

STUDY OF HEAT ISLAND PHENOMENON IN ANDEAN COLOMBIAN TROPICAL CITY. CASE OF STUDY: MANIZALES- COLOMBIA

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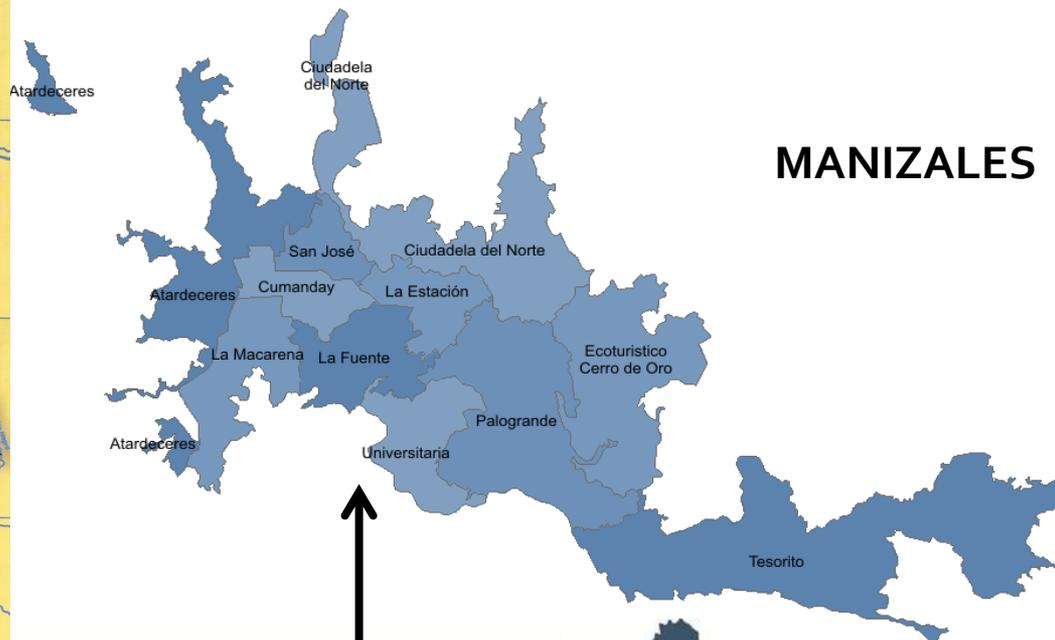
CALDAS – STATE



COLOMBIA MAPA POLITICO

- Límites internacionales
- Límites división política interna
- Capital nacional
- Capitales departamentales
- Poblaciones más importantes

Escala
0 100 200 Km

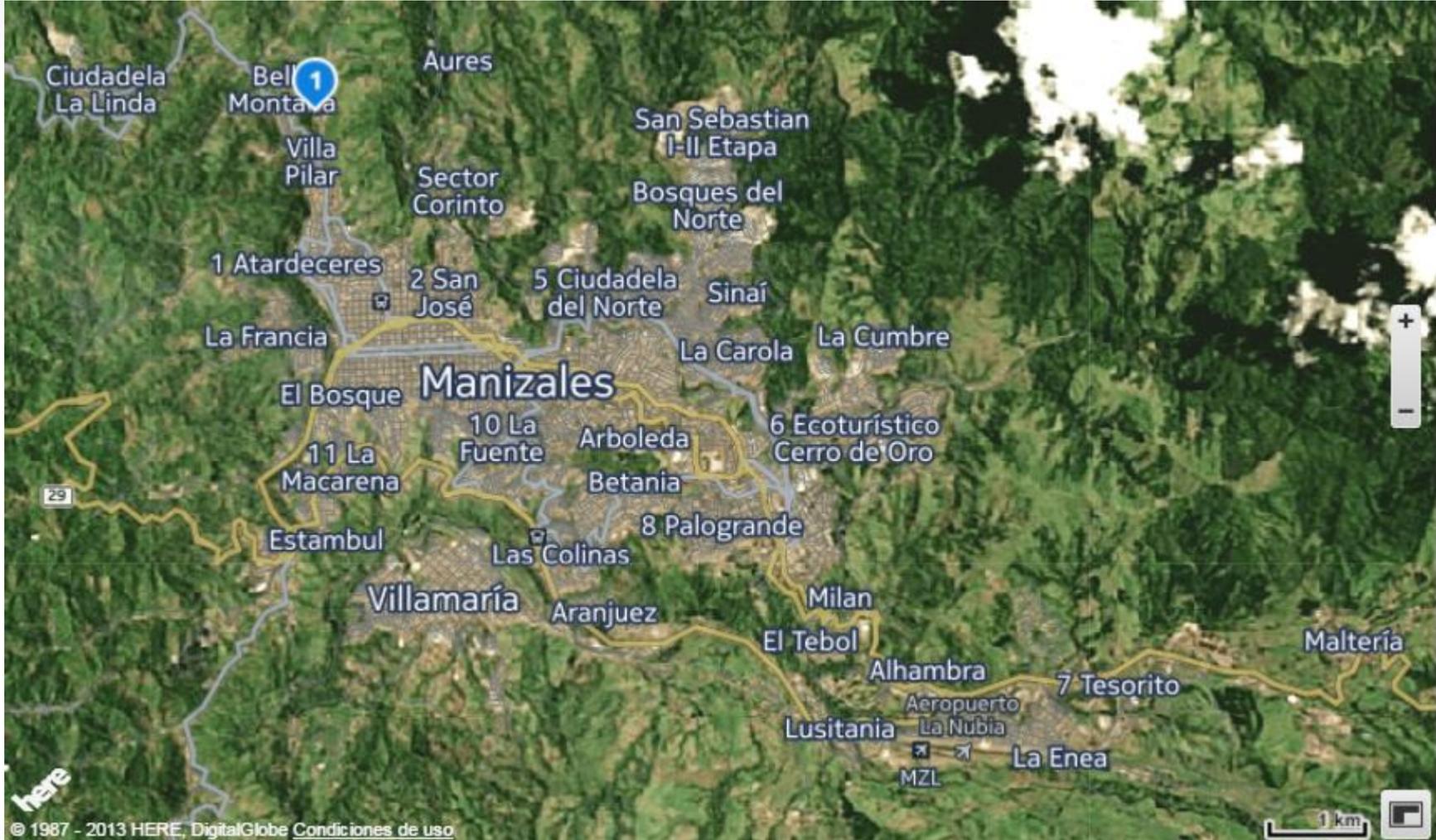


MANIZALES



CALDAS

MANIZALES - COLOMBIA



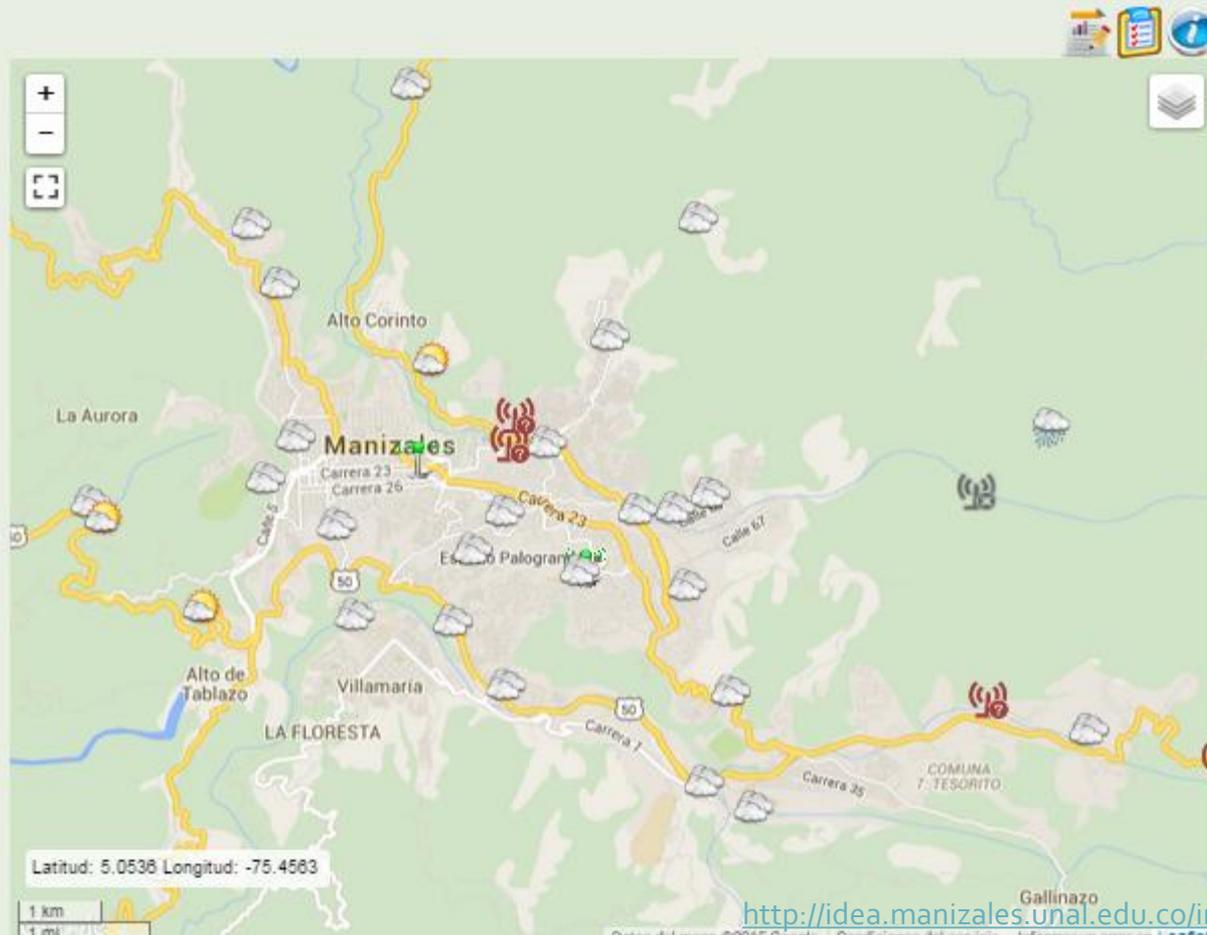
Precipitation: 1600 – 2000 mm per year
Temperature: 12 – 16 °C per year

431.563 habitants for 2014
Altitude average: 2150 m

<http://www.mapas.com.co/VisorMPC2013/spring/visor>

Estado del tiempo en la ciudad de Manizales

Datos meteorológicos e hidrometeorológicos en tiempo real registrados por treinta y seis (36) estaciones ubicadas en puntos estratégicos de la ciudad de Manizales. Para mayor información de cada estación haga clic sobre los íconos. La información en Tiempo Real se encuentra sujeta a verificación, ¡Léase con cuidado!



Estado del tiempo	CONVENCIONES Nivel de alarmas	Otras estaciones y estados
Día despejado	Alarma normal	Estación repetidora
Día parcialmente nublado	Alarma amarilla	Estación central / Estación alerta
Día nublado	Alarma naranja	Estación con funcionamiento parcial
Día con lluvia	Alarma roja	Estación temporalmente fuera de servicio
Noche Nublada	Alarma desconectada	Estación sin conexión a la base de datos
Noche con lluvia		



JUSTIFICATION

- The continuous population growth of Colombian cities, is necessary to study this climatic phenomenon in other cities like Manizales (was studied in Bogotá), to know if in this city exists the presence of heat island, or if instead, the influence of their geomorphological characteristics, dissipate the accumulation of environmental temperature and therefore, we would find the absence of the urban heat island.



TERMAL TRANSECT

Point	Name	Ubication	Altitude m.s.n.m
1	La Linda	Rural	2017
2	C Villapilar	Urban	2128
3	A.Terminal	Urban	2149
4	A. París	Urban	2122
5	Fundadores	Urban	2156
6	C. Manizales	Urban	2148
7	Plaza 51	Urban	2180
8	El Triángulo	Urban	2173
9	U. Católica	Urban	2192
10	(El Cable)	Urban	2203
11	Il Forno	Urban	2244
12	Niza	Urban	2232
13	Cerro de Oro	Rural	2306



- Route Cerro de Oro – La Linda and La Linda – Cerro de Oro
- 19 to 21 hours
- Every one minute we take the data by five minutes in each sampling point.
- Correction altitude (Stewart, 2013; Franco, 2013)

METODOLOGY

CONSTRUCTION OF THERMAL MAPS

- Climate modeling with we obtained an isotherm map, also we built a thermal map that describe the temperature behavior in the city.
- Wind map to contrast the sampling temperature with sampling wind speed

UHI INTENSITY

T °C rural station average
(Cerro de Oro)

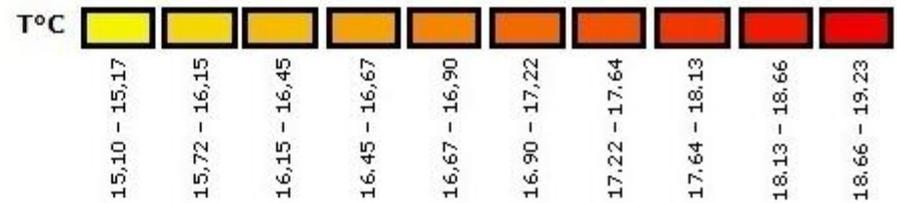
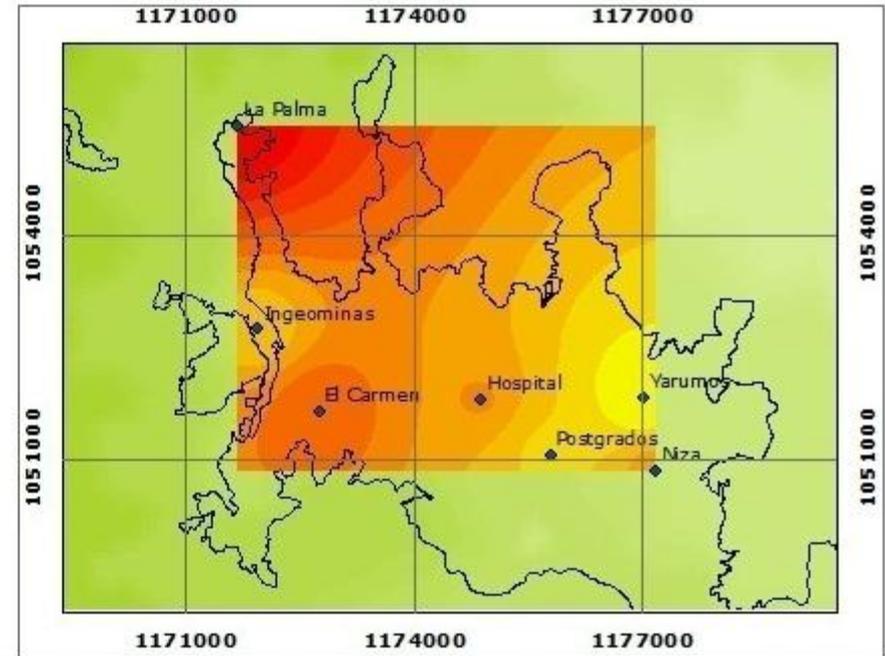
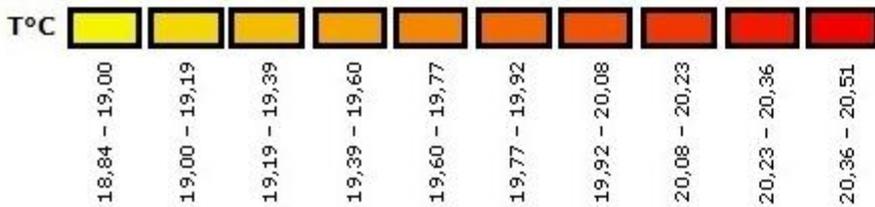
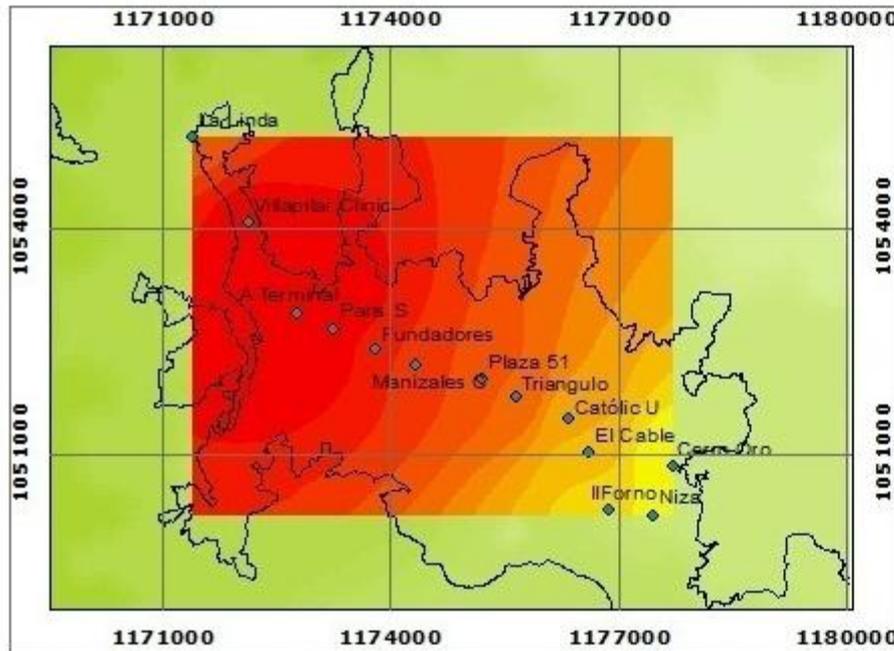


T °C urban center station
average (Fundadores)

TEMPERATURE TREND ANALYSIS

- Temperature network of stations of the Environmental Studies Institute IDEA contrasting it with temperature data of the night tour.

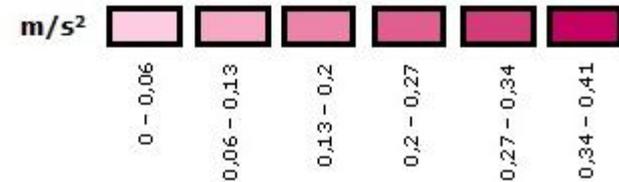
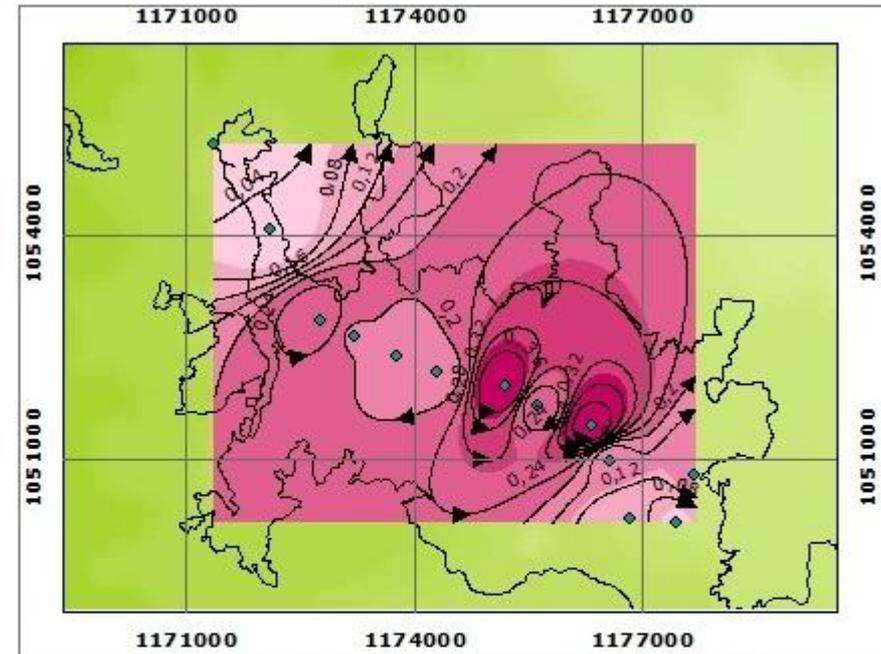
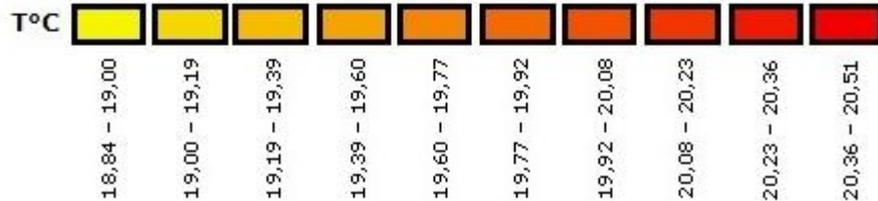
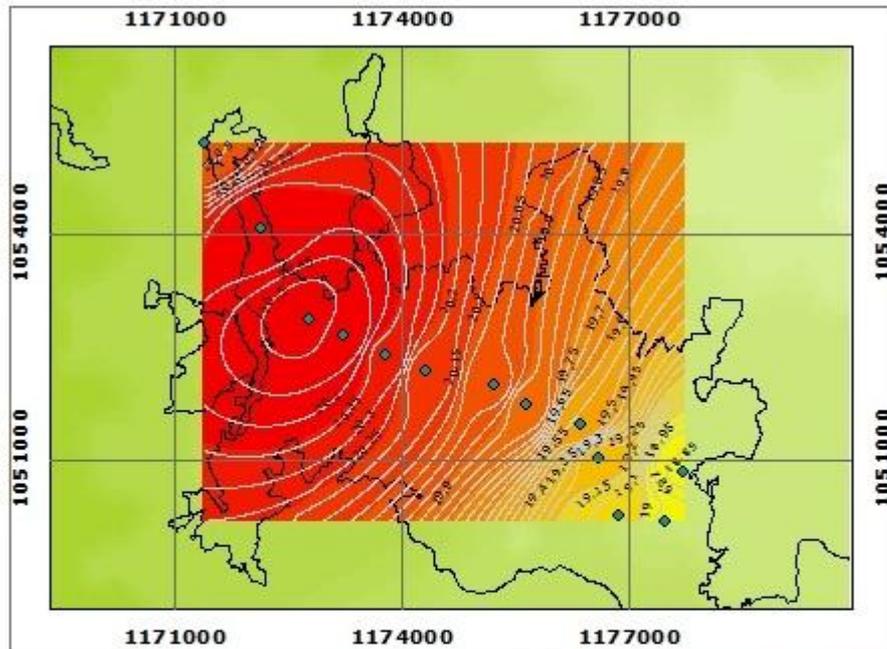
MOBILE TEMPERATURES vs NETWORK STATIONS



- Urban Perimeter
- ◆ Points Network Stations IDEA
- ◆ Nigth sampling points

Do not exist an statistical relation between the temperatures-0,16 (-1<-0,16<0).

ISOTHERMS VS WIND SPEED



- Mobile Wind Speed
- ◆ Night sampling points
- Urban Perimeter

Do not exist an statistical relation between the variables -0.119. (-1<-0.119<0)

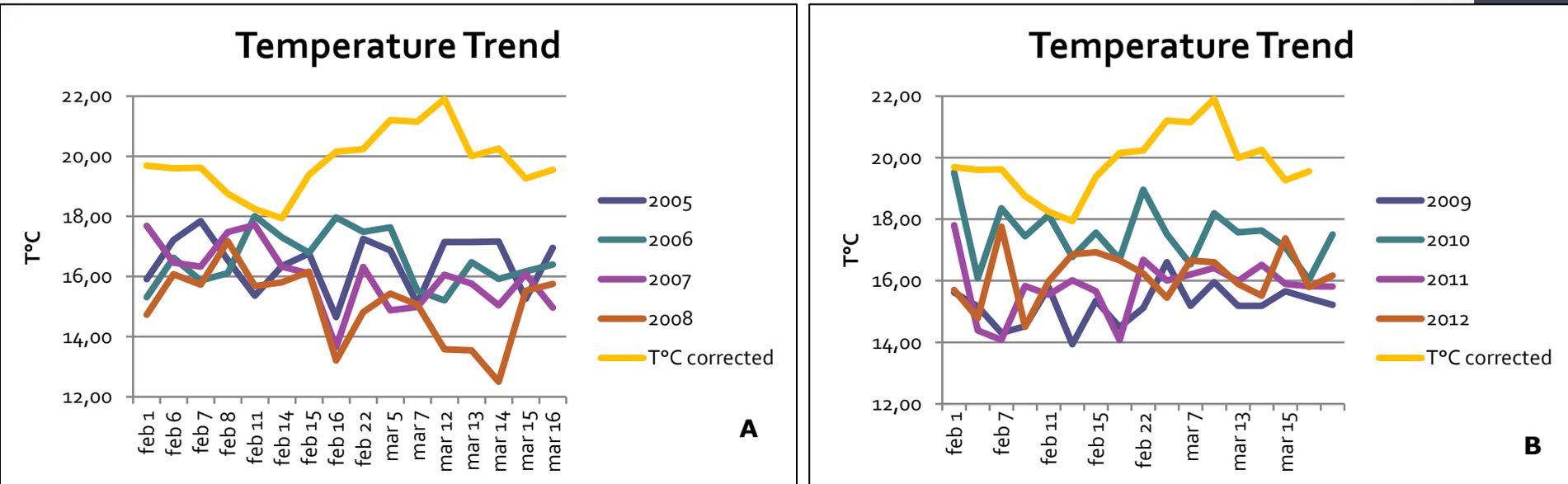
UHI INTENSITY

Day	Cerro Oro °C	Fundadores °C	UHI Intensity °C
feb1	19,11	20,16	1,05
feb6	18,89	19,86	0,97
feb7	18,56	19,74	1,18
feb8	17,62	19,12	1,50
feb11	17,68	18,3	0,62
feb14	17,04	18,6	1,56
feb15	18,94	19,3	0,36
feb16	18,71	21,34	2,63
feb22	19,85	20,66	0,81
mar5	19,32	22,84	3,52
mar7	20,29	21,76	1,47
mar12	20,08	22,7	2,62
mar13	19,55	20,2	0,65
mar14	18,86	21,2	2,34
mar15	18,82	19,42	0,60
mar16	18,21	20,3	2,09
Average	18,85	20,34	1,50

→ Less intense day

→ Most intense day

TEMPERATURE TREND

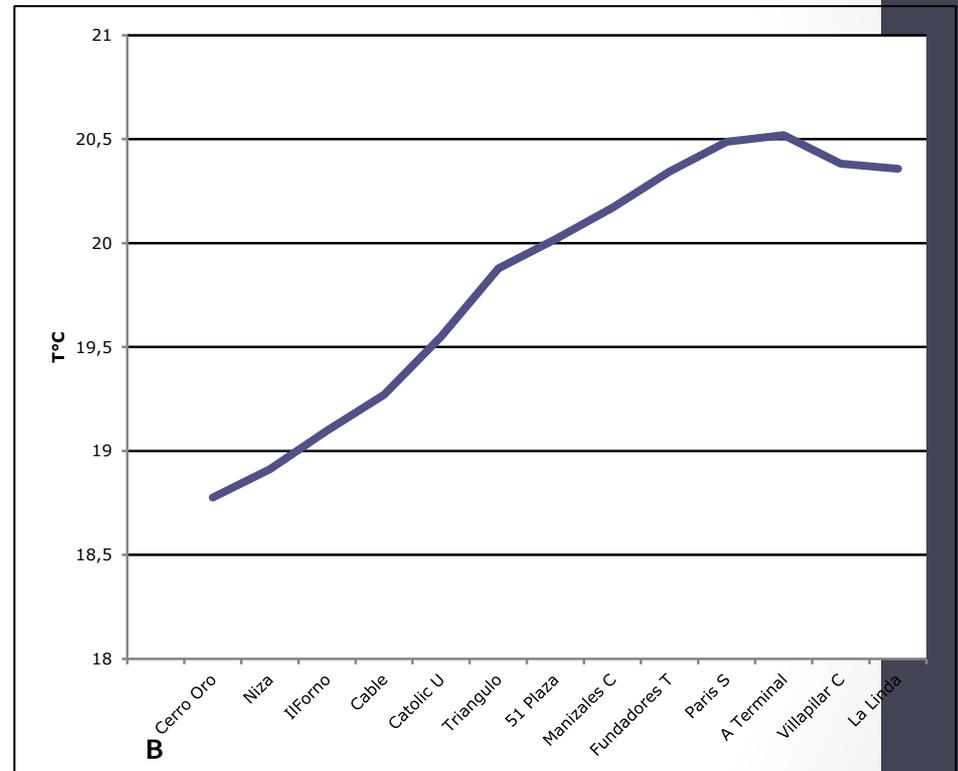
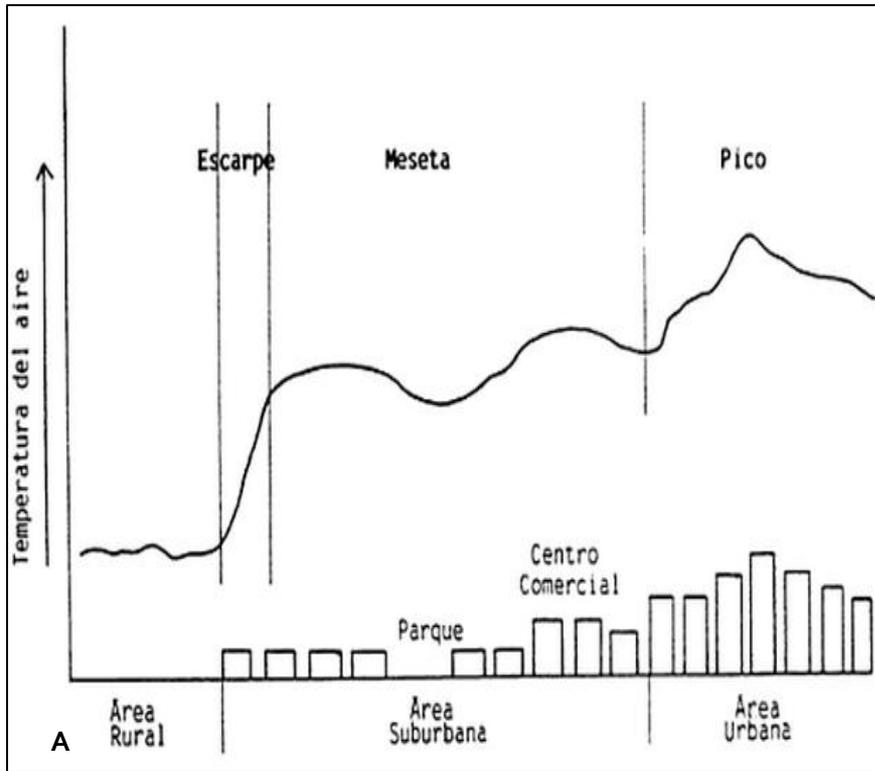


Environment temperature trend in the las eight years. A. 2005-2008. B. 2009-2012.

Low temperatures was present in 2007, 2008, 2009 y 2011 years.
Harm temperatures was register in 2010.

DISCUSION

UHI AND CONFORMATION OF THE CITY



- A. Thermal profile of heat island "typical" Oke, 1976 (view in Moreno, 1999).
- B. Behavior of mobile temperature along the transect night.

UHI AND CITY CONFORMATION



B

A. shaping the city following the classification of Stewart & Oke, 2012.
 B. Landscape of the city of Manizales, structural conformation of the urban area.

CONCLUSIONS

- The topography and disperse winds influence in the generation of urban heat island in downtown of city.
- Structural shape of the city facilitates the channeled winds.
- The growth of the city can only be generated vertically, because the rugged topography prevents the growth to the periphery.
- To be a first study and the first step to understand urban climate in Manizales we have a interest results.
- See the city with new eyes, especially downtown, because their mobility plan should be changed as important cities of the world have done.

FUTURE

- Continue with the UHI study, to deepen in the topic
- Using a methodologies that appropriate to the Manizales context
- I want to formulate a methodology for Andean cities to study with more precision UHI phenomenon and urban climate.

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Thanks for you attention see
you soon in Manizales...

