Course: Green Building Technology (L) - **Credit:** 1 - **Period:** 27 May – 7 June 2019

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Contents:

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  - The Planetary Boundary Layer
- **Lecture 2**
  - The Urban Boundary Layer
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  - The thermal balance
  - The Urban Heat Island
- **Lecture 4**
  - Outdoor ventilation indices
  - Thermal comfort indices
- **Lectures 5/6**
  - ENVI-met, overview, protocols and visualisation (and exercise)
- **Lectures 7/8**
  - ADMS-Urban, a modelling tool for urban air quality assessment (and exercises)

General description: The first part of the course is devoted to the physics of the Planetary Boundary Layer, fluid dynamics, thermodynamics and turbulence, with particular attention to the atmospheric circulation at local scale, thermal balance and Urban Heat Island in the Urban Boundary Layer. Then, the concepts of ventilation and thermal comfort are introduced, and related indices are defined. Examples of study cases from the literature are also given for each topic.

In the second part of the course the modelling approaches for the assessment of ventilation, thermal comfort and air quality in urban areas are briefly introduced. In particular, features and fields of application of two different models are shown, i.e. the computational fluid dynamics and microclimate model ENVI-met and the operational integral model ADMS-Urban. This second part also comprises guided exercises that the students perform in the class and at home using the two models and concerning the evaluation of microclimate in an

idealized urban-like geometry in the presence of vegetation (with ENVI-met) and the evaluation of the effect of atmospheric stability and local meteorological conditions on the dispersion of pollutants emitted from different sources in the urban environment.

Material: pdf of the lectures and suggested references at the end of each lecture

Method of assessment: written work consisting in a brief report with set-up and discussion of some example results of one case study (exercise), chosen by the student, performed in the class.

Final marks:

1. **Natalia Duvige Blanco** - Modelling the microclimate in an idealized arrays of buildings with ENVI-met - *The student introduces the problem of urban heat island, then briefly describes ENVI-met and the set-up by showing some figures. Results and figures on air temperature and PMV are presented and briefly discussed* - **80**
2. **Qining Chen** - Modelling the microclimate in an idealized arrays of buildings with ENVI-met - *The student introduces the importance of evaluating the thermal environment in urban areas, then describe ENVI-met by also providing a brief overview of some literature studies. The set-up is then presented and briefly discussed by also showing some figures. Results on air temperature, relative humidity and wind speed are presented and briefly discussed. Conclusions on the lessons learnt are also given* - **90**
3. **Ana Rivas Garc á** - Modelling the microclimate in an idealized arrays of buildings with ENVI-met - *The student introduces the problem of urban heat island, then briefly describes ENVI-met and the set-up by showing some figures. Results and figures on air temperature and PMV are presented and briefly discussed* - **80**
4. **Xin Guo** - Modelling a single elevated point source with ADMS-Urban - *The student introduces the problem of urban air pollution, then briefly describes ADMS-Urban. The set-up is described and results (with figures) are discussed in terms of the effect of stability on pollutant dispersion* - **90**
5. **Zhichao Xu** - Modelling the microclimate in an idealized arrays of buildings with ENVI-met - *The student briefly describes ENVI-met and the set-up by showing some figures. Results and figures on air temperature and PMV are presented and briefly discussed* - **80**

6. **Yue Zhang** - Modelling the microclimate in an idealized arrays of buildings with ENVI-met - *The student introduces the importance of using green areas to improve thermal comfort in urban areas, then briefly describes ENVI-met and the set-up by showing some figures. Results and figures on air temperature and PMV are presented and briefly discussed* – **80**

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