

# UNIVERSITY OF BIRMINGHAM

University of Birmingham  
Research at Birmingham

## Assessment and deployment of bird-carried meteorological sensors for microclimate measurements in urban terrain

Sadler, Jon; Thomas, Rick; Cropley, Ford; MacKenzie, A. Robert; Reynolds, Jim

### License:

Creative Commons: Attribution (CC BY)

### Document Version

Publisher's PDF, also known as Version of record

### Citation for published version (Harvard):

Sadler, J, Thomas, R, Cropley, F, MacKenzie, AR & Reynolds, J 2018, Assessment and deployment of bird-carried meteorological sensors for microclimate measurements in urban terrain. in *Geophysical Research Abstracts (GRA)*. vol. 20, 16288, European Geosciences Union, European Geosciences Union General Assembly 2018, Vienna, Austria, 8/04/18.

[Link to publication on Research at Birmingham portal](#)

### Publisher Rights Statement:

Checked for eligibility: 14/10/2019

### General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

### Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.



## **Assessment and Deployment of Bird-Carried Meteorological Sensors for Microclimate Measurements in Urban Terrain**

Rick M. Thomas (1), Ford Cropley (1), A. Rob Mackenzie (1), S. James Reynolds (1), Jonathan P. Sadler (1), Lee Chapman (1), Andrew Quinn (1), Jian Zhong (1), Ben Schellenberg (2), and Xiaoming Cai (1)

(1) University of Birmingham, United Kingdom (r.thomas@bham.ac.uk), (2) Department of Aerospace Engineering, University of Bristol

The Cityflocks project has been developing and deploying lightweight, fast-response meteorological sensors to be carried by bird species in urban areas to address the paucity of measurements in the region a few hundred metres above the urban rooftops. Accurate and fast routine temperature measurements in this region will help further our understanding of the above-canopy internal boundary layer structure and the spatial variability of Urban Boundary Layers (Barlow 2014). Data implications include improving forecasting of Urban Heat Island events and urban weather, improving air pollution modelling and informing sustainable urban planning. Other methods of making such measurements routinely, such as using manned aircraft or Unmanned Aerial Vehicles (UAVs), can be prohibitively expensive or require onerous permissions and logistics to achieve.

A first-iteration prototype was carried initially by a trained White-tailed Eagle (*Haliaeetus albicilla*) and an Imperial Eagle (*Aquila adalberti*) to assess probe-mounting locations (back or tail mounted temperature sensor), other met sensors and the potential for data contamination due to heat generation by birds (Thomas et al. 2017). Other characterisation tests included car-mounted solar radiation shield tests, UAV-mounted tests for altimeter testing and field tests of temperature responses to solar-heated surface elements.

We present results demonstrating that packages meet their specified target of measuring at least a 0.5 degree celcius change in temperature over each hundred metres of flight track, as well as accurately recording their location and orientation using on-board GPS, 3-axis gyroscopes and accelerometers, and a pressure altitude sensor. The package has been miniaturised and carried by captive homing pigeons (*Columba livia*) for initial tests prior to more widespread deployment later in 2018.

1. Barlow, J.F., Progress in observing and modelling the urban boundary layer. *Urban Climate*, 2014. 10, Part 2: p. 216-240.
2. Thomas, R.M., et al., Avian Sensor Packages for Meteorological Measurements in Complex Terrain and Urban Environments. *Bulletin of the American Meteorological Society* 2017. (In press. Early release available: <http://journals.ametsoc.org/doi/10.1175/BAMS-D-16-0181.1>).