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MORUSES

Implementation of an urban morphology parametrization scheme in the 300m London Model

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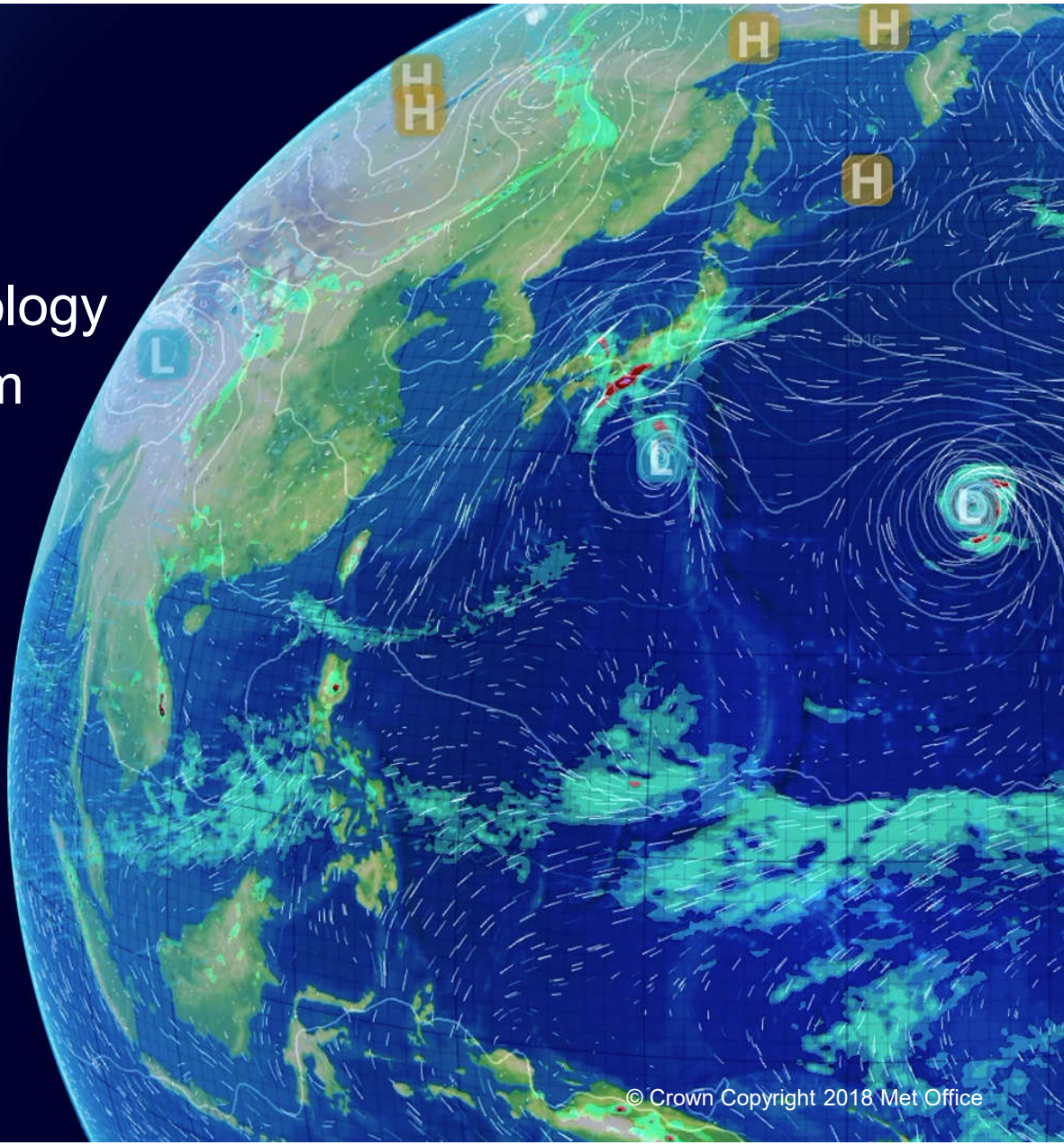

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The London Model (LM)

- 300m horizontal grid length
- Domain size approx. 125 km x 140 km
- Downscaler nested inside operational 1.5km UK model
- Running twice a day to T+36
- Research model (not operational)

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Surface Scheme in the London Model – The Status Quo

- JULES (Joint UK Land Environment Simulator)
- 9 tiles, representing different surface types
- 5 vegetation tiles + lake, ice, bare soil, and urban
- Separate energy balance calculated for each tile
- Gridbox average energy balance by weighting values from each tile

*1 urban tile → "**1-tile scheme**"*

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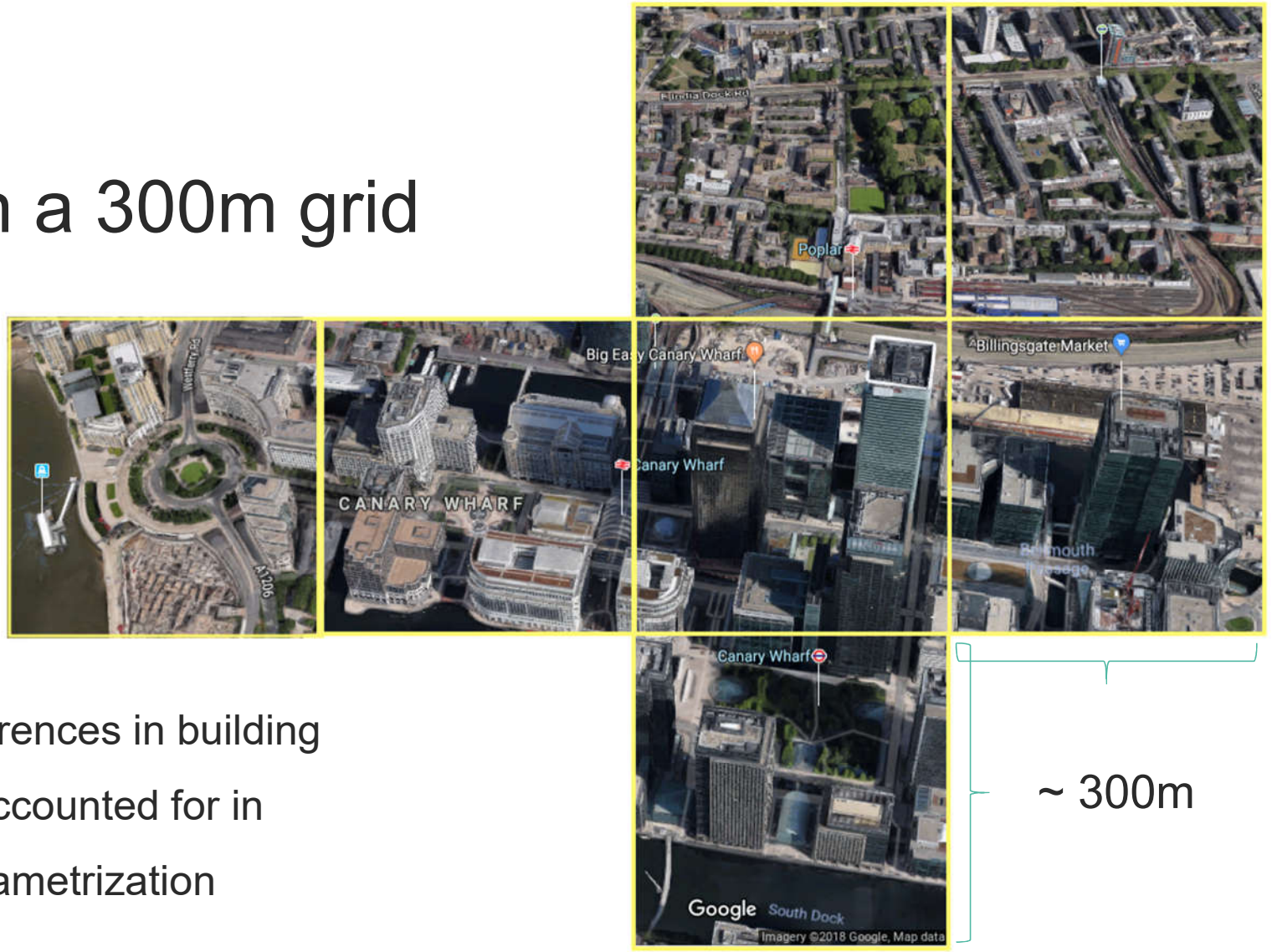
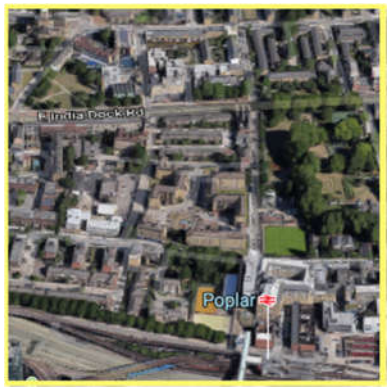
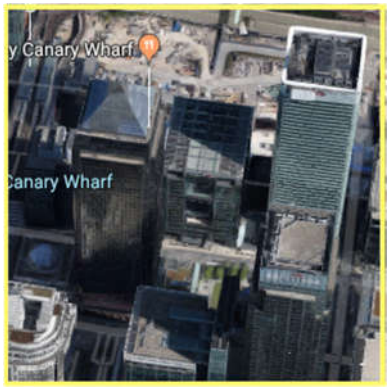
London on a 300m grid



Large spatial differences in building morphology not accounted for in current urban parametrization





- Distinction between roof and canyon tiles
- Building height
- Ratio of canyon area to roof area
- Ratio of canyon height to canyon width

→ *two urban tiles: "**2-tile scheme**"*

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Met Office Reading Urban Surface Exchange Scheme

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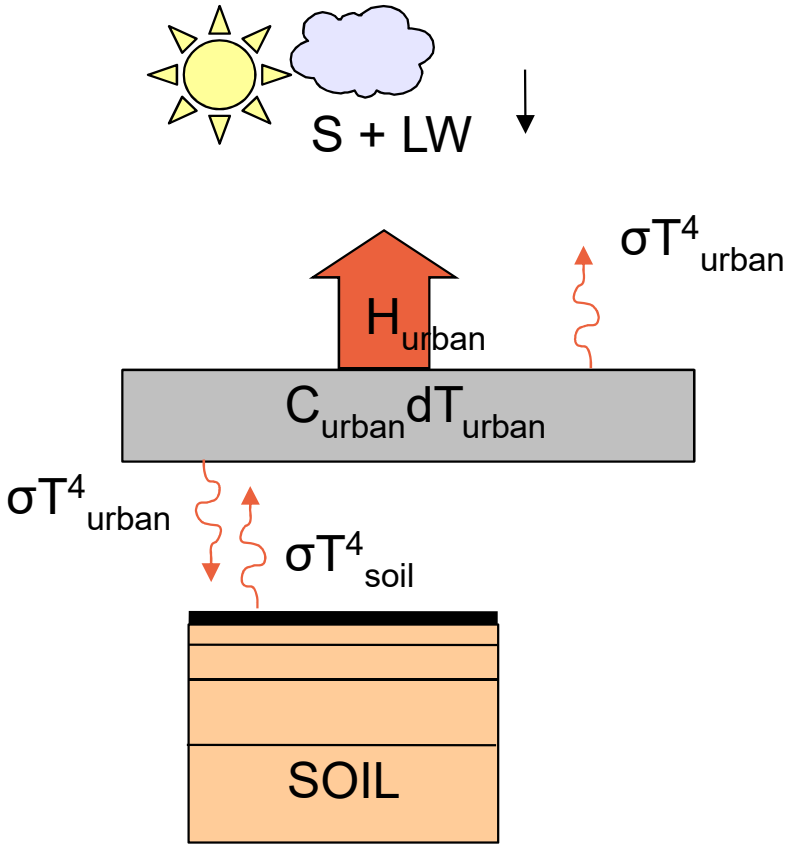

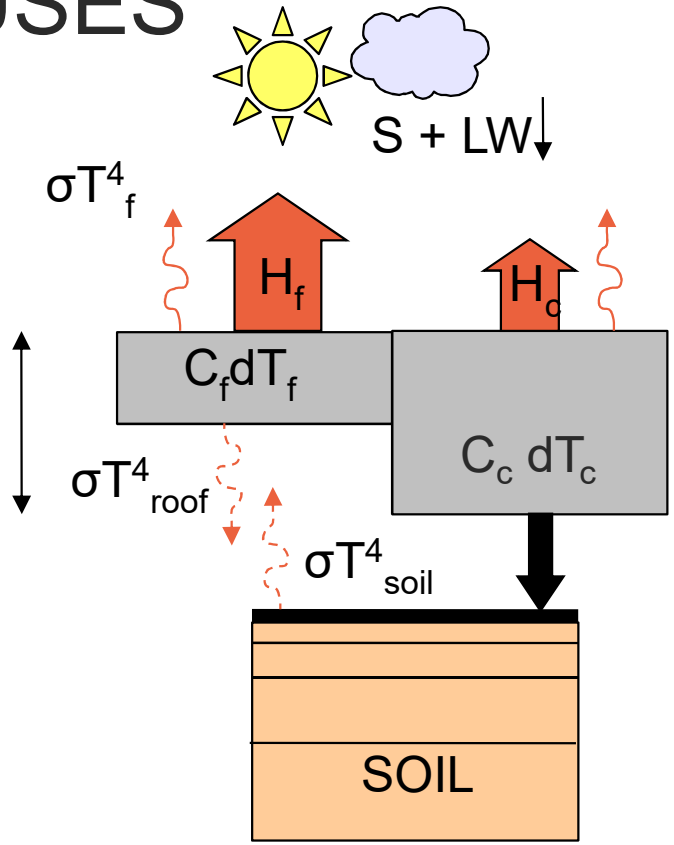

Best et al., 2006, Boundary-layer Meteorol., 118 (3), 503

Porson et al., 2010, Q. J. R. Meteorol. Soc., 136, 1530

Courtesy of Aurore Porson/ Maggie Hendry

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Met Office Reading Urban Surface Exchange Scheme

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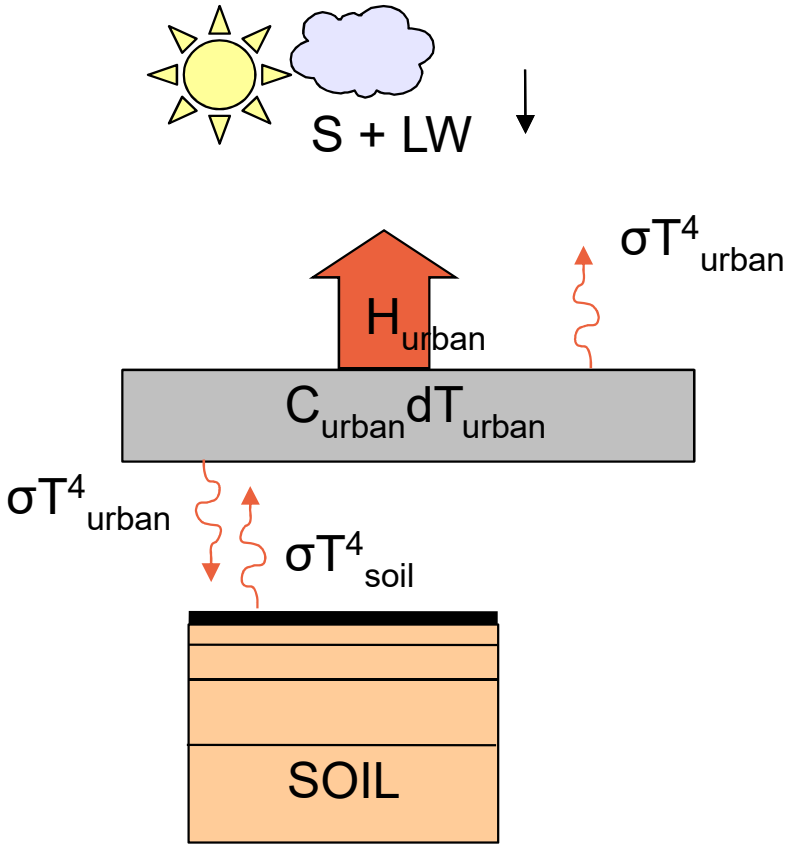
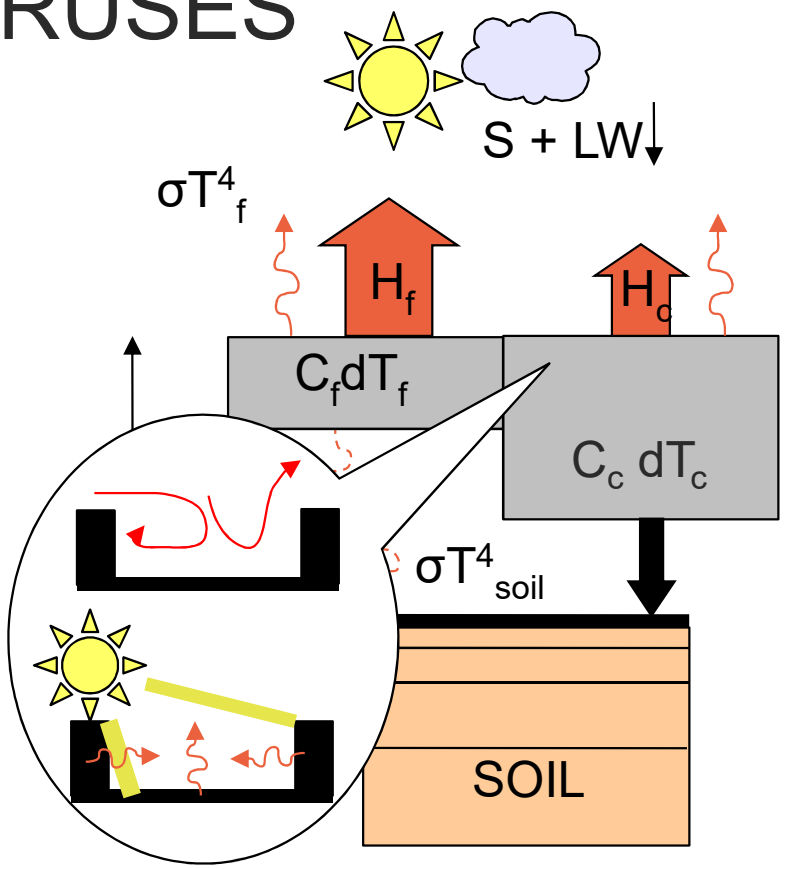


Best et al., 2006, Boundary-layer Meteorol., 118 (3), 503



Porson et al., 2010, Q. J. R. Meteorol. Soc., 136, 1530

Courtesy of Aurore Porson/ Maggie Hendry

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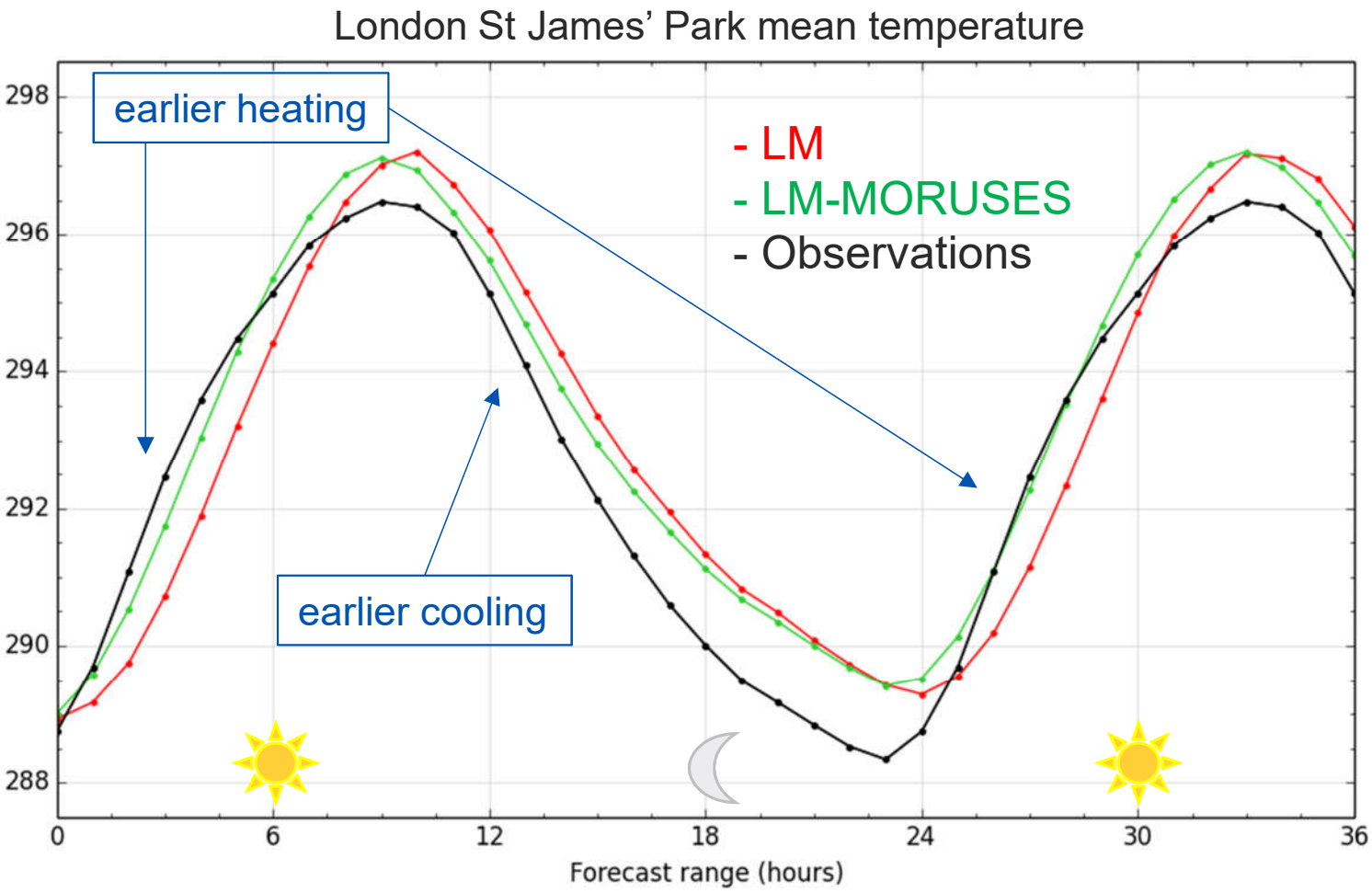
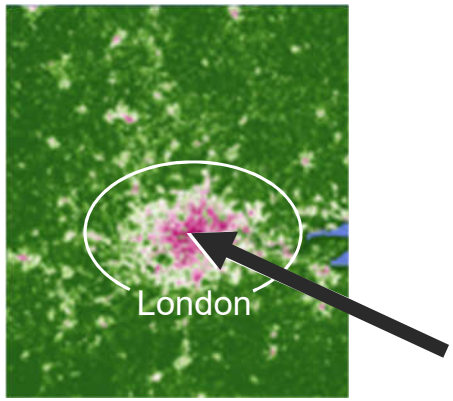
Improved timing of urban temperatures with MORUSES





St James' Park observation enclosure

Data period: 09/07/2018 – 15/09/2018

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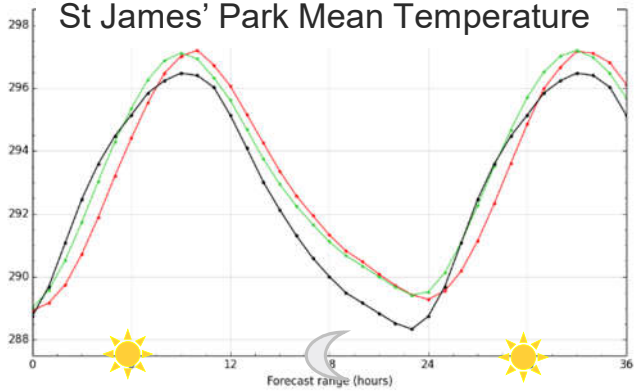
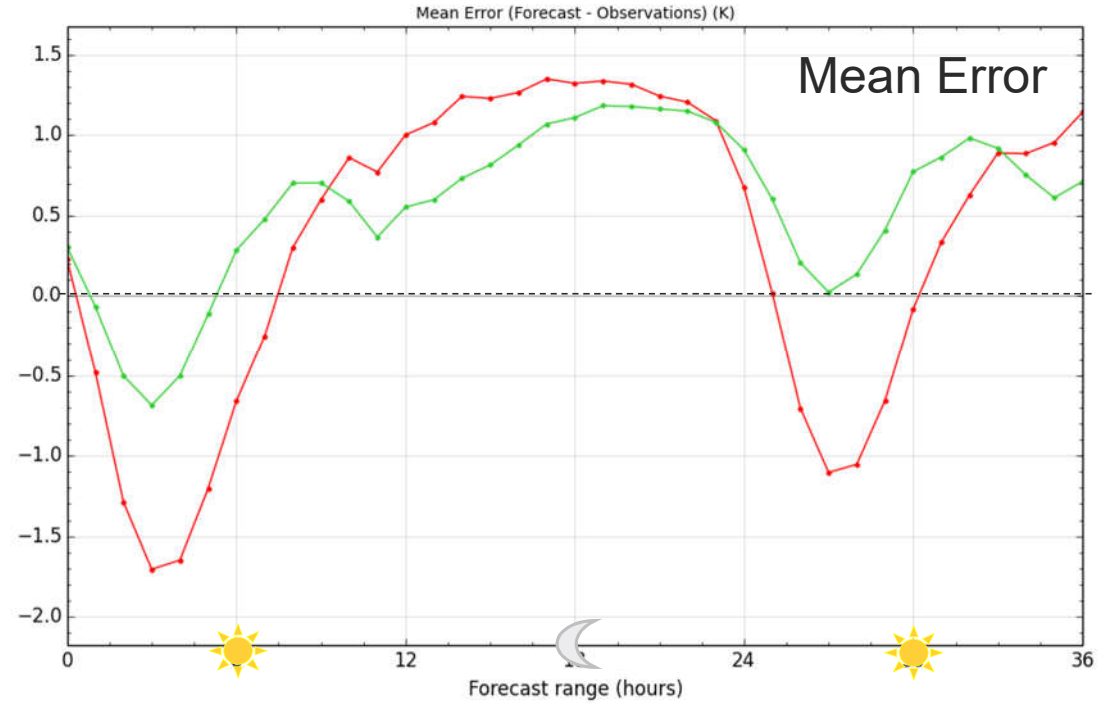
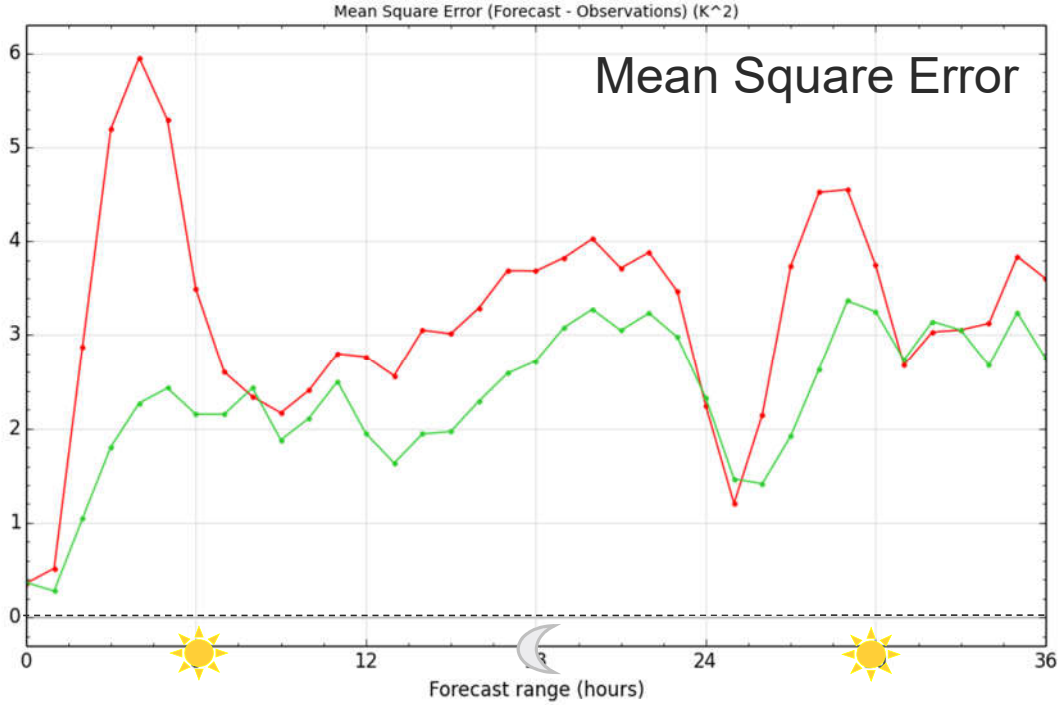
→ **Reduced forecast error**



Data period: 09/07/2018 – 15/09/2018

- LM
- LM-MORUSES

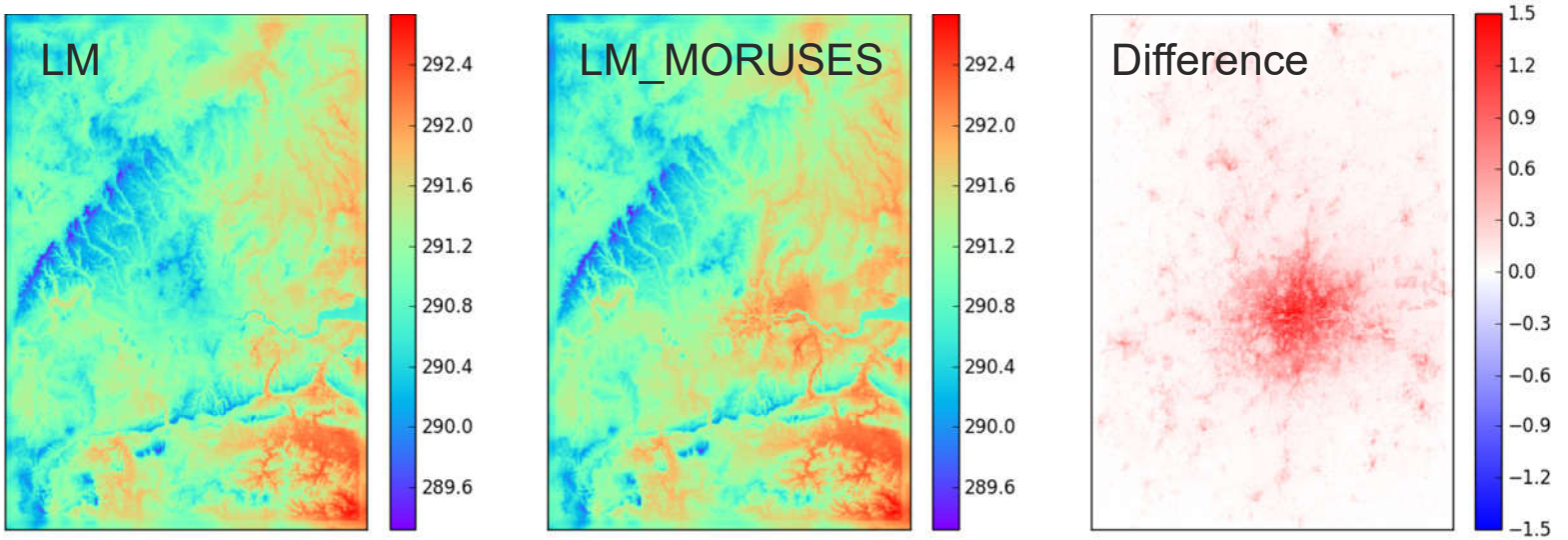




Data period: 09/07/2018 – 27/09/2018

mean temperature

09Z



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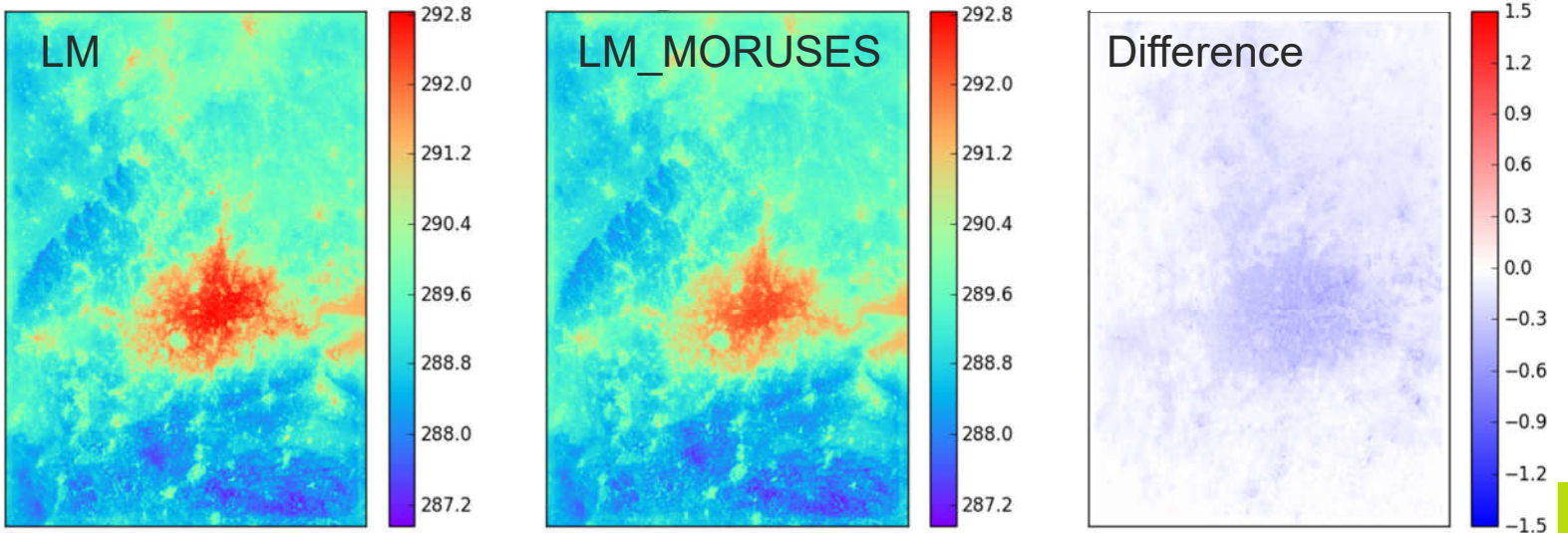

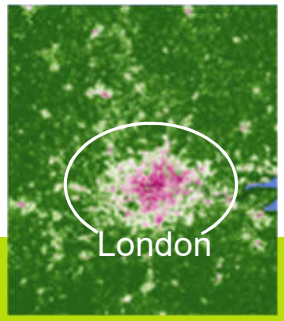

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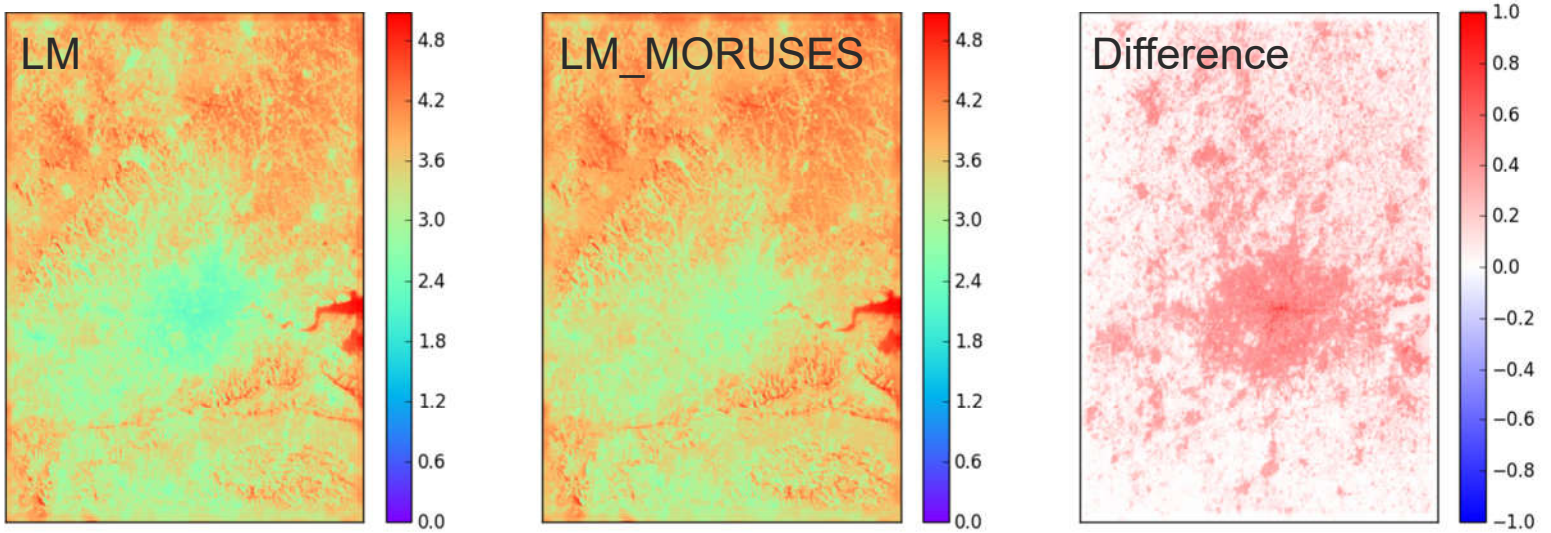

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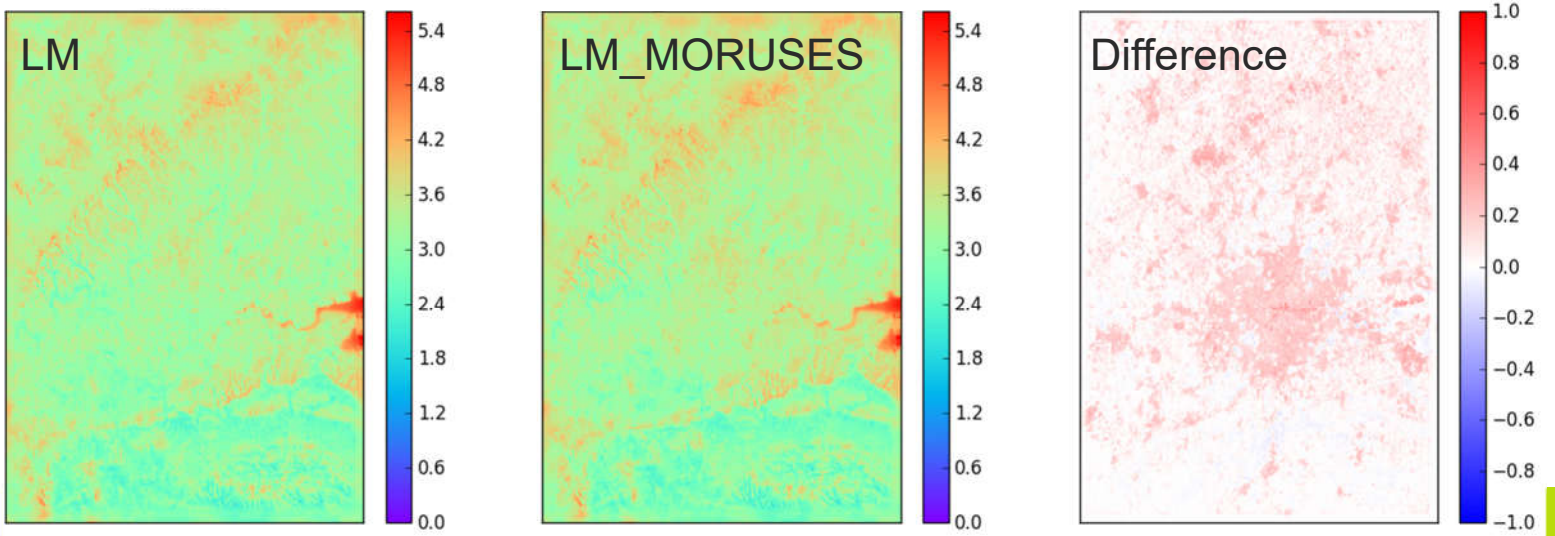

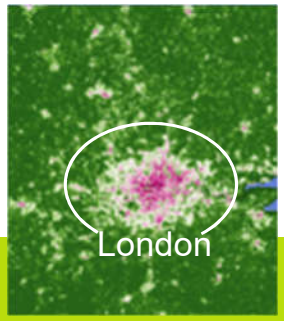

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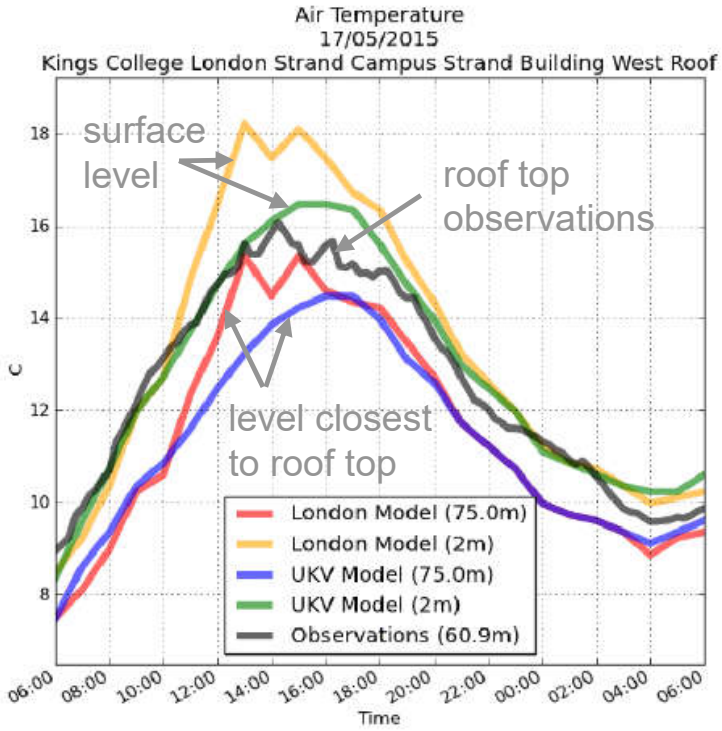
Challenges for Urban Verification

- Limited observation availability
- Are observations representative of the local meteorology?
- How does model data translate into the “real” world, e.g. roof tops vs model levels



Temperature measurements taken on top of King’s College, London.

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Summary

- 300m London Model running as “quasi-operational” research model
- Upgrade to a 2-tile urban scheme (MORUSES)
- Distinction between roof and canyon allows more realistic implementation of city morphologies
- Impact predominantly in urban areas of the domain
- Verification shows improvement for urban temperature, better timing reduces model error
- General increase in wind speed, particularly pronounced in urban areas
- More extensive urban verification planned to robustly quantify the benefits of using MORUSES for sub-km NWP models