

El mundo después de París:
construyendo el futuro

17-21 OCTUBRE 2016



6^{to} Congreso Nacional
de Investigación en
Cambio Climático

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Sánchez

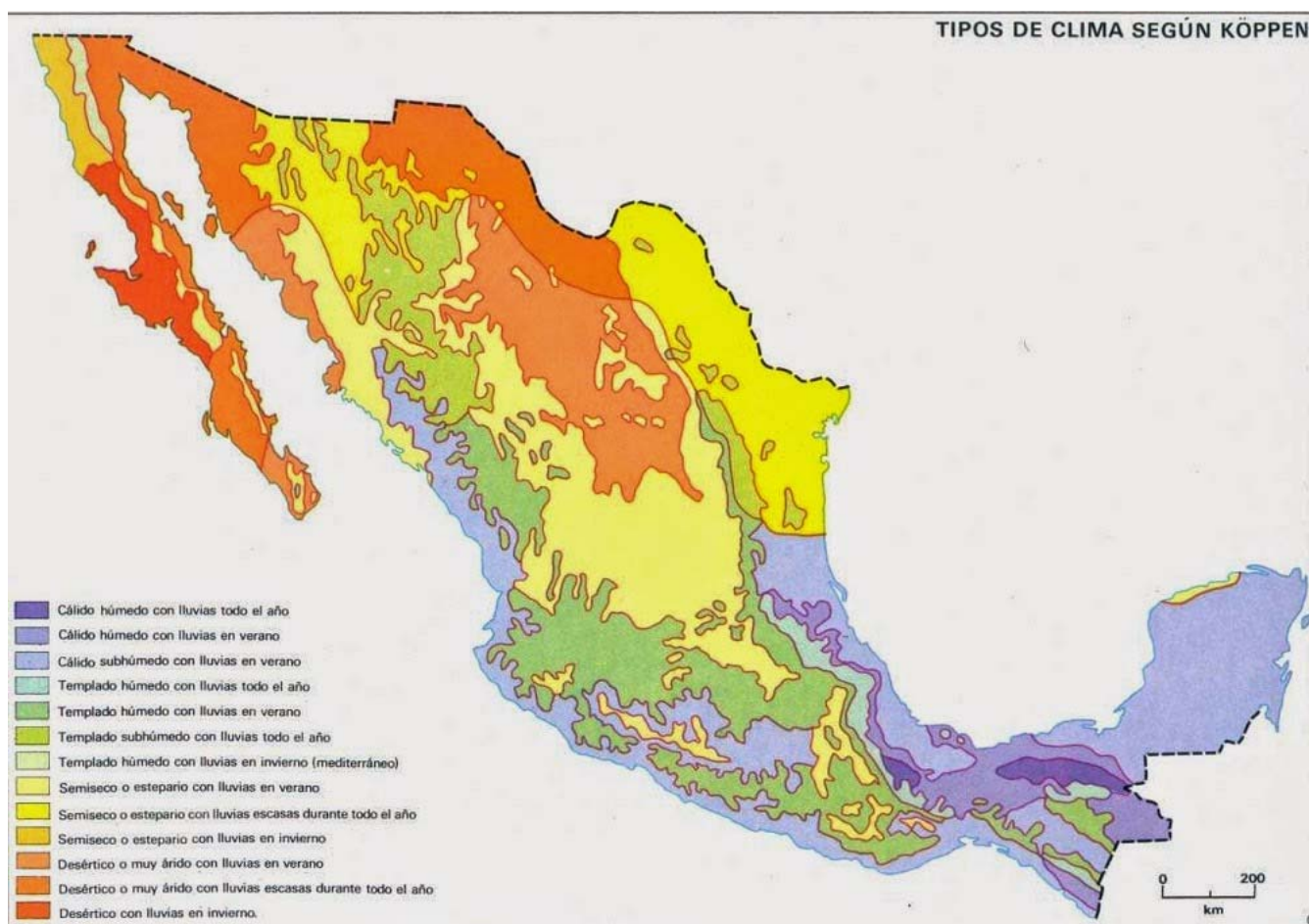
Sede Regional: Colima

Fecha:





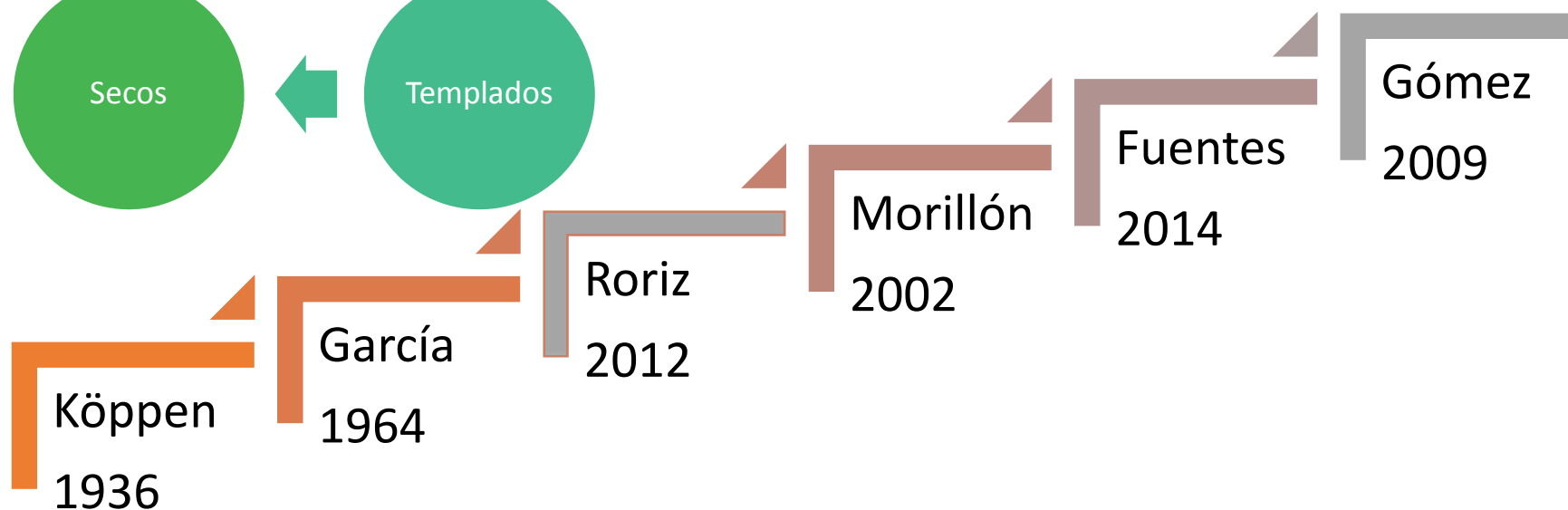
Caracterización climática de la región occidente de México desde el enfoque antropológico. Una propuesta metodológica



Antecedentes



Calor seco	Calor	Calor húmedo
Seco	Confort	Húmedo
Frío seco	Frío	Frío húmedo



Confort humano



ANSI-ASHRAE 55-2010

CONDICIONES TERMOHIGROMÉTRICAS



VARIABLES CONFORT TÉRMICO

Procedimiento



1

- Variables climáticas
- Normales climatológicas

2

- Temperaturas horarias
- **Humedades horarias**

3

- Zona de confort térmico
- Zona de confort higríco

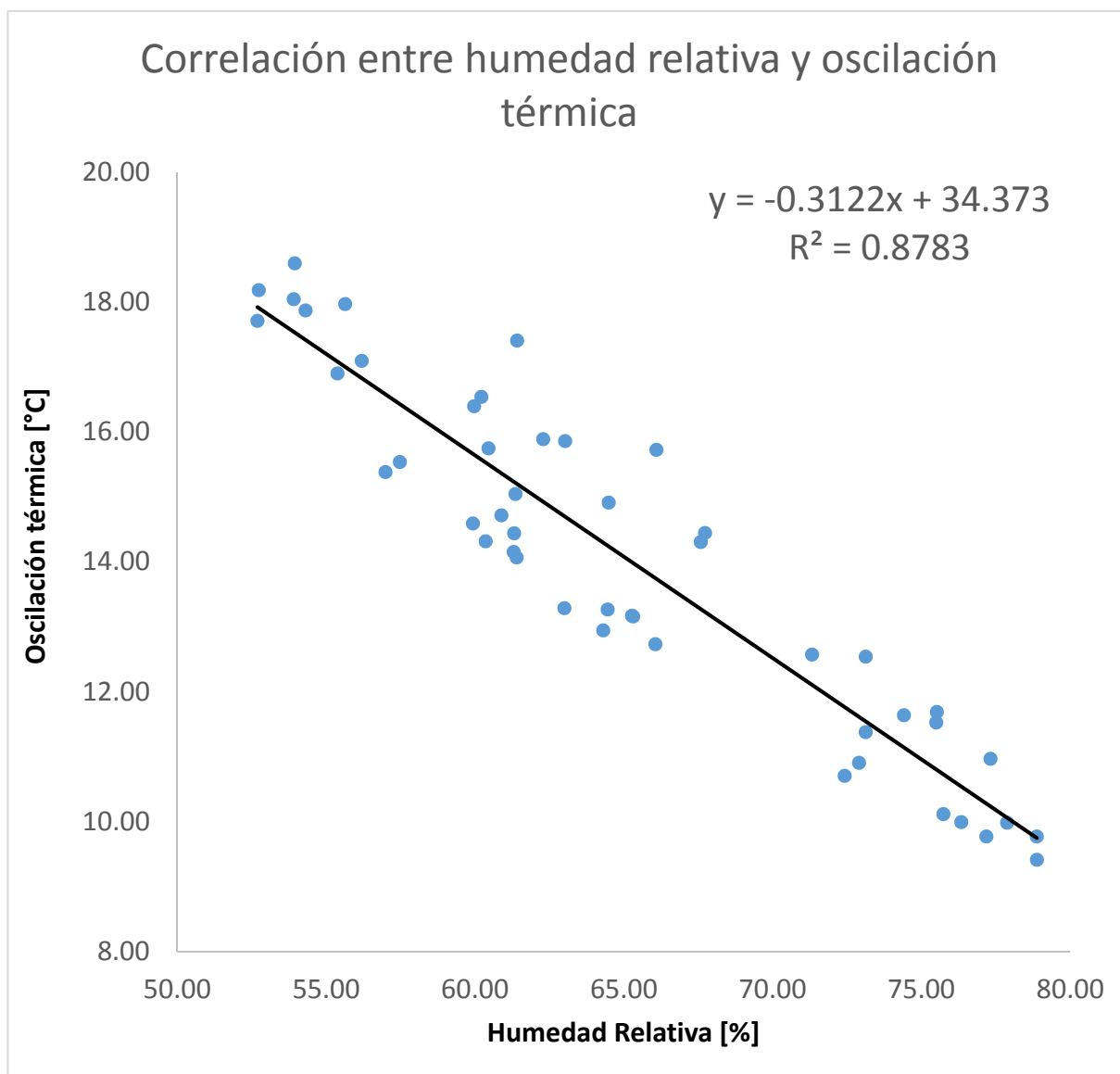
4

- Temperaturas horarias vs zona de confort

5

- Mapeo mensual

Humedades horarias



Humedad relativa [%]	Oscilación térmica [°C]	Condición
0	34.37	Seco, déficit hídrico
10	31.25	
20	28.13	
30	25.01	Confort
40	21.89	
50	18.76	
60	15.64	
70	12.52	
80	9.40	humedo, superávit hídrico
90	6.28	
100	3.15	

Resultados



Localidad	Colima	Lat.	19.25	Long.	103.65	Altitud	500						
	ene	feb	mar	abr	may	jun	jul	ago	sep	oct	nov	dic	Promedio
00:00	19.8	19.7	19.9	20.9	22.6	24.2	23.8	23.7	23.7	23.3	22.1	20.4	22.0
01:00	19.1	18.9	19.1	20.2	22.0	23.7	23.3	23.2	23.2	22.7	21.4	19.6	21.4
02:00	18.4	18.2	18.4	19.6	21.4	23.3	22.9	22.8	22.8	22.3	20.8	18.9	20.8
03:00	17.9	17.7	17.9	19.1	21.0	22.9	22.6	22.5	22.4	21.9	20.3	18.4	20.4
04:00	17.4	17.2	17.5	18.6	20.6	22.6	22.3	22.2	22.2	21.6	19.9	17.9	20.0
05:00	17.0	16.9	17.1	18.3	20.3	22.4	22.1	22.0	22.0	21.3	19.6	17.5	19.7
06:00	16.7	16.5	16.8	17.0	19.4	21.8	21.5	21.2	21.1	21.1	19.3	17.2	19.1
07:00	15.8	15.9	16.7	18.8	21.5	23.7	23.2	22.5	21.9	20.8	18.6	16.3	19.6
08:00	18.0	18.7	20.0	22.5	25.1	26.6	25.8	25.1	24.1	22.9	20.7	18.3	22.3
09:00	21.6	22.7	24.1	26.6	28.8	29.6	28.6	27.8	26.7	25.7	24.0	21.9	25.7
10:00	25.4	26.5	27.9	30.1	31.8	31.9	30.8	30.2	29.0	28.4	27.4	25.6	28.8
11:00	28.5	29.6	30.8	32.7	33.9	33.5	32.2	31.8	30.7	30.5	30.2	28.7	31.1
12:00	30.5	31.6	32.5	34.1	35.0	34.3	33.0	32.7	31.7	31.9	32.0	30.9	32.5
13:00	31.6	32.5	33.1	34.4	35.1	34.3	33.0	32.9	32.1	32.4	32.9	31.9	33.0
14:00	31.7	32.4	32.9	34.0	34.6	33.8	32.6	32.5	31.9	32.4	33.0	32.1	32.8
15:00	31.2	31.7	32.0	33.0	33.6	33.0	31.8	31.8	31.3	31.8	32.5	31.6	32.1
16:00	30.1	30.5	30.8	31.6	32.3	31.9	30.9	30.9	30.5	31.0	31.5	30.6	31.0
17:00	28.8	29.1	29.2	30.1	30.8	30.7	29.8	29.8	29.5	29.9	30.3	29.3	29.8
18:00	27.3	27.5	27.6	28.5	29.3	29.5	28.7	28.7	28.5	28.8	28.9	27.8	28.4
19:00	25.8	25.9	26.0	26.9	27.9	28.4	27.6	27.6	27.5	27.7	27.6	26.3	27.1
20:00	24.4	24.4	24.5	25.4	26.6	27.3	26.7	26.7	26.5	26.6	26.2	24.9	25.9
21:00	23.0	23.0	23.1	24.1	25.4	26.4	25.8	25.8	25.7	25.6	25.0	23.6	24.7
22:00	21.8	21.8	21.9	22.9	24.3	25.5	25.0	25.0	24.9	24.7	23.9	22.4	23.7
23:00	20.8	20.7	20.8	21.8	23.4	24.8	24.4	24.3	24.2	24.0	23.0	21.3	22.8
Max	31.7	32.5	33.1	34.4	35.1	34.3	33.0	32.9	32.1	32.4	33.0	32.1	33.0
Min	15.8	15.9	16.7	17.0	19.4	21.8	21.5	21.2	21.1	20.8	18.6	16.3	19.1
oscilación	15.9	16.5	16.4	17.4	15.7	12.5	11.5	11.7	11.0	11.6	14.4	15.9	14.2
Promedio	23.4	23.7	24.2	25.5	26.9	27.8	27.0	26.8	26.4	26.2	25.5	23.9	25.6
TN mensual	25.1	25.2	25.3	25.7	26.2	26.4	26.2	26.1	26.0	25.9	25.7	25.2	25.8
TN maxima	27.6	27.7	27.8	28.2	28.7	28.9	28.7	28.6	28.5	28.4	28.2	27.7	28.2
TN minima	22.6	22.7	22.8	23.2	23.7	23.9	23.7	23.6	23.5	23.4	23.2	22.7	23.2

Resultados



Localidad	Guadalajara	Lat. (xx.x)	20.7	Long.(xxx.x)	103.4	Altitud (m)	1567						
	ene	feb	mar	abr	may	jun	jul	ago	sep	oct	nov	dic	Promedio
00:00	14.3	15.3	17.0	18.9	20.8	20.9	19.1	19.0	19.2	18.4	16.7	15.0	17.9
01:00	13.6	14.6	16.3	18.2	20.2	20.4	18.7	18.6	18.8	17.9	16.1	14.4	17.3
02:00	13.1	14.0	15.7	17.7	19.7	20.0	18.3	18.2	18.4	17.4	15.5	13.8	16.8
03:00	12.6	13.6	15.2	17.3	19.3	19.6	18.0	18.0	18.1	17.1	15.1	13.4	16.4
04:00	12.2	13.2	14.8	16.9	19.0	19.3	17.8	17.7	17.9	16.8	14.7	13.0	16.1
05:00	11.9	12.8	14.5	16.6	18.7	19.1	17.6	17.5	17.7	16.5	14.4	12.7	15.8
06:00	11.7	12.6	14.3	15.5	17.9	18.5	17.1	16.9	16.9	16.3	14.2	12.4	15.4
07:00	10.8	12.0	14.2	17.1	19.9	20.5	18.7	18.1	17.7	16.0	13.5	11.6	15.8
08:00	12.6	14.3	17.1	20.2	23.2	23.5	21.0	20.3	19.6	17.9	15.3	13.2	18.2
09:00	15.6	17.7	20.7	23.8	26.6	26.5	23.4	22.6	21.9	20.5	18.2	16.1	21.1
10:00	18.7	21.0	24.0	26.8	29.3	28.8	25.3	24.6	24.0	23.0	21.2	19.1	23.8
11:00	21.3	23.6	26.5	29.0	31.2	30.4	26.6	26.0	25.5	25.0	23.7	21.7	25.9
12:00	23.1	25.3	28.1	30.1	32.1	31.1	27.2	26.7	26.4	26.2	25.3	23.4	27.1
13:00	24.0	26.1	28.6	30.5	32.2	31.1	27.2	26.9	26.7	26.7	26.1	24.4	27.5
14:00	24.1	26.1	28.4	30.1	31.7	30.6	26.8	26.6	26.5	26.7	26.2	24.5	27.4
15:00	23.7	25.5	27.7	29.2	30.8	29.7	26.1	25.9	26.0	26.2	25.8	24.1	26.7
16:00	22.8	24.5	26.6	28.0	29.6	28.6	25.3	25.1	25.2	25.4	24.9	23.3	25.8
17:00	21.7	23.3	25.2	26.7	28.2	27.4	24.3	24.2	24.4	24.4	23.9	22.3	24.7
18:00	20.5	21.9	23.8	25.3	26.9	26.2	23.4	23.3	23.5	23.4	22.7	21.1	23.5
19:00	19.3	20.6	22.4	23.9	25.6	25.1	22.5	22.4	22.6	22.4	21.5	19.9	22.3
20:00	18.1	19.3	21.1	22.7	24.4	24.0	21.6	21.5	21.7	21.4	20.3	18.7	21.2
21:00	16.9	18.1	19.8	21.5	23.3	23.1	20.8	20.8	21.0	20.5	19.2	17.6	20.2
22:00	15.9	17.0	18.8	20.5	22.3	22.2	20.2	20.1	20.3	19.7	18.3	16.6	19.3
23:00	15.0	16.1	17.8	19.6	21.5	21.5	19.6	19.5	19.7	19.0	17.4	15.8	18.5
Max	24.1	26.1	28.6	30.5	32.2	31.1	27.2	26.9	26.7	26.7	26.2	24.5	27.5
min	10.8	12.0	14.2	15.5	17.9	18.5	17.1	16.9	16.9	16.0	13.5	11.6	15.4
oscilación	13.3	14.1	14.4	14.9	14.3	12.6	10.1	10.0	9.8	10.7	12.7	12.9	12.5
Promedio	17.2	18.7	20.8	22.8	24.8	24.5	21.9	21.7	21.6	21.0	19.6	17.8	21.0
TN mensual	23.2	23.7	24.3	24.9	25.6	25.5	24.7	24.6	24.6	24.4	23.9	23.4	24.4
TN maxima	25.7	26.2	26.8	27.4	28.1	28.0	27.2	27.1	27.1	26.9	26.4	25.9	26.9
TN minima	20.7	21.2	21.8	22.4	23.1	23.0	22.2	22.1	22.1	21.9	21.4	20.9	21.9

Resultados



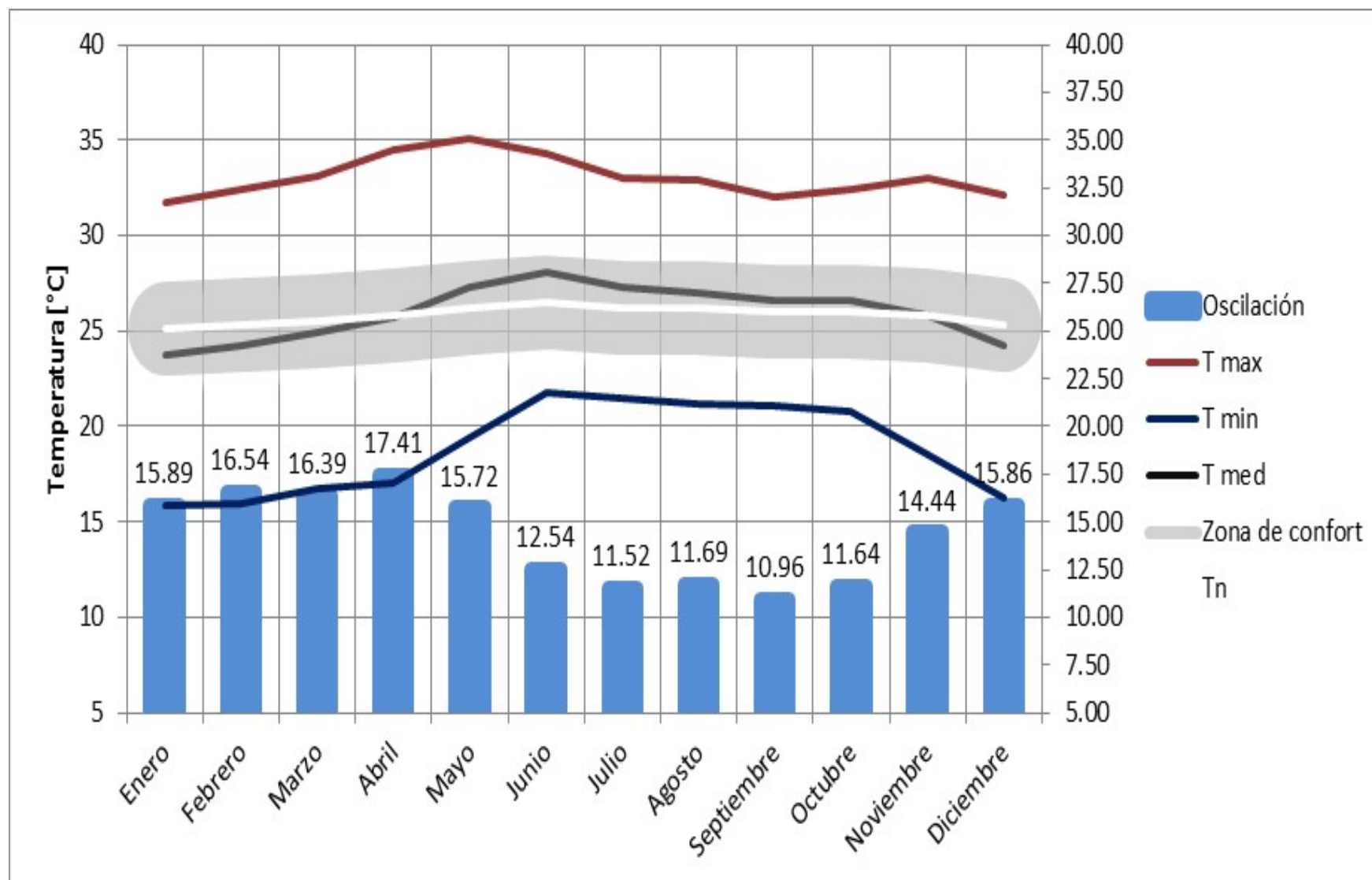
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	ene	feb	mar	abr	may	jun	jul	ago	sep	oct	nov	dic	Promedio
00:00	11.4	12.3	13.9	15.5	16.6	16.7	15.8	16.0	16.0	14.9	13.5	12.0	14.5
01:00	10.5	11.4	13.1	14.7	15.9	16.1	15.2	15.5	15.4	14.2	12.7	11.1	13.8
02:00	9.8	10.6	12.4	14.0	15.3	15.6	14.8	15.0	14.9	13.6	12.0	10.3	13.2
03:00	9.1	10.0	11.8	13.5	14.7	15.2	14.4	14.6	14.5	13.2	11.4	9.7	12.7
04:00	8.6	9.5	11.3	13.1	14.3	14.8	14.1	14.3	14.2	12.8	10.9	9.2	12.3
05:00	8.2	9.1	10.9	12.7	14.0	14.6	13.8	14.1	13.9	12.4	10.5	8.7	11.9
06:00	7.9	8.8	10.6	11.3	12.9	13.8	13.1	13.2	12.9	12.2	10.2	8.4	11.3
07:00	6.8	8.1	10.5	13.2	15.4	16.2	15.1	14.7	13.9	11.8	9.3	7.3	11.9
08:00	9.3	11.1	14.0	17.2	19.5	19.7	18.2	17.6	16.5	14.4	11.8	9.6	14.9
09:00	13.3	15.4	18.5	21.6	23.7	23.2	21.3	20.7	19.6	17.8	15.7	13.6	18.7
10:00	17.6	19.7	22.6	25.4	27.2	26.1	23.8	23.4	22.4	21.2	19.6	17.9	22.2
11:00	21.0	23.1	25.7	28.1	29.6	28.0	25.5	25.2	24.5	23.8	22.9	21.4	24.9
12:00	23.4	25.3	27.5	29.5	30.7	28.8	26.3	26.1	25.7	25.4	25.0	23.8	26.5
13:00	24.5	26.2	28.2	29.9	30.9	28.9	26.4	26.3	26.1	26.1	26.1	25.1	27.1
14:00	24.7	26.2	28.0	29.5	30.3	28.3	25.9	26.0	25.8	26.0	26.2	25.3	26.9
15:00	24.1	25.4	27.1	28.4	29.1	27.3	25.0	25.2	25.1	25.4	25.6	24.7	26.0
16:00	22.9	24.2	25.7	26.9	27.6	26.0	23.9	24.1	24.1	24.3	24.4	23.6	24.8
17:00	21.4	22.6	24.0	25.3	26.0	24.6	22.7	22.9	23.0	23.0	23.0	22.1	23.4
18:00	19.8	20.8	22.3	23.5	24.3	23.1	21.4	21.7	21.7	21.6	21.4	20.5	21.8
19:00	18.1	19.1	20.6	21.8	22.6	21.7	20.2	20.5	20.5	20.3	19.8	18.8	20.3
20:00	16.5	17.4	18.9	20.3	21.1	20.5	19.1	19.4	19.4	19.0	18.3	17.1	18.9
21:00	15.0	15.9	17.4	18.8	19.8	19.3	18.1	18.3	18.4	17.7	16.9	15.6	17.6
22:00	13.6	14.5	16.1	17.6	18.5	18.3	17.2	17.5	17.5	16.7	15.6	14.2	16.4
23:00	12.4	13.3	14.9	16.5	17.5	17.5	16.4	16.7	16.7	15.7	14.5	13.0	15.4
Max	24.7	26.2	28.2	29.9	30.9	28.9	26.4	26.3	26.1	26.1	26.2	25.3	27.1
min	6.8	8.1	10.5	11.3	12.9	13.8	13.1	13.2	12.9	11.8	9.3	7.3	11.3
oscilación	17.9	18.2	17.7	18.6	18.0	15.0	13.3	13.2	13.2	14.3	16.9	18.0	16.2
Promedio	15.4	16.7	18.6	20.3	21.6	21.0	19.5	19.5	19.3	18.5	17.4	16.0	18.6
TN mensual	22.7	23.1	23.6	24.2	24.6	24.4	23.9	23.9	23.8	23.6	23.3	22.8	23.7
TN maxima	25.2	25.6	26.1	26.7	27.1	26.9	26.4	26.4	26.3	26.1	25.8	25.3	26.2
TN minima	20.2	20.6	21.1	21.7	22.1	21.9	21.4	21.4	21.3	21.1	20.8	20.3	21.2

Resultados

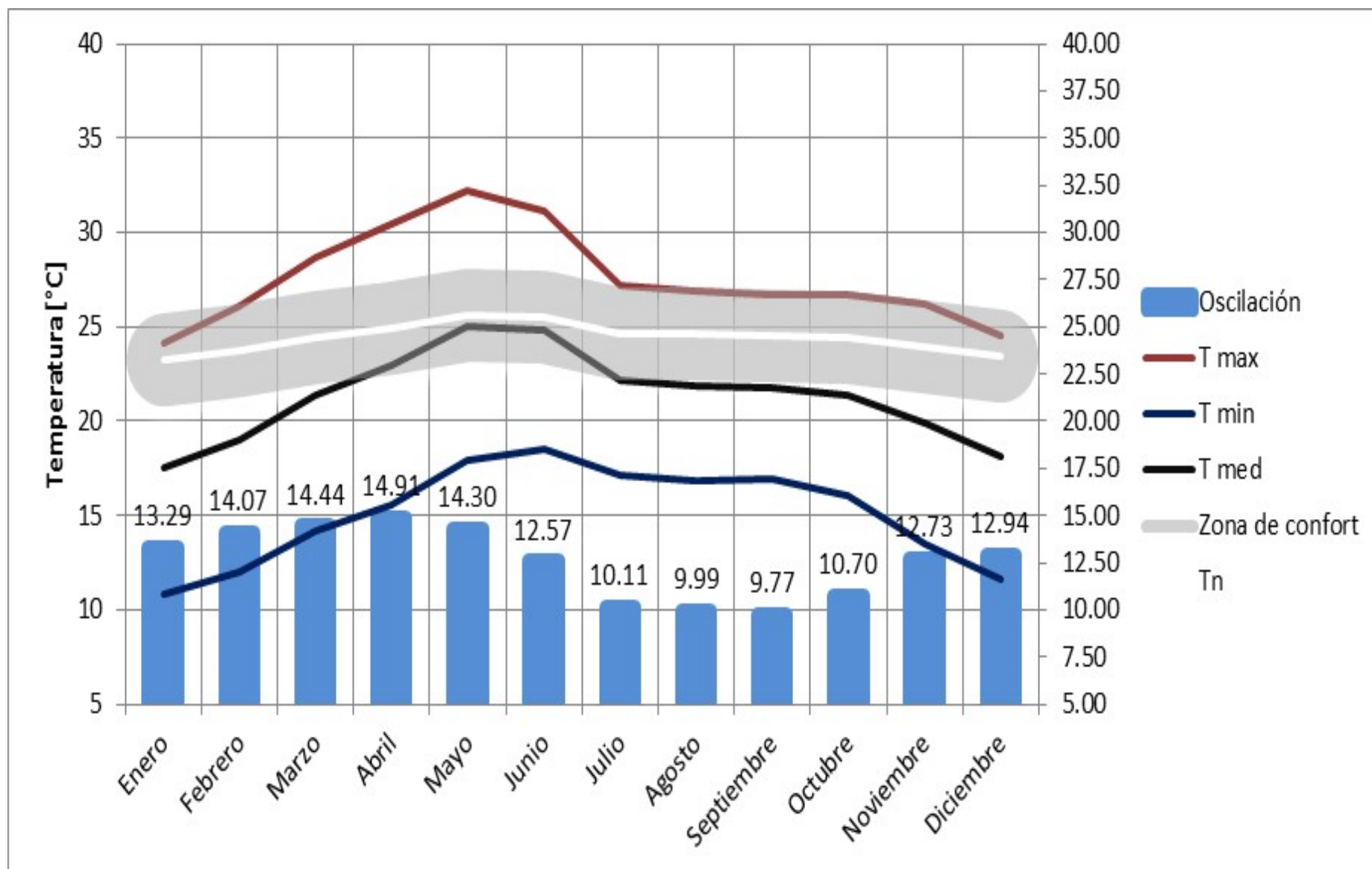


Localidad	Tepic	Lat. (xx.x)	21.5	Long.(xxx.x)	104.9	Altitud (m)	935						
	ene	feb	mar	abr	may	jun	jul	ago	sep	oct	nov	dic	Promedio
00:00	12.7	12.7	13.3	14.7	17.1	19.8	20.4	20.5	20.9	19.2	15.8	14.2	16.8
01:00	12.0	11.9	12.6	13.9	16.5	19.4	20.0	20.1	20.5	18.7	15.1	13.5	16.2
02:00	11.4	11.3	12.0	13.3	15.9	19.0	19.7	19.7	20.1	18.3	14.5	12.9	15.7
03:00	10.9	10.8	11.5	12.8	15.5	18.7	19.5	19.5	19.8	17.9	14.0	12.4	15.3
04:00	10.5	10.3	11.0	12.4	15.1	18.4	19.2	19.2	19.6	17.6	13.6	12.0	14.9
05:00	10.1	10.0	10.7	12.1	14.8	18.2	19.1	19.0	19.4	17.3	13.2	11.7	14.6
06:00	9.9	9.7	10.4	10.9	14.0	17.7	18.6	18.4	18.6	17.1	13.0	11.4	14.1
07:00	8.9	9.0	10.4	12.7	16.2	19.6	20.1	19.6	19.4	16.8	12.1	10.5	14.6
08:00	10.8	11.5	13.4	16.3	19.8	22.3	22.3	21.8	21.3	18.7	14.1	12.2	17.1
09:00	14.1	15.2	17.3	20.3	23.6	25.0	24.5	24.2	23.6	21.4	17.5	15.3	20.2
10:00	17.5	18.9	20.8	23.8	26.6	27.1	26.3	26.1	25.7	23.9	21.0	18.6	23.0
11:00	20.4	21.8	23.5	26.3	28.6	28.5	27.4	27.5	27.2	25.9	23.8	21.5	25.2
12:00	22.3	23.7	25.1	27.6	29.6	29.1	28.0	28.2	28.1	27.2	25.7	23.4	26.5
13:00	23.4	24.6	25.7	27.9	29.7	29.1	28.0	28.4	28.4	27.7	26.7	24.4	27.0
14:00	23.5	24.6	25.5	27.5	29.1	28.6	27.7	28.1	28.2	27.7	26.8	24.6	26.8
15:00	23.1	23.9	24.7	26.5	28.1	27.8	27.0	27.4	27.7	27.2	26.3	24.2	26.2
16:00	22.1	22.8	23.5	25.1	26.8	26.8	26.2	26.6	26.9	26.4	25.3	23.4	25.2
17:00	20.9	21.5	22.1	23.6	25.3	25.7	25.3	25.7	26.1	25.4	24.1	22.2	24.0
18:00	19.6	20.0	20.6	22.0	23.8	24.7	24.4	24.8	25.2	24.4	22.8	20.9	22.8
19:00	18.2	18.5	19.1	20.5	22.4	23.6	23.6	23.9	24.3	23.3	21.4	19.6	21.5
20:00	16.9	17.1	17.7	19.0	21.0	22.7	22.8	23.0	23.4	22.3	20.0	18.3	20.4
21:00	15.7	15.8	16.4	17.7	19.9	21.8	22.1	22.3	22.7	21.4	18.8	17.1	19.3
22:00	14.6	14.6	15.2	16.5	18.8	21.0	21.4	21.6	22.0	20.6	17.7	16.0	18.3
23:00	13.6	13.6	14.2	15.5	17.9	20.4	20.9	21.0	21.4	19.9	16.7	15.1	17.5
Max	23.5	24.6	25.7	27.9	29.7	29.1	28.0	28.4	28.4	27.7	26.8	24.6	27.0
min	8.9	9.0	10.4	10.9	14.0	17.7	18.6	18.4	18.6	16.8	12.1	10.5	14.1
oscilación	14.6	15.5	15.4	17.1	15.7	11.4	9.4	10.0	9.8	10.9	14.7	14.2	13.2
Promedio	16.0	16.4	17.4	19.1	21.5	23.1	23.1	23.2	23.3	21.9	19.2	17.3	20.1
TN mensual	22.8	23.0	23.3	23.8	24.5	25.0	25.0	25.0	25.1	24.7	23.8	23.2	24.1
TN maxima	25.3	25.5	25.8	26.3	27.0	27.5	27.5	27.5	27.6	27.2	26.3	25.7	26.6
TN minima	20.3	20.5	20.8	21.3	22.0	22.5	22.5	22.5	22.6	22.2	21.3	20.7	21.6

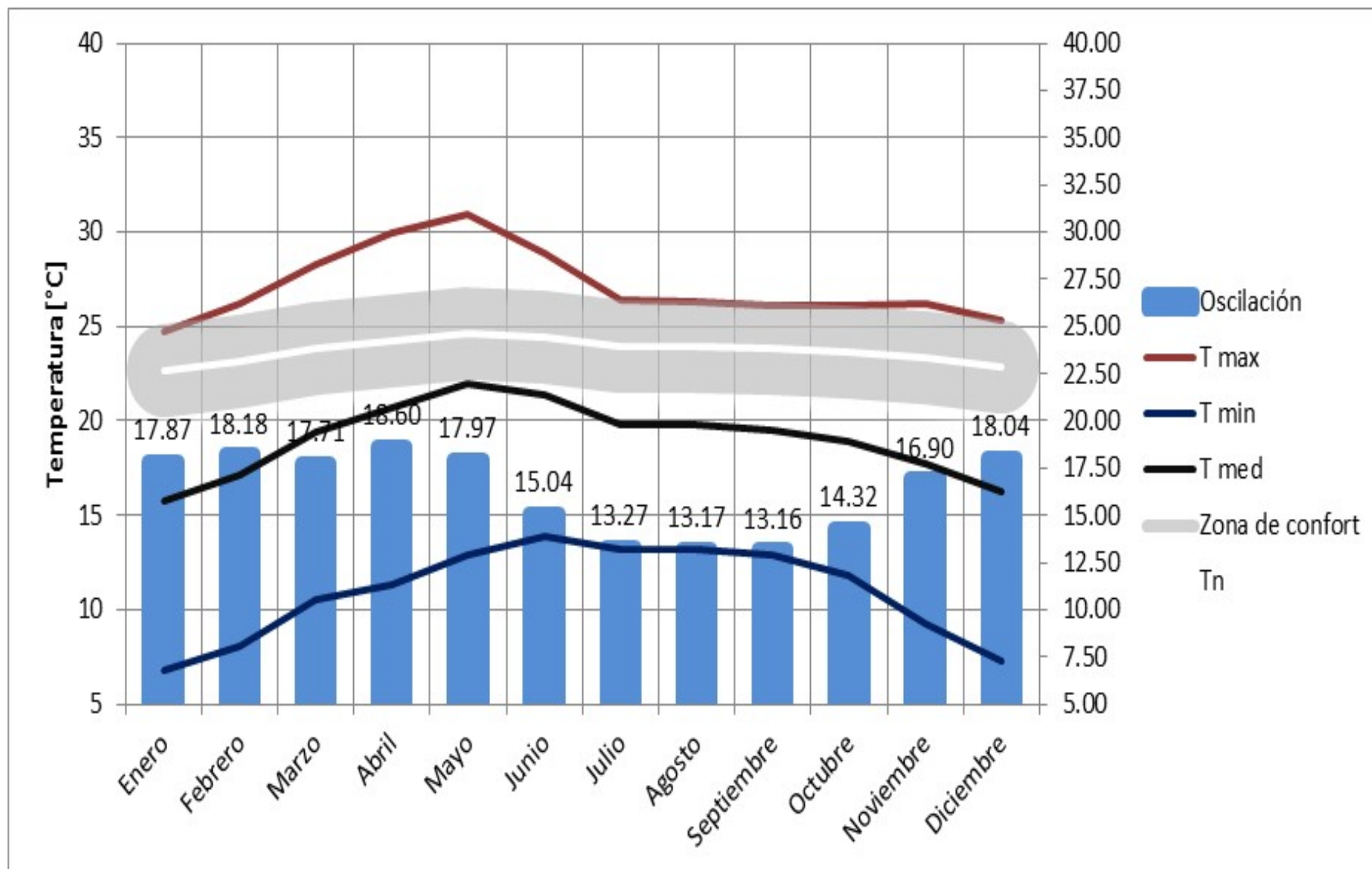
Resultados



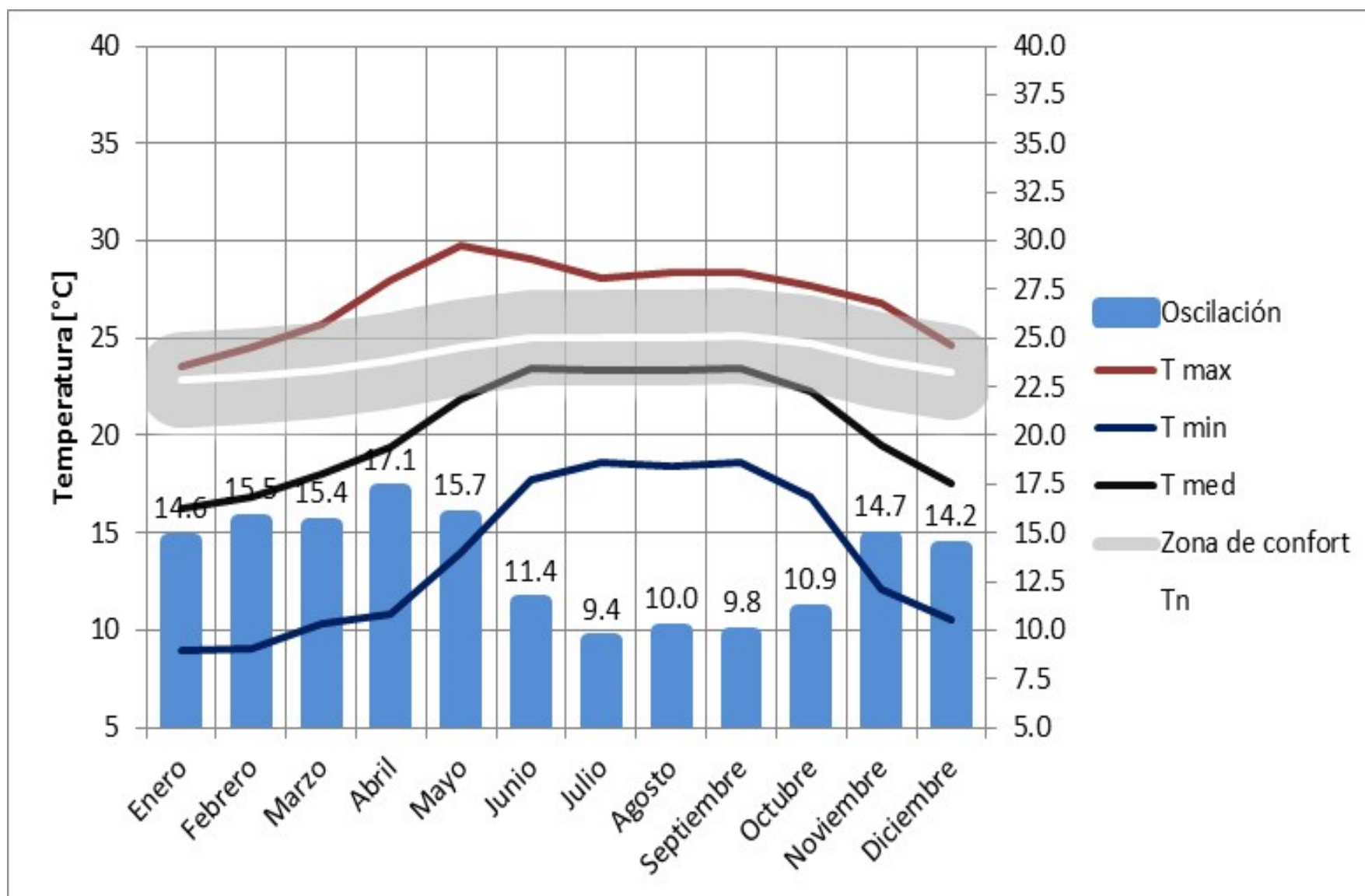
Resultados



Resultados



Resultados



Conclusiones



1. Construir una metodología a partir de algunas premisas expuestas por Roriz y Fuentes, sin embargo, es necesario puntualizar aquellos apartados donde se muestran contradicciones entre los dos autores y donde no es claro el procedimiento.
2. Determinación de la humedad relativa a partir de la oscilación térmica, el modelo trabaja correctamente y muestra una correlación alta, sin embargo, es necesario ampliar la muestra para aumentar la correlación y detallar la función.
3. Para la clasificación de la temperatura, hasta el momento no se ha determinado como se generará la categorización debido a lo complejo del problema. Grados/días, todas las locaciones analizadas se encuentran dentro de la categoría de frío. Medias mensuales, algunos meses de las ciudades se encuentran dentro de confort, pero ninguno entra en la categoría de cálido. Temperatura media del mes más cálido, no se justifica el porqué de este proceso.
4. Roriz, aplicarlo bajo los parámetros de confort adaptativo utilizando alguna función globalmente aceptada.