

Effects of Urban Form and Atmospheric Stability on Local Microclimate

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Introduction

Mapping microclimate variations in Glasgow City Centre to establish a relationship between temperature variations and urban morphology.
7 fixed weather stations
42 point mobile (traverse) measurements



The studied area.

LCZ 2 – Compact low-rise: Glasgow City Centre West from North St to Buchanan St and from Broomielaw to New City Road.

LCZ 3 – Compact low-rise: Glasgow City Centre East from Buchanan St to High St and from Clyde St to New City Rd.

LCZ 5-6 – Open set low-rise: Glasgow Green comprising the whole park area.





Three routes were defined to access all 42 points as fast as possible. All three routes were synchronized by starting at Point 25 and ending at Point 10.





ArcMap (2D) and ArcScene (3D) – Average temperature of June 2013.





3D)



Temperature Field x Sky View Factor

Establishing a relationship...



SVF_Values	
SVF	
0.017000 - 0.042000	
0.042001 - 0.149000	
0.149001 - 0.214000	
0.214001 - 0.259000	
0.259001 - 0.375000	
0.375001 - 0.500000	
0.500001 - 0.595000	
0.595001 - 0.775000	

Value 25.753





Tracing the Temperature Behaviour...



June



Two Squares: Greenery x Concrete?





Two Squares: Greenery vs Concrete?









Tracing the Temperature Behaviour...

Map of the difference = Temperature in each point – Min temperature (day)





July_Average

July_22th



Atmospheric Stability Class - Pasquill-Gifford-Turner (PGT)

	Atmospheric Stability Class -	Min -	Max -	Difference: max – min
Date	Pasquill-Gifford-Turner (PGT)	Temperature	Temperature	for each day
May 21th ^{-E}	tremely unstable A	15.63	22.83	7.20
July 18th	А	23.91	30.96	7.05
July 19th	А	25.65	33.36	7.70







A – Extremely unstable
 B – Moderately unstable
 C – Slightly unstable



Conclusions

- Background atmospheric conditions and urban morphology influence the variation in local temperature in cities.
- Maximum variation in intra-urban temperature in Glasgow city centre was strongly correlated with atmospheric stability.
- The spatial pattern of local temperature variation showed that water bodies and urban parks had consistently lower temperature variations.
- Greenery and urban materials could play an important role in influencing the local climate in cold cities.
- It appears atmospheric stability has the largest effect on daytime intraurban temperature.



