

GE3227 – Microscale Climates Semester 2, 2003/04

Instructor: A/P Matthias Roth (Geography: AS2-0408; geomr@nus.edu.sg)
Office Hours: Tuesday 11:00-12:00
Lectures: Tuesday 12:00-14:00 (AS4/0104)
Practicals: Thursday 10:00-12:00 (AS2/0327)

Assessment:

CA: 60% - Mid-term exam: 10%
- Assignment: 10%
- Literature review: 10%
- Urban heat island project report + presentation: 30%

Final exam: 60% (April 21, 2004 @ 13:00)

Lecture Outline

Week	Topics	Readings
1	1. Introduction <ul style="list-style-type: none"> • Orientation (outline, background, symbols and units) • Atmospheric scales • Review of radiation, energy and water balance concepts 	O ix-xxiv, 395-399 O 3-6 O 6-8, 20-36
2	2. Radiation I <ul style="list-style-type: none"> • Definitions. Lambert's and cosine laws • Shortwave radiation: Estimation and modelling • Shortwave radiation: Transmission within systems (Beer's law) • Shortwave radiation: Reflectivity • Shortwave radiation: Albedo 	O 8-16, M 28-31 O 371-372 O 84-85, 95-96, 98-99, 130-131, 134, 144, M 32-35 O 11-12, 117-118, M 82-86, 93-97 O 12, 85-86, 99-100, 131-133, 146, 280-281, M 79-97
3	3. Radiation II <ul style="list-style-type: none"> • Longwave radiation: Emissivity (surface and atmosphere) • Longwave radiation: Estimation for clear and cloudy skies • Radiation budget • Radiation measurement and instruments 	O 12, 281, 372-374 O 14-16, M 50-54 O 20-23, 84-87, 98-102, 117-119, 130-134, 143-148, 250, M 97-100 O 361-362, 366-375

4 - 5	4. Conduction <ul style="list-style-type: none"> • Thermal and moisture properties of substrates O 43-46, 259 • Heat flow in soils / Flux plates O 42-46, M 225-230 • Soil temperatures O 46-51
6	5. Structure of Planetary Boundary Layer <ul style="list-style-type: none"> • Scalars (temperature, humidity, etc.) O 40-42, 61-63, 66-67, 71-76, A 71-84 • Winds O 54-55, A 57-64
7 - 9	6. Turbulent Transfer <ul style="list-style-type: none"> • Laminar and turbulent flow / Properties of turbulence O 4-6, 37-39, 57-59, 382-383, A 99-115, M 101-106 • Mean and fluctuating properties of fluids / Variances and fluxes O 59-60, 375-378 • Eddy correlation and variance methods O 59-60, 375-378 • Flux-profile relations O 378-379 • Bowen's ratio O 69-71, 382-384
10	7. Wind Profile <ul style="list-style-type: none"> • Wind profile / Mixing length A 131-133 • Log and power law forms O 54-58, 75-76, 83-84, 363-365 • Surface roughness and zero-plane effects O 55-57, 139-140
11	Flux Instrumentation / Field Studies <ul style="list-style-type: none"> • Drag Plate, lysimeter, eddy flux sensors O 377-378, 389-391
12	8. Climates of Non-Homogeneous Terrain <ul style="list-style-type: none"> • Canopy layers O 124-157

Readings

Code	Text
O	Oke, T. R., 1987: <i>Boundary Layer Climates</i> , 2 nd ed., Methuen&Co, London. (compulsory) [QC981.7 Mic.O]
M	Monteith, J. L. and Unsworth, M. H., 1990: <i>Principles of Environmental Physics</i> , 2 nd ed., Edward Arnold, London. [QC911 Mon]
A	Arya, S. P., 1988: <i>Introduction to Micrometeorology</i> , Academic Press, New York. [QC883.8 Ary]

Practicals (Geolab AS2-0327)

Schedule:

P1:	Jan. 29	Introduction to practicals / Assignment of literature review / Intro to library databases (clblimpp)
P2:	Feb. 5	Introduction to UHI survey methodology (I)
P3:	Feb. 12	Introduction to UHI survey methodology (II)
	Feb/March	UHI surveys
P4:	Feb. 26	Discussion of midterm exam / Due date literature review
P5:	March 11	Assignment
P6:	March 25	Due date for UHI report; presentations by students