

Evaluating Numerical Weather Prediction (NWP) Simulations of Urban Boundary Layer Structure

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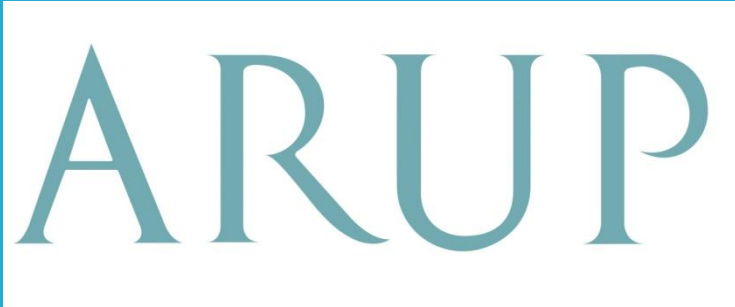
⁵UK Met Office



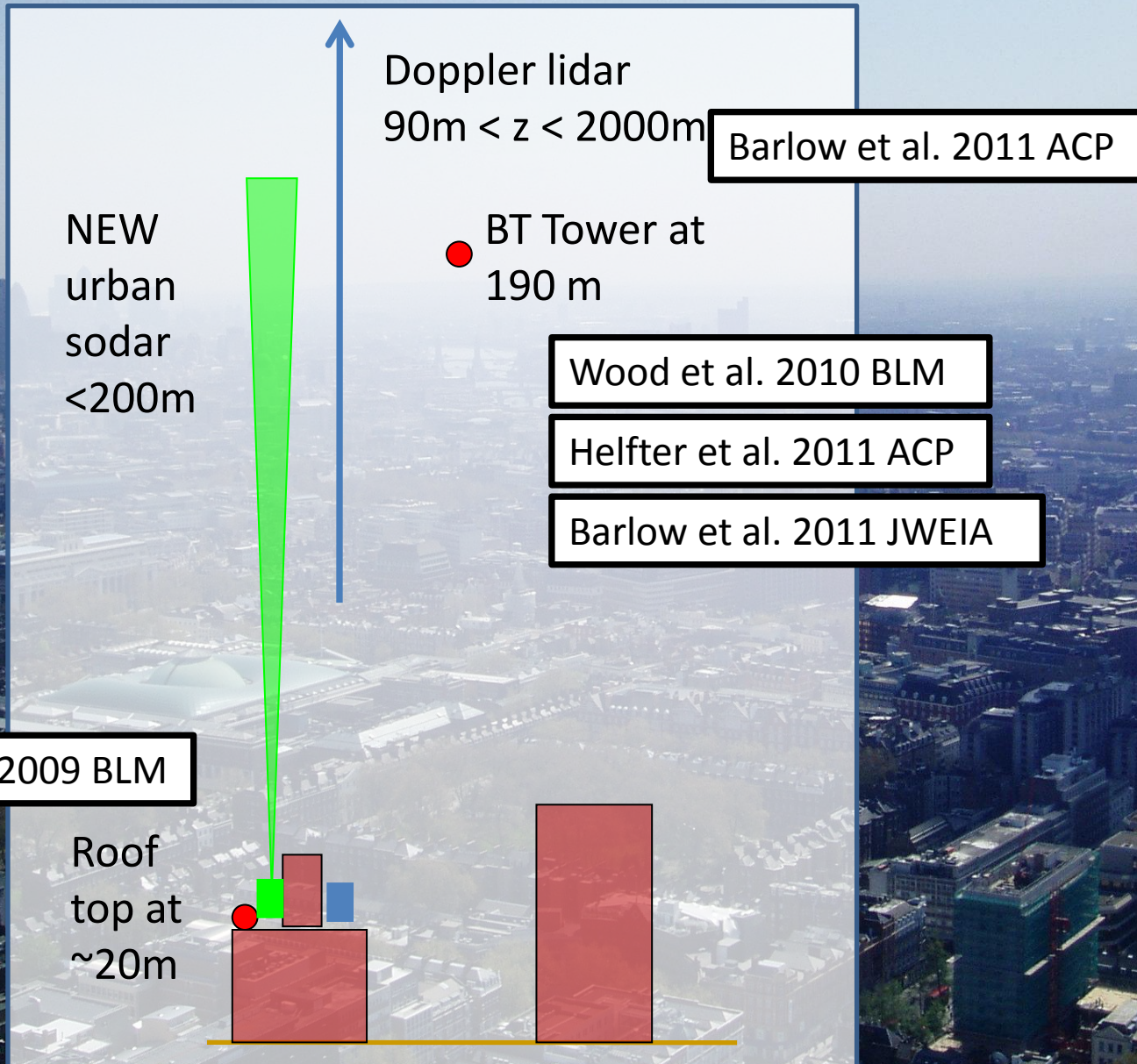


Advanced Climate Technology Urban Atmospheric Laboratory

“Buildings don’t just withstand climate, they change it”

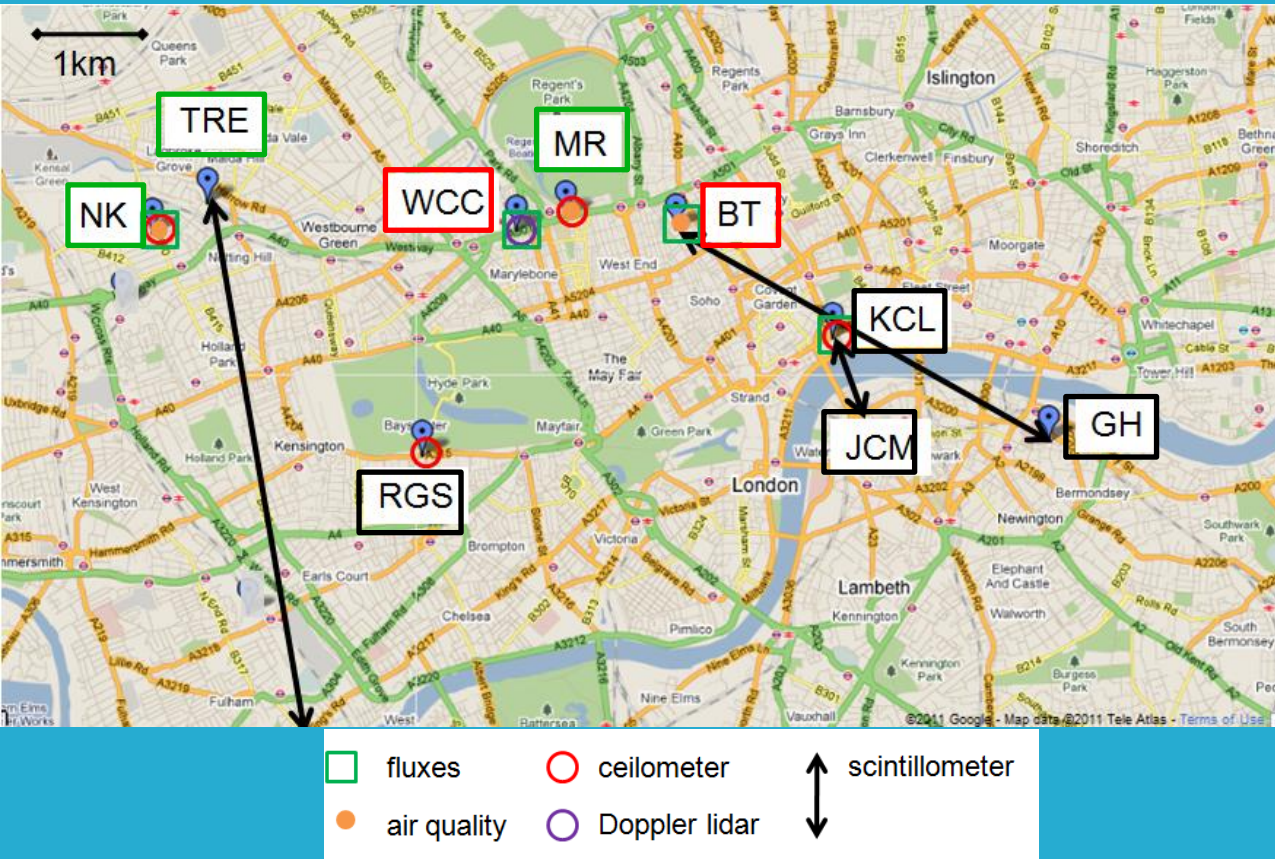


ACTUAL: observing flow at range of vertical scales





Collaboration in London



ACTUAL

BT - BT Tower

WCC – Westminster City Council

King's College London

KCL – KCL Strand campus building

GH – Guy's Hospital

JCM – James Clerk Maxwell building

RGS – Royal Geographical Society

ClearLo

NK – North Kensington

LAQN site

MR – Marylebone Road

LAQN site

TRE – Trellick Tower

**Today:
Confronting models with
model scale measurements**

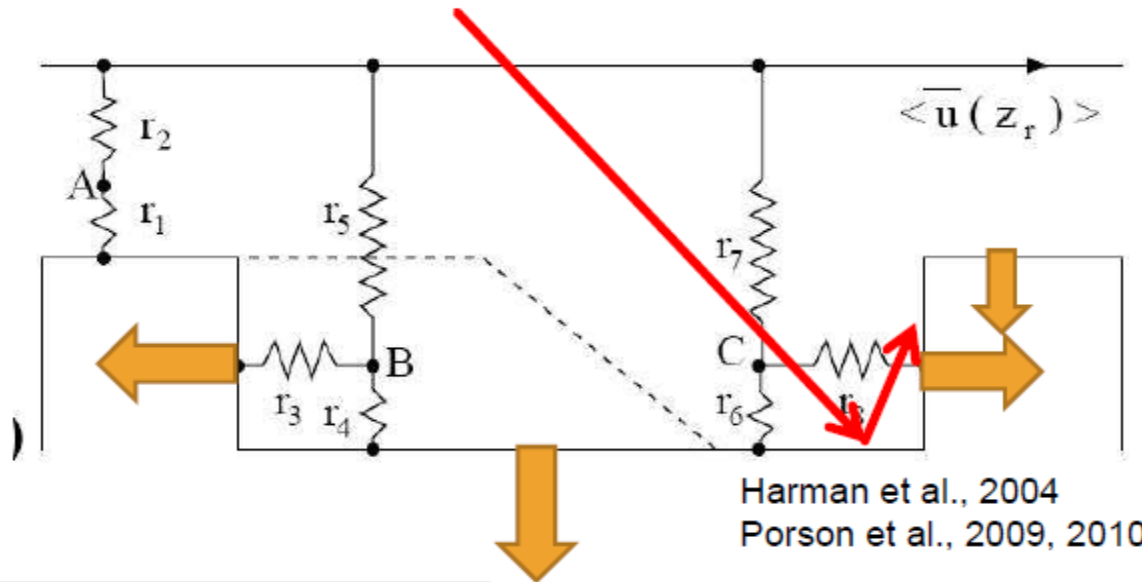


1) 1km simulation with MORUSES urban surface exchange scheme

MORUSES: Met Office Reading urban surface exchange scheme

$$R_{\text{net}} = H + L + G$$

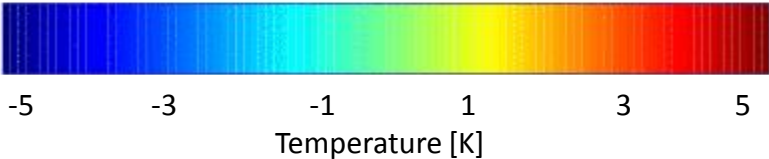
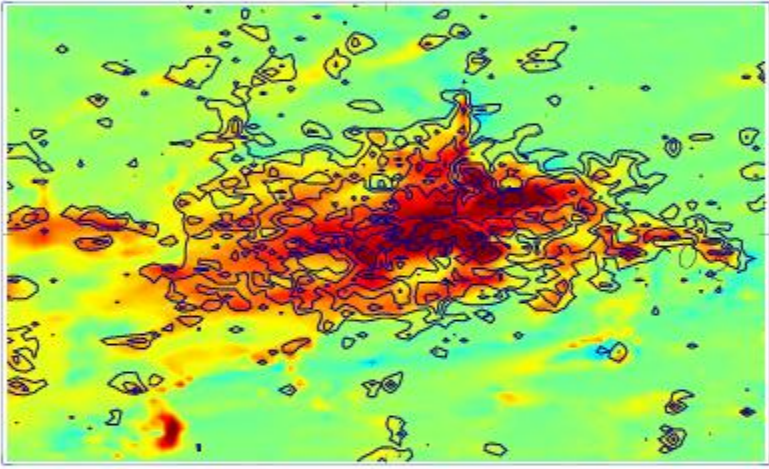
Vegetation tiles



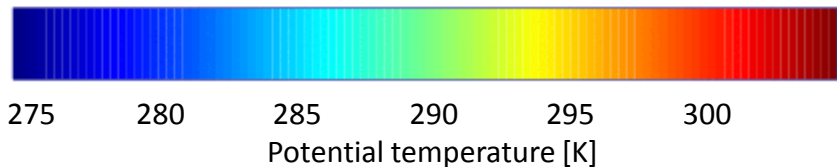
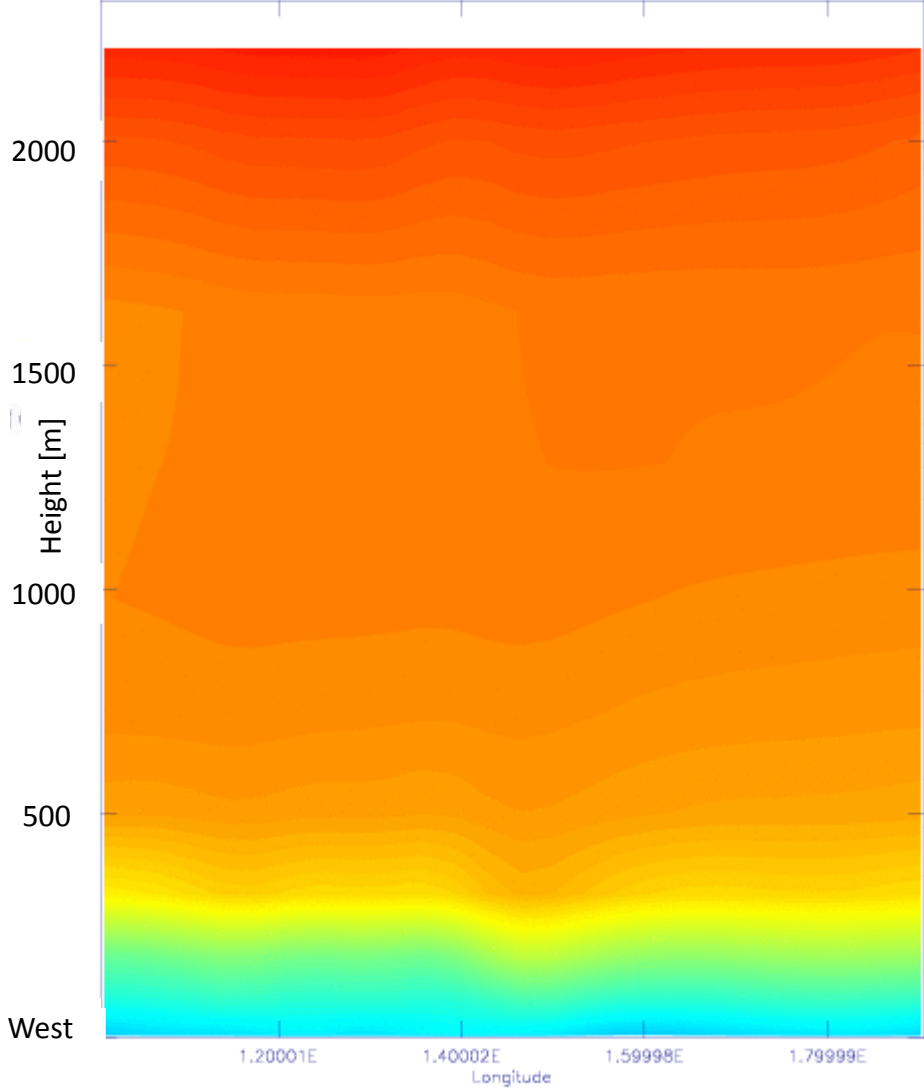
Temperature for May 2008

MORUSES urban surface energy
balance parameterisation
used in 1km UM

At 00Z on 7/ 5/2008,

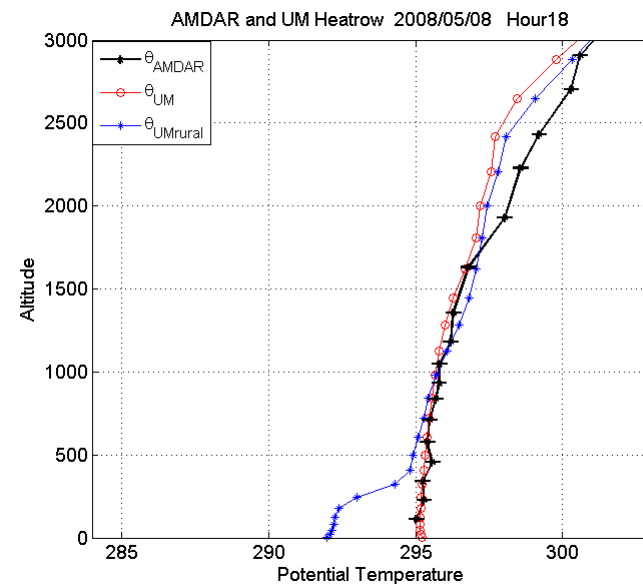
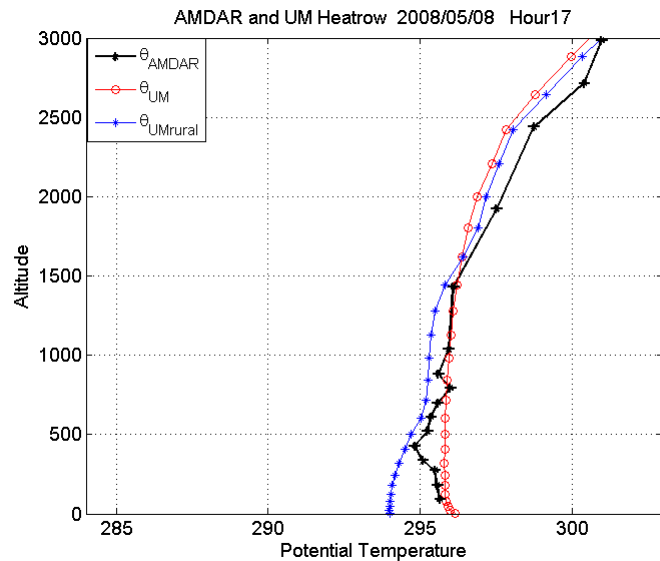
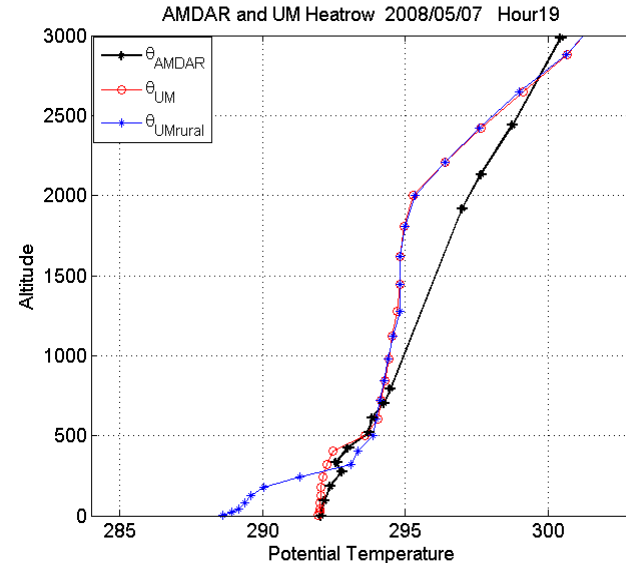
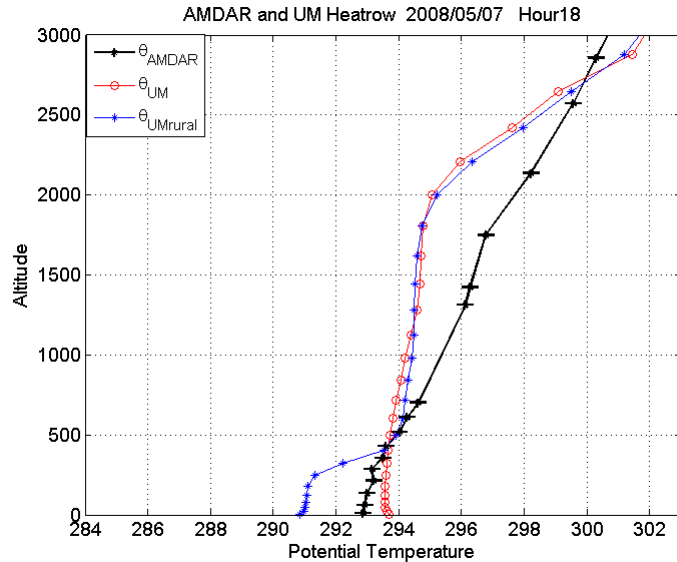


07day 00 hour 00 potential temperature
XDJKY Atmos theta after timestep at -0.5370 degrees
At 00Z on 7/ 5/2008, from 18Z on 6/ 5/2008

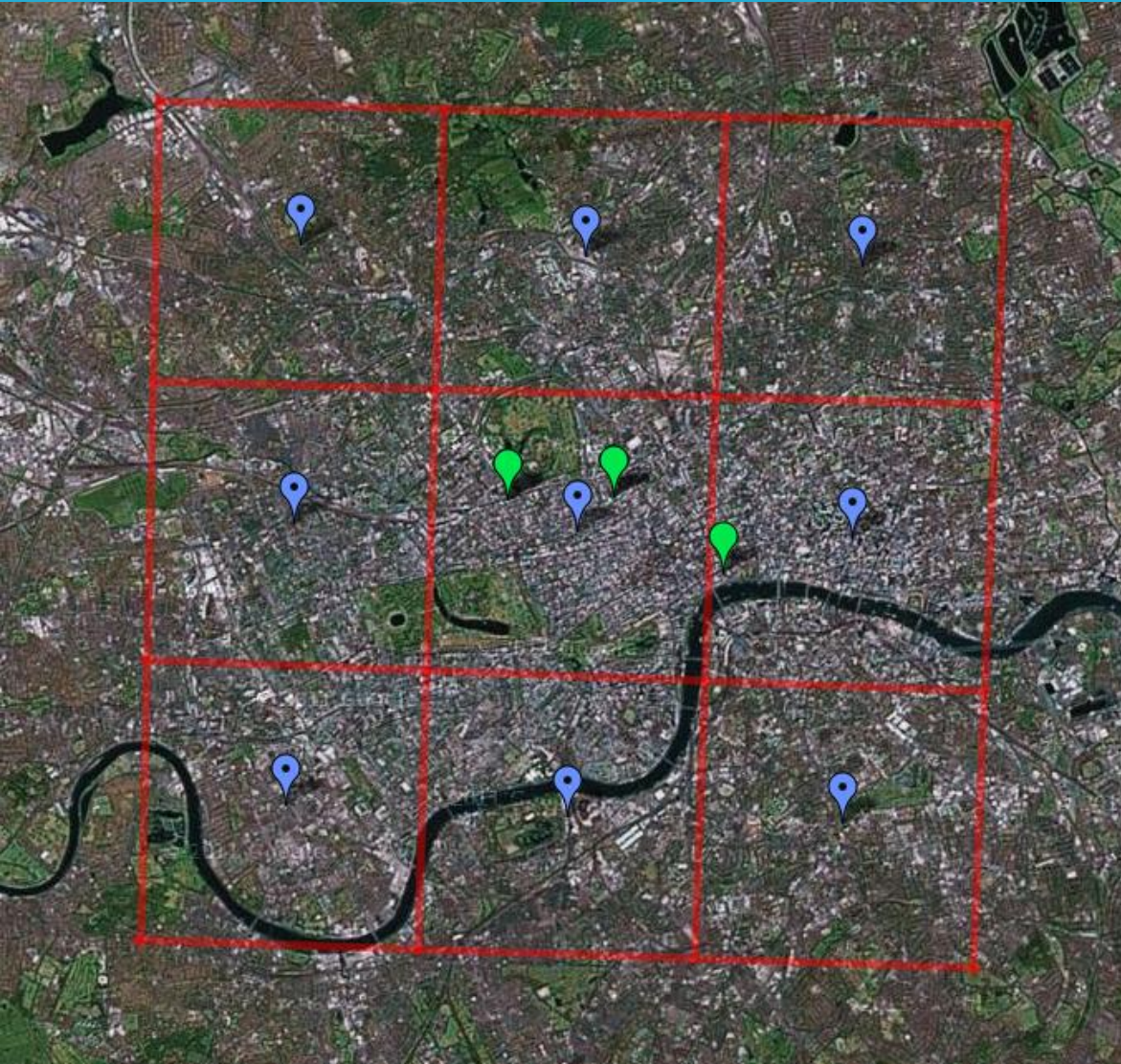


Bohnenstengel et al. 2011 QJRMS

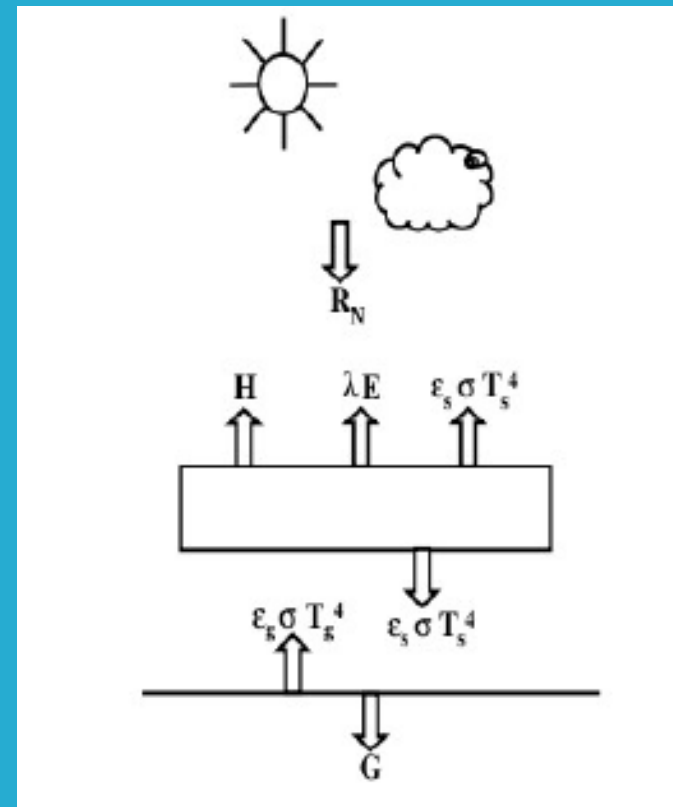
How good are simulated temperature profiles?



2) Evaluating wind profiles in operational UM

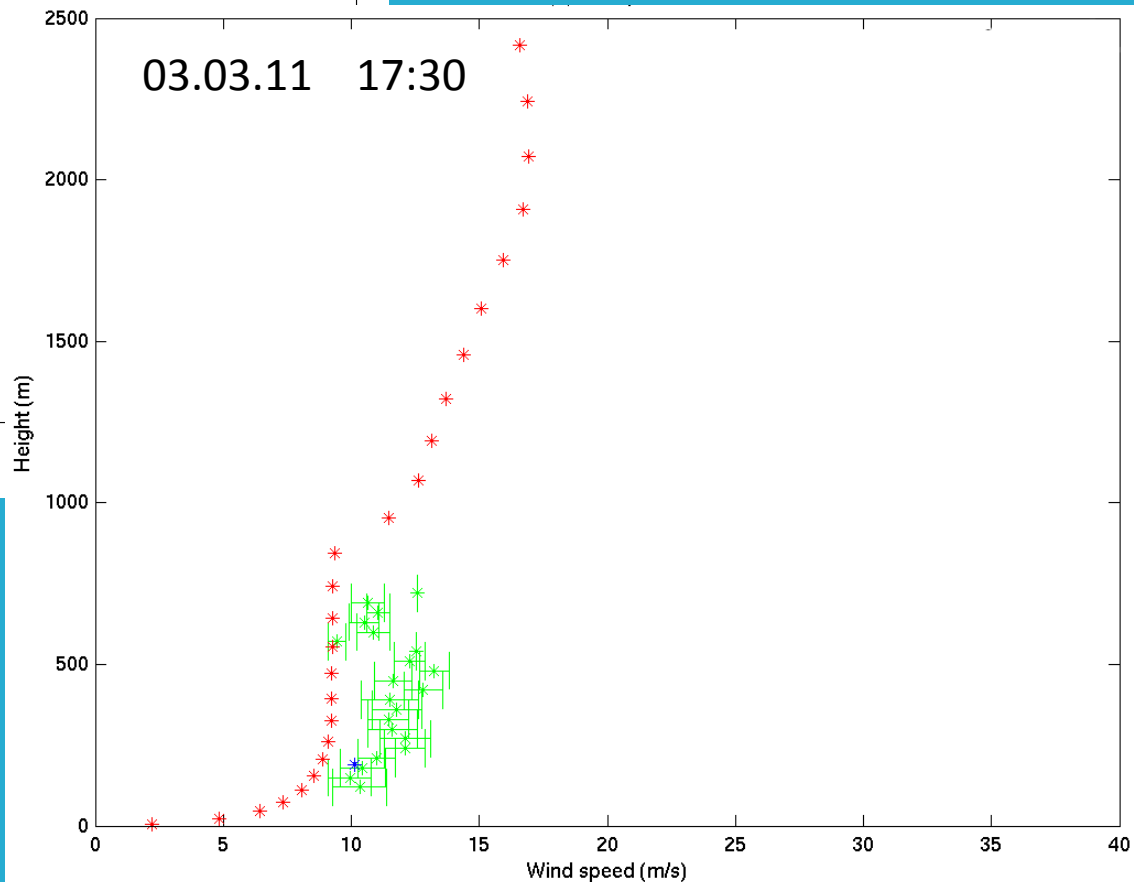
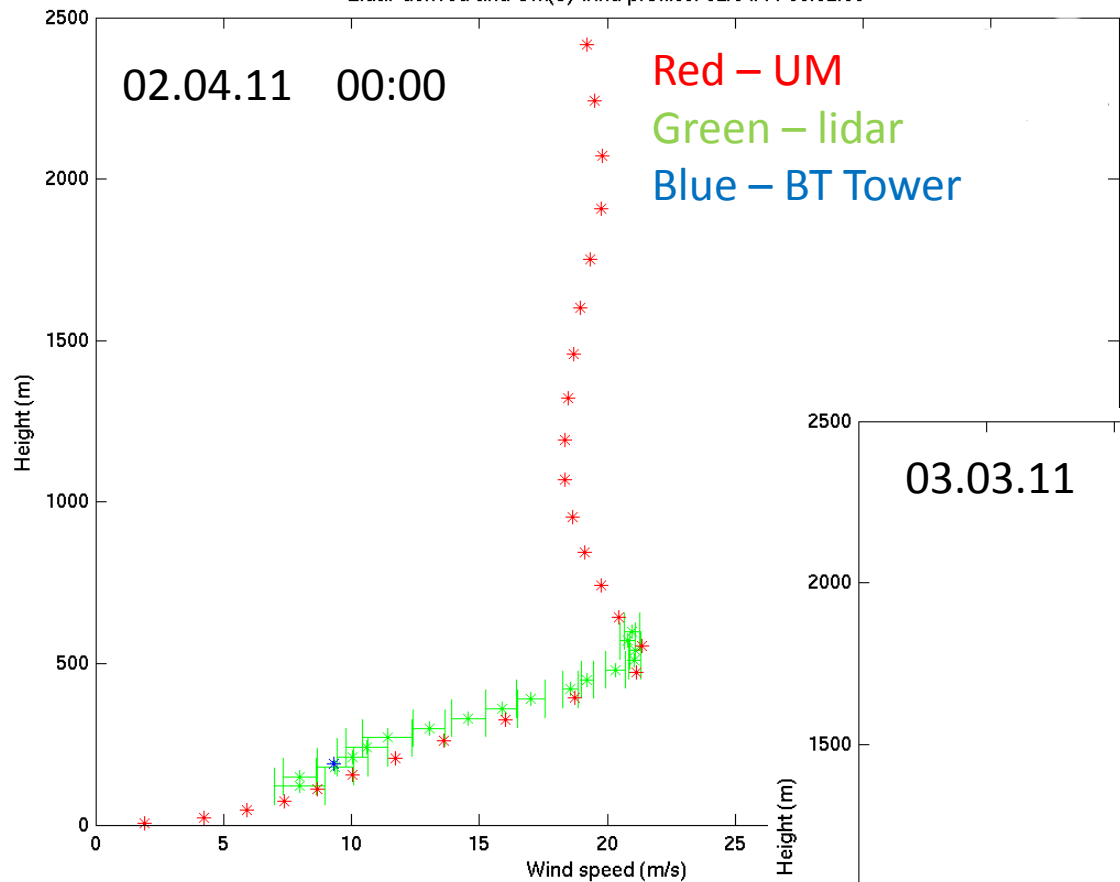


- UK Met Office Unified Model
- 4km grid resolution (1.5km also running)
- Simple slab urban representation



2) Evaluating wind profiles in operational UM

- Halo Photonics “Streamline” Doppler lidar
- For lidar validation against BT Tower measurements, see: Wood O-27 (Friday 13:30)



Conclusions and future work

- Laboratory now established (data at www.actual.ac.uk)
→ Combination of point and volume-averaged observations at range of scales useful for validation of new instrumentation and model output
- New MORUSES scheme in UM captures urban temperature profiles well in case study
→ Systematic intercomparison over period June 2011 to Sep 2012 as part of Clearflo project
- Operational UM wind profiles agree well at times with lidar
→ Is boundary layer structure influenced significantly by local heterogeneity?

