

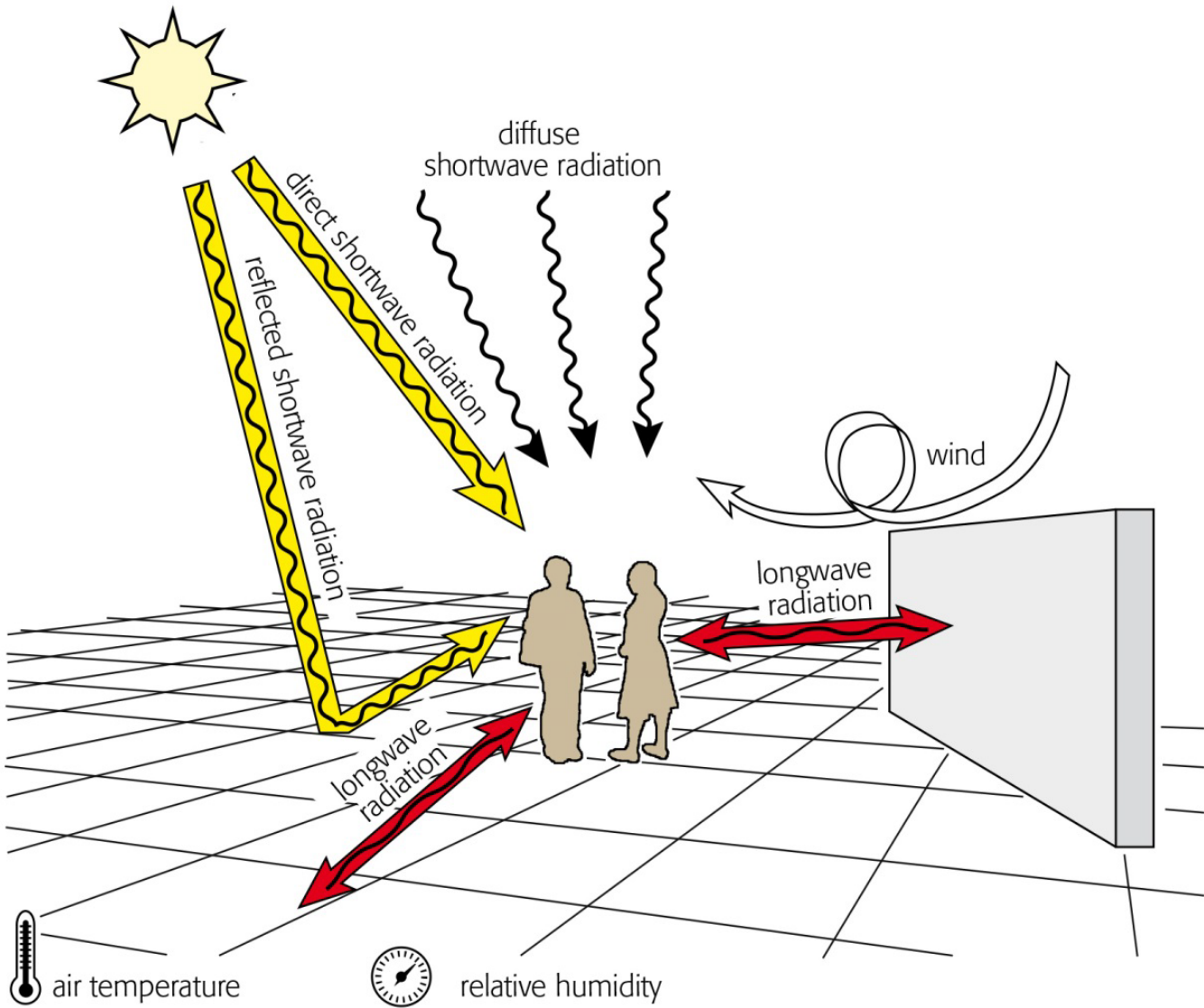
Hoe hou je de buitenruimte voldoende koel?



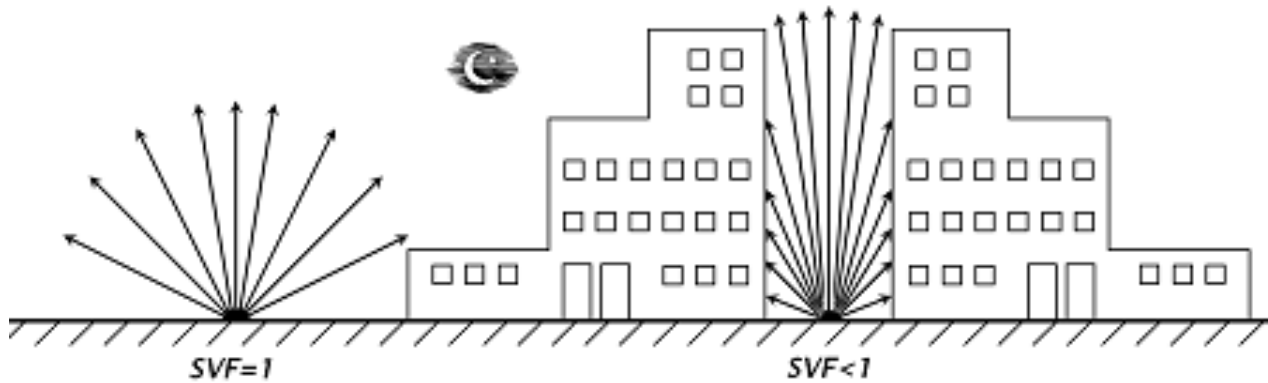
Bestens bekend van de afgelopen dagen...



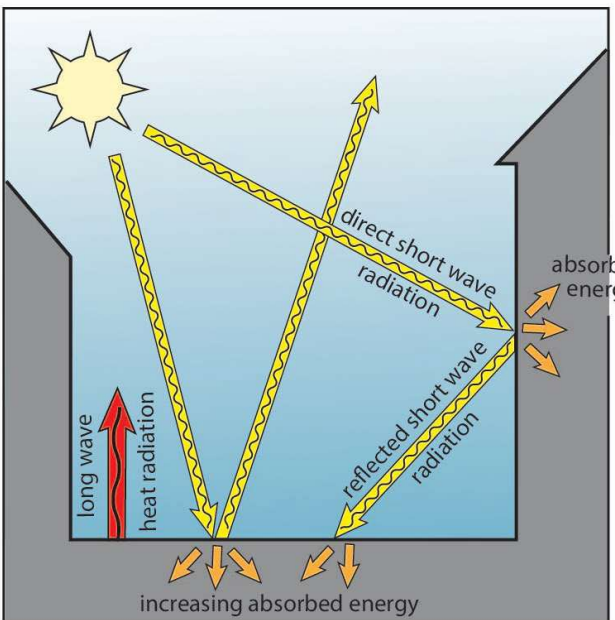
Menselijke temperatuurbeleving



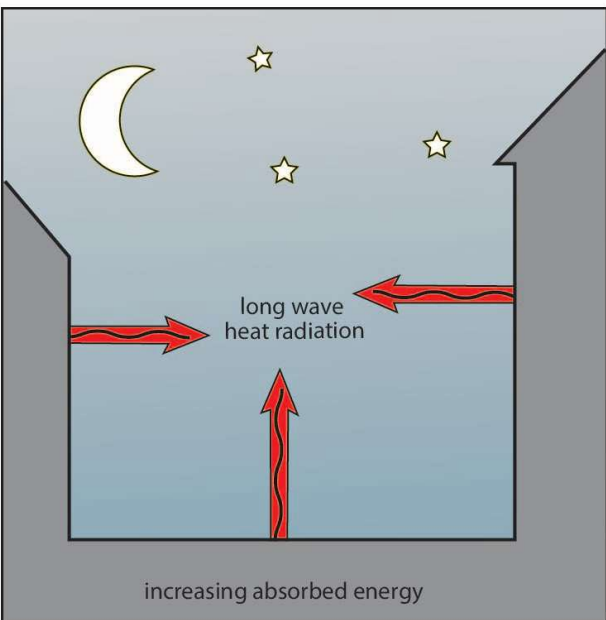
Kort- en langgolvlige straling



Source: lecture material Bert van Hove, Wageningen University

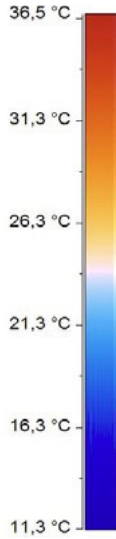
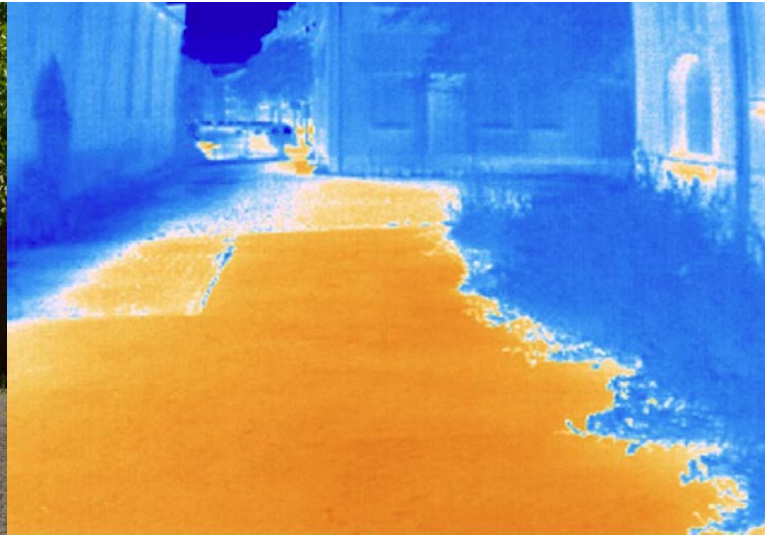


Day

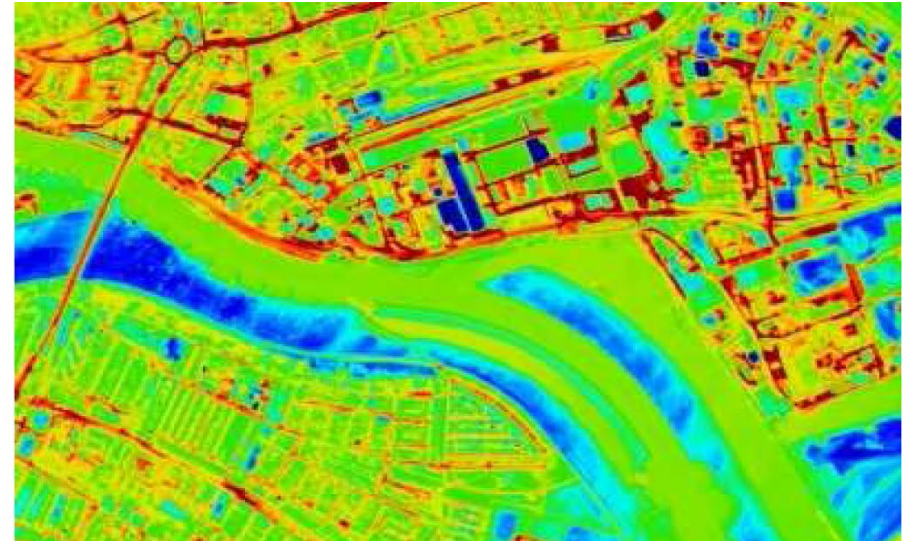


Night

Oppervlaktetemperatuur

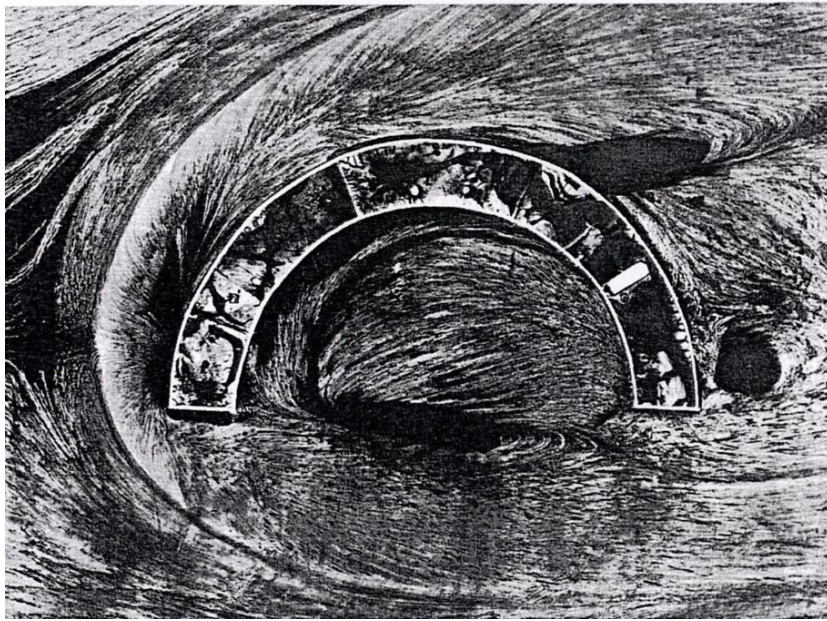
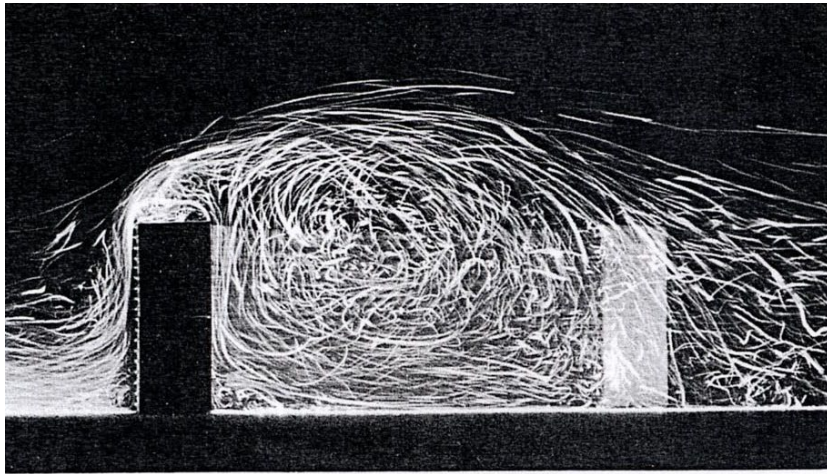


Source: Kassel University

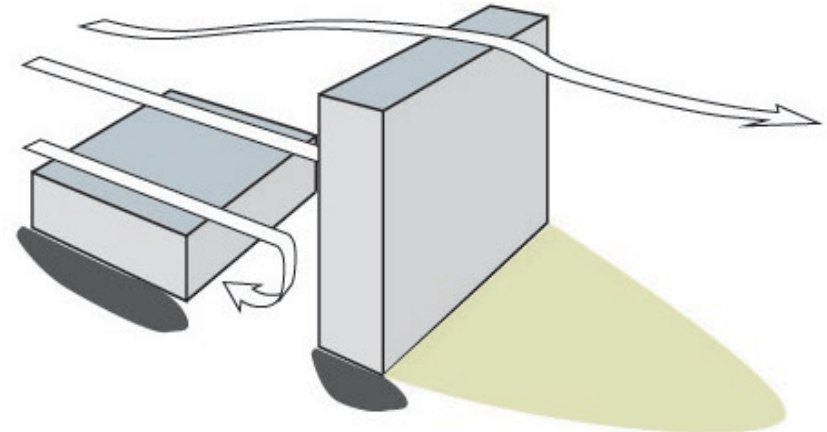
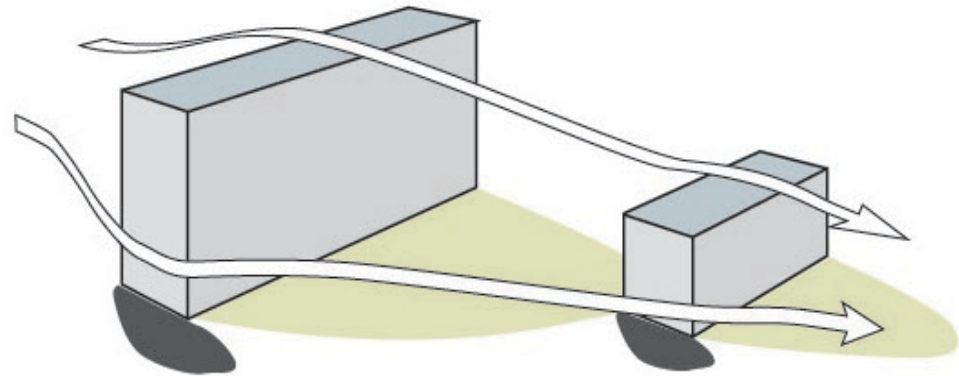


Source: Future Cities- Arnheim

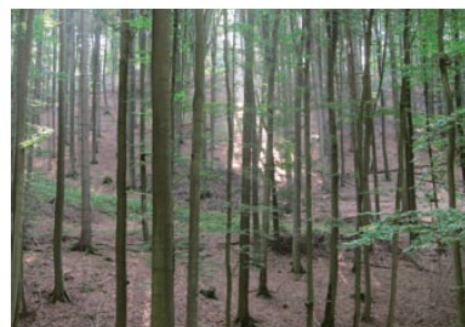
Wind patronen in de gebouwde omgeving



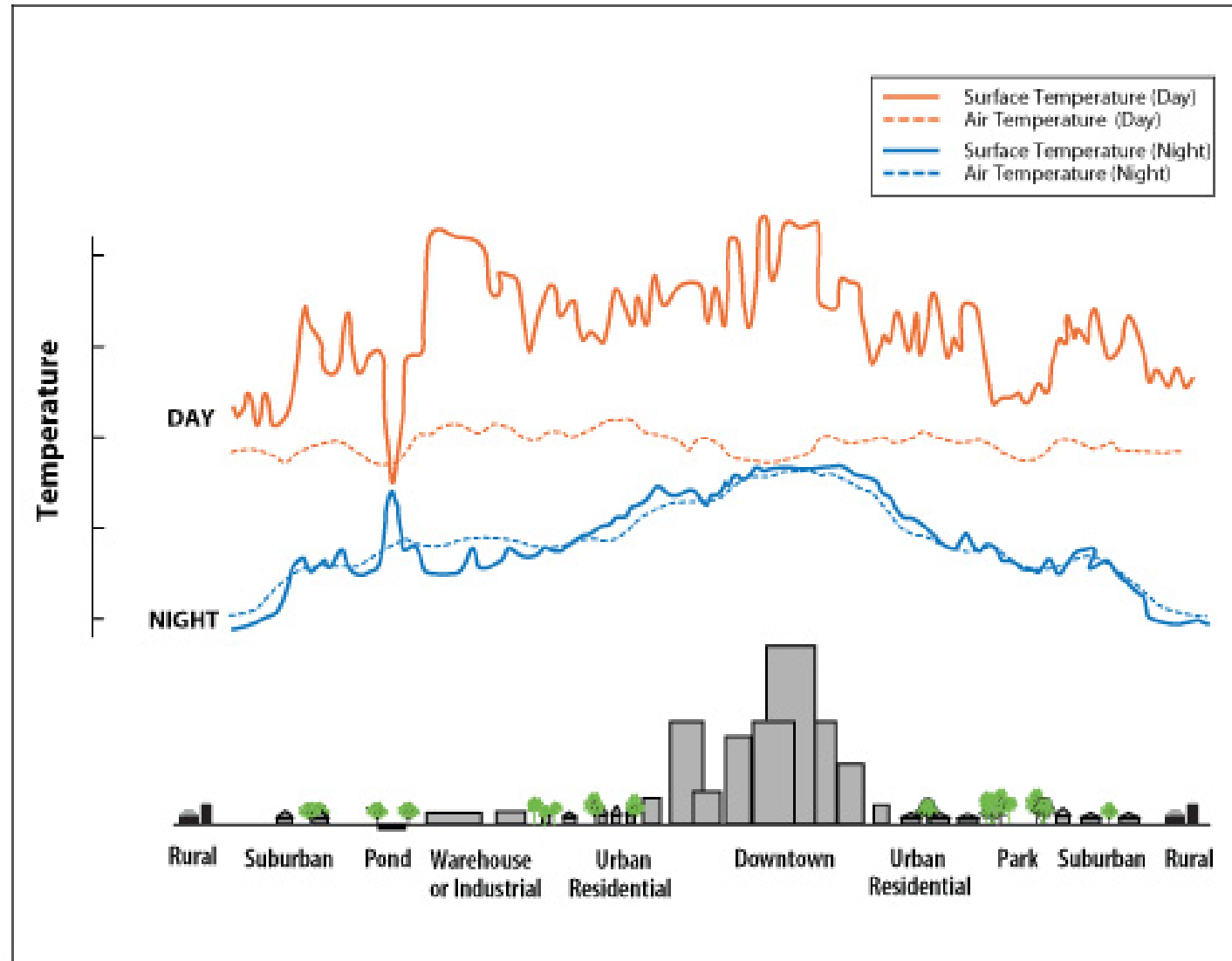
Source: Schmalz, 1977



Klimatooop concept

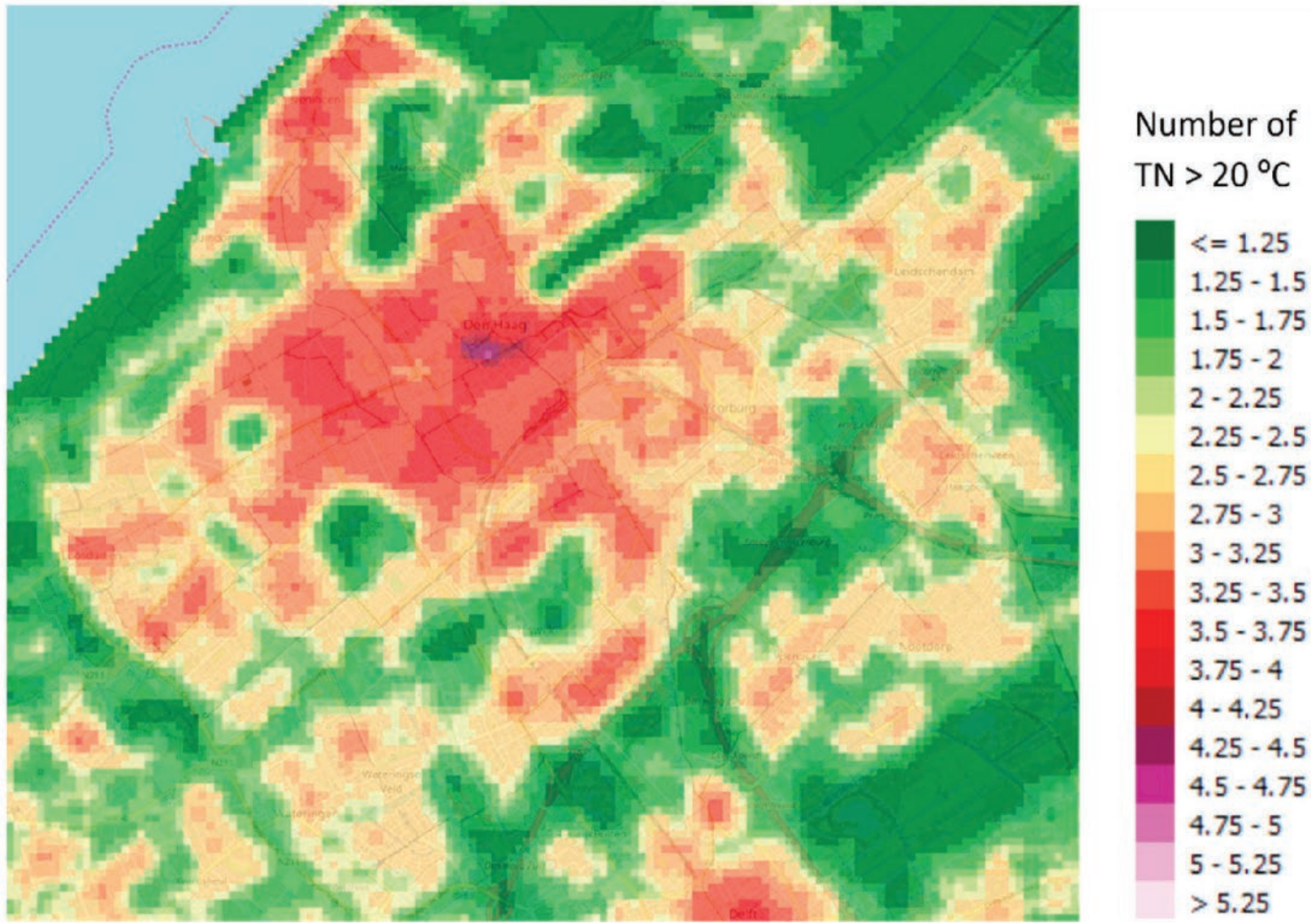


Temperaturen in de stad



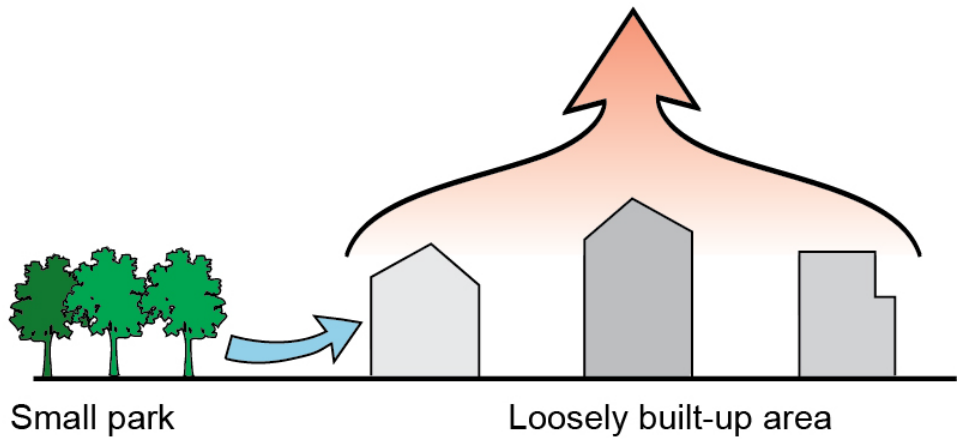
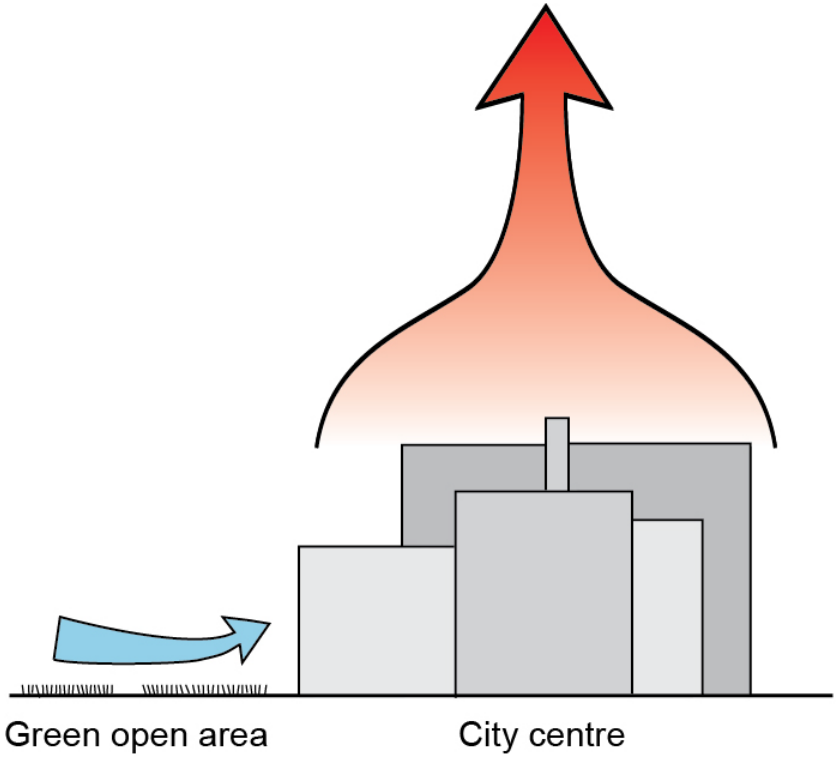
Source: lecture material Bert van Hove, Wageningen University

Urban heat islands

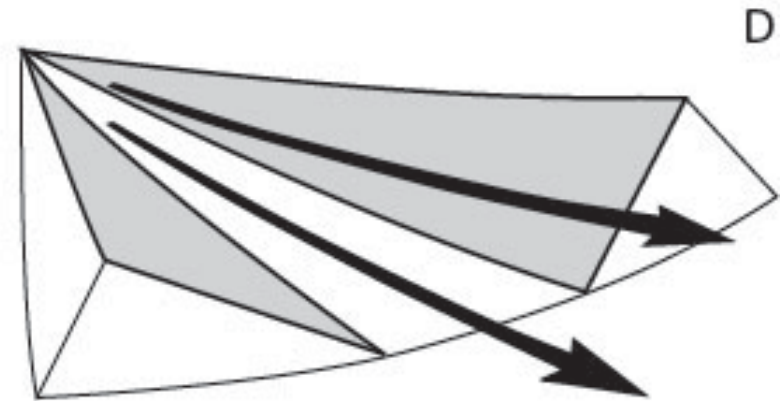
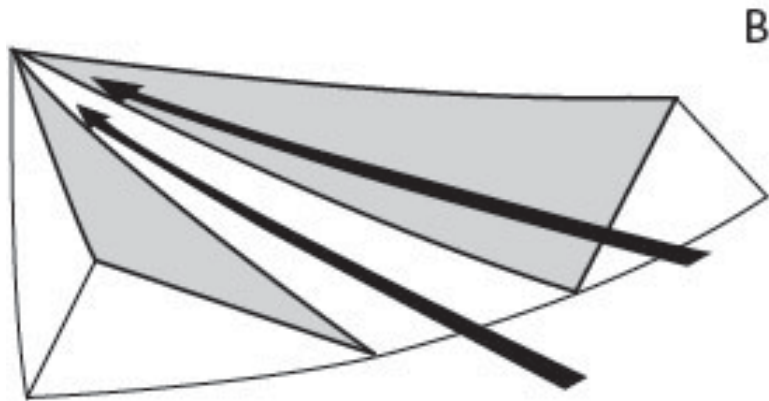
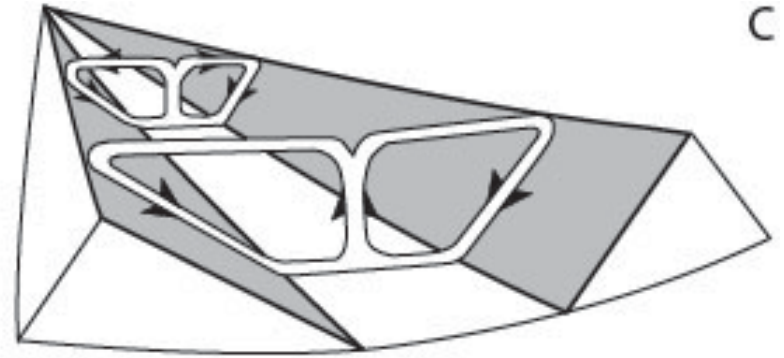
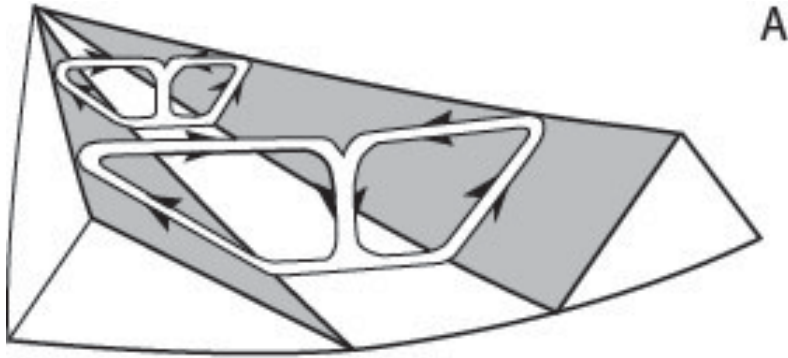


Source: Koopmans et al., Wageningen University

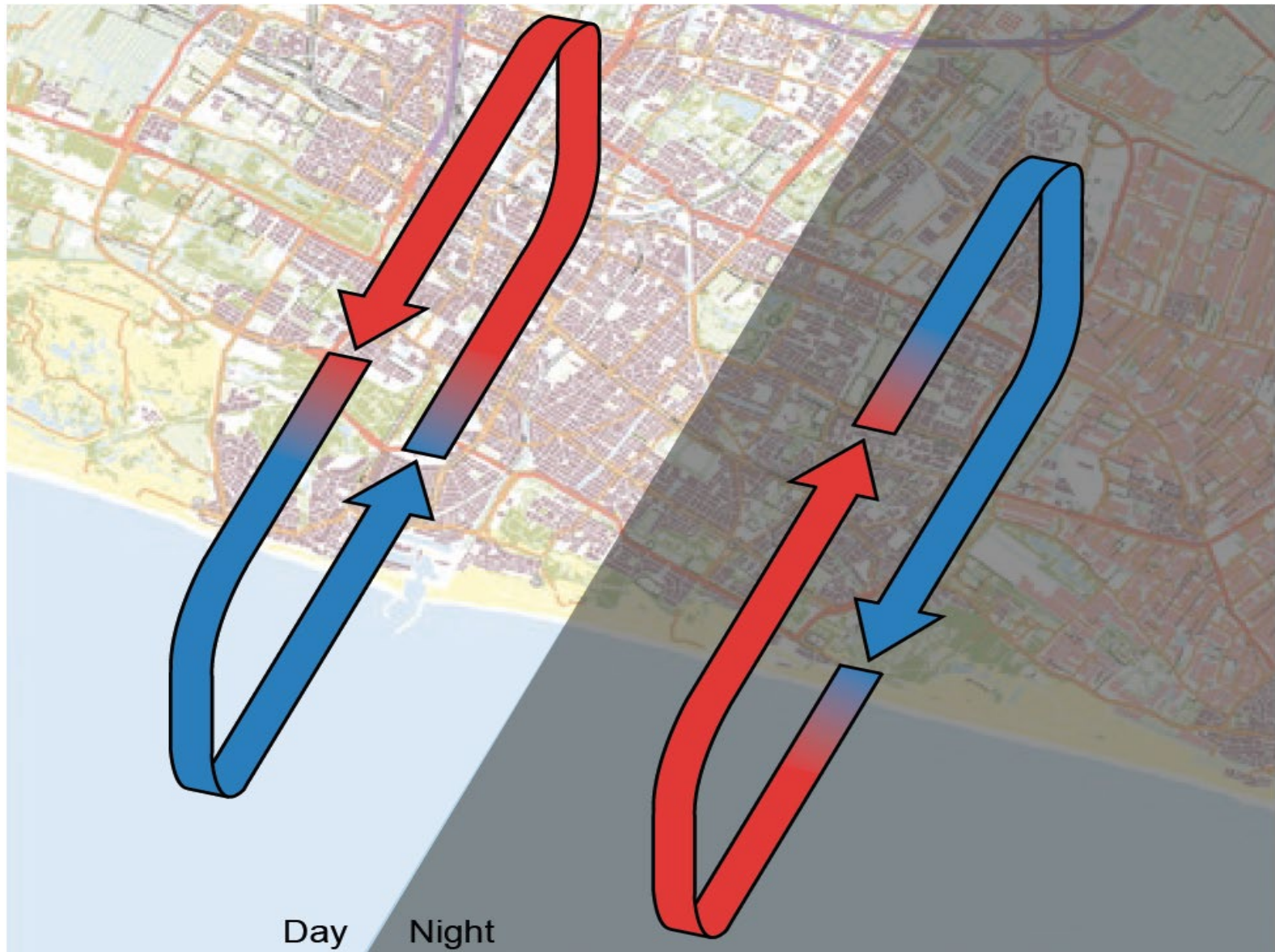
Lokale windsystemen door temperatuurverschillen



Dalwindssystemen

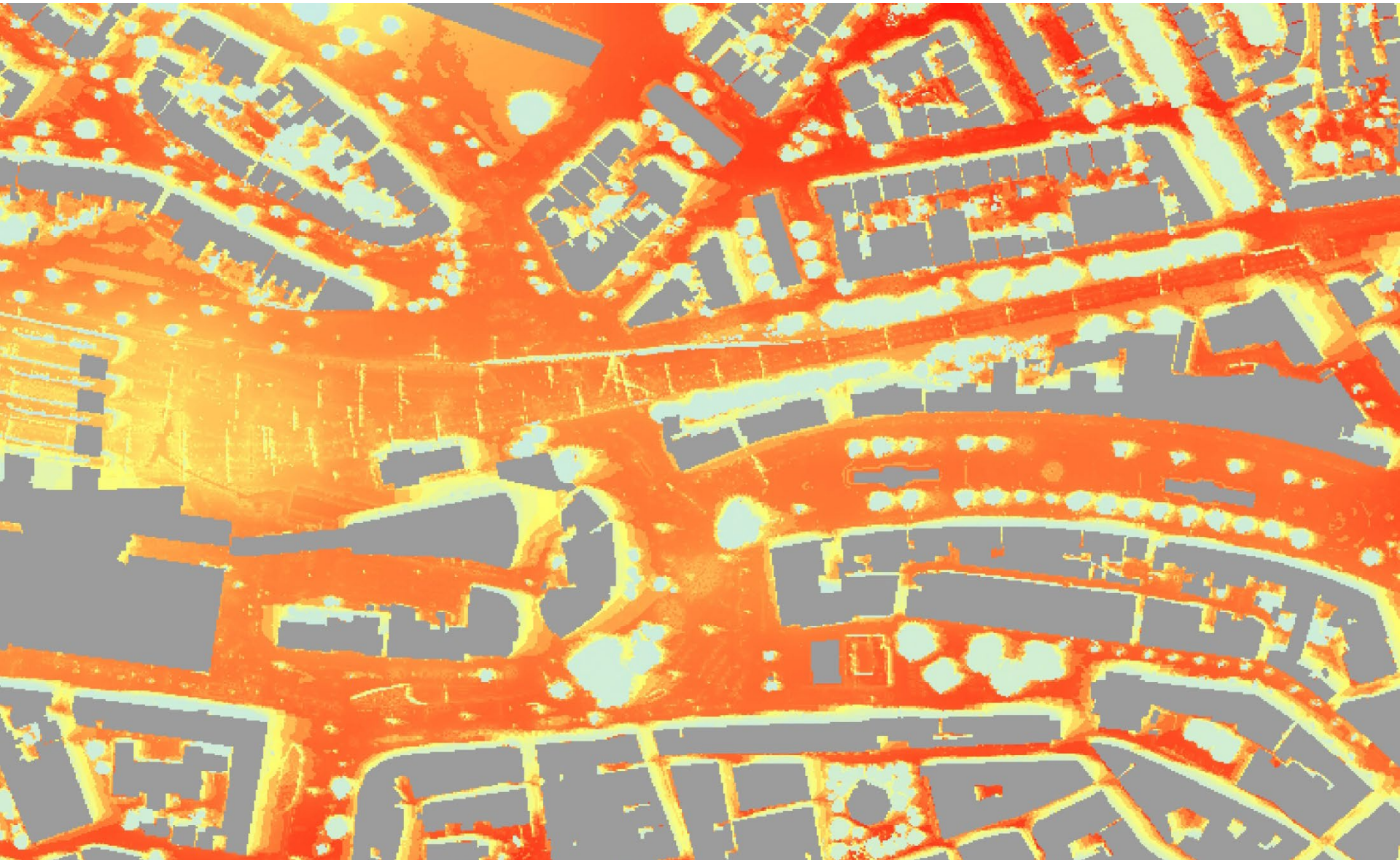


Kustwindsystemen

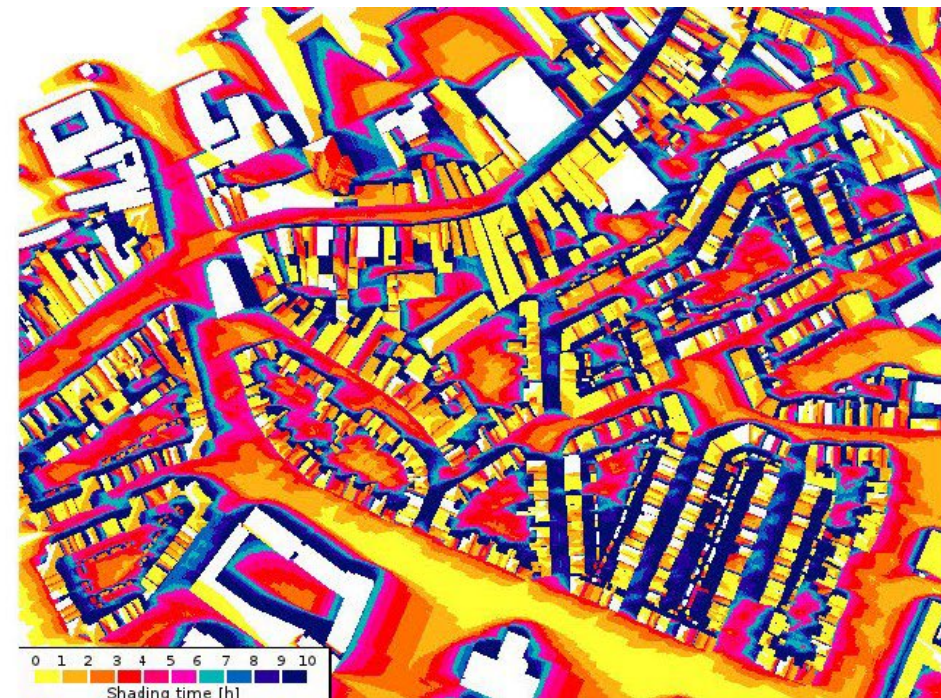
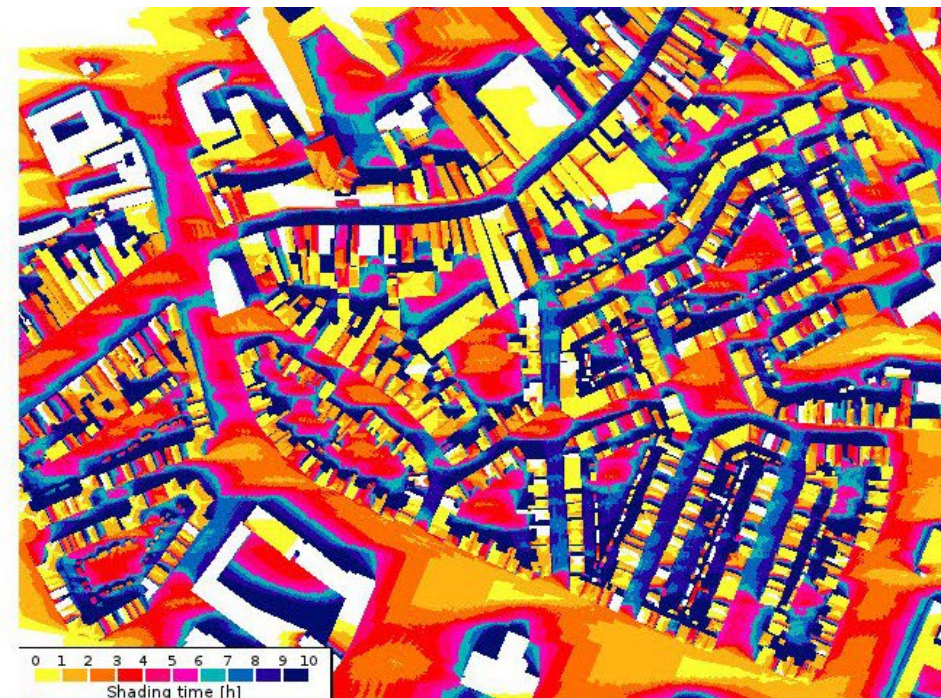
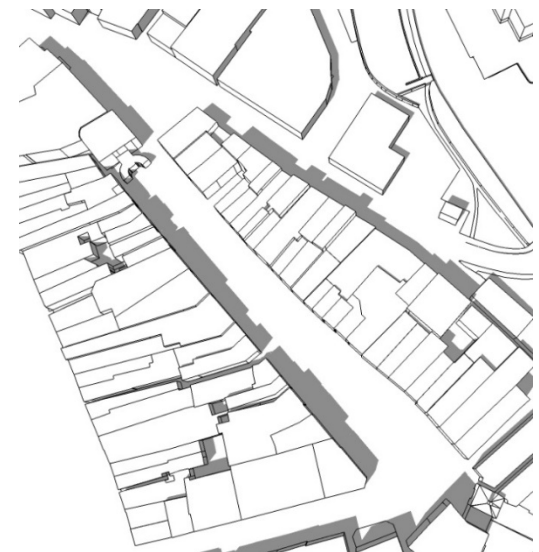


Voordat je gaat ontwerpen: begrijp de plek!

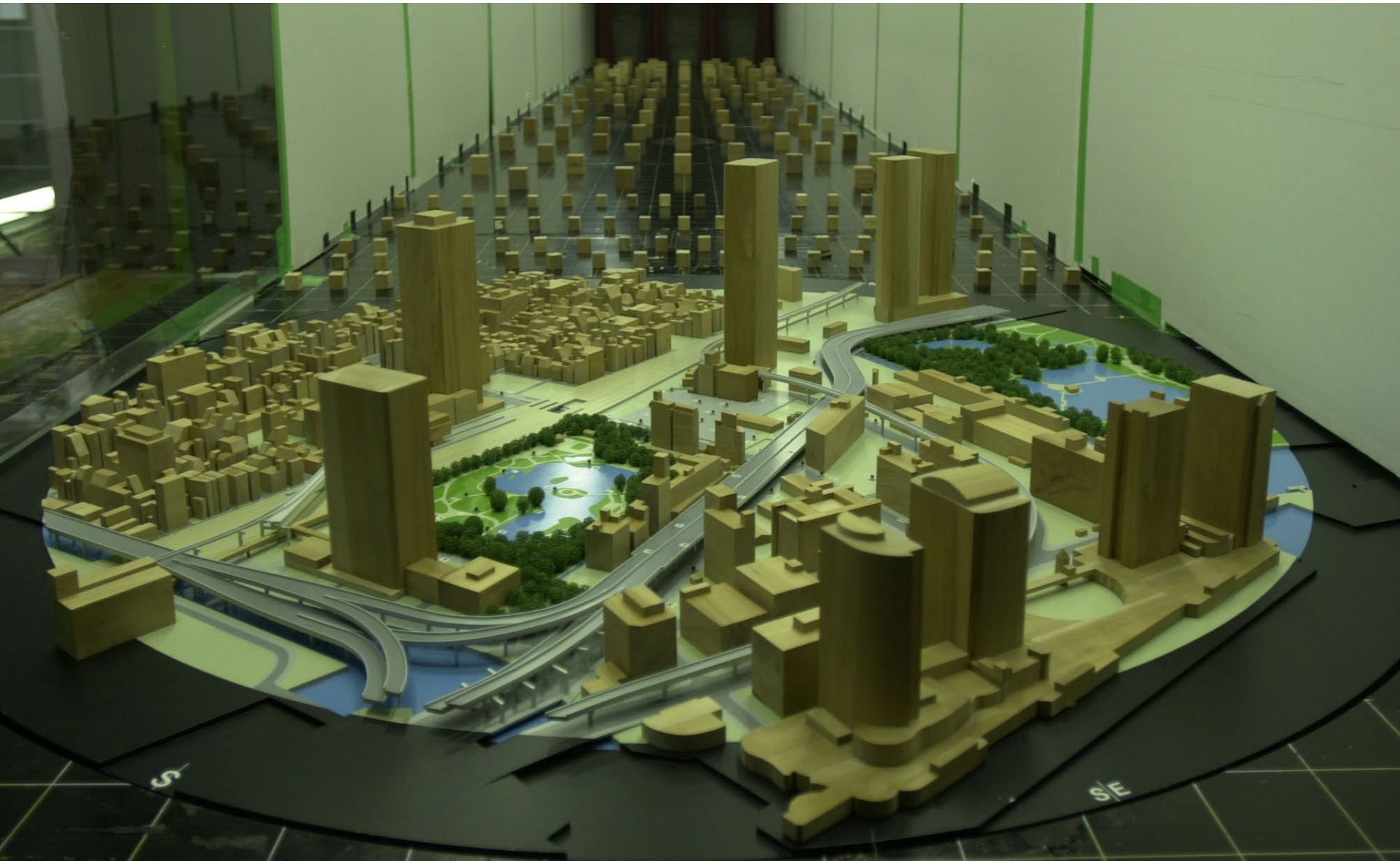
Expert simulatie: voorbeeld PET



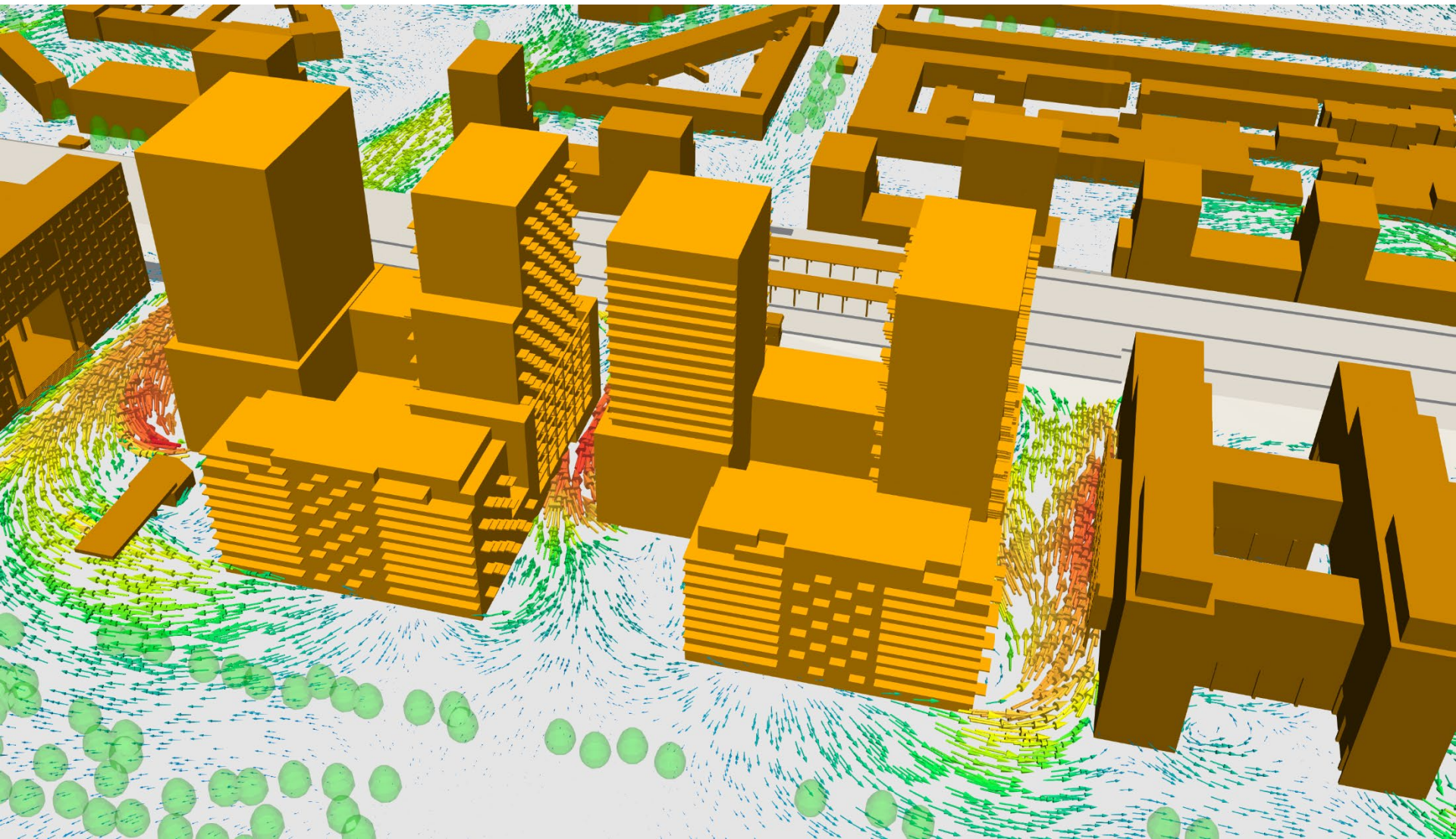
Analyse met 3D Vector software



Wind tunnel analyses

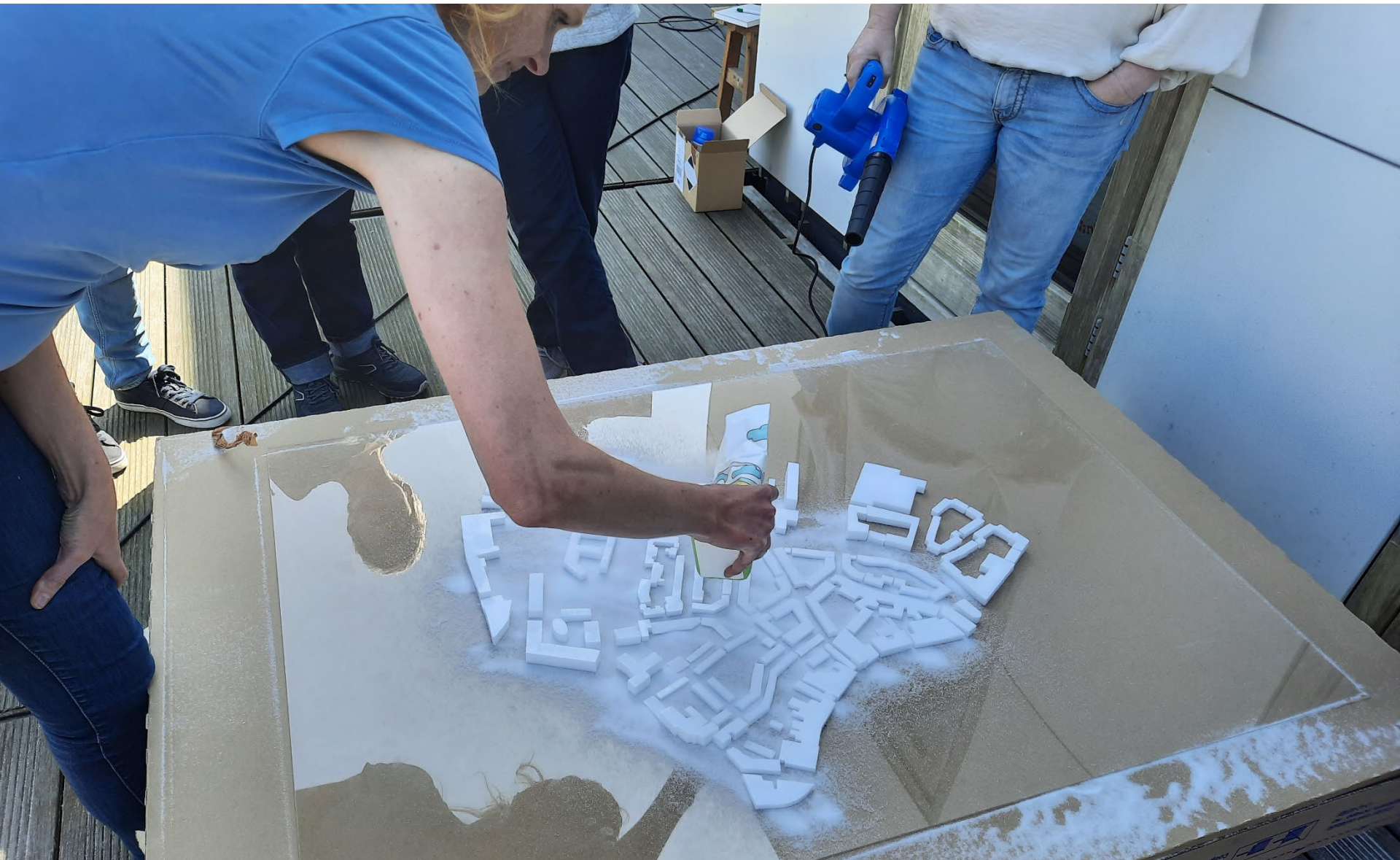


Wind simulates



Source: Peutz, 2023

Simple experimenten

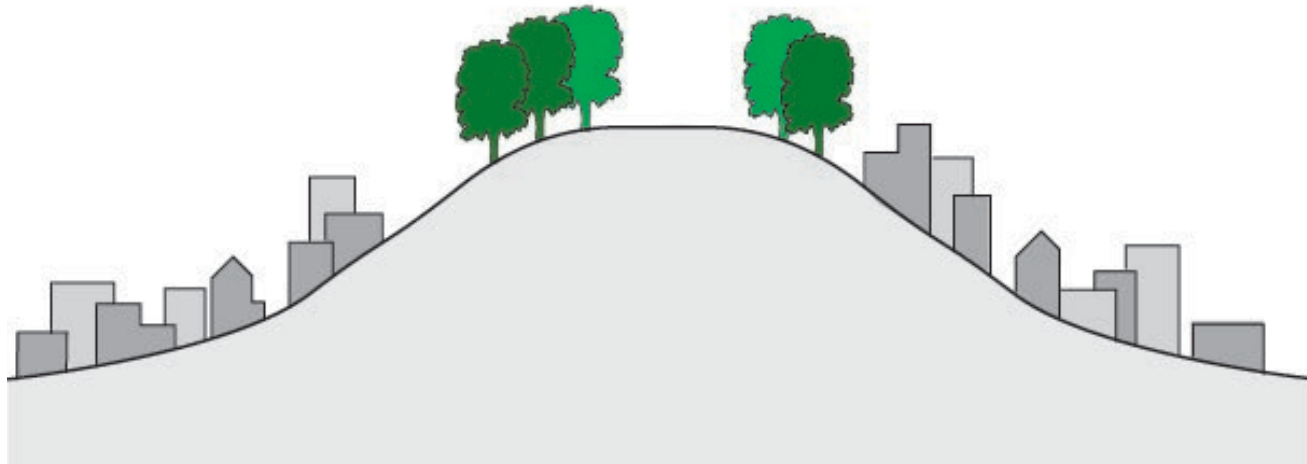
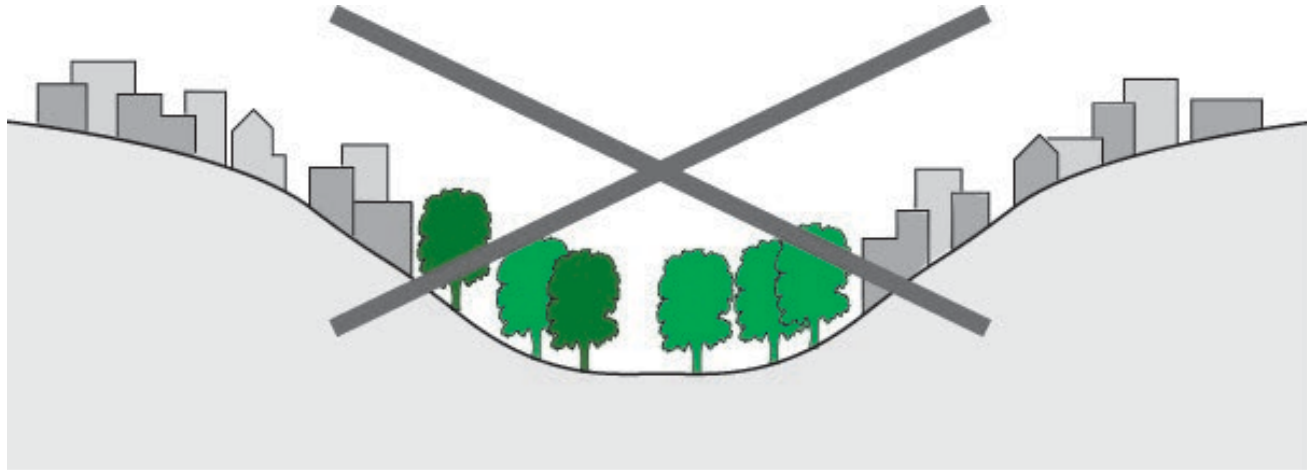


Simple experimenten

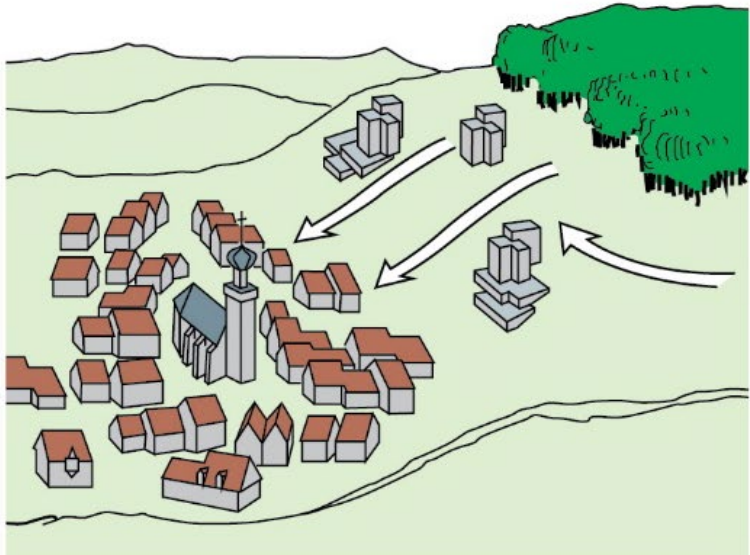
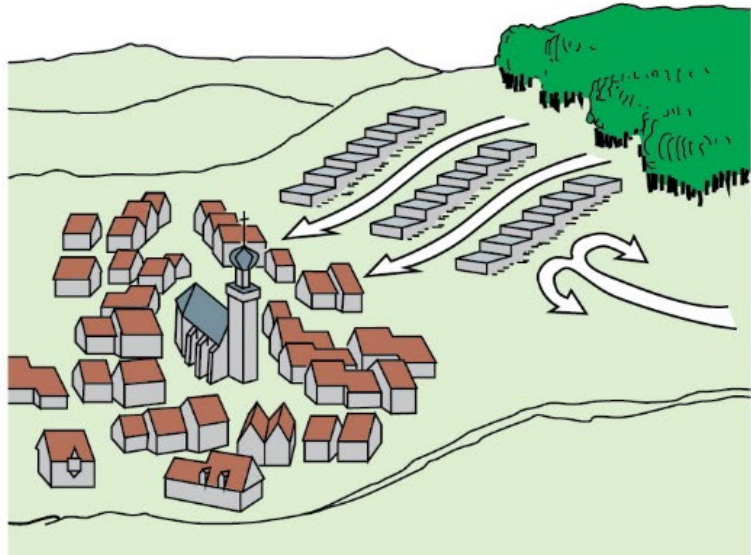
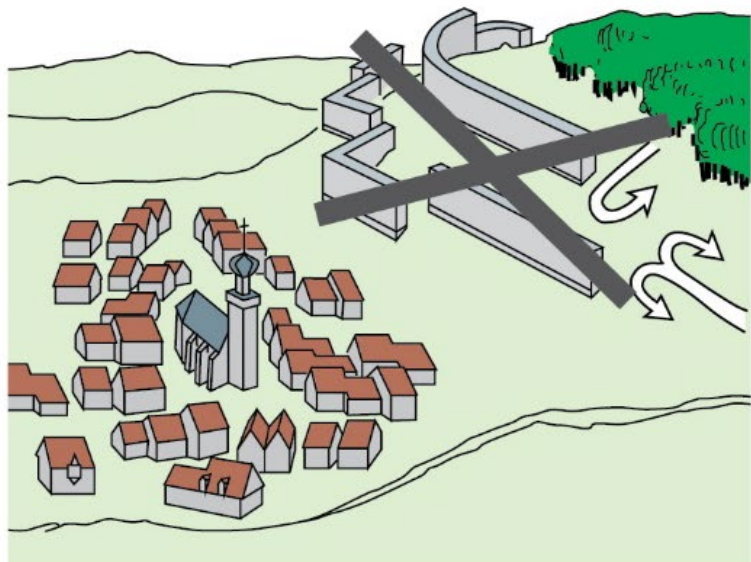


Planning op de grotere schaal

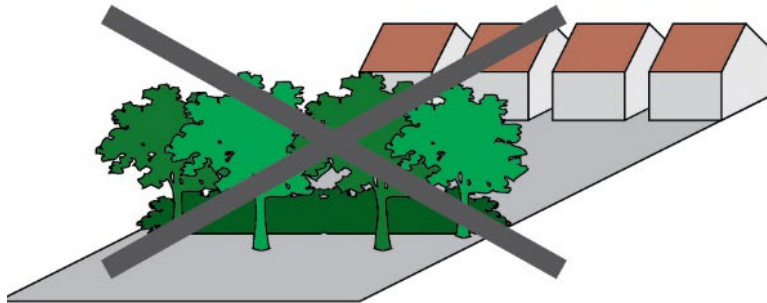
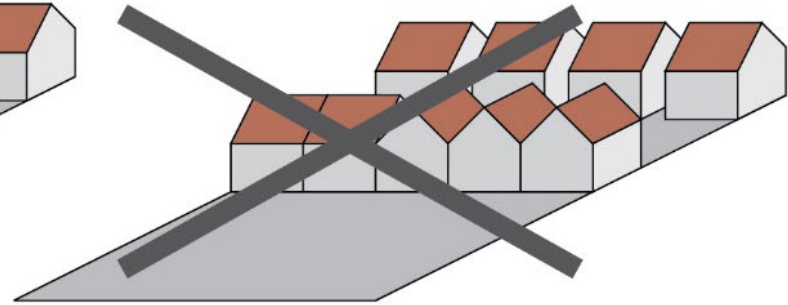
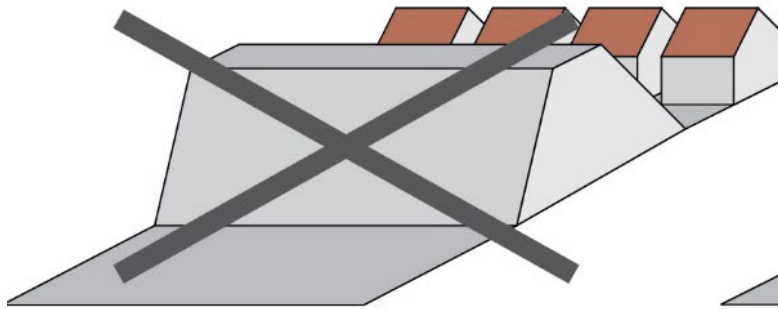
Dalwinden op de goede plek laten ontstaan



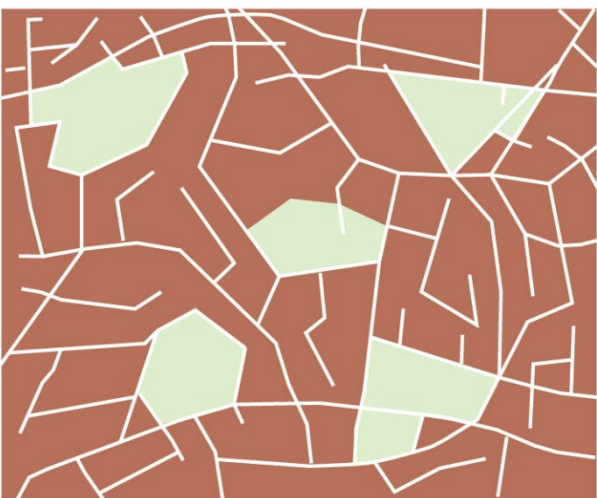
Dalwinden toelaten





Ventilatie ruimte tussen koel en warm gebied open houden



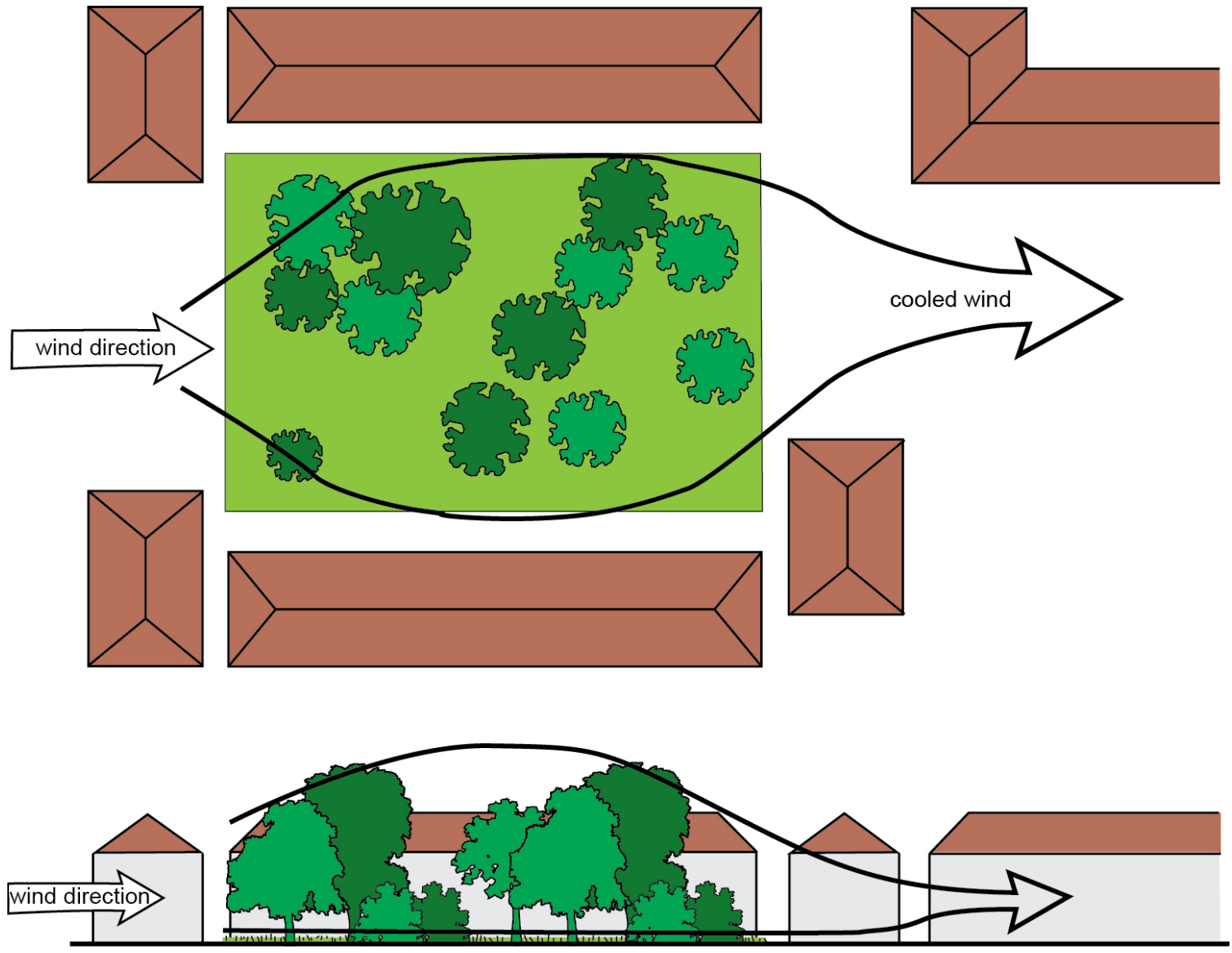
Ventilatie dmv raakvlakken van open en bebouwd gebied



 built-up area

 open area

Ventilatie uit koele parken naar bebouwde omgeving



Urban climate analysis Stuttgart

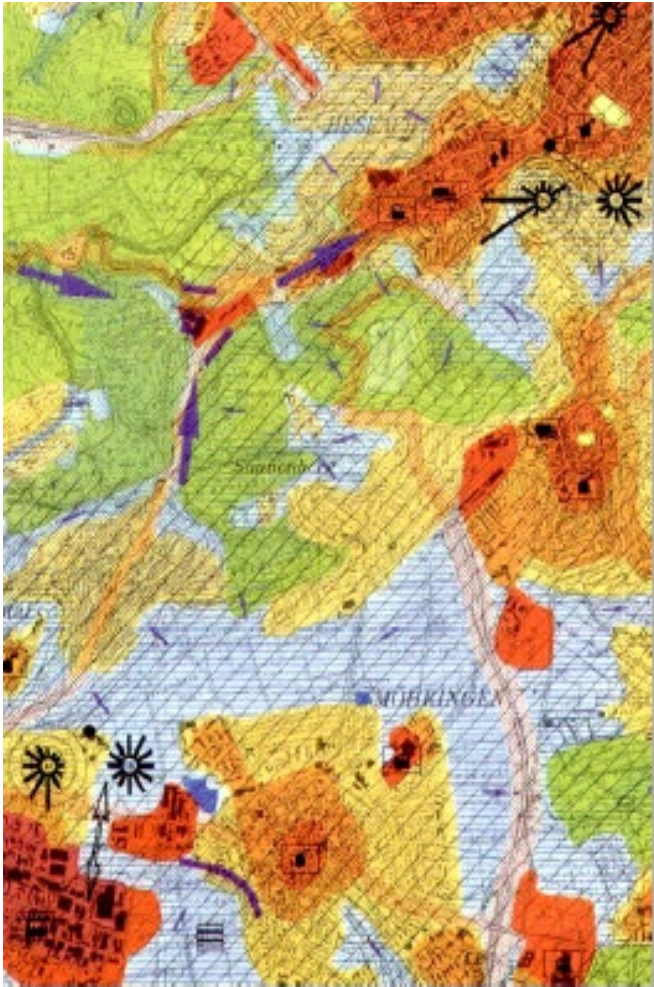


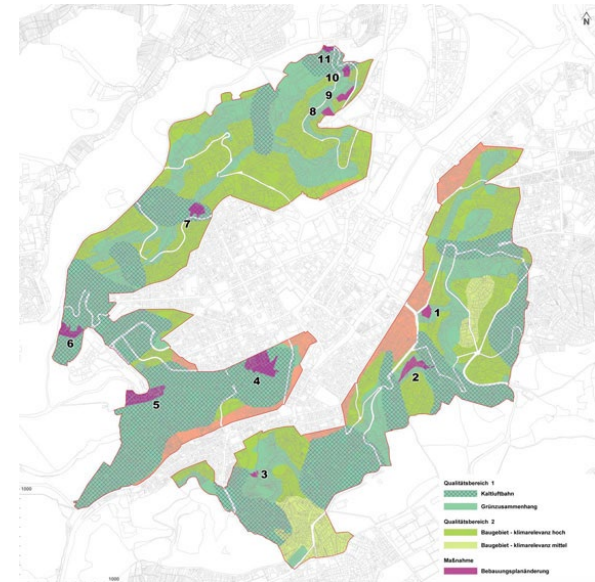
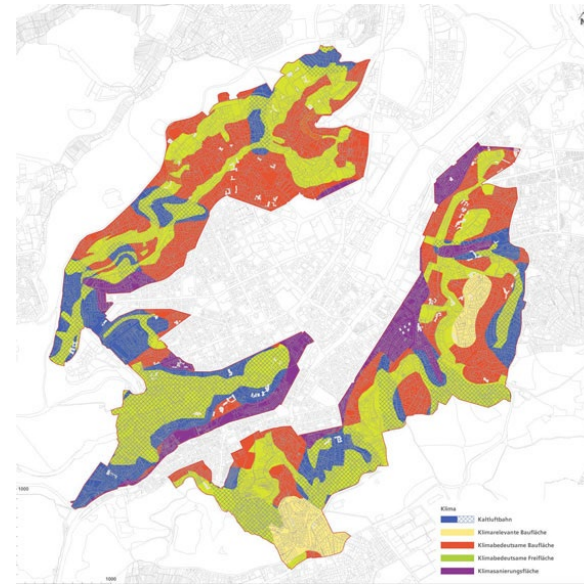
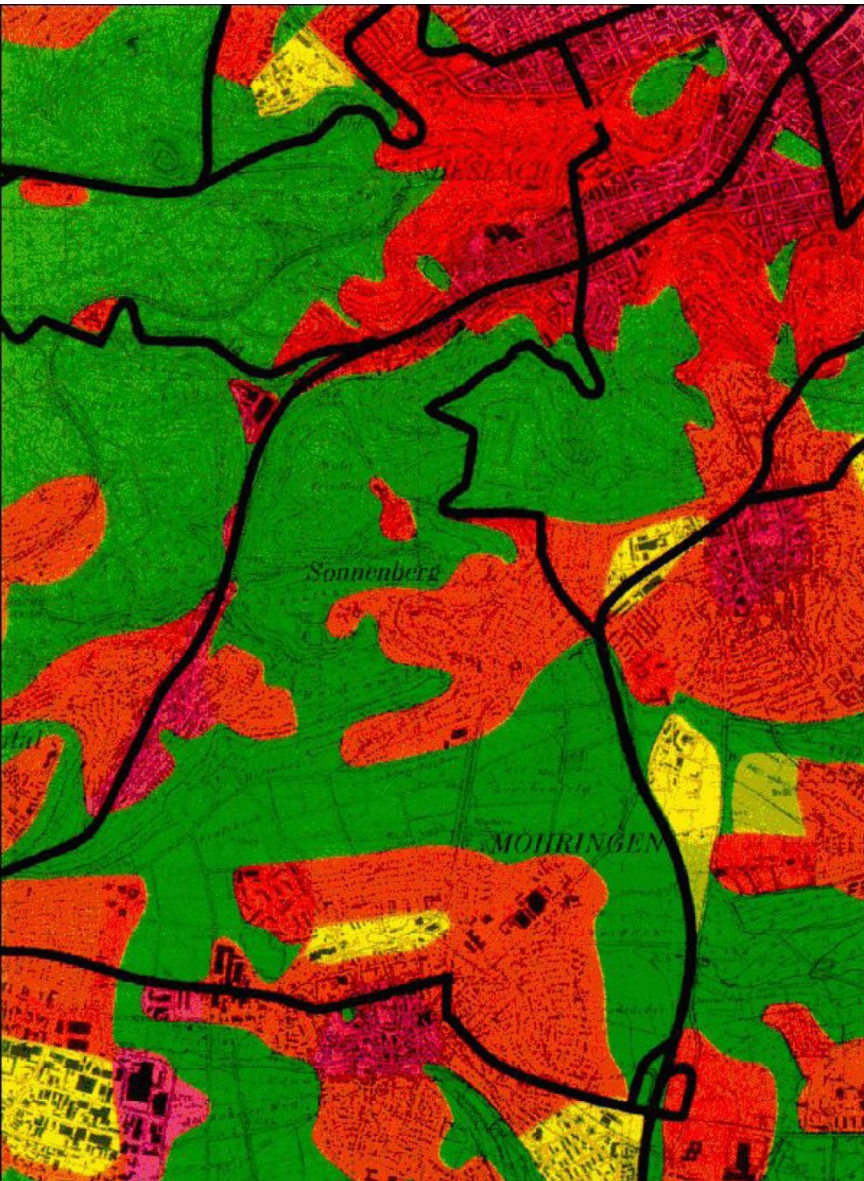
Figure 14: Example of a climate analysis map for Stuttgart city area (Source: Nachbarschaftsverband Stuttgart, 1992).

VDI 3787 Blatt 1/Part 1

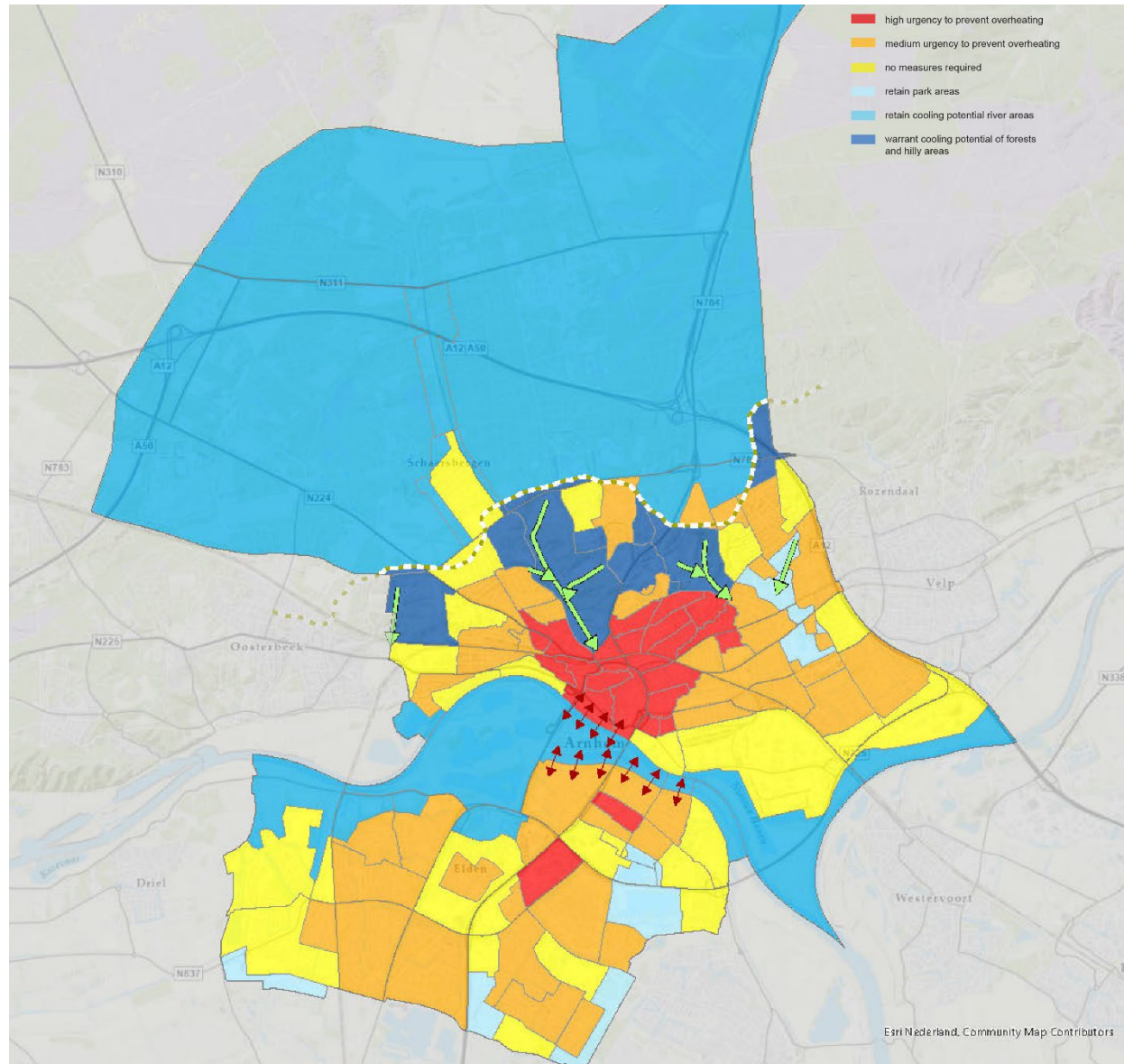
Symbols for climate and air pollution maps

CLIMATOTYPES /AEROTYPES		AIR EXCHANGE	
	Water bodies/lakes		Downslope wind, slight cold air drainage
	Open land		Downslope wind, medium cold air drainage
	Forest		Downslope wind, strong cold air drainage
	Open spaces in town centers		Mountain breeze system/valley breeze system
	Garden town/village		Air directing track (unpolluted)
	Suburban area		Air directing track (polluted)
	Agglomerated urban development		Air directing track (partially polluted/partially unpolluted)
	Town center		
	Business		
	Industry		
COLD AND WARM AIR AREAS		AIR POLLUTION	
	Cold air drainage area		Strong pollution
	Cold air catchment area		Medium pollution
	Stagnant cold air/cold air pools		Slight pollution
	Climate of the warm slope zone		No measured values
TRAFFIC EMISSIONS		PICTOGRAMS	
	Traffic loading (> 50000 vehicles per day)		Domestic fire emissions
	Traffic loading (> 30000 vehicles per day)		Traffic emissions
	Traffic loading (< 10000 vehicles per day)		Business emissions
			Industry emissions
			Loading from pollution
			Ground fog/valley fog
			Raised inversion
			Wind field change
			Wind rose
			Air pollution wind rose

Adaptation in urban planning, Stuttgart

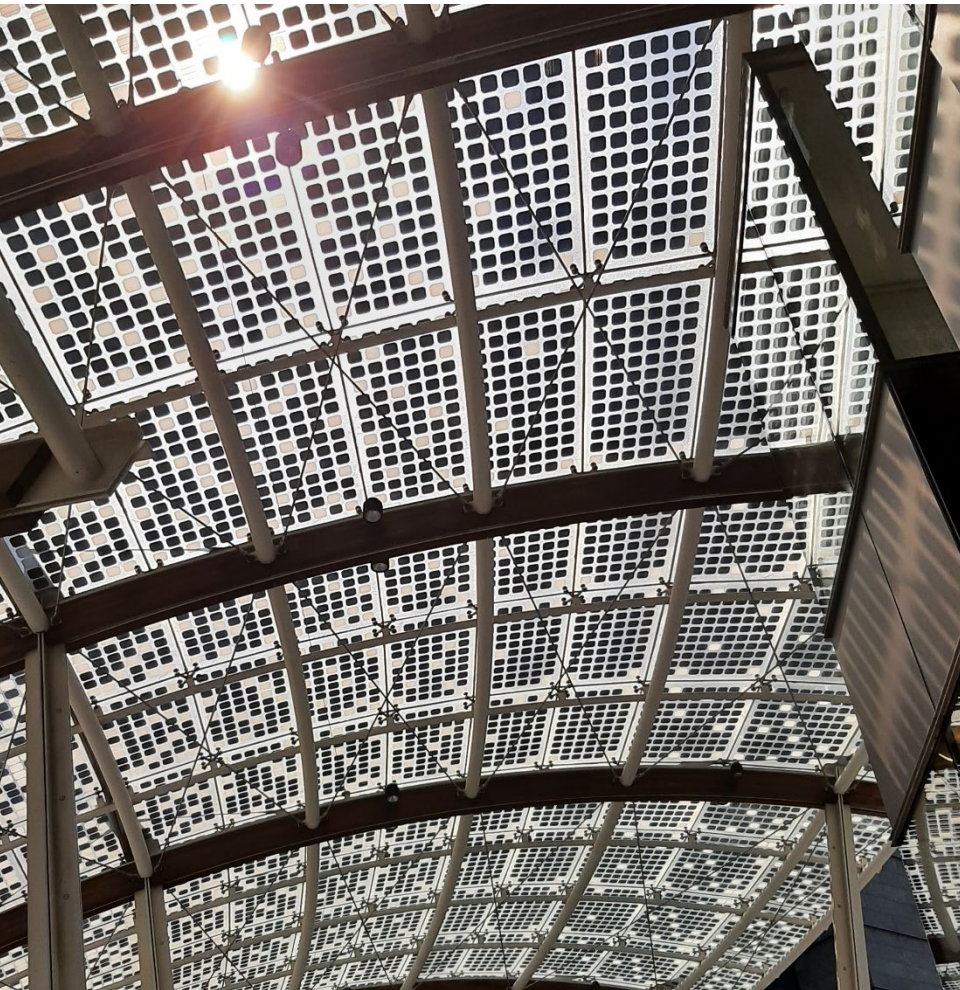


Adaptation in urban planning, Arnhem



Ontwerpen op de kleinere schaal

Schaduw creëren: vaste elementen



Effecten: directe kortgolvlige straling wordt volledig (voor 100%) opgevangen, alleen gereflecteerde kortgolvlige straling is voelbaar; langgolvlige straling kan worden vastgehouden; zonne-energie kan worden benut.

Schaduw creëren: flexibele elementen



Effecten: directe kortgolvlige straling wordt tot 100% tegengehouden, alleen gereflecteerde kortgolvlige straling is voelbaar; langgolvlige straling kan worden uitgezonden.

Materialen die minder energie opslaan en uitstralen



Effecten: de lage thermische massa van hout voorkomt opwarming van het gebouw en de omgeving; goede isolatie is nodig om de binnentemperatuur te reguleren.

Minder energie opslaan en uitstralen



Effecten: de oppervlaktetemperatuur kan tot 30°C worden verlaagd, de luchttemperatuur bij groene gevel kan op ca. een halve meter afstand met 3 tot 4°C worden verlaagd

Schaduw en verdampingskoeling genereren



Effecten: directe kortgolvlige straling geabsorbeerd en gereflecteerd door planten; straling die onder de plant verminderd wordt: tussen 50 en 70%

Schaduw en verdampingskoeling genereren



Effecten: directe kortgolvlige straling geabsorbeerd en gereflecteerd door planten; straling die onder de plant verminderd wordt: tussen 50 en 70%

Koelen met verdamping



Effecten: afhankelijk van de grootte van de fonteinen en de mate van verspreiding van de waterdeeltjes kan de afkoeling van de luchttemperatuur oplopen tot 5 °C.

Koelen met verdamping



Effecten: de oppervlaktetemperatuur kan met ten minste 15°C worden verlaagd ten opzichte van asfalt; verdamping door planten verlaagt de luchttemperatuur met maximaal 3°C .

Koelen met verdamping

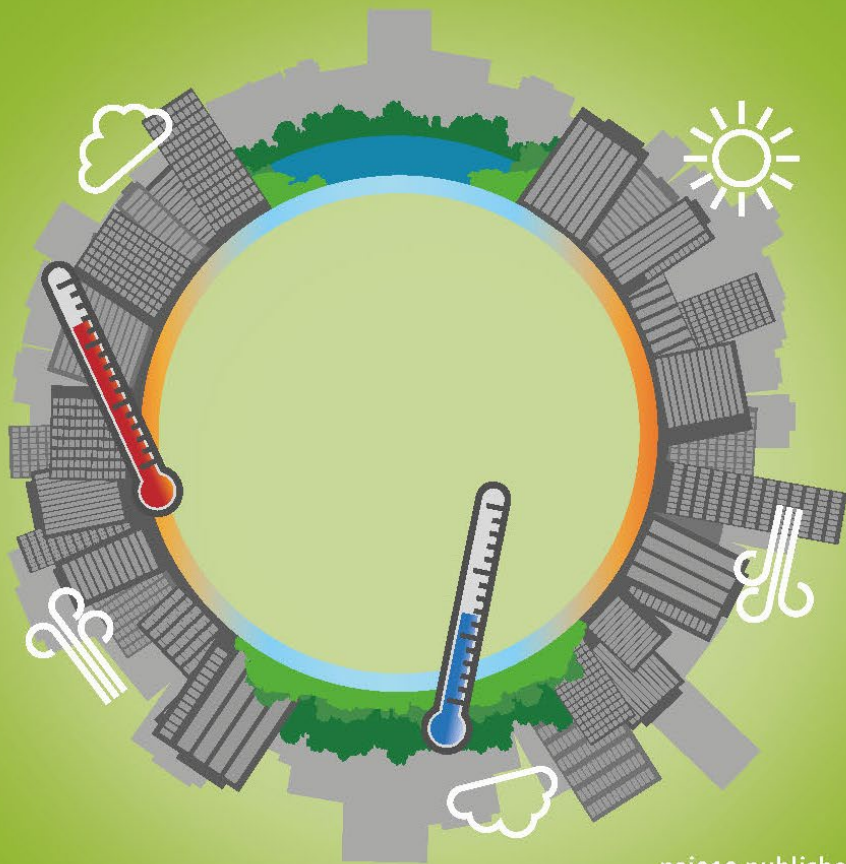


Effecten: de oppervlaktetemperatuur kan met maximaal 10 °C worden verlaagd; de luchttemperatuur wordt slechts in zeer geringe mate beïnvloed.

Sanda Lenzholzer

Weather in the City

How Design Shapes the Urban Climate



nai010 publishers

Meer weten?

Prof. Dr. Dipl. Ing. MA (AA) Sanda Lenzholzer
Full Professor, Chair Holder Landscape Architecture