

Energy Epidemiology: using building data to support energy and carbon policy in Latin America

23-25 April 2018, São Paulo, Brazil

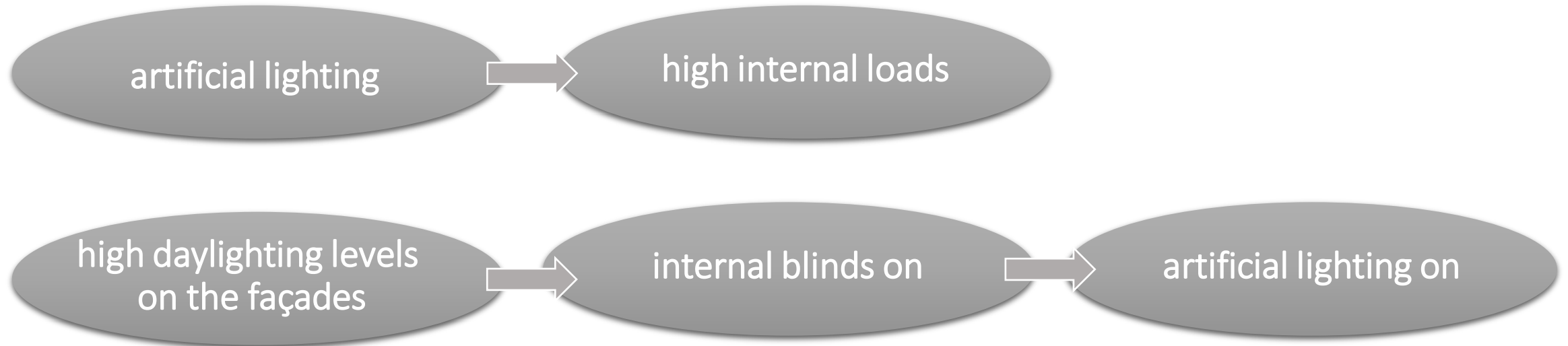
# Daylight Performance of Office Buildings in the City of São Paulo: a Climate-based Evaluation

Mônica Pereira Marcondes Cavaleri



## Motivations

- energy consumption reduction targets
- building use and operation
- architectural configuration
- climate change: temperature rise



## Objectives

- To analyse the daylight performance of a typical deep plan office building in São Paulo (2.100m<sup>2</sup>) built between 2005 and 2015, with and without external shading, through climate-based annual daylight simulations;
- To define the passive zone for daylight of a building model representative of those offices

## Method

Climate-based daylight modelling (CBDM)

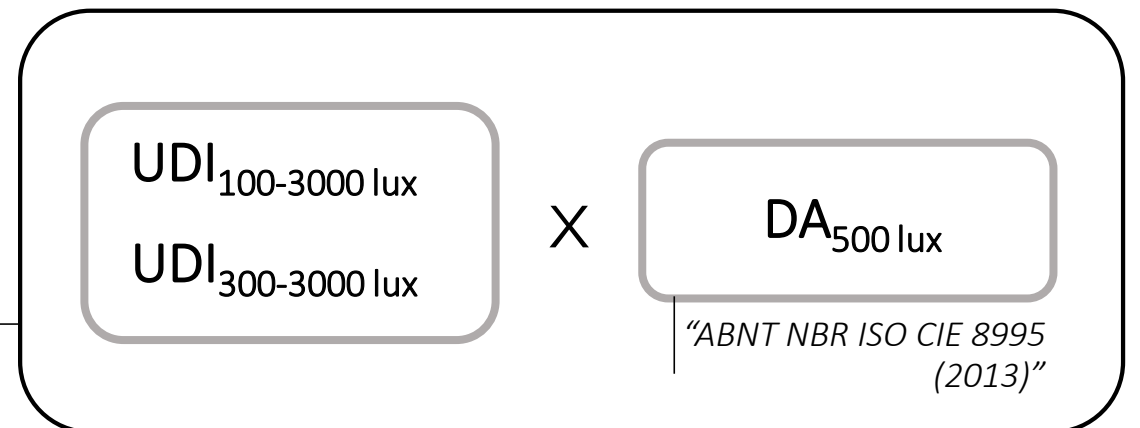
Hourly annual data on sun and sky conditions

Innovative for the local context

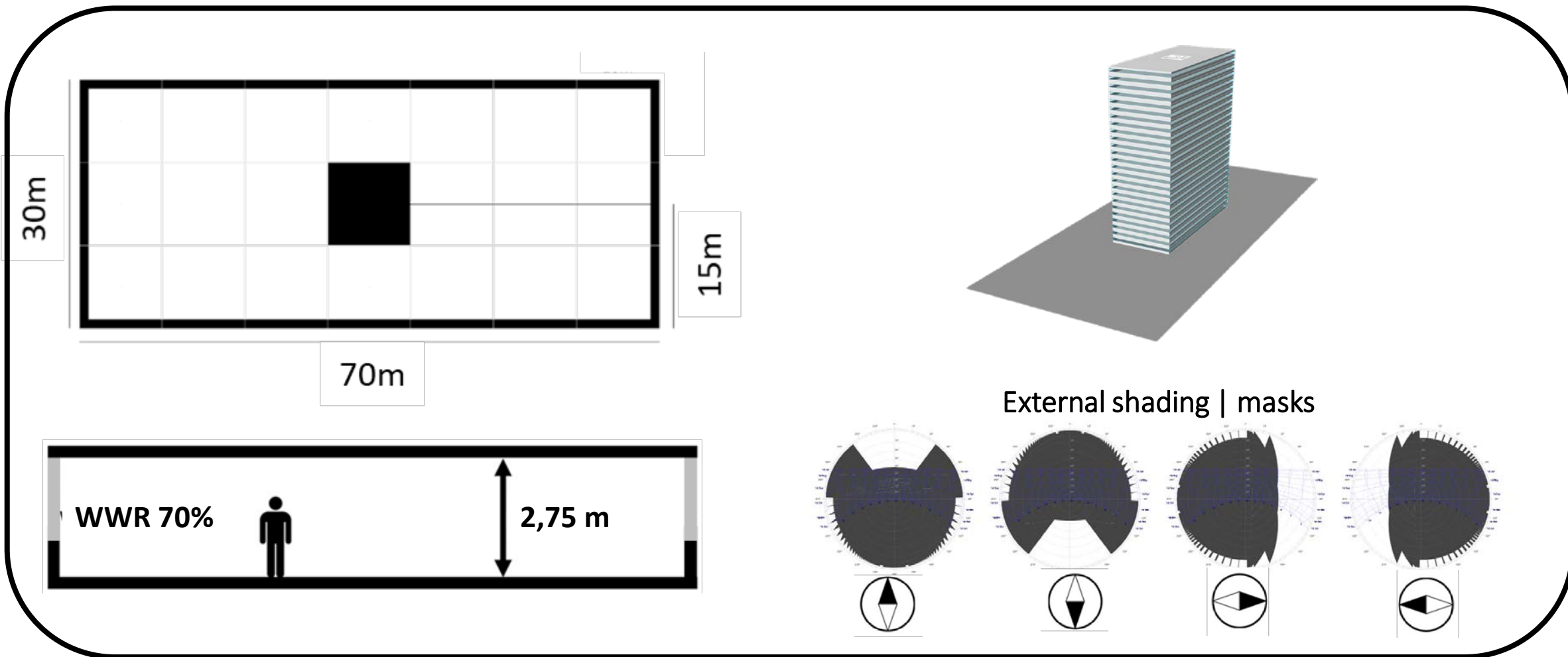
Rhinoceros v.5; Diva for Rhino v.4

### Simulations

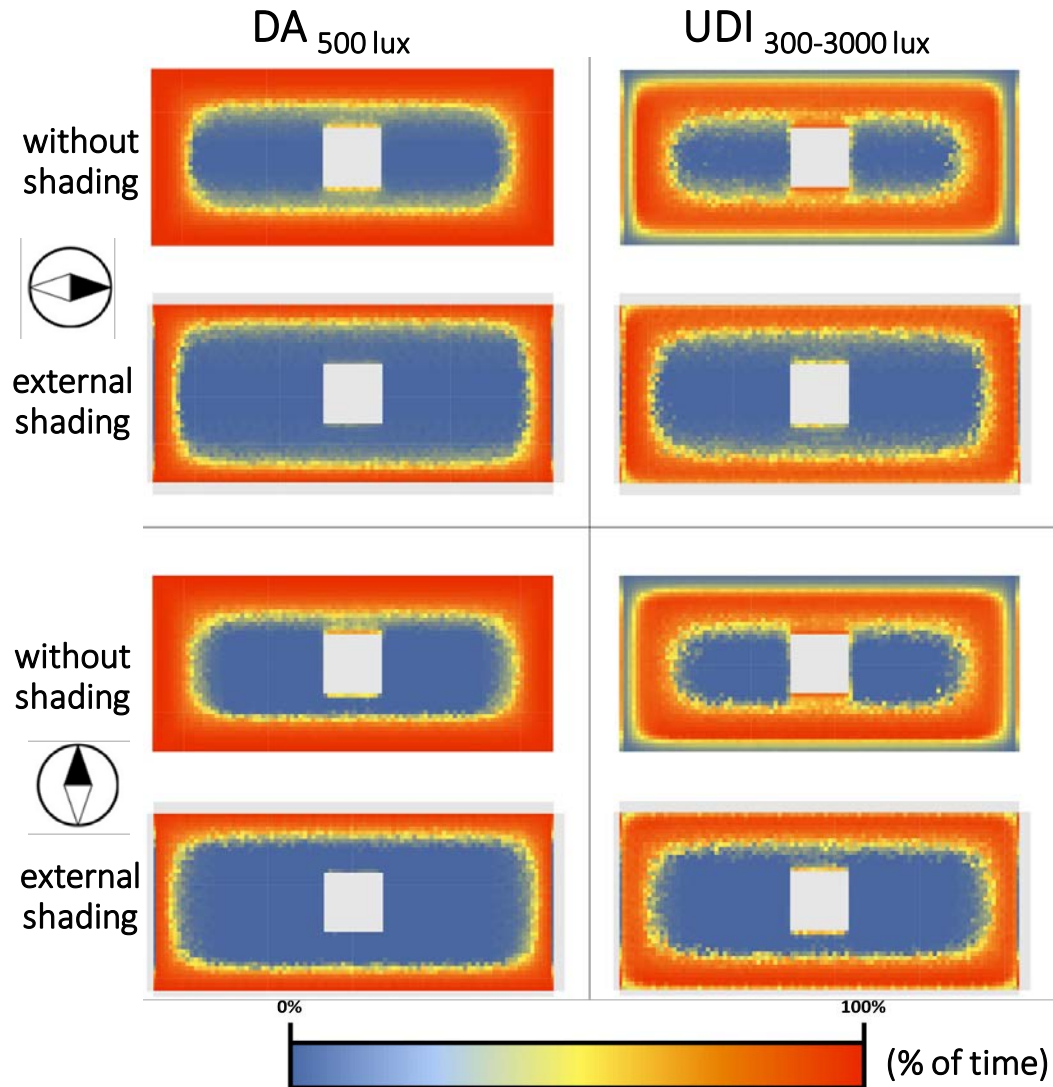
metrics | criteria: 75%







# Reference building model | Base case





## Results of the simulations



cases	UDI		DA <sub>500</sub>
 unshaded	100 – 3000 lux	50,2% of area	51,0% of area
	300 – 3.000 lux	39,5% of area	
	> 3.000 lux	11,3% of area	
 external shading	100 – 3000 lux	55,4% da área	27,6% of area
	300 – 3.000 lux	38,3% of area	
	> 3.000 lux	0,0% of area	
 unshaded	100 – 3000 lux	39,3% of area	50,2% of area
	300 – 3.000 lux	32,7% of area	
	> 3.000 lux	12,1% da área	
 external shading	100 – 3000 lux	44,3% of area	24,8% of area
	300 – 3.000 lux	35,3% of area	
	> 3.000 lux	0,0% of area	

Results with office plan area in accordance with at least 75% of evaluation criteria

Criteria	DAYLIGHT PASSIVE ZONE (distance from façade)			
	North face	South face	East face	West face
UDI <sub>300-3000</sub>	4,5 m	5,0 m	3,5 m	5,0 m
UDI <sub>100-3000</sub>	9,0 m	9,0 m	10,0 m	12,0 m

Criteria	Office plan area	
		
UDI <sub>300-3000</sub>	38,3%	35,3%
UDI <sub>100-3000</sub>	55,4%	44,3%

Performance criteria and results for cases with external shading

## Some findings...

- UDI vs. DA → UDI

The setting of a upper limit for illuminance levels can help to avoid glare and thermal discomfort

- It is difficult to comply with the 75% criteria
- External shading enabled for a drastic reduction of excessive illuminance levels, without compromising the access of the daylight on the entire floor plan (= use of internal blinds)
- (Ongoing work - "Integrated thermal-lighting simulations" )

Thermal and energy performance evaluation with dynamic controls for shading and lighting

**Preliminary results: reduction in the total annual energy consumption with external shading for all cases, up to 26,7% for the NE/SW orientation**

- The exploration of shading strategies and the design of external shading devices is encouraged

# Links with theme “User influence on performance”

Testing of different performance criteria for daylight

- Preferences of users
- Can inform the definition of performance criteria for regulations
- Energy consumption will vary accordingly

Increased daylight performance

- reduction in the need for artificial lighting
- If lighting system is efficiently operated...
- reduction in energy consumption for lighting
  - reduction in internal thermal loads
  - Reduction in energy consumption for cooling

Identification of the passive zone for daylight

- Can inform different lighting strategies for different regions of the floor plate