Invest to Save Budget

The ISB-52 Project: Improving Air Quality Forecasting.

RI Young

6th May 2004

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What is ISB?

- The Invest to Save Budget is a joint Treasury/Cabinet Office initiative
- Its goal is to promote innovation within government
- Despite the name many ISB projects goal is to improve the quality and effectiveness of services delivered to the public
- The real benefits extend beyond the lifetime, and the immediate scope, of individual projects
- These benefits can continue into the future, and influence practice in other geographical regions and policy areas

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ISB-52 Project Objective

- To achieve the ability to improve the accuracy of dispersion model forecasts
  - by improved understanding of the structure of the urban boundary layer, rather than by incorporating lidar data directly into the model
  - develop a data set to improve dispersion model parameters

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Introduction to Lidar

- Light detection and ranging
- 0.5 - 10 km range
- 100 m spatial resolution
- 0.3 m/s accuracy with line of sight velocities

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Critical success factors for ISB52

- Equipment upgrade
- Match lidar data to dispersion model parameters
- Design trials
- Undertake trials involving two lidars
- Develop visualisation software
- Compare model predictions with estimates from lidar observations

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Equipment upgrade

- TEA laser installed in QinetiQ lidar to allow both systems to make observations over of distances 6 -10 km.
- Software upgraded

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Relate lidar data to dispersion model parameters to design field trials.

The key features to observe have been defined as atmospheric turbulence and the shape of the PBL

An experimental technique to observe these features has been devised which consists of deploying the lidars with different, but complementary scanning patterns

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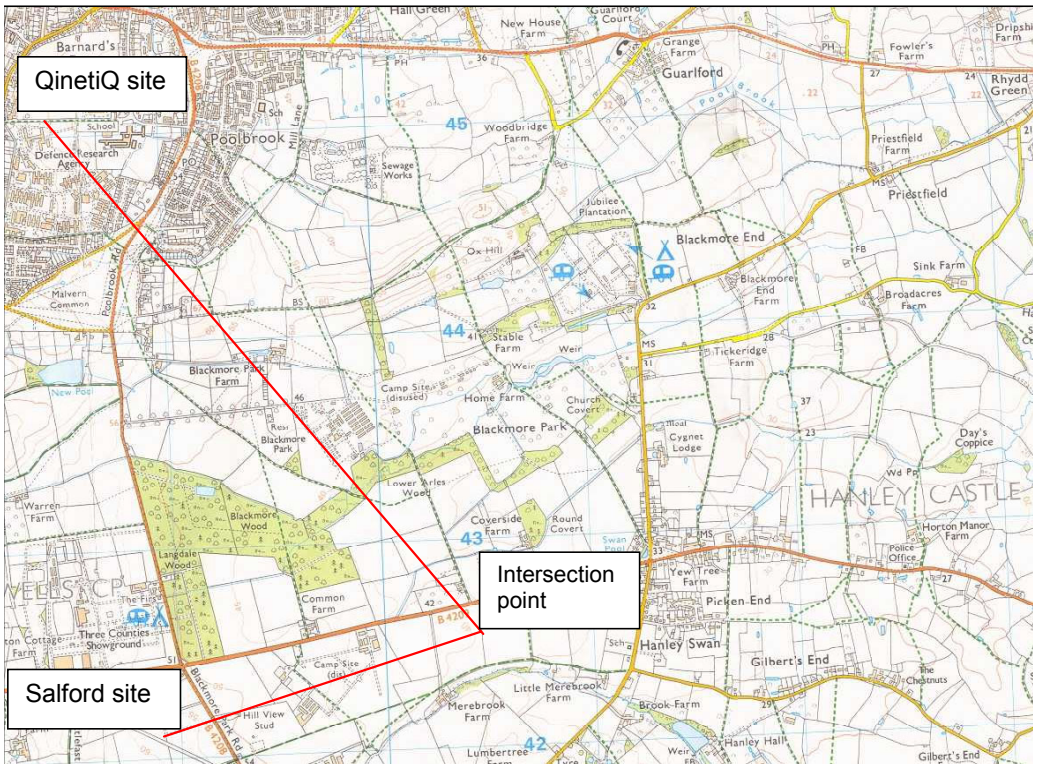
Deploy two lidars to make observations
Demonstrated dual lidar concept



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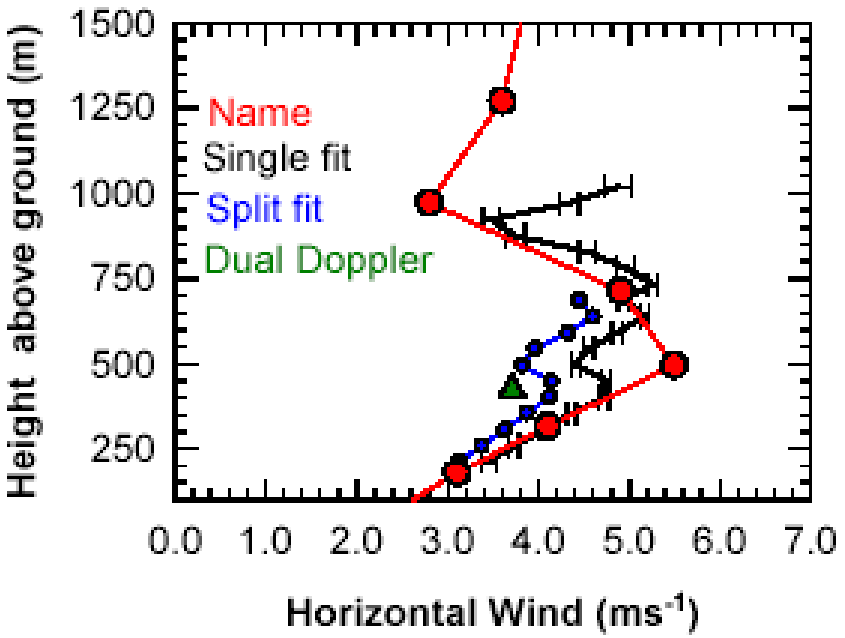
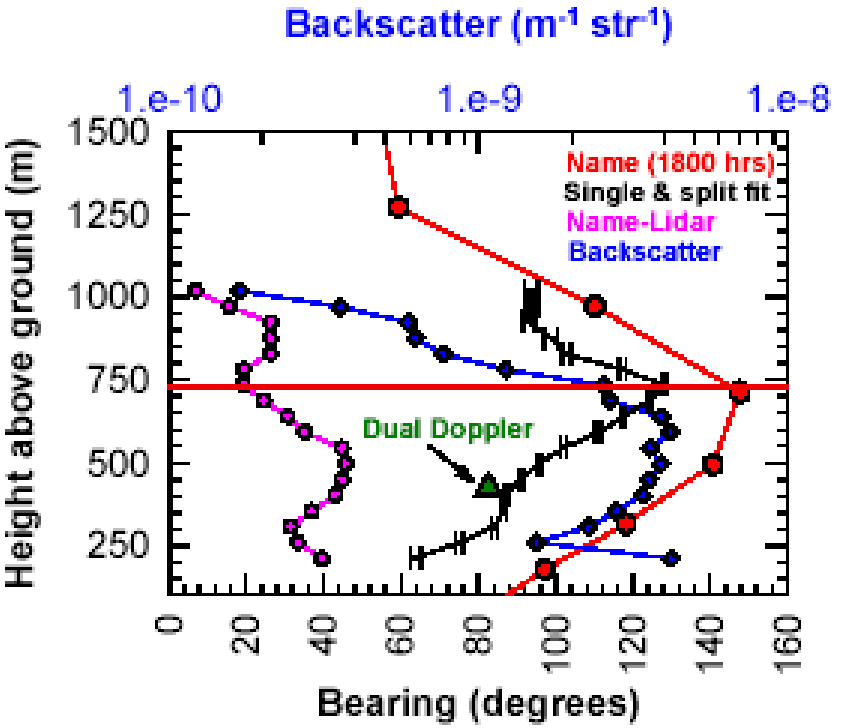
Compare lidar observations to dispersion model predictions.





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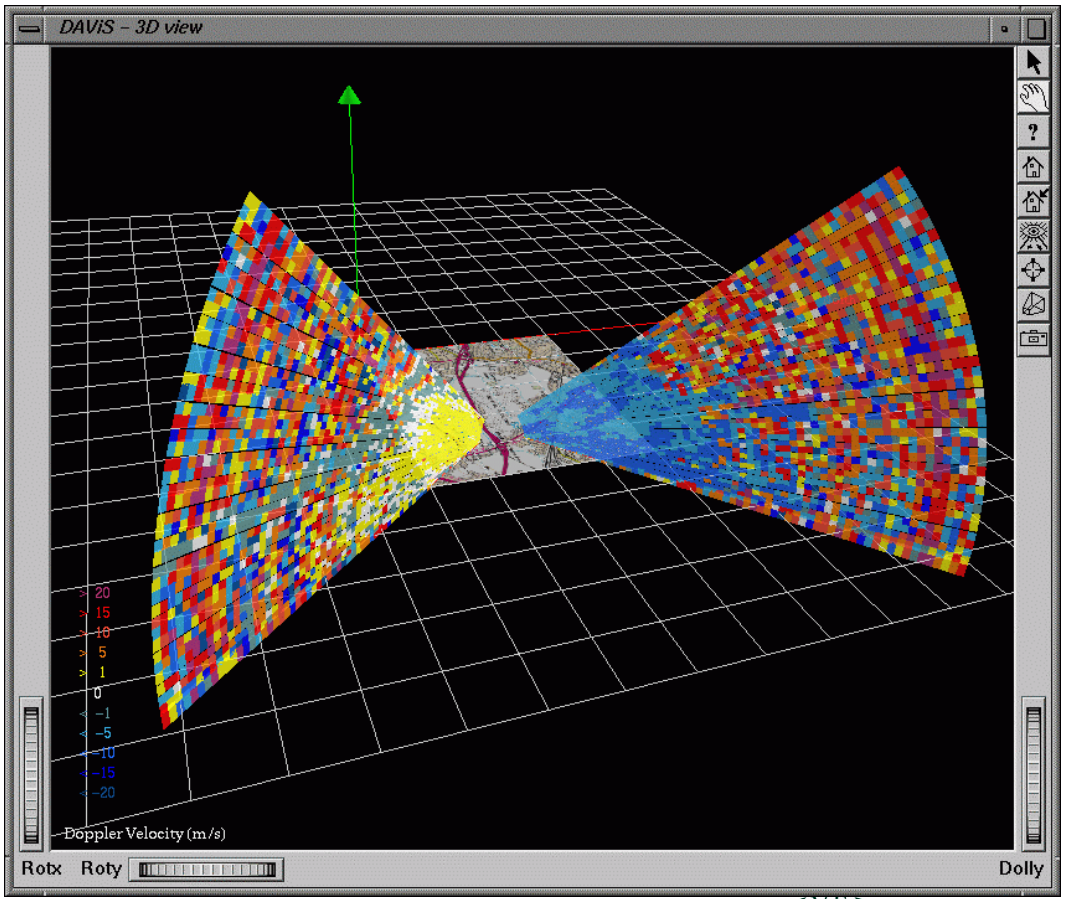
Develop a software suite to display the lidar data, DAViS



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Current position

- Key variables to be investigated identified and techniques developed to derive them from lidar observations
- Lidar equipment upgraded and deployed on two trials
- Visualisation tools completed
- Data processing ongoing

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Impact of lidar data on atmospheric dispersion models

- Spatial variations of the top of the PBL and at rural urban interface
- Shape of the top of the PBL
- Wind observation in the column observed simultaneously by the two lidars
- Eddy dissipation and surface heat fluxes

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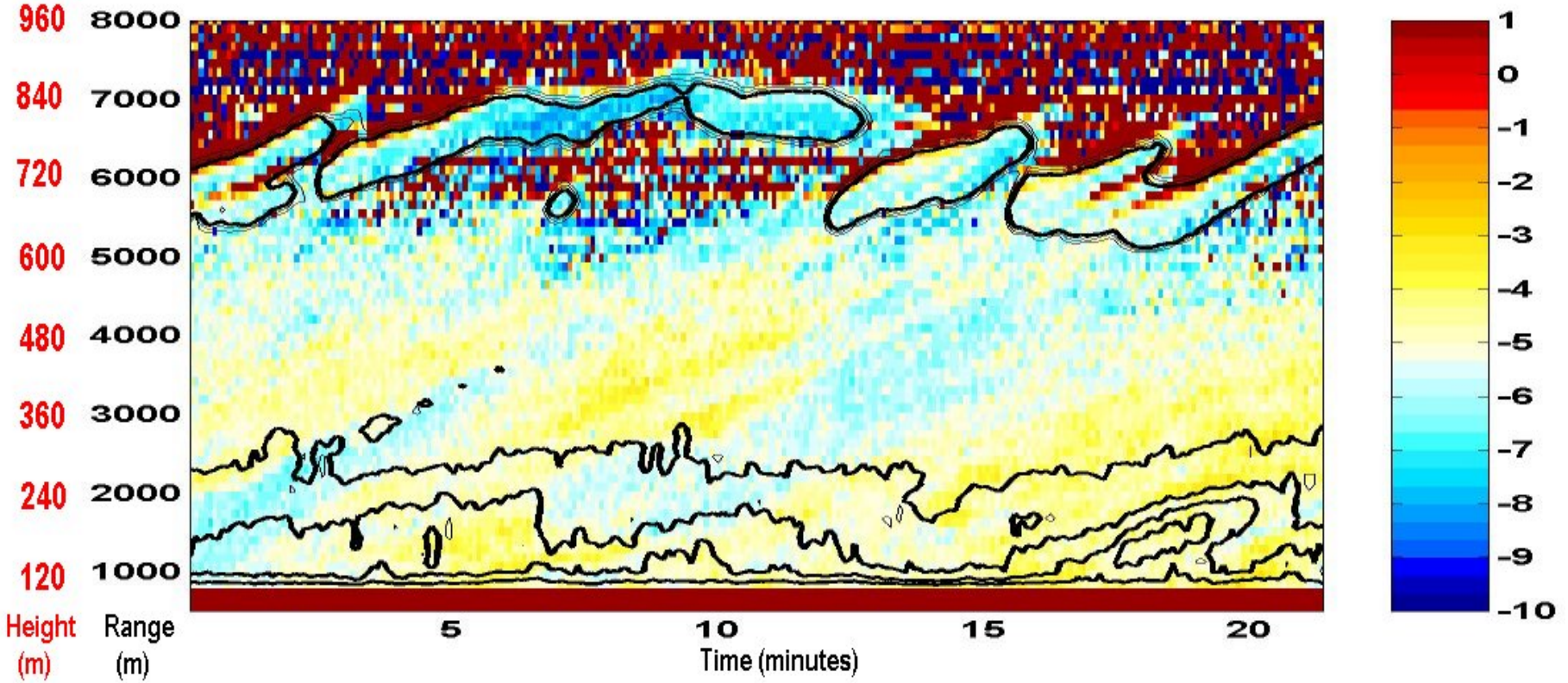
Shape of the top of the PBL



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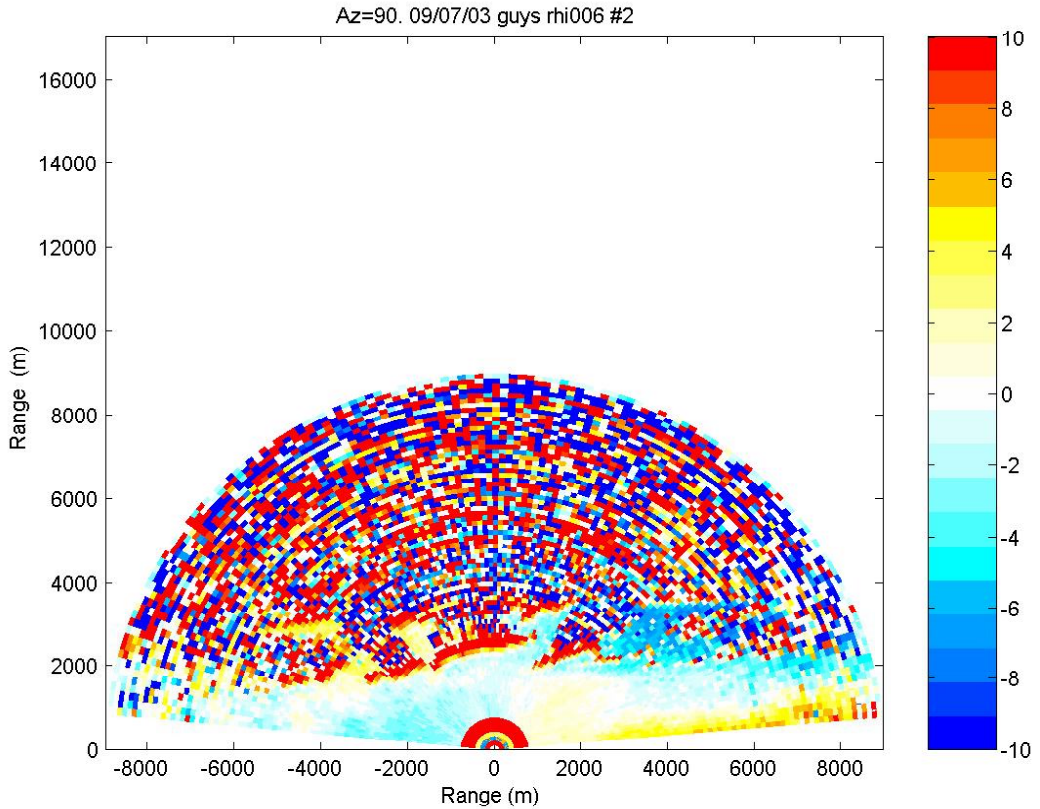
Spatial variations of the top of the PBL



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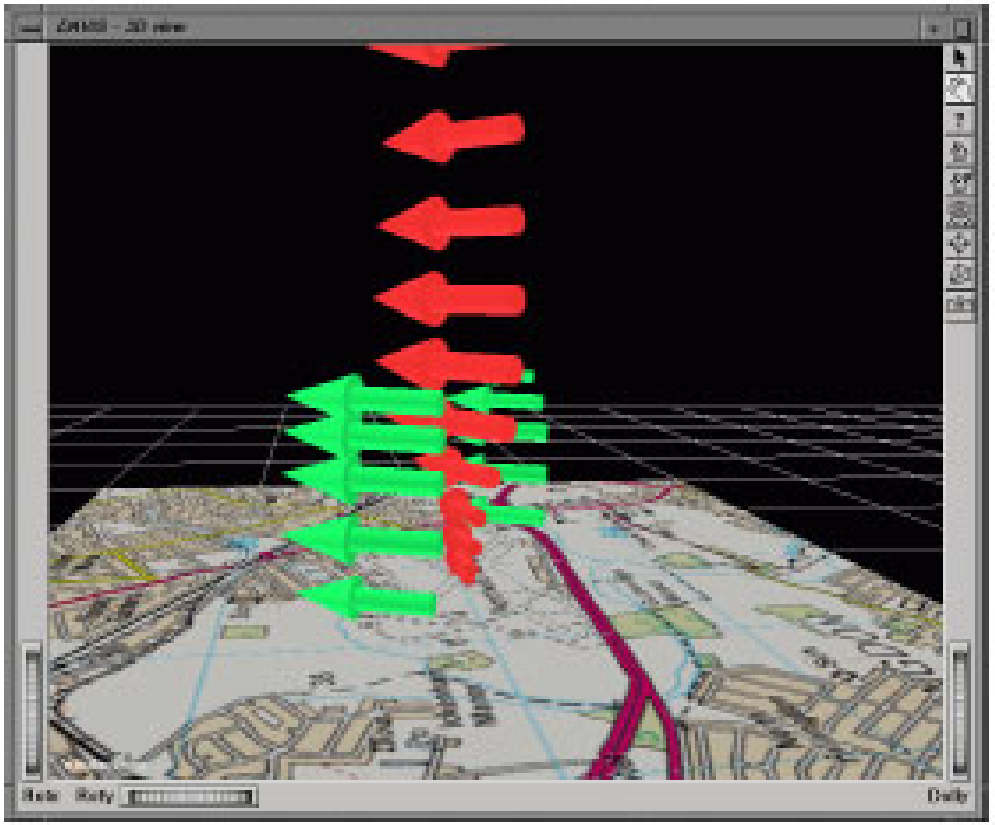
Wind observations in the column observed simultaneously by the two lidar



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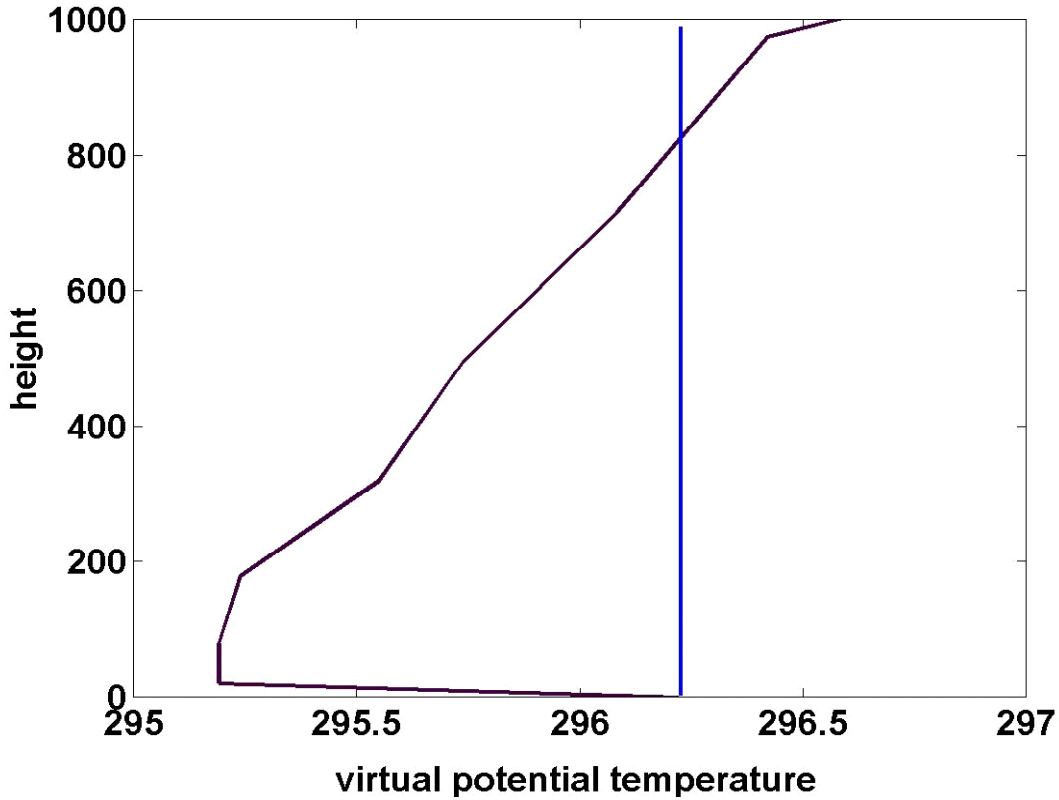
Vertical variations of the heat flux.



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Future research

- Compare NAME, ADMS diagnostics and lidar estimates
- Show where air masses come from and go to
- Compile comparison tables between diagnostic predictions and measurements
- Continue data analysis and prepare further publications

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Conclusions

- Twin Doppler lidar offers many advantages for monitoring the urban rural boundary
- Simultaneous observations of the PBL either side of the urban rural boundary have been made
- Differences attributable to the urban surfaces can be distinguished from daily changes in synoptic meteorology

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ISB-52 web sites

- ISB home site http://www.isb.gov.uk
- Project Site http://www.aqf.qinetiq.com
- Visualisation Site http://prswww.essex.ac.uk/lidar

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