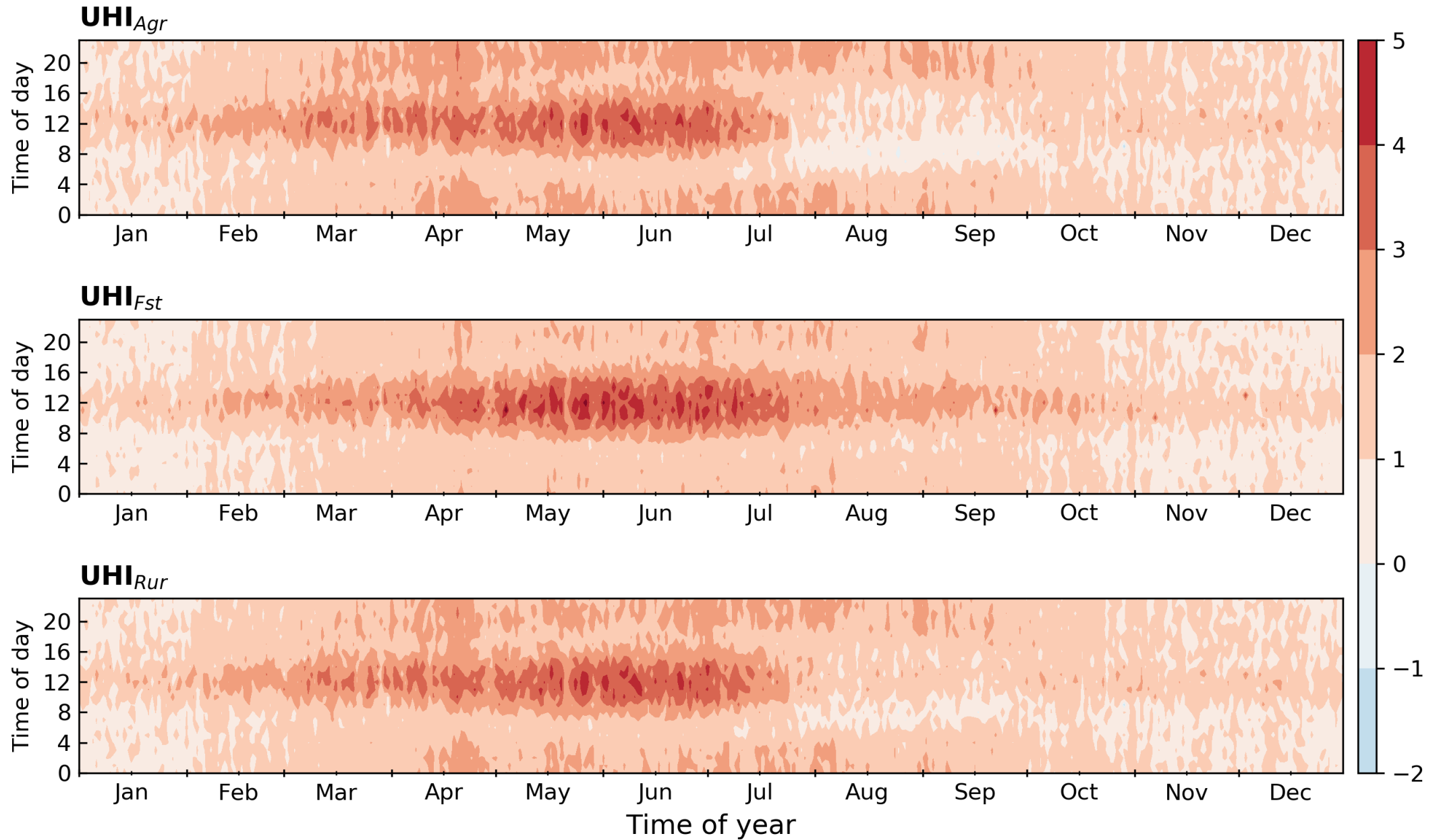
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Is there any
seasonal
variability?

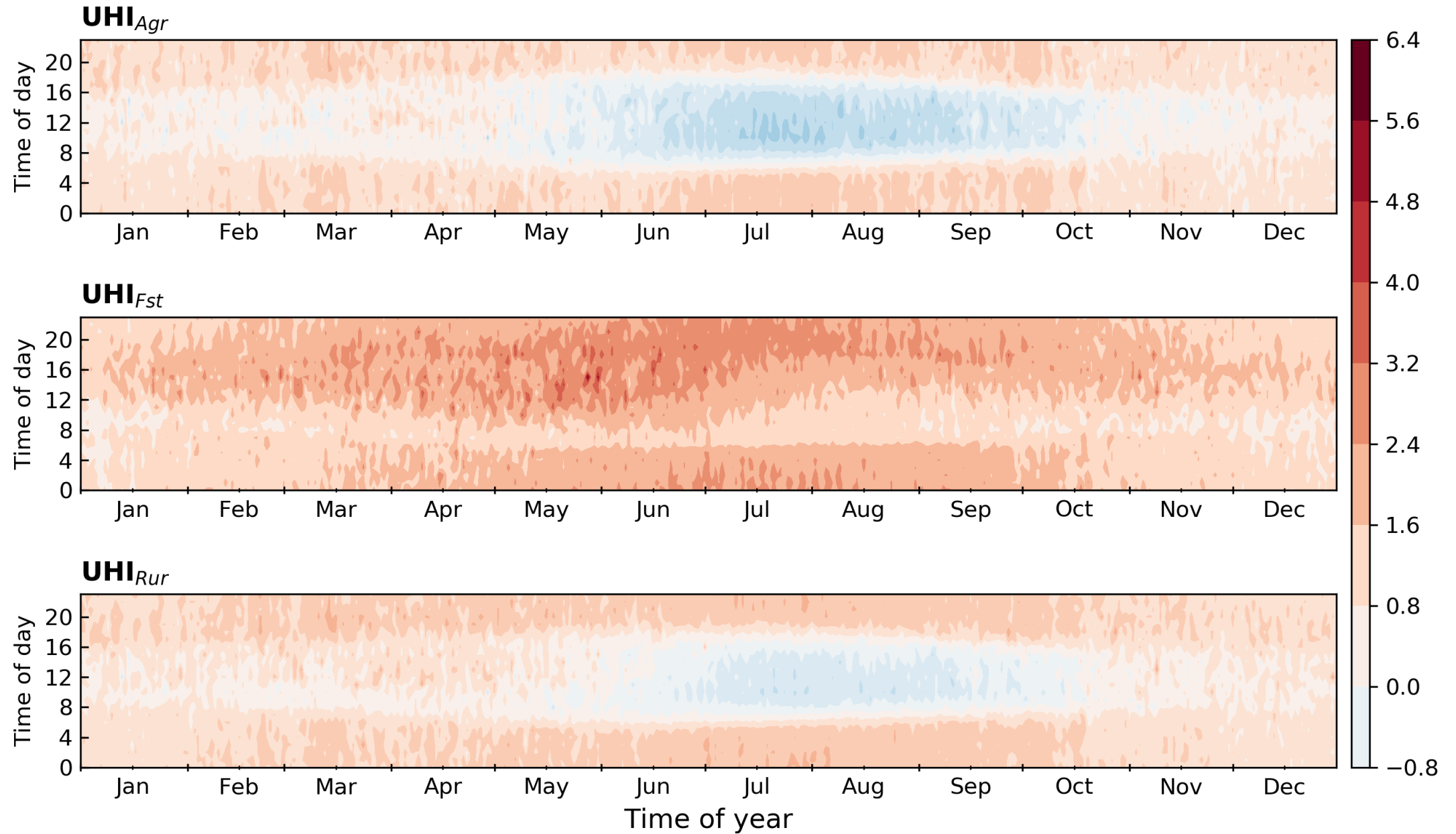
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LST vs. UHI

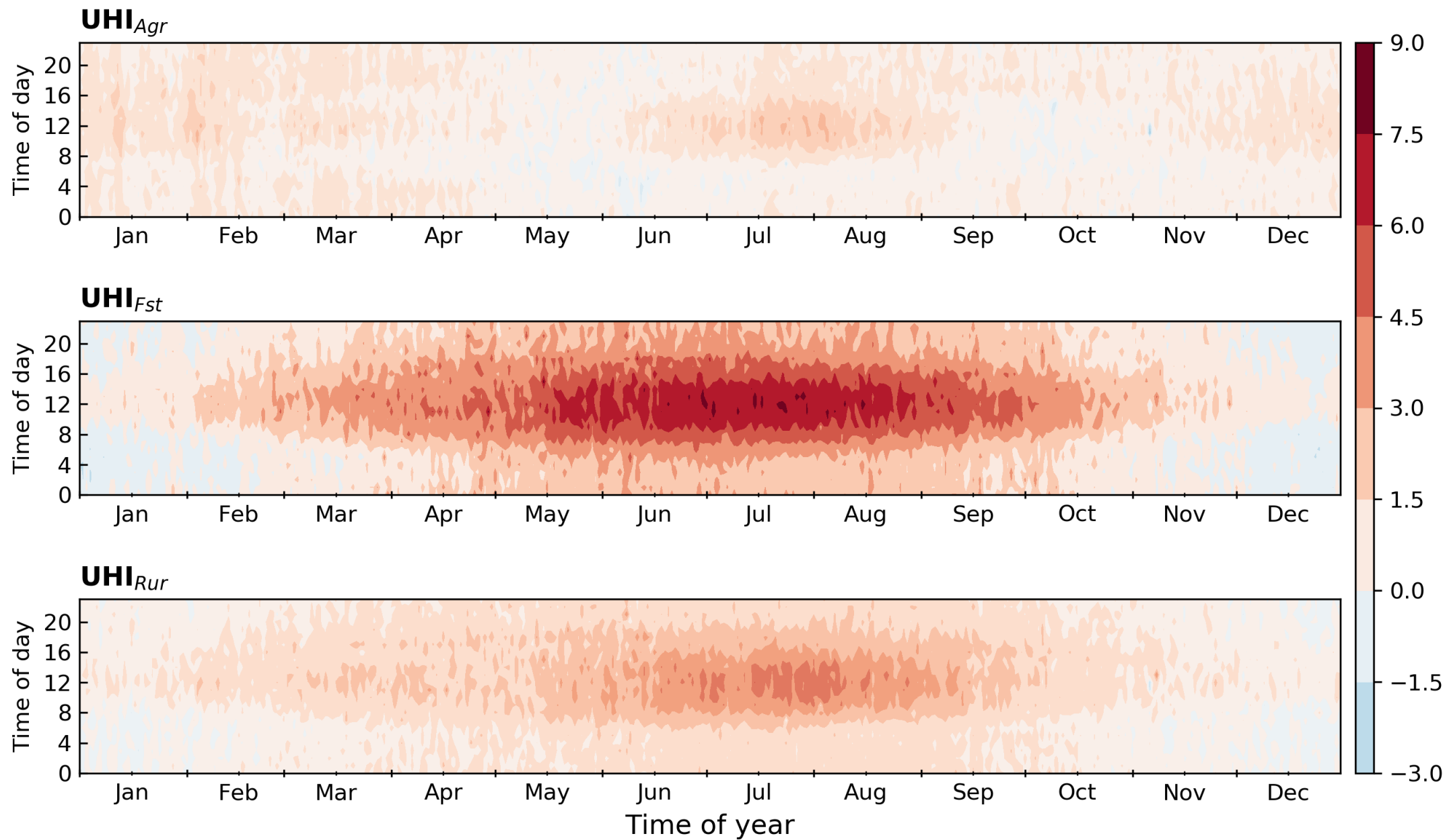
Paris



Madrid



Milan



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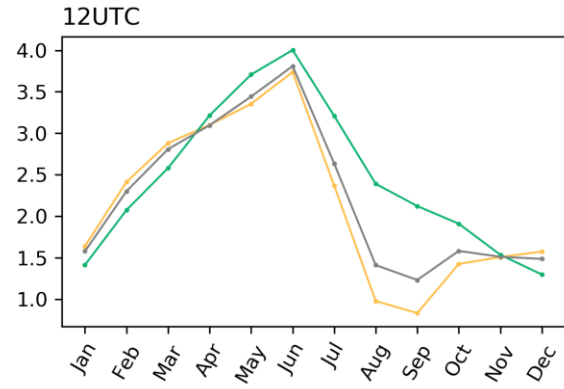
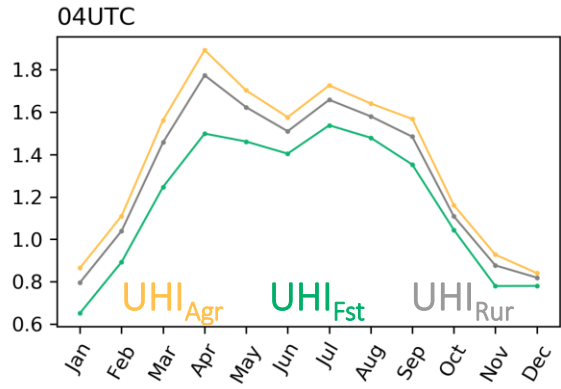
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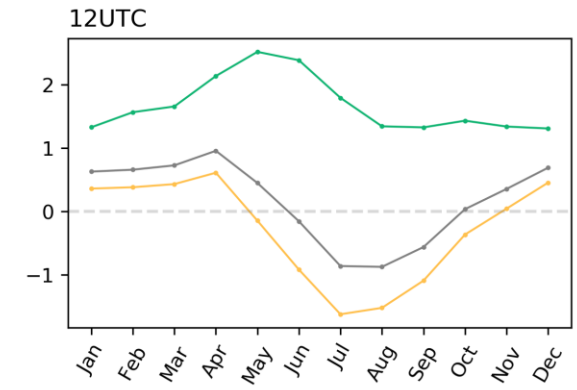
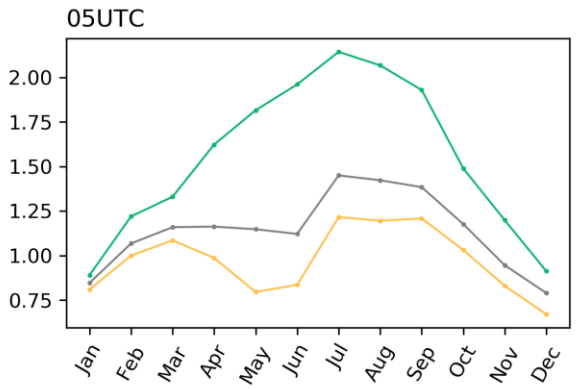
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LST vs. UHI

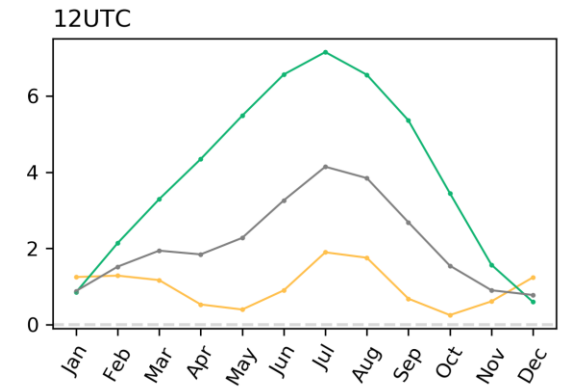
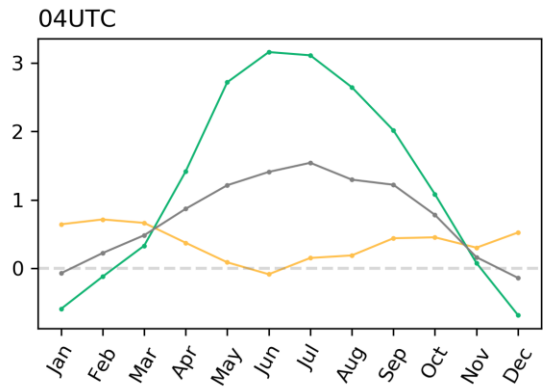
Paris UHI



Madrid UHI



Milan UHI



Seasonal variability may be influenced by human activity outside the urban region (e.g. harvesting)

1

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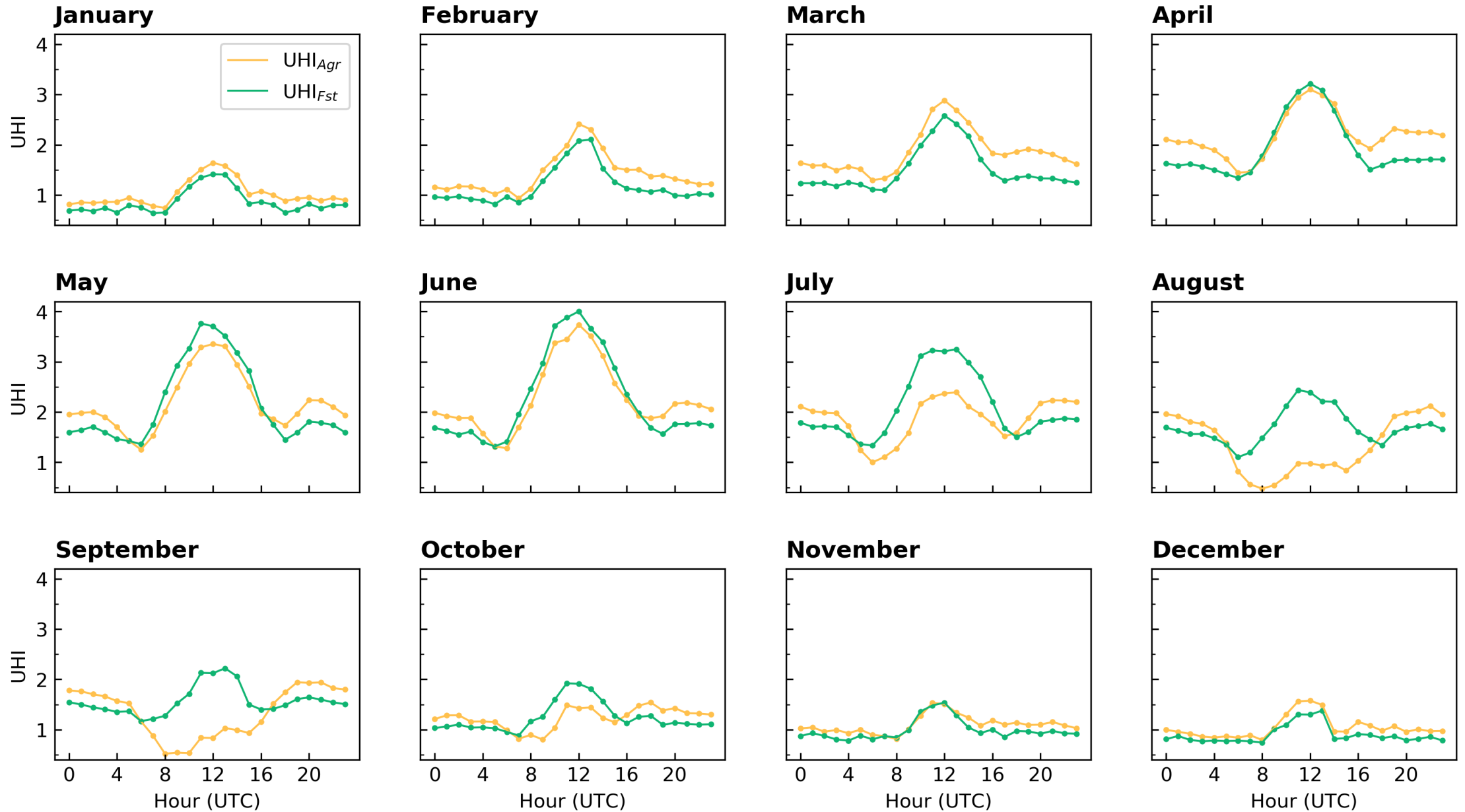
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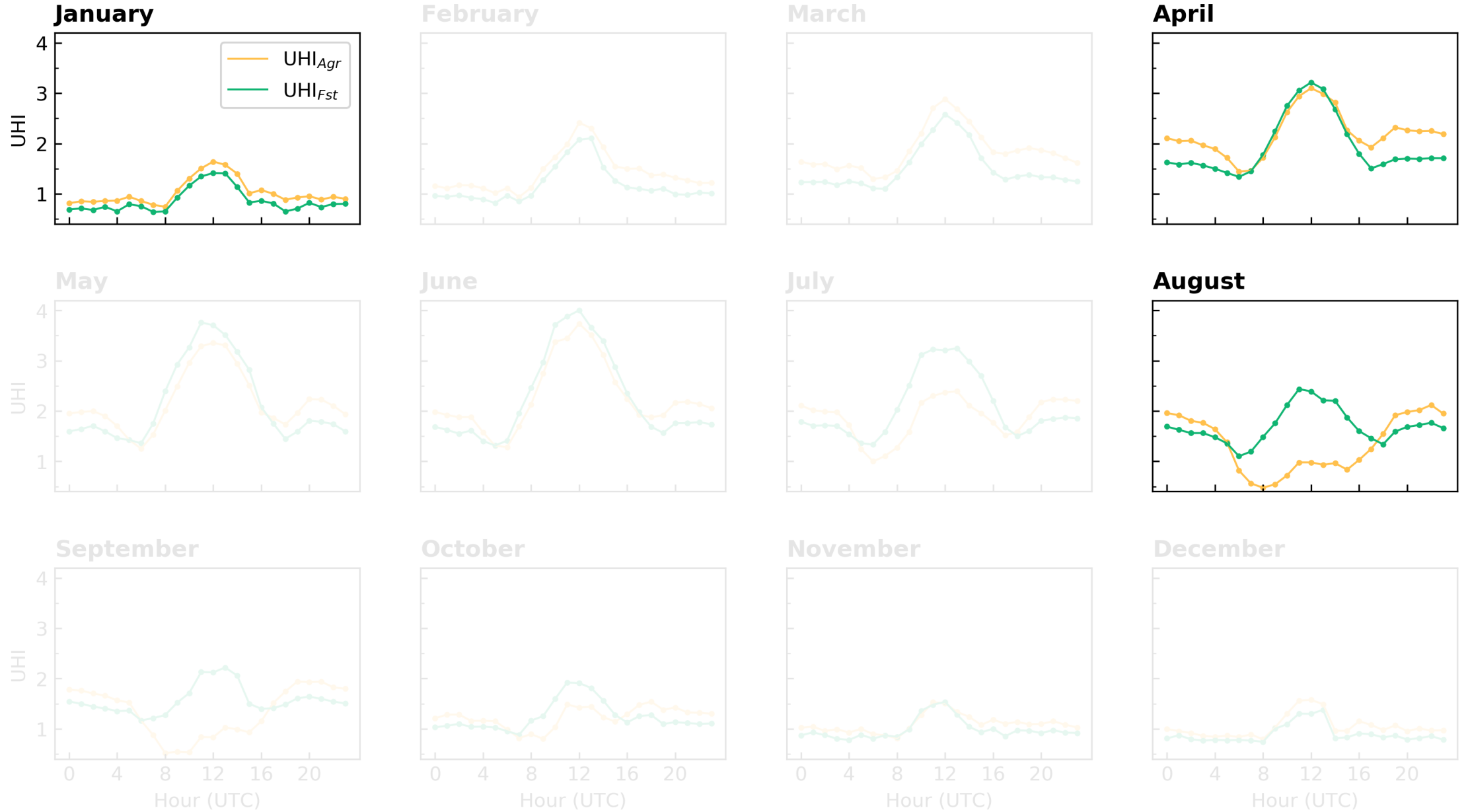
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LST vs. UHI

Paris

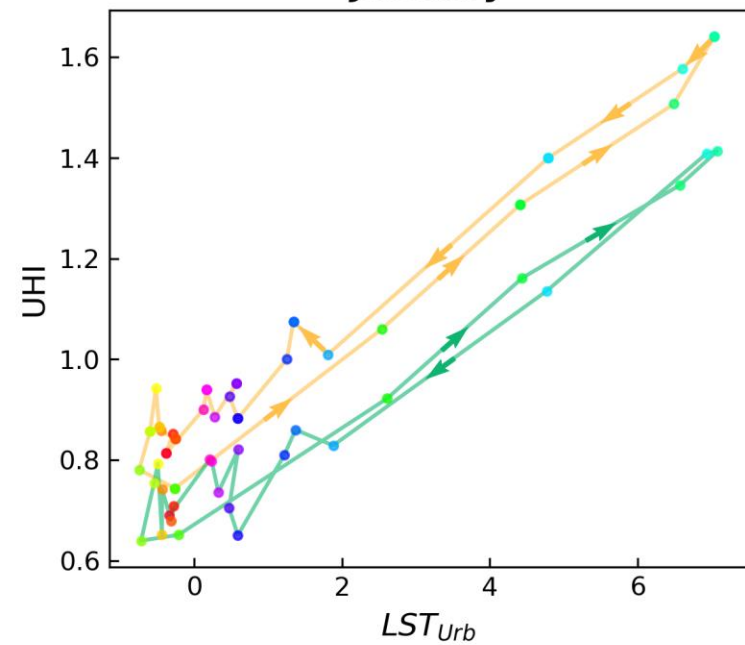


Paris

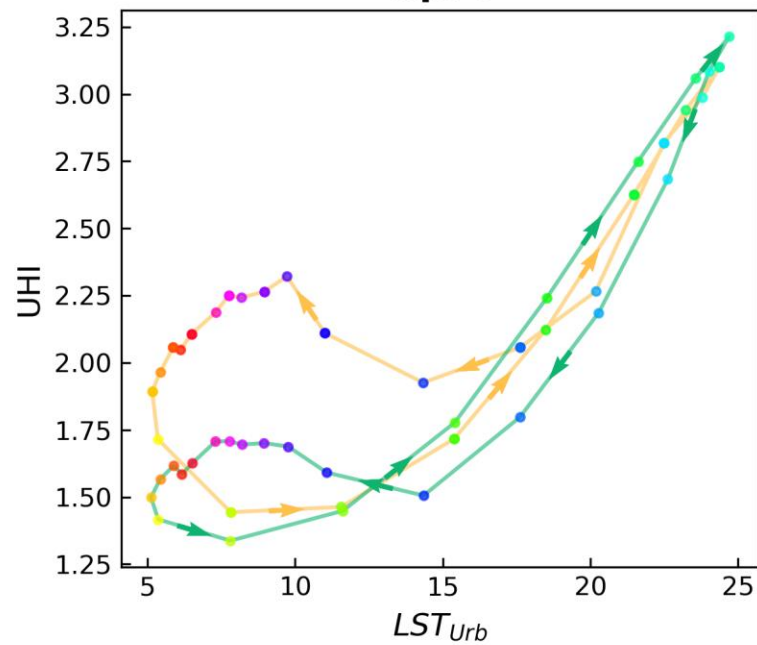


Paris

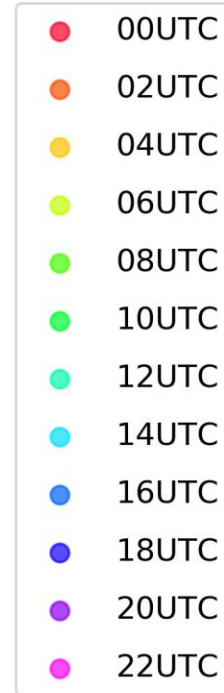
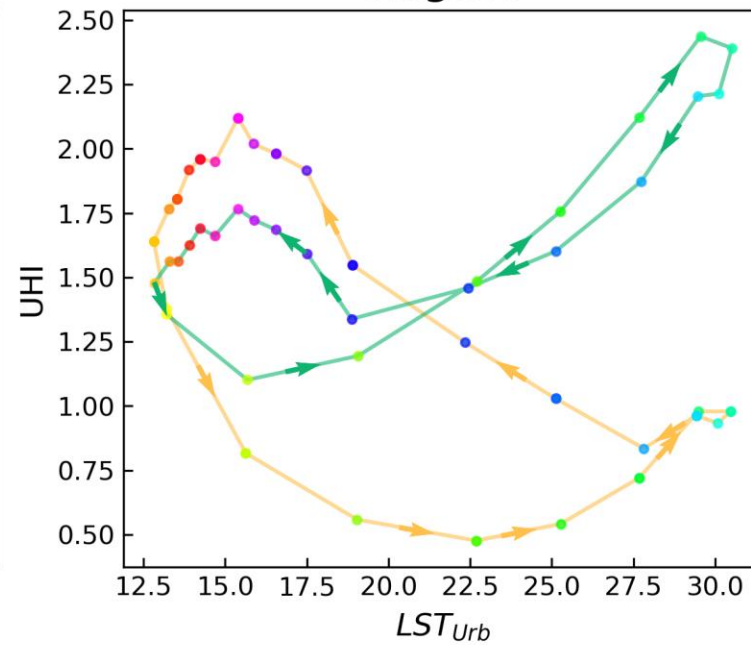
January



April

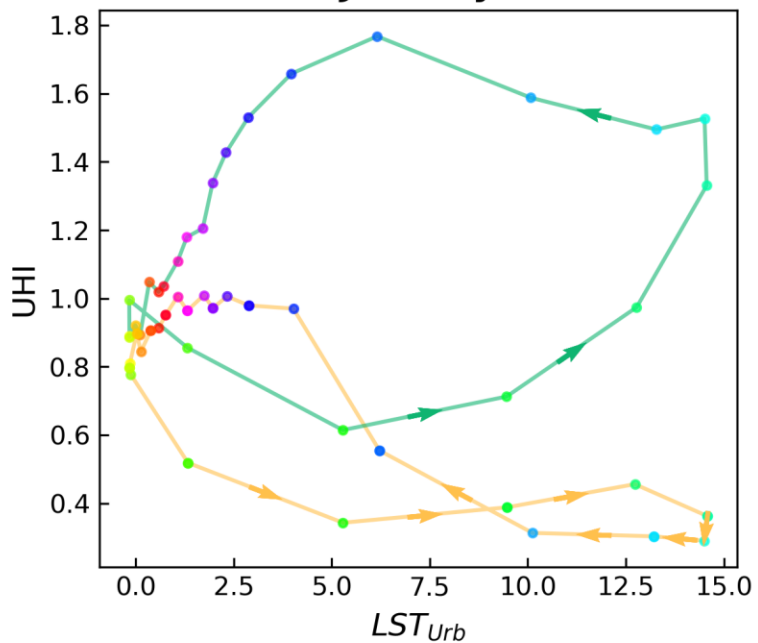


August

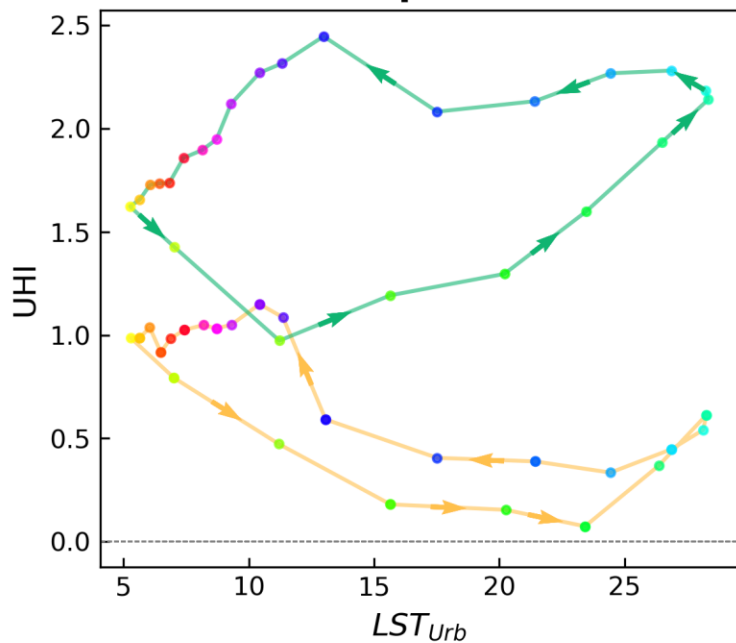


Madrid

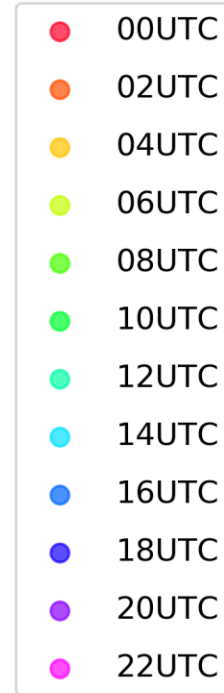
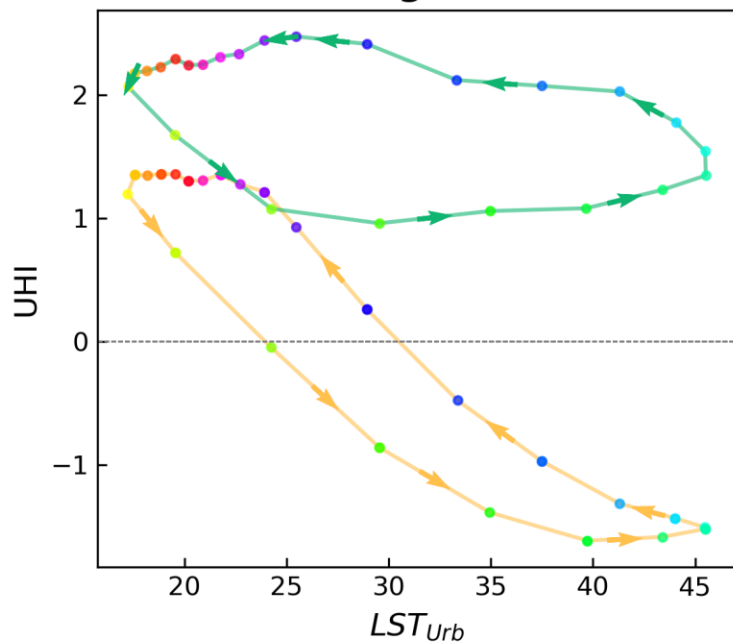
January



April



August



Why is rural land cover important?

- If $UHI = \text{Urban}_{LST} - \text{Rural}_{LST}$ then the suburban LC is as important as the urban one. Any variability we encounter in UHI intensities may be attributed to either one.
- Relevant when considering long term trends in UHI. If a city started out with mainly forest as rural LC and then progressively changed it to agricultural land, the dynamics of the UHI also changed and this has nothing to do with climate change or further urbanization of the city.

Why is temporal resolution important?

- Rural land cover influences UHI results throughout the day.
- **Different climates respond differently** (due to water availability, and solar radiation) reaching the peak UHI at different hours throughout the day/night. Having few observations throughout the day may not be representative of the full diurnal cycle.
- Not using enough observations throughout the day can only tell half the story.

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