



GLOBAL **HEAT** HEALTH
INFORMATION NETWORK

Part 5.1

Urban climate Fundamentals

Essential elements of urban
climatology for understanding
the urban heat island

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Hamburg - view from University in direction of trade fair and Altona

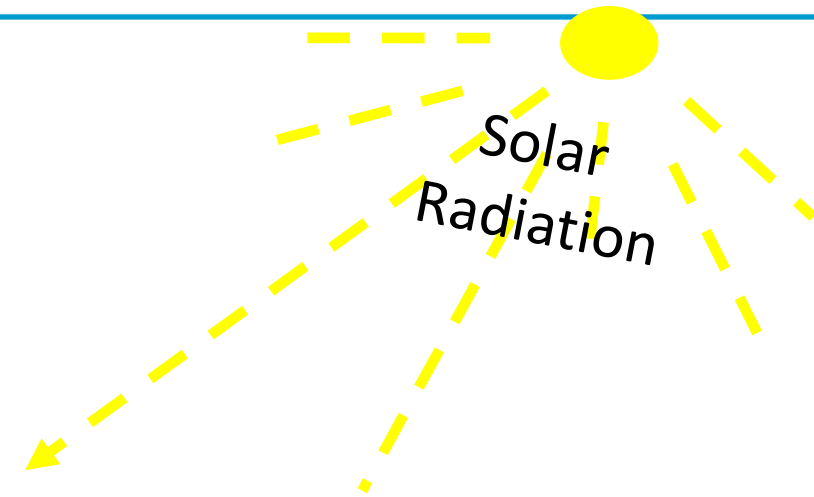
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Essential elements

- Radiation,
- Temperature,
- Pressure,

Pressure

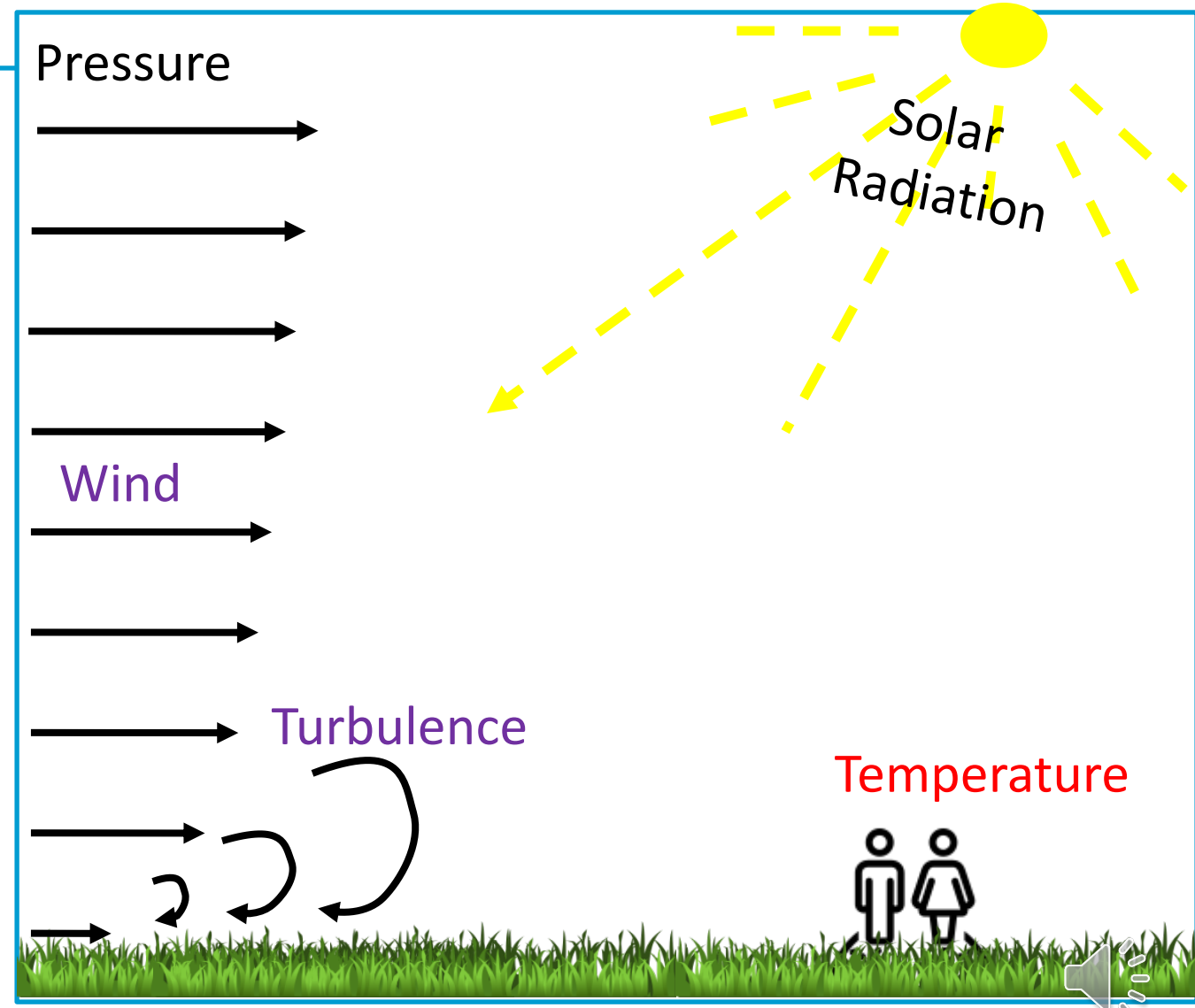


Temperature



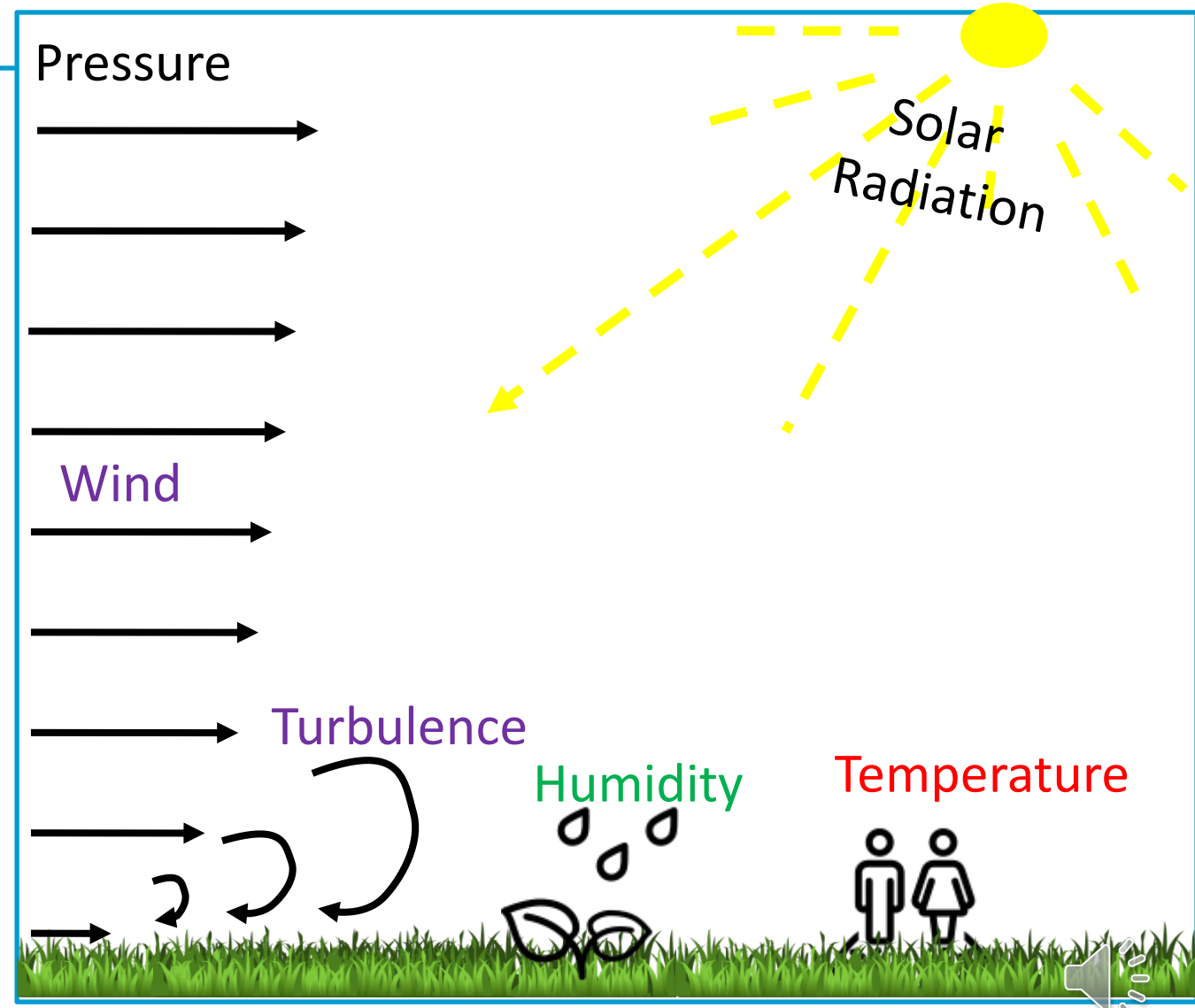
Essential elements

- Radiation,
- Temperature,
- Pressure,
- Wind,
- Turbulence,



Essential elements

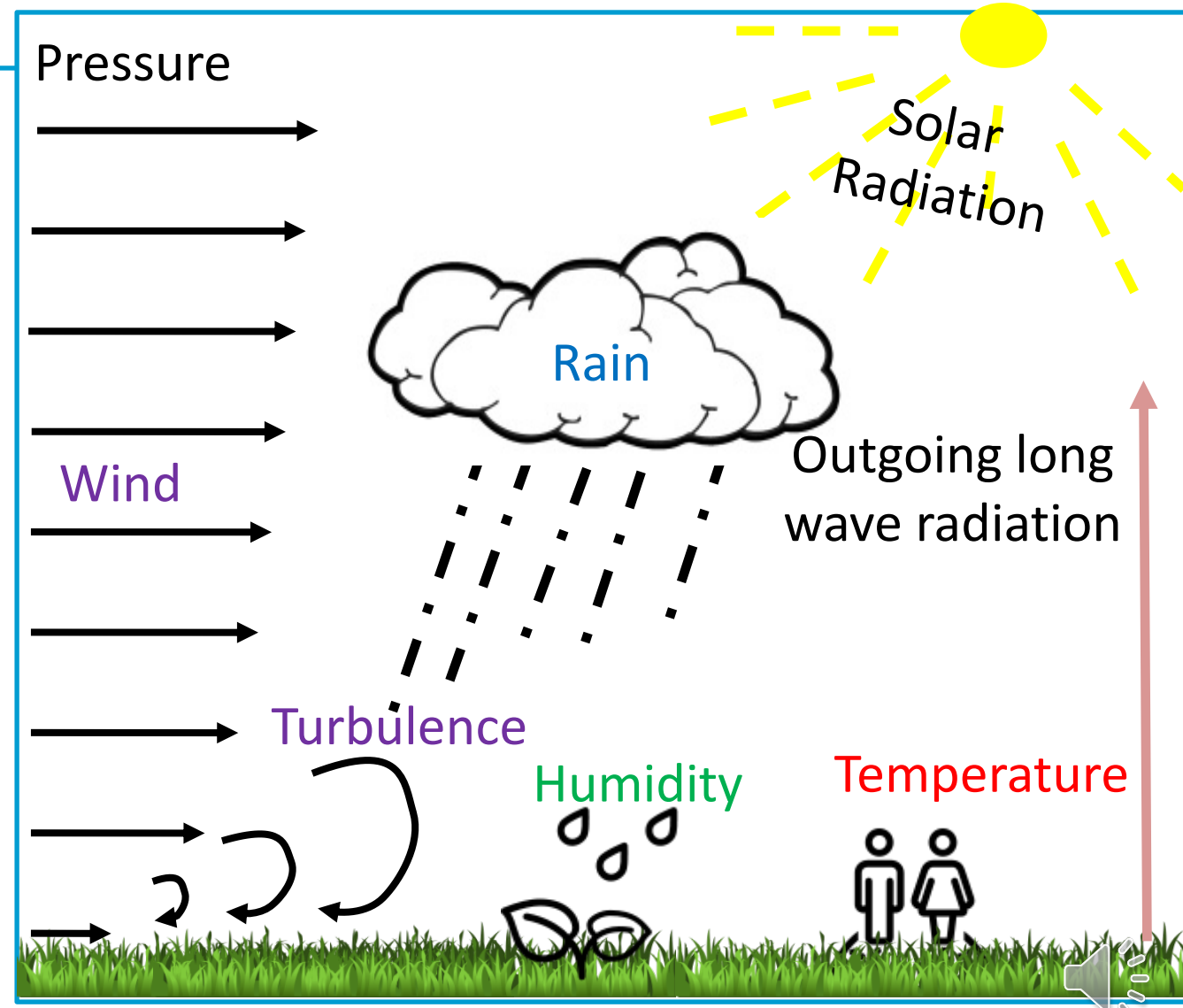
- Radiation,
- Temperature,
- Pressure,
- Wind,
- Turbulence,
- Humidity,



Essential elements

- Radiation,
- Temperature,
- Pressure,
- Wind,
- Turbulence,
- Humidity,
- Clouds, precipitation.
- Water bodies, mountains, vegetation, surface specifics (e.g. Albedo).

All elements influence local climate.

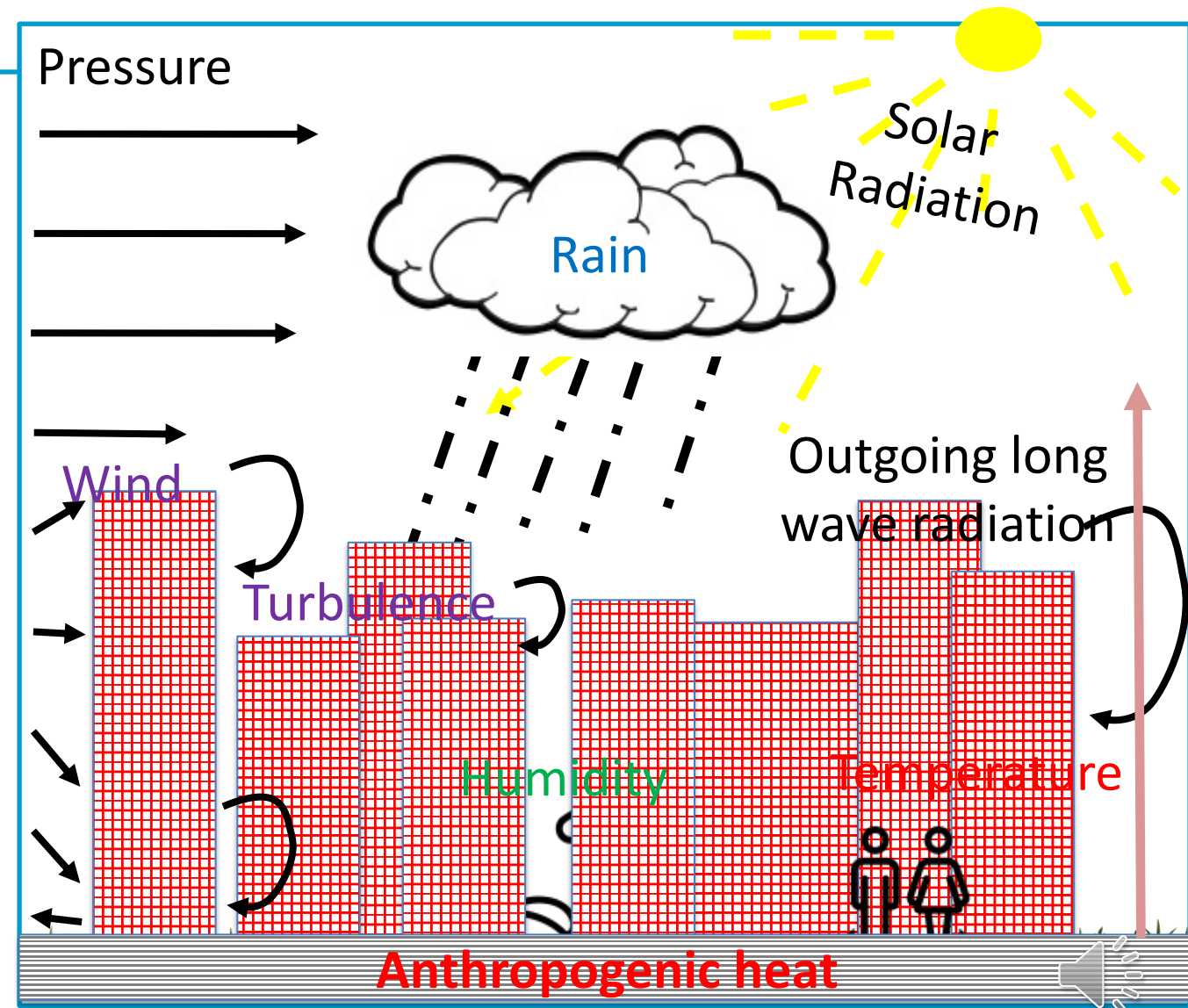


Essential elements in cities

- Same elements as outside cities.
- Plus:
 - Urban fabric (heat storage ability, albedo),
 - Anthropogenic heat emissions,
 - Other anthropogenic emissions (pollutants),
 - Heat/humidity uptake and emission above ground (elevated surfaces).

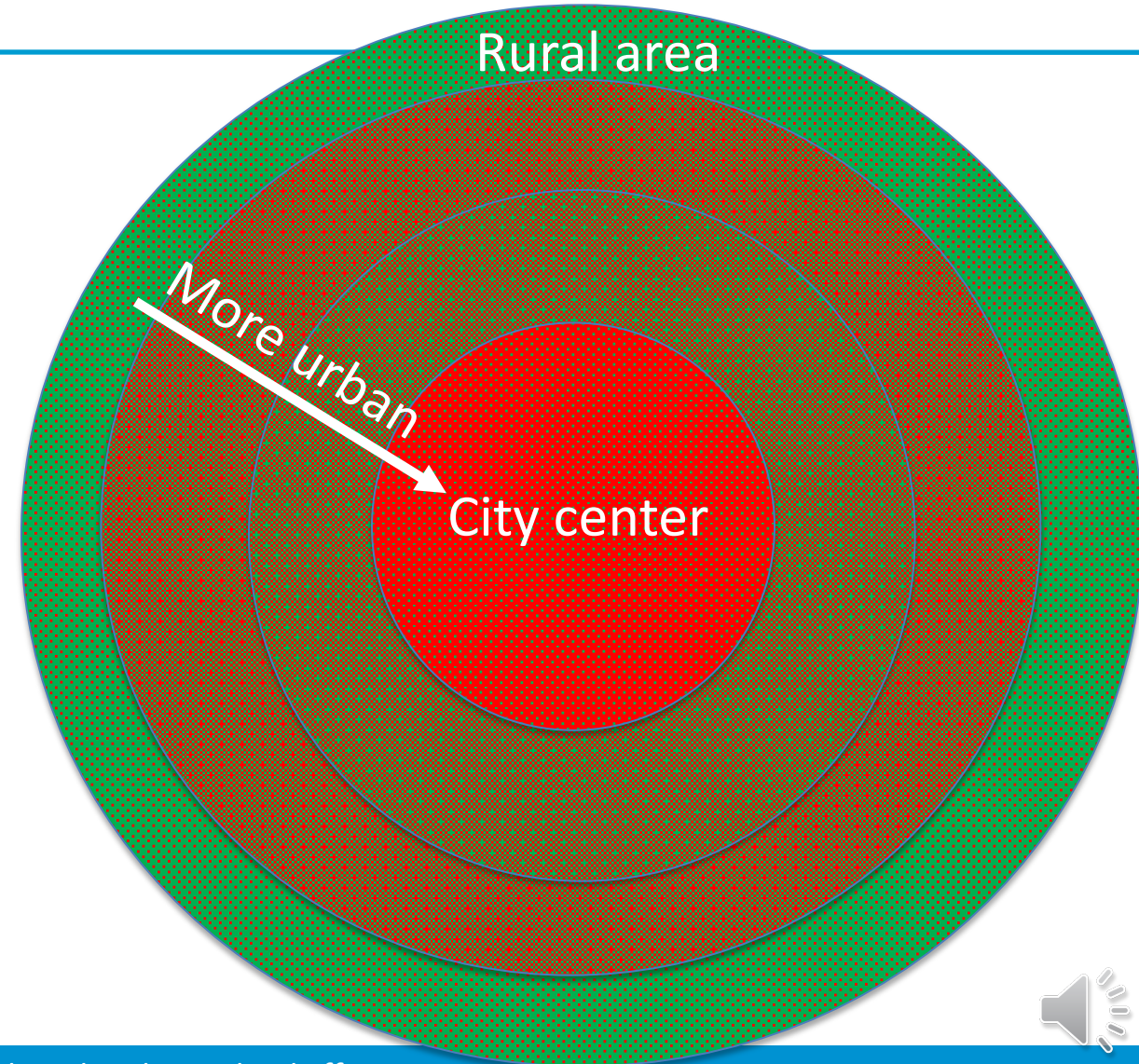
Changes in “natural” surface energy and humidity budget.

➔ Values of wind, temperature, humidity in urban areas differ from surrounding values.



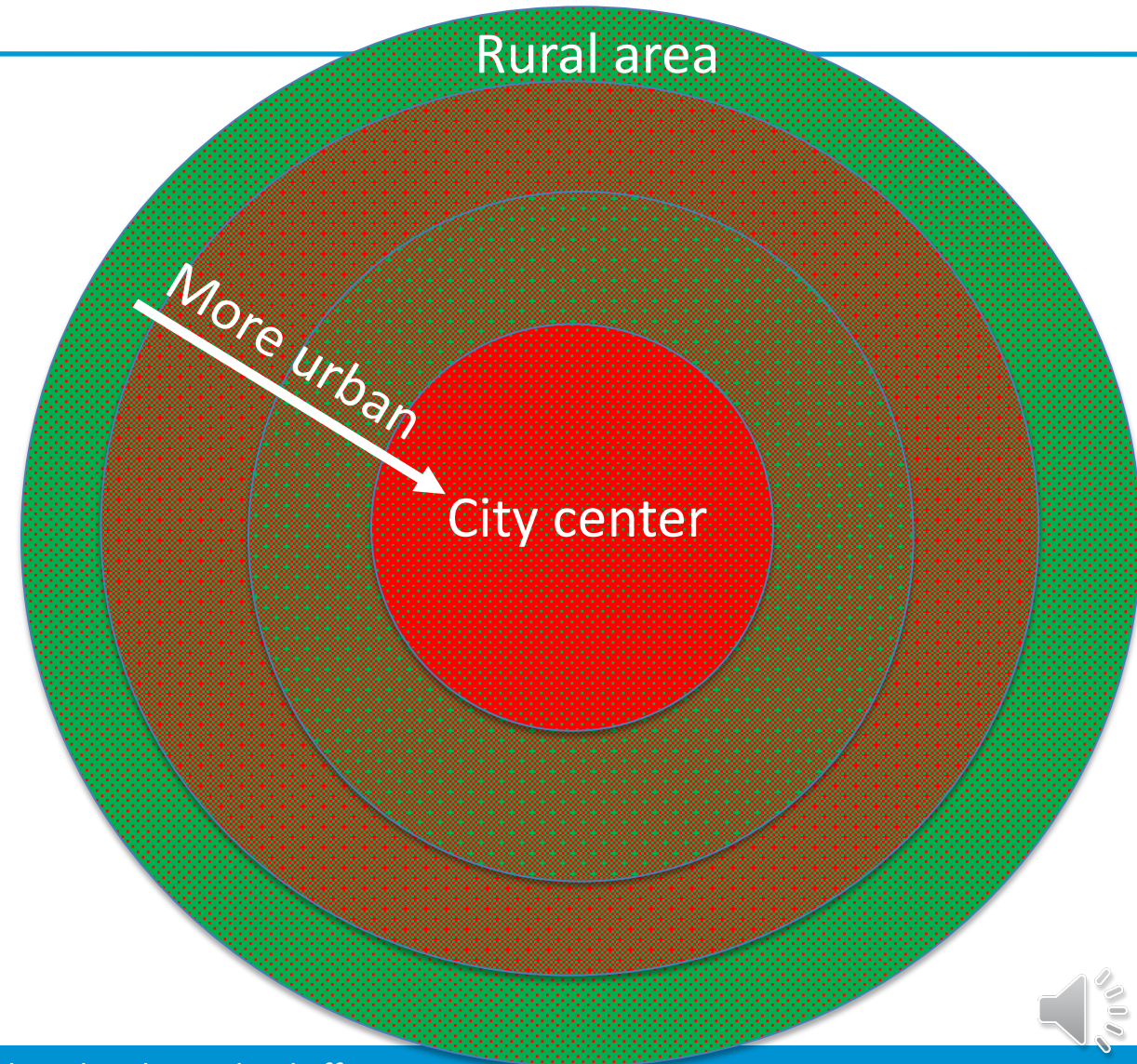
Why urban heat island (UHI)?

- Urban fabric is heterogeneous.
- Cities more densely build in their center:
 - Lower wind speed due to buildings (reduced heat exchange with atmosphere),
 - More heat storage,
 - Larger anthropogenic heat values.



Why urban heat island (UHI)?

- Urban fabric is heterogeneous
- Cities more densely build in their center:
 - Lower wind speed due to buildings (reduced heat exchange with atmosphere),
 - More heat storage,
 - Larger anthropogenic heat values.
- Warmer city center compared to more natural surrounding
 - **looks like an island in the ocean.**



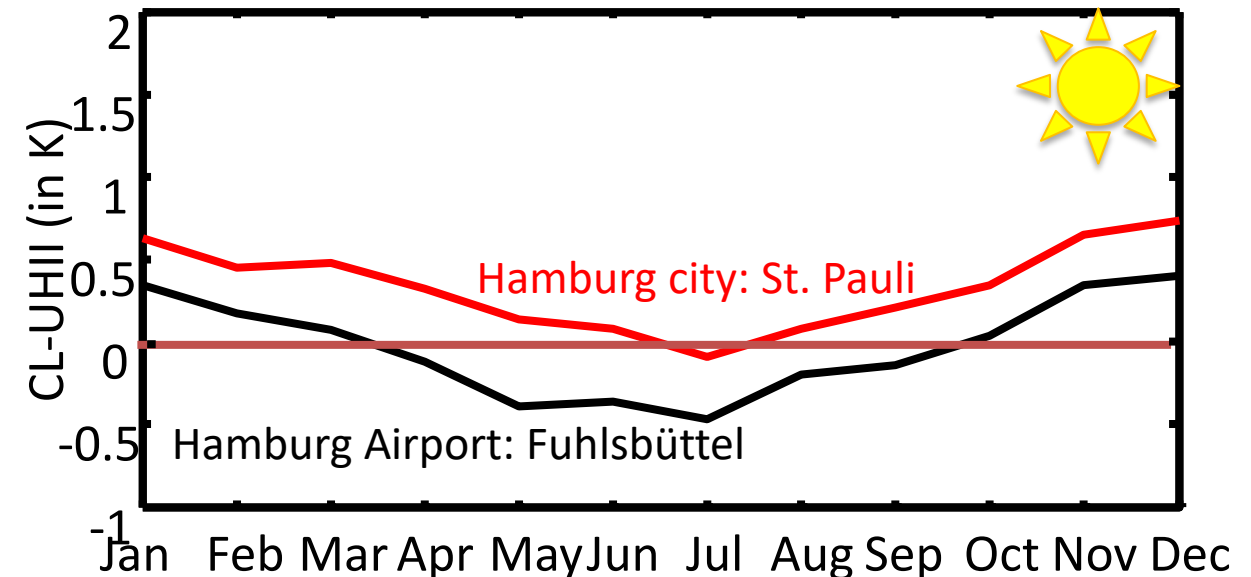
How is the UHI Intensity (UHII) calculated?

- Temperature difference between values at an urban and a close-by more natural site.
- Important for UHII calculation:
 - Same regional climate in and outside city,
 - Sites at same altitudes above sea level,
 - Same assessment method (sensor, model, ...).



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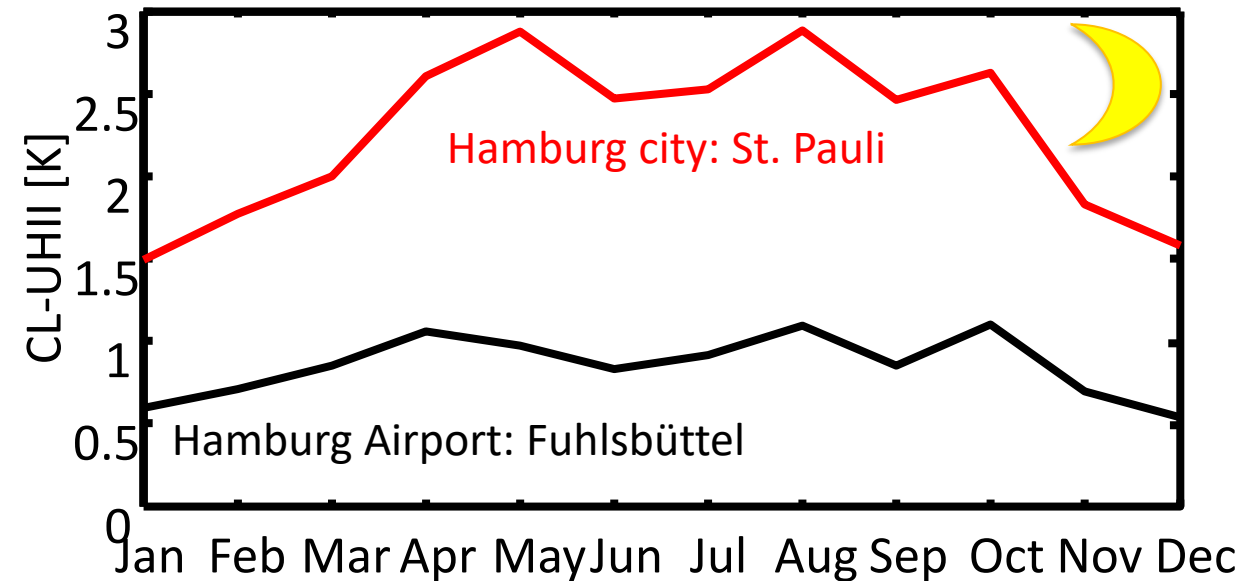
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CL-UHII in climate average based on differences of **maximum temperatures** 2 m above ground
(Figure based on Schlünzen et al., 2010;
doi: 10.1002/joc.1968)

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- Be aware:
 - UHII depends on space, time and height.
 - UHII is not total temperature.
 - UHII is an add-on to regional temperature.



CL-UHII in climate average based on differences of **minimum temperatures** 2 m above ground
(Figure based on Schlünzen et al., 2010;
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