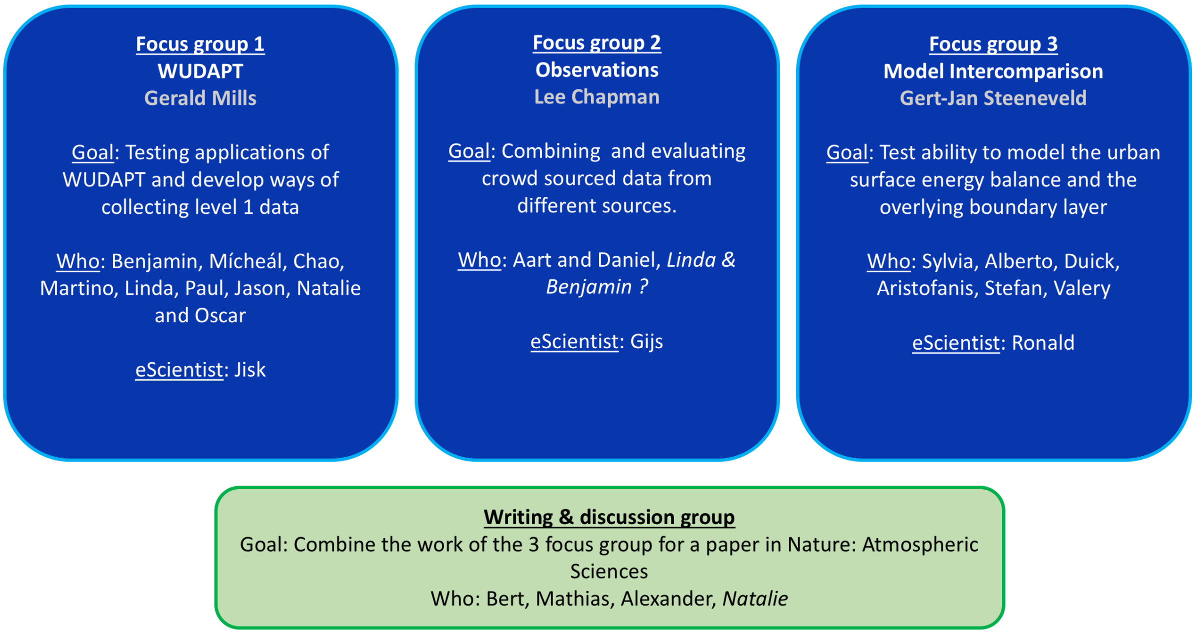
## General overview

Overall aim of the workshop:
Combining different expertise in urban climate (geography, observations, modelling) with eScience technologies to improve high resolution modelling for urban areas.

Note that this is not a workshop with a lot of talks, but we would like you to do some actual work yourselves. **So bring your laptop!**

How we plan to handle this is summarized in the figure below. We have 3 focus groups, each with specific expertise and a specific goal for the duration of the workshop. One is the WUDAPT group, the second the crowdsourcing group and the third the mesoscale modelling group.

Each of these groups will have an eScientist at their disposal to solve some of the coding, data mining, modelling and other computational problems. They have relevant experience with atmospheric models, land-use mapping, data assimilation and other things.




Furthermore, we will have a group that will integrate the expertise and products of the 3 focus and write it up (or make a first attempt to write it up) in a paper. This paper will be submitted (later on) to the new Nature journal: Climate and Atmospheric Sciences.

At the moment we have linked everyone to a group, but we are still flexible. Let us know if you have any suggestions or feel like you would be better suited to another group. Also during the workshop people are free to move around groups.

## Program

Monday 26 June 2017

09:00 – 10:00 Arrival, registration
10:00 – 10:15 Welcome by Lorentz Center
10:15 – 10:30 Opening by organizers: Welcome and explanation of objectives and way of working Workshop week.
10:30 – 11:30 "*eScience in weather and climate*" Wilco Hazeleger + Discussion
11:30 – 11.45 *Introduction to focus group 1*
11:45 – 12:00 *Introduction to focus group 2*
12:00 – 12:15 *Introduction to focus group 3*
12:15 – 12:30 *Discussion*

12:30 – 14:00 Lunch @Snellius restaurant

14:00 – 16:45 Work in individual groups (including coffee break)
16:45 – 17:00 Feedback and discussion from the individual focus groups

17:00 Wine & cheese party @common room

Tuesday 27 June 2017

09:00 – 10:00 *Crowdsourcing urban data* Linda See + discussion
10:00 – 12:15 Work in individual groups (including coffee break)

12:15 – 14:00 Lunch @Snellius restaurant

14:00 – 16:15 Work in individual groups (including coffee break)
16.15 – 17.00 Feedback and discussion from the individual focus groups
17:15 Departure to workshop dinner

Wednesday 28 June 2017

09:00 – 12:00 Free time, you can still use the facilities at the Lorentz center
12:00 – 13:00 Lunch @Snellius restaurant

13:00 – 22:00 Excursion to Amsterdam including:

- Crowdsourcing walk through Amsterdam
- Visit to Amsterdam institute for Advanced Metropolitan Solutions
- Indonesian rice table

Thursday 29 June  2017

09:00 – 10:00 *Mapping urban areas* Martino Pesaresi  (?) + discussion

10:00 – 12:15 Work in individual groups (including coffee break)

12:15 – 14:00 Lunch @Snellius restaurant

14:00 – 15:00 *Modelling urban climate* Gert-Jan Steeneveld + Discussion

15:00 – 17:30 Work in individual groups (including coffee break)

Friday 30 June 2017

09:00– 10.00 *Future urban climate studies* Mathias Rotach + discussion

10.00 – 12.00 Wrap-up discussion individual focus groups (including coffee break)

12:00 – 13.15 Lunch @Snellius restaurant

13:15  - 13.45 Conclusions focus groups

13:45 – 15:00 Final discussions and conclusions of the week by Bert Holtslag

- What lessons did we learn?
- Continuation + task division
- What’s next?
- Next meetings? (e.g. ICUC10)

# Focus group 1

## Context

The World Urban Database and Access Portal Tools (WUDAPT) project was created to gather, store, process and disseminate climate-relevant data on cities worldwide. These data describe the physical geography of cities in terms of urban form and functions, which are captured as urban canopy parameters (UCPs). WUDAPT is distinguished from other urban databases by its use of protocols to ensure consistency of data and the creation of portal tools that permit the user to extract these data in a form useful for modelling and observation studies. It acquires and structures this information according to three levels:

- Level 0: This provides the most basic description of urban surface cover using the Local Climate Zone classification scheme which is applicable as a climate concept to areas >1km$^2$. WUDAPT generates LCZ maps of cities using urban experts to identify areas within the selected city that are representative of LZC types, which are then used to automatically classify Landsat images. Each LCZ type is associated with ranges of values for UCPs that can by researchers to guide modelling and observational studies.
- Level 1: This provides more detailed UCP values across the urban landscape through sampling and crowd-sourcing techniques. The Level 0 data can provide a frame for this data gathering which relies on a variety of software 'apps' to gather geotagged information on aspects of urban form and functions.
- Level 2: This captures information on the individual elements of the urban landscape, the buildings, trees, roads, parks, etc. These data allow the determination of UCPs at any desired scale. These data exist for some elements (buildings) in some cities and all other levels can be derived from it.

The protocol for generating Level 0 data is well established and WUDAPT contains LCZ maps for more than 50 cities. In this workshop the focus will be on:

1. Using LCZ maps for selected cities to explore volunteered meteorological data gathered via the Netatmo station network: https://weathermap.netatmo.com/
2. Test the 'app' that is being developed for acquiring information on the form and function of buildings
3. Develop an 'app' to acquire details on the vegetative fraction of cities, especially the tree coverage.

The work from this working group should dovetail with the crowd-sourcing/smart sensor focus group and together permit data to be integrated with the modelling focus group.

# Focus group 2

## Context

Crowdsourcing techniques are frequently used across science to supplement traditional means of data collection. Although, atmospheric science has so far been slow to harness the technology, developments have now reached the point where the benefits of the approaches simply cannot be ignored: crowdsourcing has potentially far-reaching consequences for the way in which measurements are collected and used in the discipline.

However, to achieve this, there is much that still needs to be done with respect to quality control and assurance to prove the fidelity of the data. Whilst there are now a number of techniques and case studies available in the literature (e.g. Chapman et al 2016; Meier et al 2017), there is a need to move beyond this level of study and begin cross-comparison exercises between techniques / standard measurements. Hence, this workshop will focus on:

1. Use Netatmo and mobile phone data to characterize the Amsterdam UHI (linked with Focus Group 1), linking with available standard observations and looking at differences between the approaches
2. Add an element of quality control to the measurements. Although filters can be used to quality control data (see Meier et al 2017), the utility of data is still limited by a lack of metadata. A basic metadata protocol will be produced and used on the workshop. For example, tools such as Google Earth will be used to assign site information to the Netatmo units used in 1 (e.g. Bell et al, 2012). Where possible, fieldwork in Amsterdam will visit sites in the City Centre to further inform the process ("Netatmo-hunt").
3. Link to Focus Group 3 to consider the barriers to the assimilation of crowdsourced data in models.

References

Bell S, Cornford D, Bastin L. 2013. The state of automated amateur weather observations. Weather 68(2): 36–41.

Chapman, L., *Bell, C., *Bell, S. (20166) Can the crowdsourcing data paradigm take atmospheric science to a new level? A case study of the Urban Heat Island of London quantified using Netatmo weather stations. *International Journal of Climatology*. In Press

Meier, F., Fenner, D, Grassman, T, Otto, M., Scherer, D. (2017) Crowdsourcing air temperatures from citizen science weather stations for urban climate research. *Urban Climate*. In Press

Overeem A, Robinson JCR, Leijnse H, Steeneveld GJ, Horn BKP, Uijlenhoet R. 2013. Crowdsourcing urban air temperatures from smartphone battery temperatures. Geophys*ical* Res*earch* Let*ters*. 40(15): 4081–4085.

# Focus group 3

## Context

Urban areas are characterized by a clearly different meteorology than rural areas. With the refinement of the resolution of numerical weather prediction models, the consideration of the surface energy balance of urban areas require a specific representation to account for radiative trapping, urban vegetation, anthropogenic heat flux, heat storage in the urban fabric. Many urban canopy models of different complexity have been developed in the last decades. Grimmond et al (2010, 2011) compared a myriad of the models on the performance of the surface energy balance, and identified a ranking in the essentials of processes to be represented and parameter space. In that particular study the models were driven by observations taken above the canopy, which is a state of the art method to evaluate land surface models. However, in the real world, these urban canopy schemes are operating in conjunction with boundary-layer schemes that are responsible for transport of heat, moisture and momentum from the surface through the lower atmosphere, as well as with the free atmosphere due to entrainment. This coupling leads to feedbacks and dependencies on the schemes that have so far not been quantified. Here we propose a modelling experiment in which we further evaluate the modelling infrastructure for the urban boundary layer coupled to the urban land surface. This modelling exercise specifically aims to:

- Evaluate single-column models coupled to the urban surface for the urban environment against field observations at the surface as well and in the PBL.
- Identify key strengths and weaknesses in these model approaches.
- Identify feedbacks and their strengths between urban canopy schemes and boundary-layer scheme.
- Provide a benchmark case study for later use in the community.

In this sense the proposed work build upon earlier experiments in the GABLS (Holtslag et al, 2013) and DICE (Best and Lock, 2016) communities.

## Case selection

Since this will be the first model comparison study for urban areas, we propose to start relatively simple and search for a clear-sky period with relatively low winds (geowind < 5 m/s) for a period of 48-72 h. In general vertical information of the structure of the atmosphere is scarce from observations, though for London (Bohnenstengel et al 2013) a wide suite of observations is at hand. Therefore we propose to select a case study for London.

## Workflow

Since the setup of such a case study is not a trivial thing to do, we propose to perform the intercomparison in two phases. Phase 0 covers the time available at the eWUDAPT workshop in which the participants thoroughly prepare the intercomparison and analyse pro and cons of the setups. In phase 1 the single column model intercomparison is being released to the whole research community, and results will be discussed at later workshops (e.g. during ICUC-2018).

Moreover, each phase will cover multiple stages.

Stage 1: In this stage only the urban land surface schemes will be evaluated, analogous to PILPS-urban. Urban morphological parameters will be provided by WG1 in the eWUDAPT workshop and formulated in terms of local climate zones.

Stage 2: In this stage the same urban morphological parameters will be provided as in stage 1, but now to the single column model will be run. In this way one can identify the model behaviour of the land surface scheme in connection to the PBL scheme.

Stage 3: In this stage modellers are asked to apply their default model settings for the urban scheme. This allows for model evaluation against real world observations.
For phase 1 identical steps will be undertaken, but for the whole community.

## Role of science Engineer.

During the eWUDAPT workshop, an eScience engineer is available to accelerate the model intercomparison process. His/her role as foreseen is to develop a webportal that receives model output files in netcdf format as input and which creates a series of plots of the surface radiation and energy balance as well as vertical profiles for all models and available observations. The webportal facilitates communication between participants and model comparison coordinators, and in a later stage it can act as an archive to provide model results as open access data.

## References

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